Warning: Limitation of Liability

The ultimate responsibility of the consequences of use of toxic compounds rests with the user. PerkinElmer's role is as a supplier of instrumentation to assist in the early detection of hazardous conditions involving such compounds.

MicroFID represents a major advance in this field and, as with all complex instruments, it is vitally important to ensure that MicroFID is maintained in accordance with PerkinElmer's instructions and that proper calibration is regularly performed.

As with any complex device, MicroFID is subject to failure and, while PerkinElmer has taken, and continues to take, all possible precautions to (a) reduce the possibility of failure, and (b) warn the user in the event of failure, circumstances may occasionally occur in which there is a failure despite such precautions on PerkinElmer's part. PerkinElmer regrets that it cannot accept liability for damages of any kind caused as a result of either failure of the user to follow instructions or of MicroFID to perform.

Photovac MicroFID
Portable Flame Ionization Detector

Release History

Part Number	Release	Publication Date
396003	G	February 2000
396003	F	August 1997

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FCC Warning

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Subpart B, Class B of Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

MicroFID I/S & I/SC Notice

Listed (ETL)® *77463* (ETL)® C	CONFORMS TO UL STANDARD 913 CERTIFIED TO CSA STANDARD CSA 22.2 No. 157
Intrinsically safe/Sécurité intrinsèque for use in Class I, Division 1, Groups A, B, C, D, Hazardous Locations, Temperature Code T4, Exia	
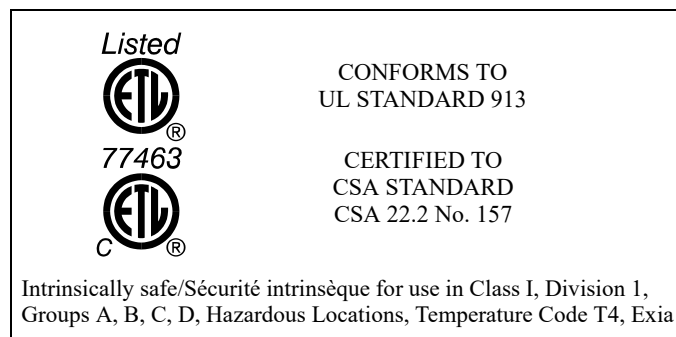
MICROFID I/S IS CLASSIFIED FOR USE IN CLASS I, DIVISION 1, GROUPS A, B, C, D HAZARDOUS LOCATIONS.

It has been listed by ETL® to comply with Underwriters Laboratories® Inc. UL® 913 *Standard for Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, Division 1, Groups A, B, C, D Hazardous (Classified) Locations*, Fourth Edition.

MICROFID I/SC IS CLASSIFIED FOR USE IN CLASS I, DIVISION 1, GROUPS A, B, C, D HAZARDOUS LOCATIONS. T4 (135ºC) RATING.

It has been listed by ETL to comply with *CSA Standard 22.2 No. 157-92 Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations*.

MICROFID I/S AND I/SC ARE NOT INTENDED TO DETECT COMBUSTIBLE LEVELS OF GASES. MICROFID I/S AND I/SC ARE CLASSIFIED FOR USE IN ATMOSPHERES CONTAINING COMBUSTIBLE LEVELS OF GASES.

These accessories are for use with MicroFID I/S and IS/C in a hazardous location:

MX395002	Shoulder Strap
MX396001	Short Sample Probe
MX396007	Carrying Case
MX396011	Calibration Kit
MX396018	Long Sample Probe
MX396021	Charcoal Filters (2 pieces)
MX396022	Charcoal Filters (10 pieces)
MX396053	Headset
MX396054	Bar Code Reader and Interface Module (I/S)

Do not use any other accessories with MicroFID I/S or I/SC in a hazardous location.

Substitution of components may affect safety rating.

To reduce the risk of fire or injury to persons, read and follow these instructions:

CAUTION

1. *All calibration, maintenance and servicing of this device, including battery charging, must be performed in a safe area away from hazardous locations.*

2. *For replacement battery pack use only Part No. MX396005 (I/S), MX396006 (I/SC).*

3. *Do not dispose of the battery pack in a fire. The cell may explode. Check with local codes for possible special disposal instructions.*

4. *Do not open or mutilate the battery pack. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.*

5. *Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conductor may overheat and cause burns.*

6. *Do not defeat proper polarity orientation between the battery pack and battery charger.*

7. *Charge the battery pack using the charger provided with or identified for use with this product only in accordance with the instructions and limitations specified in this manual. For battery charger use only Part No. MX396014 (110 Volts AC), MX396013 (220 Volts AC).*

NOTICE

MICROFID I/SC EST CLASSIFIÉ POUR USAGE DANS LES EMPLACEMENTS DANGEREUX DE CLASSE I, DIVISION 1, GROUPES A, B, C, D. ÉVALUATION T4 (135ºC).

MicroFID I/SC est conforme à la norme de <u>CSA Standard 22.2 No. 157-92 - Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations</u>.

MICROFID I/SC C'EST NE PAS INTENDER POUR DÉTECTER DES NIVEAUX DE COMBUSTION DES GAZ. CET APPAREIL EST CLASSIFIÉ POUR USAGE DANS DES ATMOSPHÈRES CONTENANT DES NIVEAUX DE COMBUSTION DES GAZ.

Les accessoires PerkinElmer suivants peuvent également être utilisés avec l'appareil dans un emplacement dangereux:

MX395002	Bandoulière
MX396001	Petite Gamme d'échantillons
MX396007	Étui de Transport
MX396011	Equipment de Calibration
MX396018	Gamme d'échantillons
MX396021	Filtres de Charbon (2 pièces)
MX396022	Filtres de Charbon (10 pièces)
MX396054	Lecteur de Codes à Barres et Module d'Interface (I/S)
MX396053	Casque telephonique

Ne pas utiliser d'autres accessoires avec cet appareil dans un emplacement dangereux.

La substitution des composantes peut nuire à la sécurité d'emploi.

Afin de réduire les risques d'incendie et les blessures, lire et suivre ces instructions:

MISE EN GARDE

1. *Tout étalonnage, entretien et réparation de cet appareil, y compris le chargement de la pile, doit être effectué dans un endroit sûr, à l'écart des zones dangereuses.*

2. *N'utiliser que la pièce PerkinElmer numéro MX396006 (I/SC) lorsqu'il faut remplacer le bloc-pile.*

3. *Ne pas jeter la pile dans un feu. La cellule pourrait exploser. Vérifier les codes locaux, qui peuvent comporter des instructions de mise au rebut particulières.*

4. *Ne pas ouvrir et ne pas abîmer le bloc-pile. L'acide sulfurique qui risque de s'en échapper est corrosif et peut causer des lésions aux yeux et à la peau. Cet acide est toxique lorsqu'avalé.*

5. *Manipuler le bloc-pile avec soin, afin de ne pas court-circuiter les bornes avec des matériels conducteurs tels qu'une bague, un bracelet ou des clés. La pile ou le conducteur pourraient surchauffer et causer des brûlures.*

6. *Ne pas modifier l'orientation de la polarité appropriée entre le bloc-pile et le chargeur.*

7. *Charger le bloc-pile fourni avec ou reconnu pour usage avec ce produit seulement conformément aux instructions et restrictions spécifiées dans ce manuel. Pour le chargeur, n'utiliser que la pièce numéro MX396014 (110 Volts AC), MX396013 (220 Volts AC).*

CE Directive

CONFORMS TO
COUNCIL DIRECTIVE 89/336/EEC
COUNCIL DIRECTIVE 91/157/EEC

Council Directive 89/336/EEC - Electromagnetic Compatibility and the Applicable Standards. MicroFID complies with EN50082-01 Generic Immunity Standard for Electromagnetic Compatibility Part 1: Light Industrial Environment. MicroFID has been tested and conforms to the guidelines specified in EN50082-02 Generic Immunity Standard for Electromagnetic Compatibility Part 2: Industrial Environment

Council Directive 91/157/EEC - Recovery and Disposal of Spent Batteries

You must use the 220 V battery charger (Part No. MX396013) in order to comply with the requirements of the applicable Council Directives.

Introduction 1

About this Manual

This manual provides detailed instructions for the setup, operation and maintenance of the MicroFID™ Portable Flame Ionization Detector.

Before unpacking the instrument, please read *Warnings and Safety Practices* on page 22. This section describes possible hazards that may injure the user, damage the instrument or compromise its operation. Some general safety information is also provided.

To help you learn to use MicroFID quickly this manual is organized by tasks beginning with a tutorial in Chapter 2. More detailed operational instructions are provided in Chapter 3. Connecting accessories is covered in Chapter 4. Routine maintenance is covered in Chapter 5. Troubleshooting techniques are covered in Chapter 6. Chapter 7 provides a technical description of MicroFID.

The MicroFID manual uses a few conventions for key names on the keypad and for text that is shown on the display.

UPPERCASE	Key names are denoted by uppercase text. ARROW keys is the collective name for the UP ARROW and DOWN ARROW keys.
"Display Text"	Text that appears on the MicroFID display is in quotation marks.
<Angle Brackets>	Computer keyboard names are denoted by angle brackets, e.g. <Ctrl>.
MD FID	Text that must be typed in using the computer keyboard is shown in italics.

In the text you will find various warnings and notes.

A warning indicates an operation that could cause personal injury if precautions are not followed.

WARNING

A caution indicates an operation that could cause damage to the instrument if precautions are not followed.

CAUTION

NOTE: *A note indicates significant information.*

Warnings and Safety Practices

Please read this section before operating MicroFID.

Approved Models of MicroFID

This manual provides operational information for all models of MicroFID. The MicroFID I/S and the MicroFID I/SC are intrinsically safe and approved for use in hazardous locations. Refer to the manual introduction for details of each approval.

Throughout the manual, notes are provided to inform you of the limitations of usage for the MicroFID I/S and MicroFID I/SC models.

If the MicroFID you are using is not specifically identified as intrinsically safe, do not use it in a location were flammable concentrations of gases and vapors may exist.

WARNING

Compressed Gases

Cylinders of compressed gas, such as hydrogen and calibration gas, must be handled with extreme care. When using the calibration gas bag adapter, take care not to kink or stress the tubing. For safety, the hydrogen and calibration gas cylinders must be secured before use.

Please observe the following handling procedures:

- Do not mutilate cylinders.

- Do not expose the cylinders to direct sunlight.

- Do not heat the cylinders. The cylinders may rupture at high temperatures.

- Use only the specified regulator for the calibration gas. Confirm regulator type and material with your specialty gas supplier. Use only the MicroFID refill adapter for the hydrogen (Part No. MX396004).

- Always secure cylinders before removing the cylinder valve protection cap

- Do not drag or roll cylinders. Use a cylinder hand truck to move large cylinders.

- Wear safety glasses when working with compressed gases.

- Store cylinders in an upright position.

- Do not store cylinders in a hazardous location.

- Store cylinders away from possible sources of ignition.

- Keep regulators and related equipment in the same gas service. Do not change service or adapt equipment without consulting your gas supplier.

Regulators for Compressed Gases

When connecting a regulator to a large cylinder:

- Ensure cylinder valve and regulator connection match.

- Ensure regulator construction materials are compatible with the gas, and that the cylinder pressure gauge will withstand the cylinder pressure.

- Never use the regulator as a shut-off valve. Close the cylinder when it is not in use.

- Do not subject the regulator to an inlet pressure greater than recommended.

- Do not move or detach the regulator when it is pressurized or when it is in use.

- Before connection, ensure the gas cylinder valve and the regulator CGA connection are clean.

- Turn the pressure control valve on the cylinder all the way out (close the cylinder). Turn the regulator outlet to off. Open the gas cylinder valve slowly and check for leaks. Adjust the delivery pressure and then open the regulator outlet valve.

Hydrogen Gas

Hydrogen gas is a fire and explosion hazard when exposed to heat or flame. The lower explosive limit (LEL) is 4%. The lower explosive limit is the minimum concentration of gas or vapor in air that will ignite in the presence of a source of heat or sparks.

Refer to the Material Safety Data Sheet (MSDS) before handling this gas. You will receive the MSDS from your gas supplier when you order the gas.

Calibration Gas

Adequate ventilation must be provided when MicroFID is being calibrated.

If compound threshold limit values (TLV™) are exceeded, you should use a gas bag for sampling and calibration.

To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder. See *Calibration* on page 65 for details of calibration using a gas bag.

Battery Pack Care

Do not leave battery packs uncharged for an extended period of time. This will result in damage to the battery packs and possible loss of logged data.

Leaving MicroFID for more than 3 months, without turning it on, may result in the loss of recorded data and setup parameters. If MicroFID is not used for long periods of time, turn the instrument on for a few hours every month to avoid loss of data. See *Battery Charging* on page 30 for instructions on charging the battery.

Please observe the following:

1. For replacement battery pack use only Part No. MX396005 or MX396006.

2. Do not dispose of the battery pack in a fire. The cell may explode. Check with local codes for possible special disposal instructions.

3. The battery pack is 57% lead (Pb) by weight. This battery pack must be disposed of properly. Check with local codes for special disposal instructions.

4. Do not open or mutilate the battery pack. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.

5. Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conduct or may overheat and cause burns.

6. Do not defeat proper polarity orientation between the battery pack and battery charger.

7. Charge the battery pack using the charger provided with or identified for use with this product only in accordance with the instructions and limitations specified in this manual. For battery charger use only Part No. MX396014 (110 V AC), MX369013 (220 V AC).

Excessive Heat and Cold

Do not expose the instrument to intense sunlight for prolonged periods.

Exposure to excessive heat may result in erroneous readings.

At low temperatures, water vapor, a by-product of the hydrogen flame, may condense at the exhaust port. At sub-zero temperatures the water vapor will freeze and obstruct the exhaust port. If the exhaust port becomes obstructed, pump operation will be inhibited. Flame out may also result.

Transporting MicroFID

When you transport MicroFID, you should empty the internal hydrogen cylinder and then refill it when you arrive at your destination.

If you are transporting MicroFID in the carry case or in any enclosed container, you must empty the hydrogen cylinder and fill it when you arrive at your destination

If you are traveling by passenger aircraft, you must empty the cylinder. You cannot transport MicroFID by passenger aircraft with hydrogen in the cylinder. Refer to *Emptying the Hydrogen Cylinder* on page 110 for more details.

Oxygen Concentration Limits

A minimum of 17% oxygen is required to start the hydrogen flame. The oxygen is supplied from the sample as it is drawn in by the pump. A minimum of 10% oxygen is required to maintain the hydrogen flame. An oxygen deficiency will reduce the height of the

flame or cause the flame to be extinguished and may affect the displayed reading.

If you will be using the MicroFID in a highly contaminated area where it is possible that the oxygen content is below 10%, watch for indications of reduced flame height such as lowered detection limits or a flame out fault.

Flammable Gases

High concentrations of flammable gases (gases within their flammable range) can act as an additional fuel source. When this happens, the flame height may increase beyond the confines of the combustion chamber. The hydrogen supply will then be cut off and the flame will go out.

Flame out may also occur when the concentration of sample gas is so great that it causes an oxygen deficiency. This may occur when sampling enclosed or confined spaces where vapors and gases cannot escape. Watch for indications of increased flame height such as erratic readings or sudden high concentrations followed by a flame out fault.

Unpacking

The following accessories are included with your MicroFID:

1. Shoulder Strap

2. Sample Probe

3. MicroFID Instrument Manual

4. Hydrogen Refill Adapter

5. MicroFID Multi-Tool

6. Battery Charger with AC Line Cord

7. Replacement Sample Inlet Filters (10 pieces)

Ensure all of these accessories have been included with the instrument. If any items are missing or damaged, contact PerkinElmer immediately.

Support Equipment and Consumables

Hydrogen Fuel

You must obtain a tank of hydrogen from which you can fill the internal cylinder. When ordering hydrogen specify ultra high purity hydrogen, 99.999% pure. This grade of hydrogen is also referred to as Grade 5 or zero zero grade. The hydrogen must have less than 1 ppm hydrocarbon contamination.

You can obtain the hydrogen in various size cylinders. Regardless of the cylinder size, the cylinder must have a fill pressure of at least 1800 psig in order to completely fill the MicroFID internal cylinder. Specify a tank with no more than 2400 psig.

The hydrogen cylinder must also have CGA 350, male outlet.

The MicroFID refill adapter (Part No. MX396004) is shipped with the instrument. You cannot fill the MicroFID hydrogen cylinder without the refill adapter.

If the hydrogen supply tank is more than 6 months old it should be replaced with a new cylinder.

Calibration

For normal operation these items are required:

1. Calibration Kit (Part No. MX396011). The calibration kit contains a regulator, a gas sampling bag and a gas bag adapter.

2. Calibration gas containing the appropriate concentration of methane. The exact concentration of the calibration gas will depend on your application. 500 ppm methane in air is available from PerkinElmer. (Part No. MX396028)

Some applications may require calibration gas at more than one concentration. When ordering calibration gas, specify methane in hydrocarbon free air. Air should have not more than 0.1 ppm total hydrocarbons (THC).

Method 21 protocol requires that commercial cylinders of calibration gas be analyzed and certified to be within +/- 2% accuracy and a shelf life must be specified on the cylinder. At the end of the shelf life, the cylinder must be replaced or re-analyzed.

If you will be using a portable cylinder, specify a regulator with a C-10, 5/8" - 18 UNF valve inlet and a 1/4" parallel, compression fitting outlet. A regulator, matching this specification, is included in the calibration kit.

If you will be using large tanks of gas, specify a single stage, high purity regulator with a CGA 590 connection at the inlet. The regulator should also have a 1/4" parallel, compression fitting outlet with which to connect the regulator to the gas bag adapter. The delivery pressure must be adjustable to approximately 40 psig (275 kPa).

3. Zero air. Occasionally, clean, ambient air is suitable for calibration. If you are unsure about the quality of ambient air, you can connect a charcoal filter (Part No. MX396021 or MX396022) to MicroFID during the first step of calibration.

    Alternatively you can use an additional gas sampling bag and a source of hydrocarbon free air. Air should have not more than 0.1 ppm total hydrocarbons (THC).

    If you will be using large tanks of gas, specify a single stage, high purity regulator with a CGA 590 connection at the inlet. The regulator should also have a 1/4" parallel, compression fitting with which to connect the regulator to the gas bag adapter. The delivery pressure must be adjustable to approximately 40 psig (275 kPa). You should obtain an additional gas bag and gas bag adapter. (Part No. MX396017 - gas bag, MX396010 - gas bag adapter)

Field Operation

For field operation a MicroFID Field Kit (Part No. MX396058) is available. The field kit includes a printer cable, a long sample probe, a carrying case and a calibration kit.

Refer to the check list in *Preparing for Field Operation* on page 82. Ensure you have all the necessary accessories and equipment before beginning field operation.

Printer

MicroFID may be used with a serial printer. The printer must have a print width of at least 65 characters and a proportionally spaced font. A serial printer with an RS-232 port, can be connected directly to MicroFID. See *Printer* on page 87 for details of connecting a printer to MicroFID.

If you are using a parallel printer, you will need the serial to parallel converter (Part No. MX380145). See *Serial to Parallel Converter* on page 98 for details.

NOTE: *MicroFID is not classified for use in hazardous locations with a printer.*

Computer

MicroFID may also be connected to a computer. The computer must be 100% compatible with an IBM PC. You can use the printer cable to connect MicroFID to the computer.

You will also need terminal emulation software. If you are using Microsoft® Windows™ you do not need to purchase any separate software. If you are already using another type of communication or terminal emulation software package, it is not necessary to purchase separate software for MicroFID. See *Computer* on page 88 for details.

NOTE: *MicroFID is not classified for use in hazardous locations with a computer.*

Battery Charging

Before beginning operation of MicroFID, the battery pack must be charged. You can connect the battery charger to the battery pack while the battery pack is still attached to MicroFID. You can also remove the battery pack and replace it with a fully charged, spare pack (Part No. MX396005 or MX396006) and charge the battery pack independently of the instrument.

Removing and Replacing the Battery Pack

NOTE: *Do not remove or recharge the battery pack in a hazardous location.*

To remove the battery pack:

1. Stop the flow of hydrogen gas by turning the hydrogen shut-off valve fully clockwise. See *Figure 1*. If the instrument has been turned on, turn it off by pressing the On/Off switch twice.

2. Use the MicroFID multi-tool to loosen the two captive screws in the bottom of the battery pack.

3. A retainer at the rear of the instrument helps to secure the battery pack to the instrument. Free the battery pack from the instrument.
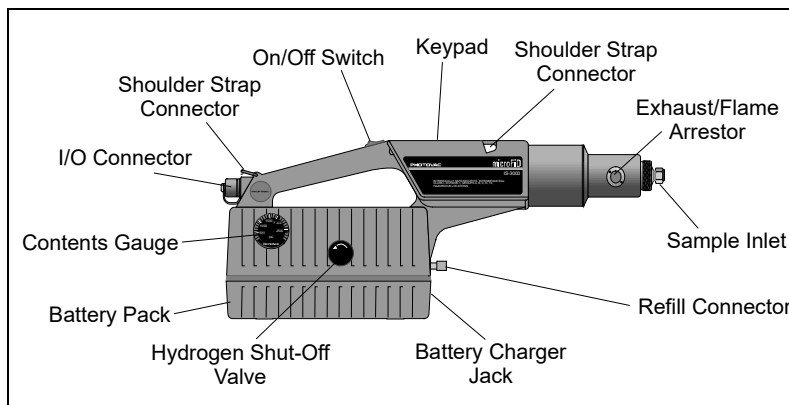
Figure 1   MicroFID Layout

4. Connect the charged battery pack to the retainer at the rear of the instrument.

5. Use the MicroFID multi-tool to tighten the two captive screws into the bottom of the battery pack. Do not over-tighten the screws.

Charging the Battery Pack

To charge the battery pack:

1. Ensure the correct plug is installed on the line cord of the battery charger. If it is not correct for the wall outlet in your area, then it must be replaced. See *Installing Alternate AC Plug on the Battery Charger* on page 147.

NOTE: *Do not charge the battery pack in a hazardous location. Use only a MicroFID battery charger.*

2. Plug the charger into the jack located on the front of the battery pack.

3. Plug the charger into an AC outlet.

   The LED, on the battery pack, indicates the charge state. Red indicates the battery is being charged. Green indicates the battery is fully charged and ready for use.

   It is normal for a fully charged battery to indicate it is charging (red light) when first plugged in. The LED will turn green as the battery charges.

4. When the battery pack is fully charged remove the charger, first from the wall outlet then from the battery pack.

5. If you removed the battery pack from the instrument to recharge it, you can replace the battery pack now or when necessary.

Charging a fully discharged battery pack will take approximately 8 hours. Leaving the charger connected to a charged battery pack will not harm the battery or the charger in any way. If a battery pack is

to be left indefinitely, leave it connected to the charger so that it will be fully charged and ready for operation.

On average a fully charged battery pack will provide 15 hours of continuous operation. Battery life is shorter if the instrument is turned off and then on again repeatedly.

Filling the Hydrogen Cylinder

The Refill Adapter

<table>
<tr>
<td>⚠️
WARNING</td>
<td>*DO NOT attempt to fill the hydrogen cylinder without a refill adapter!*</td>
</tr>
</table>

The refill adapter (Part No. MX396004) consists of an adapter fitting with a left handed thread for cylinder attachment, a three-way valve and a flexible hose. The three-way valve can be positioned to deliver gas from the cylinder to the port on the MicroFID. Alternatively, the valve can be turned to release gas held in the hose, after filling. A flow restrictor is also incorporated in line with the hose in order to limit the rate of gas flow.

<table>
<tr>
<td>⚠️
WARNING</td>
<td>*DO NOT MODIFY OR DISASSEMBLE THE REFILL ADAPTER! If you have any problems, the unit must be returned for repair or replacement.*</td>
</tr>
</table>

Connecting the Refill Adapter to the Hydrogen Tank

NOTE: *Read through this section before filling the internal cylinder.*

Store the hydrogen tank in a well ventilated area, well away from heat or possible ignition sources.

> *Hydrogen gas is a fire and explosion hazard when exposed to heat or flame. The lower explosive limit is 4%.*

WARNING

---

1. Connect the refill adapter to the tank of hydrogen. Hydrogen is usually supplied with a CGA 350 cylinder valve outlet. The refill adapter is supplied with the matching fitting for ease of connection.

NOTE: *Do not force the connection.*

Do not use Teflon tape with CGA fittings. In general, these fittings are designed for metal to metal sealing.

Do not use adapters to connect one CGA fitting to another type of CGA fitting. If the refill adapter does not match the outlet on your hydrogen tank contact PerkinElmer.

2. Tighten the refill adapter onto the tank with a wrench. Do not over tighten.

3. Hold the flexible hose and open the cylinder. Ensure there are no leaks. Use soap solution to leak test the connection.

DO NOT use an open flame to test for leaks!

WARNING

Filling the Internal Hydrogen Cylinder

Do not fill the hydrogen cylinder in a hazardous location.

WARNING

1. Turn MicroFID off.

2. Place MicroFID on a sturdy, flat surface within easy reach of the flexible filling hose.

3. Turn the refill adapter 3-way valve so that it points away from the cylinder. See *Figure 3*.

4. Hold the delivery hose and turn the 3-way valve on the refill adapter so that it points towards the cylinder. Open the cylinder valve. A steady flow of gas will be heard escaping from the end of the flexible hose. This serves to purge the hose of any impurities. Return the 3-way valve to point away from the cylinder.

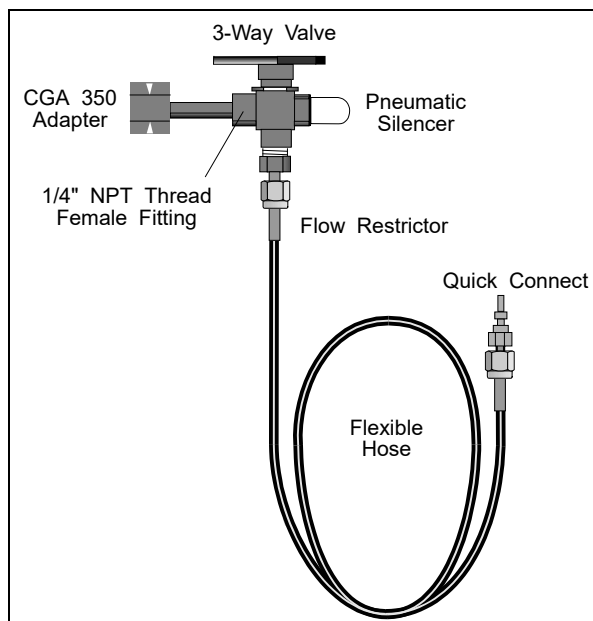**Figure 2   MicroFID Refill Adapter**

5. Hold the knurled collar of the MicroFID refill connector and slide it in towards the instrument.
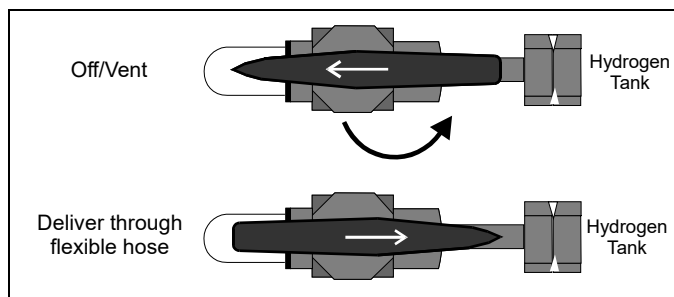
Figure 3   Refill Adapter 3-Way Valve

6. Insert the fitting at the end of the flexible hose into the port until it seats against the port. You will hear a click.

7. Release the knurled collar and allow it to slide up to its original position.

8. Turn the 3-way valve on the refill adapter so that it once again points towards the cylinder and watch the pressure increase on the MicroFID Contents Gauge.

⚠	*DO NOT leave the MicroFID unattended during the filling procedure! It is possible to overfill the cylinder and damage MicroFID.*
WARNING	

9. The contents pressure MUST NOT exceed 2400 psig and the cylinder valve must be closed before this occurs.

10. When the contents gauge on MicroFID indicates Full (approximately 1600-1800 psig), turn the 3-way valve to point away from the cylinder. This will stop the flow of gas to MicroFID. High pressure gas trapped in the flexible hose will be vented. A check valve in the MicroFID prevents gas in the reservoir from escaping.

11. Close the cylinder valve on the tank of hydrogen.

12. AFTER relieving the gas pressure in the hose, disconnect it from MicroFID. Pull the knurled collar down and extract the fitting.

The internal cylinder is now full and will provide approximately 11 hours of operation.

If you have not used MicroFID for six months or longer, empty the hydrogen cylinder and refill it before beginning operation. See *Emptying the Hydrogen Cylinder* on page 110 for more details.

Overview

MicroFID measures the concentration of airborne organic, combustible gases and vapors and automatically displays and records these concentrations. It does not distinguish between

individual pollutants. The reading displayed represents the total concentration of all ionizable chemicals present in the sample. MicroFID does not distinguish between individual pollutants.

MicroFID operates automatically. The user reads concentrations directly from the display. The display updates itself twice per second.

MicroFID has many datalogging options. You can select an averaging interval, you can log all data with no averaging or you can use the Method 21 mode. If you select an averaging interval, the minimum, maximum, and average concentrations measured in each period are automatically recorded in MicroFID's datalogging memory, if the datalogger is turned on. If you are recording all data with no averaging you will only be able to log data for a short time before the datalogger becomes full. If you are averaging data you can log data for a longer period of time. The exact duration will depend on the averaging interval.

The Method 21 mode prompts you to locate a site and then to record a background and sample reading for the site. You can record up to 750 such entries. There is no averaging of data in Method 21 operation.

Recorded data can be played back from memory on MicroFID's display, sent to a printer in either tabular or graphical format or sent to a computer. Data are recorded by date, time, and by an event name. Event names can be entered using the MicroFID keypad, an external bar code reader or a computer. Data are played back by specifying the start event name.

The keypad is used to set up and calibrate MicroFID, and allows you to manipulate the concentrations measured and recorded by MicroFID in various ways. MicroFID has 16 keys for direct numeric entry and for using MicroFID's functions.

All information entered from the keypad, the bar code reader or the computer and stored in MicroFID's memory is retained when the instrument is switched off. The clock and calendar continue to operate and do not need to be reset each time MicroFID is used.

Tutorial Session 2

Beginning Operation

To print or review logged data, you can operate MicroFID without the flame. You conserve the hydrogen this way.

If you choose to start the flame, MicroFID will attempt to ignite the flame once you have turned on the flow of hydrogen gas. If MicroFID has been unused for a while it is possible that the gas supply lines are filled with air. If the flame cannot be started, MicroFID will begin a 30 second purge cycle. During the purge cycle it will flush the gas supply lines with hydrogen. After the purge cycle it will attempt to light the flame again. If it fails again, another purge cycle will be performed and MicroFID will try a third time to ignite the flame.

To operate MicroFID:

1. Turn the instrument on by pressing the front of the On/Off switch. When the instrument is powered up, the version number and creation date of the instrument software are displayed. Press ENTER.

2. You will be prompted to start the flame. If you do not want to start the flame, use the ARROW keys to select "No Flame Needed" and press ENTER. To start the flame use the ARROW keys to select Start Flame and press ENTER.

3. If you selected "Start Flame", MicroFID will prompt you to start the flow of hydrogen. Turn the shut-off valve counterclockwise to start the flow of hydrogen and press ENTER. See *Figure 1* for the location of the shut-off valve.

4. The pump will start and MicroFID will then ignite the flame. You will hear a small pop when the flame has been ignited. Once the flame has been started the message "Detector flame has been started OK" will be displayed followed by the default display, shown in *Figure 4*.
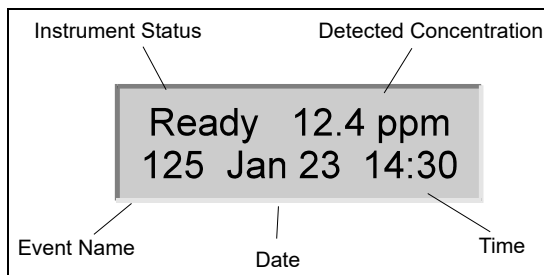
Figure 4   Default Display

The default display provides the following information: instrument status, current detected concentration, Event name (if the datalogger is on), time, and date. If an event name is longer than three characters the bottom line of the display will scroll through the information.

The instrument status appears at the left of the upper line of the display and on the Print and Graph outputs. Each status has a priority assigned to it. If more than one status is in effect, then the status with the highest priority is displayed until the condition is corrected or until the option is turned off.

When the bar graph is selected, the instrument status is reduced to a one-letter code.

Status	Code	Priority	Description
NoFlm	N	1	Flame has not been ignited.
Check	K	2	One of 4 faults is occurring. Press the TUTOR key for details.
Over	O	3	Detector electronics have been saturated.

Table 1   Instrument Status

Status	Code	Priority	Description
Cal	C	4	This status will never be observed on the display during normal operation as various calibration prompt messages are displayed while MicroFID is calibrating. If the instrument is turned off during calibration, Cal will appear on the display when MicroFID is turned on again indicating the last calibration was incomplete. "Cal" status is also shown on printed and graphed output.
Alarm	A	5	Detected concentration exceeds the set alarm level.
LoBatt	L	6	Battery pack power is low. Connect MicroFID to AC supply or replace the battery pack.
Play	P	7	The instrument is playing back previously recorded data.
Endlog	E	8	The datalogger is full.
Sniff	S	9	High Sensitivity operation.
Ready	R	10	Normal operation.
Locate	L	11	Locate site. Used for Method 21 operation
BkGnd	B	12	Record background reading. Used for Method 21 operation
Sample	S	13	Record sample reading. Used for Method 21 operation
Max	M	14	Displays maximum detected concentration.

Table 1   Instrument Status - continued

To turn the instrument off:

1. To turn the instrument off, press the front of the On/Off switch. You will then be prompted to turn of the flow of hydrogen.

2. Stop the flow of hydrogen gas by turning the hydrogen shut-off valve fully clockwise.

3. Pressing the On/Off switch twice to power down the instrument.

Tutorial Session

TUTOR Key

To assist you in learning the key functions, MicroFID has a built-in tutorial session that displays a two-line description of the function of each key. Pressing the TUTOR key begins a tutorial session and pressing the EXIT key after any other key, ends the session. While in the tutorial session, key presses have no effect on MicroFID's operation.

To begin a tutorial session:

1. Turn on MicroFID and select the "No Flame" option.

2. Press the TUTOR key and begin a tutorial session.

3. Press each key and read the display. The tutorial display for each key is provided in *Table 2*.

If a fault is encountered during normal operation, press the TUTOR key to display a description of the fault. If more than one fault is occurring at the same time, press the TUTOR key to see each of the faults in turn. When all the faults have been viewed, press EXIT to return to the normal display.

Key	Tutor Description	Key	Tutor Description
BATT	Shows battery V normally 6-8.9V	ALARM	Shows set-point for conc alarm
DISPLAY	Displays conc as graph or numeral	SETUP	Sets date time & options for keys
LIGHT	Shows detector flame status	MAX	Displays highest conc measured
AUDIO	Selects alarm or tone or no audio	EVENT	Sets options for recording data
PRINT	Prints table of recorded data	TUTOR	Press a key then read explanation
GRAPH	Prints graph of recorded data	CLEAR	Erases the last number pressed
PLAY	Replays recorded data on display	EXIT	Exits from tutorial session
CAL	Calibrates with zero & span gas	ENTER	Confirms display then continues

Table 2   TUTOR Displays

Key Functions

Press a key to execute a function. If there are no options to the key function, the key acts immediately. The BATT key is one example. If there are options, the current option is displayed. You are prompted to display the other options by pressing the ARROW keys. Pressing ENTER confirms that the displayed value is correct and moves to the next option.

If the function requires numeric input, the current value is displayed. You can change the value using the numeric keys on the

keypad. Pressing ENTER confirms that the displayed value is correct and moves to the next key option.

Some functions have multiple steps for options and/or numeric inputs. These are arranged so that the most frequently changed inputs are displayed first. Once the desired changes have been made you can bypass the rest of the steps by pressing EXIT.

Each key function is described in more detail in the following sections. Leave MicroFID on and try each key in turn.

BATT Key

Press the BATT key to open a window that displays the battery voltage. The voltage will be 9 volts when the instrument is fully charged. When the voltage drops below 7.2 volts, a "LoBatt" status will be displayed and the battery pack must be recharged. See *Battery Charging* on page 30.

NOTE: *Do not remove or recharge the battery pack in a hazardous location.*

An audio signal will be generated when "LoBatt" occurs. The signal will not clear until you connect the battery pack to an AC supply or replace the battery pack with a fully charged one.

NOTE: *Do not leave the battery pack uncharged for an extended period of time. This will result in damage to the battery pack.*

DISPLAY Key

If a numerical display is shown, pressing DISPLAY will change it to a bar graph. If the bar graph is shown, pressing DISPLAY changes it to a numerical display. The top line of the bar graph display shows the instrument status and the concentration range. The bar graph range is selected with the SETUP key.

In the bar graph display, the instrument status becomes a one-letter code. See *Table 1* for a description of the instrument status codes.

The bottom line of the display remains unchanged in bar graph mode and will continue to scroll and display data.

LIGHT Key

Press the LIGHT key to display the flame status. If the flame has been ignited and is burning, the status will be Detector flame is lit. If you are not analyzing, the flame status will be "Detector Flame is not lit".

EXIT Key

The EXIT key terminates all MicroFID functions. When you press the EXIT key the display reverts to the default display. Most functions exit automatically if no key is pressed for 15 seconds.

When EXIT is pressed during printing, MicroFID stops sending information to the printer. The printer will continue to print until its buffer is empty.

CLEAR Key

CLEAR erases the last entry. If a value is entered in error, press CLEAR to erase the entry and then re-enter the correct number.

CLEAR used in conjunction with the MAX key clears the Max register.

MAX Key

Press the MAX key. The maximum concentration, the event during which it was encountered and the time and date of the occurrence will be displayed. Max is shown for 15 seconds and then the display reverts to the default display.

Press MAX then press CLEAR twice to reset the Max register. "Max Cleared" will be displayed with the current date and time. After 15 seconds the display reverts to the default display.

Recording of real time data is not interrupted when the MAX key is pressed or when the Max register is cleared.

AUDIO Key

If an "Alarm" status, "LoBatt" status or a flame out fault occurs, an audio signal will be generated. Under these conditions you will hear the audio signal even if a headset is not connected.

If you have a "LoBatt" status, the audio signal will not clear until you connect the battery pack to an AC supply or replace the battery pack with a fully charged one.

If a flame out fault has occurred, the audio signal will not stop until the flame has been re-started or you turn MicroFID off.

In the case of an alarm condition, an audio signal will be generated when an alarm is encountered.

To turn off the audio signal on alarm:

1.   Press the AUDIO key.

2.   Select "Audio Off" with the ARROW keys and press ENTER.

ALARM Key

Press the ALARM key to display the current alarm level or to enter a new alarm level. The displayed alarm level is specific to the current Cal Memory. When the Cal Memory is changed, the alarm level associated with the newly loaded Cal Memory will be displayed and used during sampling.

To display the current alarm level or to enter a new alarm level:

1.   Press CAL and select the desired Cal Memory. Press ENTER and then press EXIT. You do not want to calibrate MicroFID at this point.

2. Press ALARM to display the current alarm level. If this value is correct, press EXIT to return to the normal display.

3. If a new value is to be set, enter the new value, and press ENTER. This alarm level is specific to the current Cal Memory.

When an alarm condition is detected, the instrument status changes to "Alarm" and an audio signal is generated. The "Alarm" status will not clear until the detected concentration falls below the set alarm level.

PLAY Key

The PLAY key plays back previously recorded data.

To play back previously recorded data:

1. Press PLAY. Two options are available. Pressing ENTER begins playback where it was last stopped. Press the SETUP (*) key to set the playback options.

2. Select the start Event. MicroFID will display a list of available events. Use the ARROW keys to scroll through the list. When the start event you want is displayed, press ENTER.

NOTE: *An event name may not be available if it has been deleted.*

3. If data has been averaged over an interval, select which value is to be displayed, either the Minimum, the Average, or the Maximum, and press ENTER. If you are playing back Method 21 data select Background, Sample or Difference to be displayed.

4. The data can be played back in either numerical or bar graph display. Press the DISPLAY key to select the desired option.

5. Press the ARROW keys to play back the data. You can move forward or backward through the datalogger.

6. Press EXIT at any time to return to normal operation.

If the flame is on, MicroFID is measuring and recording real time concentrations when the instrument status is "Play". If, during playback, an instrument status with a priority higher than that of "Play" is encountered in real time, it will be displayed. MicroFID will however, continue to play back recorded data.

The PLAY function provides a speed search to review data or to find the desired start and stop event names for printing or graphing.

SETUP Key

The setup key is used to enter analysis information. Press SETUP and step through the options. Press ENTER to accept the displayed data or enter a numerical value using the keypad and then press ENTER. If no values are entered the display reverts to the default display after 15 seconds.

To enter analysis information:

1. The first option is for the detector. If you have been using the instrument with no flame and you now need to start the flame, use this option. You can also use this option to start the flame after a flame out fault. If you do not want to change the status of the detector use the ARROW keys to select "No Change". Press ENTER to move to the next option.

2. The next option is Repair. Use Repair to record the state of repair. You must define the repair codes and ensure all users are aware of the codes. This option is most useful for Method 21 monitoring.

    For example, a code of 0 may represent no repair under way, 1 may represent first attempt at repair with 5 days, 2 may represent final repair attempt within 15 days, 3 may indicate irreparable damage, and a 4 may represent a state in which a repair can not be attempted until the next scheduled shut down.

3. Next, select the operating range. This option sets the full-scale range for the bar graph display, the graph output. Use the ARROW keys to select a Range of 20, 200, 2000, 10000,

50000 ppm. This does not affect MicroFID's numeric display and datalogging.

4. Select the Interval next. You can average data over intervals of 1 second (s) 5 s, 10 s, 15 s, 30 s, 1 minute (m), 2 m, or 5 m. You may also select Method 21 mode.

   If you select Method 21, the datalogger will be cleared. If you do not want to lose your previously recorded data, press EXIT. Then print or save the data to disk before changing the interval to Method 21. See *PRINT Key* on page 55, *GRAPH Key Mode* on page 58 and *Computer* on page 88 for more information on printing and saving logged data.

NOTE: *The datalogger will be cleared when you change from Interval mode to Method 21.*

Method 21 mode first prompts you to locate a specific sampling site and then allows you to record both a background and sample entry in the datalogger. Method 21 mode will be covered in more detail on page 72.

5. The date option is next. Enter the current day, month and year. Press ENTER to confirm the entry. The date is retained when the instrument is turned off. You do not need to enter this information every time you use MicroFID.

6. Next enter the correct time. Press ENTER.

EVENT Key

Events may be used to identify a particular sample or sampling location in memory. An event name is used in Method 21 operation to identify a sampling location. Recorded data are played, printed and removed from the datalogger by specifying a start and stop event name.

The EVENT key controls MicroFID's datalogger. Press the EVENT key to see the event options.

To display or add events:

1. Press the ARROW keys until the "Insert" option is displayed.

2. To insert an event, press ENTER. You will be prompted to enter an event name. You can enter a numerical name directly from the MicroFID keypad or you can connect MicroFID to a computer and enter the event name using the STAR 21 Software (Part No. MX396027). An event name may be up to 16 characters long. Refer to the Software Manual for the STAR 21 software for details of using the software with MicroFID.

3. Press the ARROW keys to move to the next option.

    If you want to delete a range of events you must select a start and stop event. Use the ARROW keys to scroll through the list of events to select the start event and then to select the stop event.

NOTE*: Deleted information cannot be recovered. You should play back and print or download the contents of the datalogger before deleting any information.*

4. You can delete the current event, all recorded events or a range of events. Press ENTER then use the ARROW keys to select the desired option.

5. You can turn the datalogger off by selecting Stop. MicroFID will continue to analyze, but no data will be stored. To turn the datalogger on again press the EVENT key and use the ARROW keys to select Start. MicroFID will begin logging data again.

6. You can find a specific event in the datalogger using the "Find" option. Use the ARROW keys to scroll through the list of events to select the desired event. When you press ENTER, the selected event will be displayed. Use this option in Method 21 operation to find an event for monitoring or re-monitoring.

7. The next option is "Scan". You can use a bar code reader (Part No. MX396054) to scan a bar coded event name. See *Bar Code Reader* on page 103 for details of connecting the bar code reader to MicroFID.

8. To activate the bar code reader, use the ARROW keys to select "Scan". Press ENTER to activate the bar code reader. It will remain activated until you scan a code. If no bar code is scanned within 15 seconds the bar code reader will be deactivated. This is done to conserve battery life. "Scan", when used with the bar code reader has the same function as the "Insert" option.

MicroFID can record continuously until the datalogger is full. When the datalogger is full the instrument status will change to "Endlog". The datalogger will stop logging data when it is full.

If it is necessary to retain a copy of recorded data, the data should be printed or stored in a computer when "Endlog" is displayed. This will prevent loss of information.

CAL Key

The CAL key is used to calibrate MicroFID. Calibration has been automated for ease of operation. Before beginning calibration ensure you have a reliable source of zero air and calibration gas. A brief description of the functions under the CAL key will be provided here. For more information on calibrating MicroFID, see *Calibration* on page 65.

When you press the CAL key you will first be prompted to select a Cal Memory. Each Cal Memory stores a unique zero point, sensitivity setting, response factor and alarm level.

You will then be prompted to enter a response factor. Refer to *Response Factors* on page 148 for a list of response factors. If the compound is not in this list or you are measuring gas mixtures, enter a value of 1.00. The concentration detected by MicroFID will be multiplied by the response factor before it is displayed and logged.

Next select Low Range or High Range operation. Use Low Range if you are sampling concentrations between 0.5 and 2000 ppm (methane equivalents). Use High Range if you are sampling concentrations between 10 and 50,000 ppm (methane equivalents).

You will now be prompted to connect a supply of zero air. You can use ambient air, a charcoal filter (Part No. MX396021, MX396022) to clean ambient air or, for best results, use a clean sampling bag filled with zero grade air.

After MicroFID has set its zero point, you then enter the concentration of the calibration gas and then connect the calibration gas. MicroFID sets its sensitivity for the specified Cal Memory. You must have a supply of calibration gas ready before calibrating MicroFID. See *Calibration* on page 28 for detailed calibration instructions.

When calibrating MicroFID, ensure the instrument is level. If MicroFID is tilted from side to side, gravity will affect the flame height and cause erroneous readings.
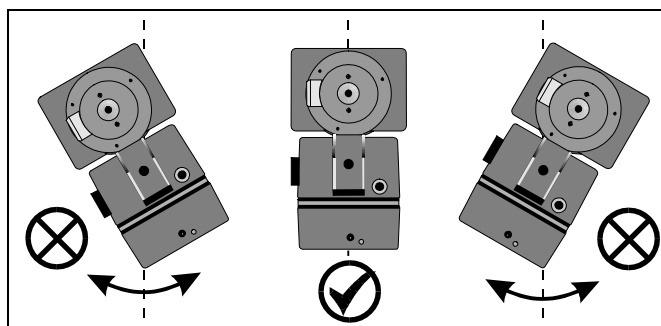
Figure 5   Keep MicroFID Level

PRINT Key

MicroFID has been designed for use with a serial printer. The printer must have a print width of at least 65 characters and a proportionally spaced font. If you are using a parallel printer, you will also need the serial to parallel converter (Part No. MX380145).

See *Printer* on page 87 for instructions on connecting and configuring a printer for use with MicroFID. See *Serial to Parallel Converter* on page 98 for instructions on connecting the serial to parallel converter to MicroFID and to the printer.

When MicroFID is printing data it is still measuring real time concentrations.

NOTE: *MicroFID is not classified for use in hazardous locations with a printer*.

To print data:

1. Turn MicroFID off.

2. Use the MicroFID printer cable (Part No. MX396051) to connect the MicroFID I/O connector to the printer.

3. Turn MicroFID on and press the PRINT key and then the SETUP (*) key to select the desired setup options.

4. MicroFID will ask for the start and stop Events. Use the ARROW keys to scroll through the list of events to select the start event and then to select the stop event.

5. Enter an ID number if desired. Any number up to 16 digits long may be entered as an ID number.

   The ID number can be used, for example, to differentiate between users or instruments. If more than one person is using a single instrument, each person can use an individual number for printed reports. If more than one MicroFID is

being used, each instrument can have its own ID number on printed reports.

If an ID number is not required, leave this option blank and move to the next option by pressing ENTER.

6. Enter the baud rate. This value is specific to the printer being used and must be set correctly. Refer to the printer user's manual to determine the correct baud rate

7. Enter the parity. The parity is specific to the printer being used and must be set correctly. Most printers will have parity set to none.

8. When the setup is correct, ensure the printer is on-line and press ENTER.

MicroFID stores one set of readings (Min, Avg and Max) each interval. In each averaging interval the printed minimum is the minimum of all the stored readings in that interval. The printed Avg is the average of all the recorded average readings and the Max is the maximum of all the recorded maximum readings. In Method 21 operation, the background, sample and the difference are stored.

When you are using interval mode, the date and time are printed along with the event name, repair code and the minimum, average and maximum concentration of each interval. The date, time, event name, and repair code are only printed when they change.

```
             Photovac MicroFID Analysis Report
                    (All units are PPM)
                          ID: 100

Date              Time   Event REP Stat    Min     Avg     Max
Nov 28,94         16:06                     0.0     1.1     22.6
                  16:07                     0.0     11.6    91.7
                                   Ready    1.7     22.5    50.1
                                   Cal      8.0     16.0    22.0
                                            1.2     3.7     7.6
                                            0.0     0.4     1.2
                                            0.0     0.0     0.0
                  16:08                     0.0     0.0     0.0
                         112       HiSens   0.0     6.7     128.0
                                            2.9     173.0   503.1
                                            17.4    417.9   520.5
                                   Cal      485.5   515.0   519.5
                                            489.8   505.2   518.9
```

Figure 6   Printed Output for Interval Mode

When you are using Method 21 mode, the date and time are printed along with the event name, repair code and the background, difference and sample concentration of each interval. The date, time, event name, and repair code are only printed when they change. See *Figure 7*.

While the information is being printed, the display shows that printing is in progress. The keypad will not accept commands until the present print job has been completed.

Pressing EXIT during printing stops the job. The printer will continue to print until its buffer is empty.

```
             Photovac MicroFID Analysis Report
                    (All units are PPM)

                    ID:100781

Date              Time   Event REP Stat    BkGnd   Diff    Sample
Nov 30,94         13:29  100       Ready   1.7     15.4    17.2
                  13:35  101               1.7     15.8    17.6
                  13:48  102               0.8     0.0     0.8
                  14:13  103               1.6     8.2     9.8
                  14:53  104   3   Alarm   6.0     2464    2470
                  15:54  105       Ready   0.1     0.0     0.1
                  16:05  106               0.2     20.9    21.2
                  16:12  107               0.2     0.0     0.2
                  16:56  108               1.5     19.6    21.1
Dec 1, 94         10:39  109               0.2     0.0     0.2
                  10:57  110               0.1     98.6    98.8
                  11:13  111               122.0   215.7   337.8
                  11:29  112   2   Alarm   55.8    2474    2530
                  11:35  113   2           13.9    809.3   823.2
                  12:00  114       Ready   0.2     154.5   154.8
                  12:21  115               0.2     20.8    21.0
                  12:32  116               0.2     0.0     0.2
```

Figure 7   Printed Output for Method 21 Mode

GRAPH Key **Mode**

Pressing the GRAPH key prints the recorded data in graphical format. When MicroFID is graphing recorded data it is also measuring real time concentrations.

NOTE: *MicroFID is not classified for use in hazardous locations with a printer.*

To graph logged data:

1. Turn MicroFID off.

2. Use the MicroFID printer cable (Part No. MX396051) to connect the MicroFID I/O connector to the printer.

3. Turn MicroFID on and press the SETUP key to set the range for the graph. Use the ARROW keys to select the 20, 200, 2000, 10,000 or 50,000 ppm range.

4. Press the GRAPH key and then the SETUP (*) key to select the desired setup options.

5. MicroFID will ask for the start and stop events. Enter the desired event and press ENTER. Use the ARROW keys to scroll through the list of events to select the start event and then to select the stop event.

6. Enter an ID number if desired. Any number up to 16 digits long may be entered as an ID number.

    The ID number can be used, for example, to differentiate between users or instruments. If more than one person is using a single instrument, each person can use an individual number for printed reports. If more than one MicroFID is being used, each instrument can have its own ID number on printed reports.

    If an ID number is not required, leave this option blank and move onto the next option by pressing ENTER.

7. Enter the baud rate. This value is specific to the printer being used and must be set correctly. Refer to the printer user's manual to determine the correct baud rate.

8. Enter the parity. The parity is specific to the printer being used and must be set correctly. Most printers will have parity set to none.

9. When the setup is correct, ensure the printer is on-line and press ENTER.

MicroFID stores one set of readings (Min, Avg and Max) for each averaging interval. In each averaging interval the graphed minimum is the minimum of all the stored readings in that interval. The graphed Avg is the average of all the recorded average readings and the Max is the maximum of all the recorded maximum readings. In

Method 21 operation, the background, sample and the difference are stored.

In Interval mode the date and time are printed along with the event name and the repair code. The date, time, event name, and repair code are only printed when they change. See *Figure 8*.

A minus sign is used to draw the graph from the minimum to the average. Plus signs are used to graph the area between average and maximum.

In Method 21 mode the date and time are printed along with the event name and the repair code. The date, time, event name, and repair code are only printed when they change. See *Figure 9*.

A minus sign is used to draw the graph from the background to the difference. Plus signs are used to graph the area between difference and sample. Difference is calculated by subtracting the background from the sample.

```
        Photovac MicroFID Analysis Report
                (All units are PPM)


      ID:100
  Date   Time     Event   REP Stat   [0---------------2000]
  Nov 29,94       13:36   10         Ready  -
                                            -+
         13:37                              -
                                            -+
         13:38            Cal               ----+++
                                            ---+++
         13:39                              -
                          Ready             -
         13:40                              -
                                            -++
         13:41                              --+++++
                                            -----++
         13:42            Cal               -
                                            -
         13:43   11       HiSens            ---------+++++++++++
                                                              -----
-----++++++++
```

Figure 8   Graphed Output for Interval Mode

While the information is being printed, the display shows that printing is in progress. The keypad will not accept commands until the present print job has been completed.

Pressing EXIT during printing stops the job. The printer will continue to print until its buffer is empty.

```
                    Photovac MicroFID Analysis Report
                    (All units are PPM)

                    ID: 100781

Date                Time   Event REP Stat    [0---------------- 2000]
Nov 30,95           13:29  100       Ready   -
                    13:35  101               -
                    13:48  102               -
                    14:13  103               -
                    14:53  104   3   Alarm   ----------------------+
                    15:54  105       Ready   -
                    16:05  106               -
                    16:12  107               -
                    16:56  108               -
Dec 1,94            10:39  109               -
                    10:57  110               -+
                    11:13  111               --++
                    11:29  112   2   Alarm   ----------------------+
                    11:35  113   2           ----------+
```

Figure 9   Graphed Output for Method 21 Mode

Detailed Operation   3

Calibration

General Information

MicroFID must be calibrated in order to display concentration in ppm units equivalent to the calibration gas. First a supply of zero air, which contains no ionizable gases or vapors, is used to set MicroFID's zero point. Then, calibration gas, containing a known concentration of an ionizable gas or vapor, is used to set the sensitivity.

Occasionally clean ambient air will be suitable as zero air. Due to MicroFID's sensitivity, outdoor air is usually unsuitable for calibration. A charcoal filter (Part No. MX396021, MX396022) may be connected to the instrument to produce clean air from otherwise unsuitable ambient air. For best results, use a commercial source of zero grade air and a second sampling bag. Zero air should have not more than 0.1 ppm total hydrocarbons (THC).

Methane in air is recommended as span gas. The concentration of the calibration gas will depend on your application. When ordering calibration gas, specify methane in hydrocarbon free air. Balance air should have not more than 0.1 ppm total hydrocarbons (THC).

Method 21 protocol requires that commercial cylinders of calibration gas be analyzed and certified to be within +/- 2% accuracy and that a shelf life must be specified on the cylinder. At the end of the shelf life, the cylinder must be replaced or re-analyzed.

Preparing the Calibration Gas Bag and the Zero Air Bag

Use the calibration kit (Part No. MX396011) as follows:

> ⚠️ **WARNING**
>
> *Observe proper handling techniques for all gases! See* Warnings and Safety Practices *on page 22*.

---

1. Connect the regulator to the calibration gas cylinder.

    If you are using a portable tank of calibration gas, connect the regulator supplied with the calibration kit.

    If you are using a large cylinder of calibration gas, you must obtain a high purity regulator as specified in *Support Equipment and Consumables* on page 28. Methane in air is usually supplied with a standard CGA 590 cylinder valve outlet. Obtain a regulator with the matching fitting. Connect the regulator to the tank of calibration gas.

NOTE: *Do not force the connection.*

Do not use Teflon tape with CGA fittings. In general, these fittings are designed for metal to metal sealing.

Do not use adapters to connect one CGA fitting to another type of CGA fitting. If the regulator does not match the outlet on your calibration tank, contact your specialty gas supplier.

2   Tighten the regulator onto the tank with a wrench. Do not over-tighten.

3. Attach the knurled nut on the gas bag adapter to the regulator. Finger-tighten the fitting.
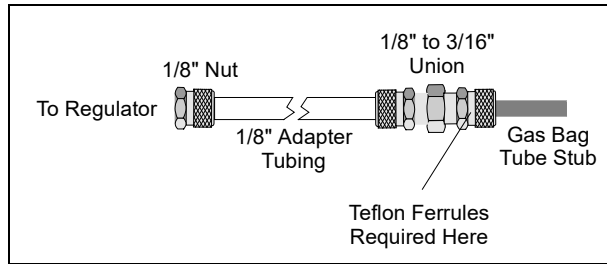
Figure 10   Gas Bag Adapter

4. Loosen the knurled nut on the reducing union of the gas bag adapter.

NOTE: *Do not remove the nut from the union, as the Teflon ferrules contained inside the nut may be lost. See* Figure 10.

5. Insert the tube stub from the gas bag into the knurled nut. Tighten the knurled nut and ensure the tube stub is secure. If the gas bag is not secure, ensure you have inserted the tube stub far enough into the knurled nut. Do not over tighten the fitting.

Over-tightening the Teflon ferrules will result in damage to the ferrules.

CAUTION

6. The union should be connected to the gas bag adapter. If it is not, then tighten the nut on the adapter tube to the union.

7. Open the gas bag valve. Turn the knurled plastic knob counter clockwise to loosen it, then use the knurled collar on the valve tube to gently push the valve tube toward the bag.
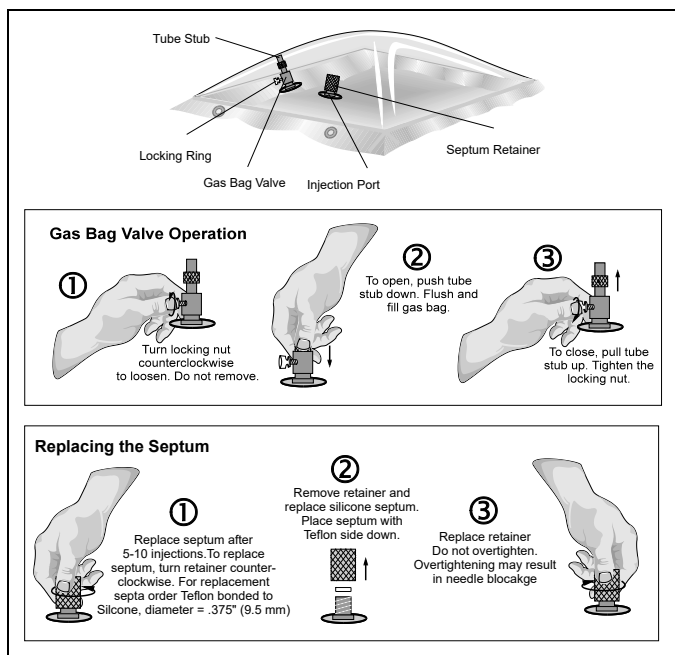
Figure 11   Using the Gas Bag

8. Turn the regulator knob counter clockwise about half a turn to start the flow of gas. Fill the gas bag about half full and then close the regulator.

9. Disconnect the gas bag from the gas bag adapter and empty the bag. Flush the bag a few times with the calibration gas and then fill it.

10. Close the gas bag valve. Gently pull the valve tube away from the bag, and then turn the knurled plastic knob clockwise to tighten it against the valve tube.

11. Remove the knurled nut on the adapter tube from the regulator.

12. Repeat this procedure, if necessary, to prepare a bag of zero air.

NOTE: *Do not use the same gas bag or gas bag adapter for the bag of zero air. You will contaminate the bag of zero air.*

Calibrating MicroFID

To calibrate MicroFID:

1. Press CAL and select the desired Cal Memory. MicroFID has 10 Cal Memories and can be calibrated with 10 different span gases or response factors if desired. Only one Cal Memory can be used at a time. Each Cal Memory stores a different response factor, zero point, sensitivity, and alarm level

2. Enter the desired response factor and press ENTER. Refer to *Response Factors* on page 148 for a list of Response Factors. If the compound is not in this list or you measuring gas mixtures then enter a value of 1.00. The concentration detected by MicroFID will be multiplied by the response factor before it is displayed and logged.

3. Select Low Range or High Range and press ENTER. Use Low Range if you are sampling concentrations between 0.5 and 2000 ppm (methane equivalents). Use High Range if you are sampling concentrations between 10 and 50,000 ppm (methane equivalents)

4. Connect the supply of zero air. If you are using room air press ENTER.

5. If you are using a charcoal filter, connect the filter as outlined in *Charcoal Filters* on page 95. Press ENTER and MicroFID will set its zero point.

NOTE: *The charcoal filter does not filter methane or ethane. If these compounds are present, use a gas bag with a supply of commercial zero air.*

6. If you are using a gas bag with zero air, connect the gas bag adapter to the inlet. Open the bag and press ENTER. MicroFID sets its zero point.

7. MicroFID then asks for the span gas concentration. Enter the known span gas concentration and then connect the gas bag adapter to the inlet. Open the bag.

8. Press ENTER and MicroFID sets its sensitivity.

NOTE: *Readings may fluctuate slightly as the gas bag empties. Do not allow the MicroFID to evacuate the bag completely.*

9. When MicroFID's display reverts to normal, it is calibrated and ready for use. Remove the span gas bag from the inlet.

10. Press the ALARM key and enter the alarm level for the selected Cal Memory.

Programming the Cal Memories

MicroFID has 10 Cal Memories and can be calibrated with 10 different span gases or response factors if desired.

To program the Cal Memories:

1. Prepare the bags of calibration gas as outlined in *Preparing the Calibration Gas Bag and the Zero Air Bag* on page 66. Use a different gas bag and gas bag adapter for each concentration and for each type of calibration gas.

   You can use the same gas bag to zero all the Cal Memories; however, you must refill the bag for each Cal Memory.

2. Press CAL and select the desired Cal Memory (1 to 10) with the ARROW keys.

3. Enter the desired response factor and press ENTER. See *Response Factors* on page 148.

NOTE: *It does not matter which Cal Memory is selected or which response factor is entered, MicroFID's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.*

4. Select the Low Range or High Range and press ENTER. The range will depend on the concentration of the calibration gas. Use Low range if you are sampling

concentrations between 0.5 and 2000 ppm (methane equivalents). Use High Range if you are sampling concentrations between 10 and 50,000 ppm (methane equivalents).

5. You will now be prompted to connect a supply of zero air. You can use ambient air, a charcoal filter (Part No. MX396021, MX396022) to clean ambient air or, for best results, use a clean sampling bag filled with zero grade air.

6. After MicroFID has set its zero point, you then enter the concentration of the calibration gas and then connect the calibration gas. MicroFID sets its sensitivity for the specified Cal Memory. The span gas concentration, response factor and alarm level entered here are specific to the selected Cal Memory only.

When the calibration is completed it is automatically stored in the selected Cal Memory.

7. Press the ALARM key and enter the alarm level for the selected Cal Memory.

8. Repeat this procedure for each Cal Memory you need.

When calibrating MicroFID, ensure the instrument is level. If MicroFID is tilted side to side, gravity will affect the flame height and cause erroneous readings

Whenever the instrument is calibrated, MicroFID updates the selected Cal Memory only. Each Cal Memory must be calibrated at least once a day. Frequency of calibration will depend on ambient conditions and instrument response. If ambient conditions change or the response has drifted, a calibration must be performed for each Cal Memory to ensure reliable operation.

High Sensitivity Operation

MicroFID can be used as a high sensitivity leak detector. In high sensitivity operation, MicroFID does not read in ppm units

equivalent to the calibration gas, but displays a reading proportional to the total concentration of ionizable gases and vapors detected.

During calibration, no span gas is required. MicroFID zeros its reading with zero air and then sets itself to maximum sensitivity.

To use the High Sensitivity option:

1. Press SETUP. Select the 0-20 ppm display range with the ARROW keys and press ENTER.

2. Press CAL. Under Cal Memory, use the ARROW keys to select High Sensitivity and press ENTER.

3. Press EXIT. Select the bar graph with the DISPLAY key.

4. Press CAL and calibrate MicroFID with zero air. You should use a supply of commercial zero grade air and a gas sampling bag when zeroing MicroFID for high sensitivity operation.

As MicroFID samples air closer to the leak, the length of the shaded area on the display increases.

MicroFID's 3 second response time and detection limit of 0.5 ppm methane permit fast detection of small leaks.

Method 21 Operation

Method 21 is a US EPA protocol for the determination of volatile organic compound (VOC) leaks in process equipment. MicroFID has a Method 21 mode that facilitates Method 21 measurements. The STAR 21 Software (Part No. MX396027) provides more comprehensive data management consistent with the Method 21 protocol. Contact PerkinElmer for more information.

You must be familiar with the Method 21 protocol to use MicroFID for Method 21 monitoring. You must use the specifications outlined in the Method 21 documentation for programming MicroFID's Cal Memories and monitoring the sites.

As part of Method 21 operation, you must setup MicroFID to monitor various locations. Since each location may contain different compounds and concentration ranges you will store a Cal Memory and the associated response factor and alarm level as part of each event. In this way you can sample numerous locations without having to re-calibrate MicroFID at each location.

You can enter the monitoring schedule in one of two methods. Regardless of the method you use to enter the monitoring schedule; you must calibrate the required Cal Memories before you enter the monitoring schedule.

Calibration

You must determine the number of calibration standards that will be required to perform Method 21 monitoring for your site. Refer to the Method 21 documentation for details.

To program your cal memories:

1. Prepare the bags of calibration gas as outlined in *Preparing the Calibration Gas Bag and the Zero Air Bag* on page 66. Use a different gas bag and gas bag adapter for each concentration and for each type of calibration gas.

    You can use the same gas bag to zero all the Cal Memories; however, you must refill the bag for each Cal Memory.

2. Press CAL and select the desired Cal Memory (1 to 10) with the ARROW keys.

3. Enter the desired response factor and press ENTER. See *Response Factors* on page 148.

NOTE: *It does not matter which Cal Memory is selected or which response factor is entered, MicroFID's response is not specific to any one compound. The displayed reading represents the total concentration of all ionizable compounds in the sample.*

4. Select the Low Range or High Range and press ENTER. The range will depend on the concentration of the

calibration gas. Use Low Range if you are sampling concentrations between 0.5 and 2000 ppm (methane equivalents). Use High Range if you are sampling concentrations between 10 and 50,000 ppm (methane equivalents).

5. Follow the displayed calibration instructions. When the calibration is completed it is automatically stored in the selected Cal Memory. The span gas concentration and response factor entered here are specific to the selected Cal Memory only.

6. Press the ALARM key and enter the alarm level for the selected Cal Memory.

Whenever the instrument is calibrated, MicroFID updates the selected Cal Memory only. Each Cal Memory must be calibrated at least once a day. Frequency of calibration will depend on ambient conditions and instrument response. If ambient conditions change or the response has drifted, a calibration must be performed for each Cal Memory to ensure reliable operation.

Programming the Monitoring Schedule in the Field

The easiest way of entering the Method 21 information is to go to each site and enter the required information. In this way, the schedule will be entered into the instrument in the exact manner in which it will be used.

To program the monitoring schedule:

1. Press the SETUP key. Press ENTER until "Interval" is displayed. Use the ARROW keys to select Method 21 as the Interval. Press ENTER.

2. You will be prompted to clear the datalogger. If you want to save the contents of the datalogger, press EXIT. You must print or save the data to disk. See *PRINT Key* on page 55, *GRAPH Key Mode* on page 58 or *Computer* on page 88 for details of printing or saving your data. Press ENTER to clear the datalogger.

3. Go to the first site to be monitored. You can enter the sites in any order; however, using the schedule after it has been stored is easier if the sites are stored in the order in which they will be monitored.

4. Press the EVENT key. Use the ARROW keys to select "Insert". Press ENTER. Use the keypad to enter an event name up to 16 characters long. To obtain alphabetic characters you must use the STAR 21 software (Part No. MX396027).

   If your site is bar coded, use the ARROW keys to select "Scan". Press ENTER to activate the bar code reader. The bar code reader will remain activated until you scan a code. If no bar code is scanned within 15 seconds the bar code reader will be deactivated. See *Bar Code Reader* on page 103 for details of connecting the bar code reader to MicroFID.

   It is possible to enter an event name that already exists in the datalogger. When you select "Insert" or "Scan" you can enter the name of an event that already exists in the datalogger. MicroFID will not overwrite the existing event. It will insert an event with the same name. In this way you can create multiple copies of the same schedule in the datalogger. You can see the duplicate events when you print the contents of the datalogger.

5. Press the CAL key and select the calibration memory to be used for this site. Press ENTER and then press EXIT.

6. Press SETUP and enter a 2-digit repair code for this location. See *SETUP Key* on page 50 for a description of Repair code. This step is optional.

7. When you return to the default display, the instrument status will be "Locate". You should be at the site. If not, locate the site. If the event name is greater than 3 characters the bottom line of the display will scroll from right to left.

8. Once you have located the designated site, press ENTER. The instrument status will change to "BkGnd". A background measurement must be made as specified in the Method 21 protocol. When you have an accurate

background, press ENTER. MicroFID will record the maximum background concentration when you press the ENTER key.

9. The instrument status will now be "Sample". Take a sample measurement, as specified in the Method 21 protocol. When you have an accurate sample, press ENTER. MicroFID will record the maximum sample concentration when you press the ENTER key.

10. The instrument status will again be Locate. At this time, since there are no other locations stored in the datalogger the same event will be displayed.

11. Press EXIT at anytime to return to the beginning of the current event and repeat the readings.

12. To store the next location, go the next site and press the EVENT key. Select "Insert" or "Scan" to enter an event name.

13. Press the CAL key and select the calibration memory to be used for this site.

14. Press SETUP and enter a repair code for this location.

15. When you return to the default display, the instrument status will be "Locate". Record a background and sample reading for this site. You will now have two events recorded in the datalogger.

16. Repeat this procedure for all sites that must be monitored. You can record data for up to 250 sites.

17. Once all event entries have been recorded in the datalogger, you may want to download them to a computer to perform your own calculations.

Programming the Monitoring Schedule before Field Operation

Use this method of programming the schedule if you are unable to go into the field. You will create a monitoring schedule with place-holders for the data.

To preprogram your monitoring schedule:

1. Press the SETUP key. Press ENTER until "Interval" is displayed. Use the ARROW keys to select Method 21 as the Interval. Press ENTER.

2. You will be prompted to clear the datalogger. If you want to save the contents of the datalogger, press EXIT. You must print or save the data to disk. See *PRINT Key* on page 55, *GRAPH Key Mode* on page 58 or *Computer* on page 88 for details of printing or saving your data. Press ENTER to clear the datalogger.

3. You can enter the sites in any order; however, using the schedule after it has been stored is easier if the sites are stored in the order in which they will be monitored.

4. Press the EVENT key. Use the ARROW keys to select "Insert". Press ENTER. Use the keypad to enter an event name up to 16 characters long. To obtain alphabetic characters you must use the STAR 21 software. (Part No. MX396027)

    If your site is bar coded and you have a list of the bar codes, use the ARROW keys to select "Scan". Press ENTER to activate the bar code reader. The bar code reader will remain activated until you scan a code. If no bar code is scanned within 15 seconds the bar code reader will be deactivated. See *Bar Code Reader* on page 103 for details of connecting the bar code reader to MicroFID.

    It is possible to enter an event name that already exists in the datalogger. When you select "Insert" or "Scan" you can enter the name of an event that already exists in the datalogger. MicroFID will not overwrite the existing event. It will insert an event with the same name. In this way you

can create multiple copies of the same schedule in the datalogger. You can see the duplicate events when you print the contents of the datalogger.

5. Press the CAL key and select the calibration memory to be used for this site. Press ENTER and then press EXIT.

6. Press SETUP and enter a 2 digit repair code for this location. See *SETUP Key* on page 50 for a description of Repair code. This step is optional.

7. When you return to the default display, the instrument status will be "Locate". If the event name is greater than 3 characters the bottom line of the display will scroll from right to left.

8. Press ENTER. The instrument status will change to "BkGnd". Press ENTER to create a placeholder and to move to the next step.

9. The instrument status will now be "Sample". Press ENTER to create a placeholder and to move to the next step. The instrument status will again be Locate. At this time, since there are no other locations stored in the datalogger the same event will be displayed.

10. Press EXIT at any time to return to the beginning of the current event.

11. To store the next location, press the EVENT key. Select "Insert" or "Scan" to enter an event name.

12. Press the CAL key and select the Cal Memory to be used for this site.

13. Press SETUP and enter a repair code for this location.

14. Press ENTER. The instrument status will change to "BkGnd". Press ENTER to create a placeholder and to move to the next step.

15. The instrument status will now be "Sample". Press ENTER to create a placeholder and to move to the next step. The instrument status will again be "Locate".

16. Repeat this procedure for all sites that must be monitored. You can record data for up to 250 sites.

Once all event entries have been recorded in the datalogger, you are ready to use the schedule for monitoring the sites. You may want to print the schedule to ensure all your sites have been entered correctly.

Using the Schedule

Once you have programmed the schedule you can use it at any time to perform Method 21 monitoring. Frequency of monitoring is determined from percentage leaker calculations. Refer to the Method 21 documentation for details.

To use the schedule:

1. Calibrate MicroFID as outlined in *Calibration* on page 65.

2. If the first event of the schedule is not displayed, you can find a specific event in the datalogger using the "Find" option. Press SETUP and use the ARROW keys to scroll through the list of events. Select the desired event. When you press ENTER, the selected event will be displayed.

3. Locate the specified site and press ENTER.

4. The instrument status will change to "BkGnd". A background measurement must be made as specified in the Method 21 protocol. When you have an accurate background, press ENTER. MicroFID will record the displayed concentration when you press the ENTER key.

5. The instrument status will now be "Sample". Take a sample measurement, as specified in the Method 21 protocol. When you have an accurate sample, press ENTER. MicroFID will record the displayed concentration when you press the ENTER key.

6. The instrument status will again be "Locate". If you recorded the sites in order, the next site will be displayed. You can move through the stored list. If the sites were not entered in order or the order of sites has changed, use the "Find" option to locate the next site.

7. Press EXIT at any time to return to the beginning of the current event and repeat the readings.

8. To repeat a measurement recorded previously in the datalogger, press the EVENT key and use the ARROW keys to select "Find". Select the event you need to repeat and press ENTER.

If you change from Method 21 operation to a set averaging interval, you will lose your Method 21 schedule and associated programming. Print or save the data to disk before changing the interval. See *PRINT Key* on page 55, *GRAPH Key Mode* on page 58 or *Computer* on page 88 for details of printing or saving your data.

NOTE: *The datalogger will be cleared when you change from Method 21 to Interval mode.*

Response Factors for Gases and Vapors

In situations where only a single pure compound is present in air, MicroFID should be calibrated with a standard of that specific compound as span gas. MicroFID's 10 Cal Memories can be used to store calibration information for 10 different span gases.

MicroFID's reading will always be influenced by any other ionizable compounds present in the air sample. Even if MicroFID has been calibrated with a specific compound, its response is not specific and the presence of another ionizable impurity may render the numerical result invalid.

It is often impractical to carry a range of different standards into the field. Approximate results can be obtained by calibrating MicroFID with the recommended span gas and entering the appropriate response factor. The response factor is based on the ratio of the

response of the specific compound to the response of the span gas. The response factor multiplies MicroFID's reading then displays and records it (if the datalogger is on).

Response Factors on page 148 provides a list of response factors from which approximations can be made for guidance purposes. Data extrapolated from the use of response factors must be regarded as interim and approximate only. The response factors in the list should be used only for concentrations up to 500 ppm of the specific compound, as response factors change with concentration.

To use the response factors:

1. Press the CAL key and enter the response factor for the specific compound.

2. Calibrate MicroFID with zero air and 500 ppm methane as described in *Calibration* on page 65.

3. Expose MicroFID to the sample. The displayed reading is the approximate concentration of the specific compound.

The response factors on page 148 serve as a guide to concentrations measured by MicroFID.

Results are expected to be accurate to within +/-10 ppm or +/-25% of result, whichever is greater. Accuracy of response factors to other gases and vapors may differ from that stated.

NOTE: *It does not matter which Cal Memory is selected or which response factor is entered, MicroFID's response is not specific to any one compound. The displayed reading represents the total concentration of all ionizable compounds in the sample.*

Preparing for Field Operation

Field Check List

The following items should be carried into the field to reduce or eliminate instrument down time. If you will be in the field for a single 8-10 hour day, you should include the following accessories:

☐ Spare battery pack (Part No. MX396005 or MX396006)

☐ Long sample probe (Part No. MX396018)

☐ Calibration kit(s) (Part No. MX396011)

☐ Tank(s) of calibration gas (Part No. MX396028)

☐ Spare gas bag for zero air (Part No. MX396017)

☐ Gas bag adapter for zero air (Part No. MX396010)

☐ Supply of commercial zero air

☐ Charcoal filters (Part No. MX396021, MX396022)

☐ Shoulder strap (Part No. MX395002)

☐ Spare inlet filters (Part No. MX396020 or MX396015)

☐ Bar code reader and interface module (Part No. MX396054)

☐ Spare 9 volt battery for bar code reader

☐ Carrying case (Part No. MX396007)

☐ Headset (Part No. MX396053)

☐ MicroFID Instrument Manual (Part No. MX396003)

Table 3   Check List for Field Operation

If you will be in the field for more than one day you should include the following additional items:

☐ Battery chargers (Part No. MX396013 or MX396014). Take one charger for each battery pack.

☐ Hydrogen and refill adapter (Part No. MX396004)

☐ Printer cable (Part No. MX396051)

☐ Computer and associated cables

Table 4   Additional Field Items

Operational Check List

Before beginning field work, set up and calibrate MicroFID for your particular application. Ensure the instrument is in working order before heading into the field.

To prepare MicroFID for field work:

1. Ideally, you should not transport MicroFID with the hydrogen cylinder filled. If it is possible to fill the internal hydrogen cylinder when you arrive at your destination then do so. If not, then you must fill the cylinder before you leave and observe all precautions for handling compressed, flammable gases. See *Warnings and Safety Practices* on page 22.

  If you are travelling by passenger aircraft, you must make arrangements to fill the hydrogen cylinder when you arrive at your destination. You cannot transport MicroFID by passenger aircraft unless the internal hydrogen cylinder is empty. See *Emptying the Hydrogen Cylinder* on page 110 more information.

2. Press the BATT key and ensure the battery pack is fully charged. The voltage should be 9 volts.

3. Press the SETUP key and ensure the correct date and time are entered.

4. Program and calibrate all the Cal Memories you will be using. See *Calibration* on page 65. After calibration is complete, sample the bag of calibration gas and the bag of zero air to ensure MicroFID has been calibrated correctly.

5. Press the MAX key and clear the Max register if necessary.

6. If you are using an averaging interval, you may also want to delete all events from the datalogger to avoid confusion between different days' data and to avoid running out of space in the datalogger. See *EVENT Key* on page 51.

7. If you are performing Method 21 monitoring ensure you have programmed and calibrated all the Cal Memories. You must also program your monitoring schedule. See *Method 21 Operation* on page 72 for more information.

Accessories   4

Printer

MicroFID has been designed for use with a serial printer. The printer must have a print width of at least 65 characters and a proportionally spaced font. The printer cable (Part No. MX396051) has been configured for this application only. If the printer does not have an RS-232 serial interface you will need to use the serial to parallel converter (Part No. MX380145). See *Serial to Parallel Converter* on page 98 for details.

If you are unsure of the compatibility of the printer, refer to the printer user's manual or contact the printer's manufacturer.

Ensure the printer is set to 8 data bits and 1 stop bit, parity has been set to none and that the appropriate baud rate has been selected.

NOTE: *MicroFID is not classified for use in hazardous locations with a printer.*

To connect a printer:

1. Turn MicroFID off.

2. Connect the RS-232 printer cable (Part No. MX396051) to the I/O port on the back of the MicroFID and then to the serial port on the printer. See *Figure 12*.

3. Turn MicroFID on.

4. Determine the baud rate for your printer. Refer to the printer user's manual for details.
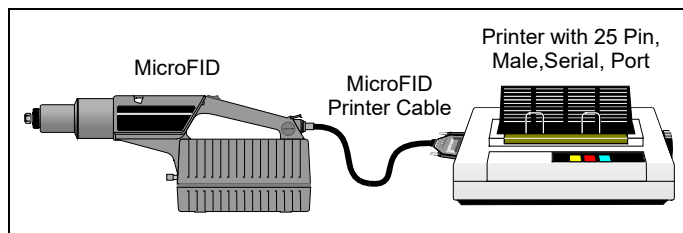
Figure 12   Connecting MicroFID to a Serial Printer

5. Press the SETUP key and select the Baud Rate option. Use the ARROW keys to select the baud rate corresponding to the printer. The baud rate in the SETUP option must match the baud rate of the printer.

6. Use the PRINT and GRAPH keys as detailed on pages 55 and 58.

7. Turn MicroFID off before disconnecting the printer cable from the I/O port.

If this arrangement does not produce the desired results, see *Printer Troubleshooting* on page 124.

Computer

MicroFID will send information stored in its datalogger to a computer. This option may be used if you need to prepare reports based on MicroFID's recorded data. This feature may also be used if you need the recorded data in a format that can be imported into a spreadsheet or database for further calculations.

NOTE: *MicroFID is not classified for use in hazardous locations with computers.*

You may need to keep more data than can be logged by MicroFID. If this is the case you have two options: you may print the data before they are deleted from the datalogger and keep the printed reports, or you may store the data on disk for later use. You may

not, however, load data that has been stored on disk back into MicroFID.

In order to establish communication with MicroFID and send data stored in the datalogger to a computer, the computer must be set up to emulate a terminal. In order to do this you will need a communications software package that will allow you to transfer data from MicroFID to a computer. If you are using Microsoft Windows, you do not need to purchase any separate software. Instructions for downloading information to Windows' HyperTerminal are provided below.

If you are already using another type of communication or terminal emulation software package it is not necessary to use HyperTerminal. Use your communications package to set up the computer to receive data with 8 data bits, 1 stop bit and no parity at the desired baud rate. Refer to the manual, provided with your software, for specific details.

Once the data have been transferred to HyperTerminal, it must be saved to a floppy disk or a hard disk. In order to manipulate the data you must import the data either as a text file into a spreadsheet, where it may be parsed and converted to numeric data, or into a text editor or word processor where it may be viewed and edited.

Refer to the computer setup options to determine the baud rate, as this value will depend on the computer. MicroFID's baud rate can be set from 1200 to 19200 to match the computer's setting.

The instructions below will provide you with the most basic information for using MicroFID with communications software. Please refer to the software user's manual for specific details of operation.

If you are using Microsoft Windows you do not need to purchase any separate software. You can use the HyperTerminal program that is shipped with Windows.

In order to use these instructions, you must be familiar with Microsoft Windows and it must be installed and running on your computer. These instructions are based on HyperTerminal Version 1.1.

NOTE: *As newer versions of HyperTerminal and Windows are released, the exact names and contents of dialog boxes may change. Use these instructions as a general guideline.*

To initiate communications between MicroFID and Windows:

1. Turn MicroFID off.

NOTE: *You must turn the instrument off before connecting or disconnecting the printer cable.*

2. MicroFID must be connected to a serial port. Use the printer cable (Part No. MX396051) to connect MicroFID to one of the computer's serial ports. Remember which serial port you are using as you will need this information when you set up HyperTerminal. Normally you will use Com1 or Com2.

3. If the MicroFID printer cable plugs directly into the port on the computer without the gender changer or the 9 to 25 pin adapter, you are most probably connected to a parallel port. You will need at least one of the adapter cables to connect MicroFID to a serial port. To communicate with a parallel port, you will need to use the serial to parallel converter (Part No. MX380145).

4. Once all connections have been made, turn on the computer and the instrument.

5. Start Windows and then start the HyperTerminal. HyperTerminal will most likely be in the may be in the Accessories Program Group. Its location will depend on how you have set up Windows. Refer to your Windows documentation for details.

6. HyperTerminal may prompt you to connect a modem. You do not need a modem for this application, so press No, to close the pop up window.

7. The Connection Description dialog box will open. Enter the instrument name and select an icon. If you choose to save the session after you have completed downloading the data, this icon will then appear in the HyperTerminal group.
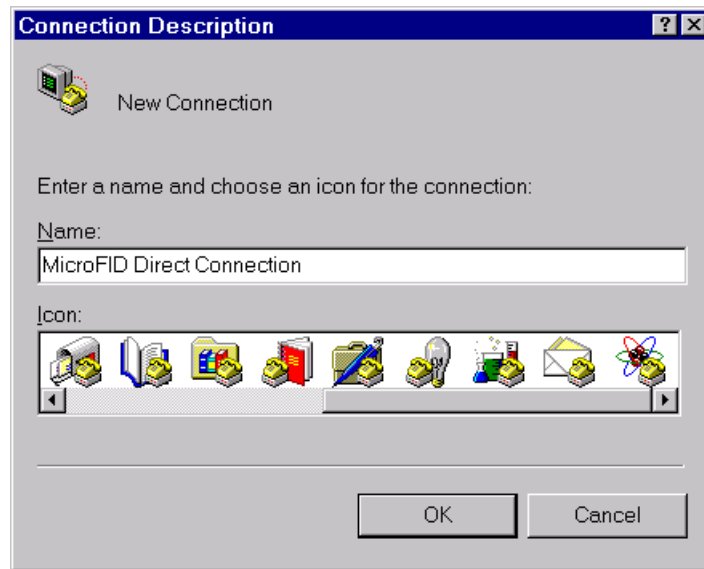
Figure 13   Connection Description Dialog Box

8. Press OK to accept the information.

9. The Connect To dialog box opens next. Select the serial port to which you connected MicroFID Press OK to move to the next dialog box.

Figure 14   Connect To Dialog Box

10.   The current properties of the selected serial port will be
       displayed. Enter 9600 as the baud rate (bits per second). This
       sets the baud rate at which the computer will receive data from
       MicroFID.

NOTE: *The baud rate setting of 9600 is being used here as an
           example. In order for this setting to work, your computer
           serial port must be set to send/receive at 9600 baud. If
           your computer serial port is set to send/receive at a
           different baud rate, set the Speed command and MicroFID
           accordingly.*

11.   On MicroFID the number of data bits has been fixed at 8, stop
       bits has been fixed at 1. Parity has been set at None and the
       Flow control is Xon/Xoff. Enter these values and then press
       OK.
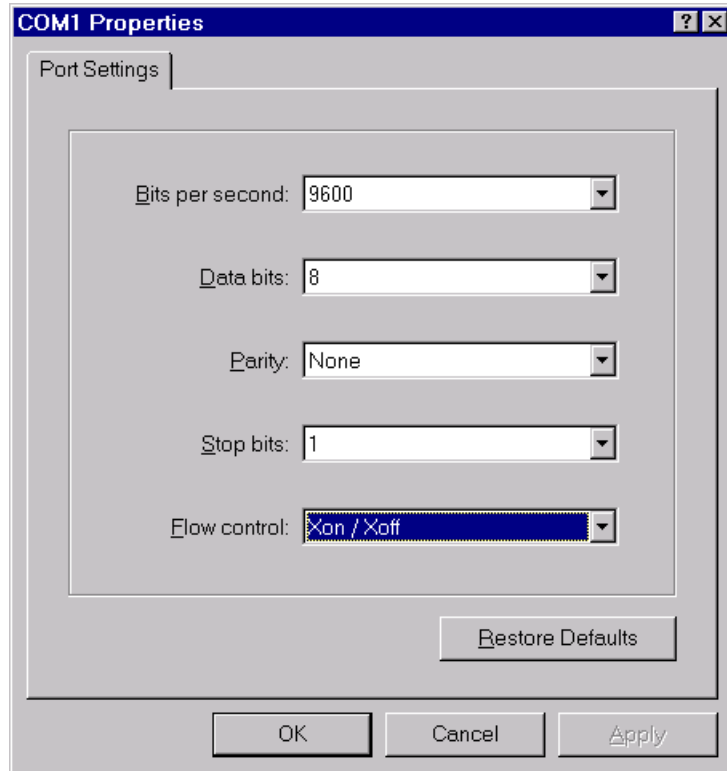
Figure 15 Properties Dialog Box

12. Select the correct Baud Rate, Data Bits, Stop Bits, Parity.
    Select Xon/Xoff for the Flow Control option. Leave the Parity
    Check and Carrier Detect options off. Select OK to close the
    dialog box and accept the settings.

13. Open the Transfer menu and select Capture Text. A "Capture
    Text" dialog box will appear. Type in the desired path and
    filename for the data that are to be downloaded. Ensure the
    path is correct.
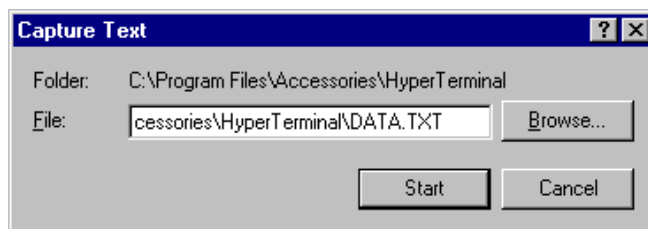
Figure 16   Properties Dialog Box

14. Ensure the file name has a .txt extension. The .txt extension will make it easier to use the downloaded data later.

15. Press Start. Select the Table Format option and then select OK. At the bottom of the screen the message, "Receiving Data" is displayed.

16. On MicroFID, ensure the same baud rate is entered under the PRINT key. The number of Data Bits has been fixed at 8, the number of Stop Bits is fixed at one. Parity has been set to none. The settings in the Properties dialog box must match these settings.

17. Press the MicroFID PRINT or GRAPH key. Press SETUP (*) and set the start and stop run numbers. Press ENTER (on MicroFID). The logged data will begin to appear on the computer screen. It will be saved to the specified file as it appears on the screen.

18. To terminate communications select Stop from the bottom of the screen. This will close the text file.

The logged data can now be copied or cut to the Windows Clipboard and pasted into a text editor, such as Windows' Notepad, or into a spreadsheet for analysis.

Refer to the Microsoft Windows User's Guide for detailed instruction on operation of HyperTerminal.

Chart Recorder

MicroFID's output can be displayed as a 0 to 1 volt analog voltage on a chart recorder in real time.

NOTE: *MicroFID is not classified for use in hazardous locations with a chart recorder.*

To connect MircoFID to a chart recorder:

1. Set the chart recorder to 1 volt full scale.

2. Turn MicroFID off and connect the analog output cable (Part No. MX396052) to the I/O port.

3. Connect the analog output cable to the chart recorder.

4. Turn MicroFID on.

The analog output has been fixed at 50000 ppm as full scale.

Gas Sampling Bag

A gas sampling bag is required for calibration of MicroFID. If you are unsure of the quality of ambient air you should use an additional gas bag filled with zero air. Connect the sample bag to the inlet fitting with the gas bag adapter. See *Calibration* on page 65 for details.

One sampling bag is included in the calibration kit. Additional gas bags are also available (Part No. MX396017).

Charcoal Filters

A charcoal filter (Part No. MX396021 or MX396022) may be connected to MicroFID during calibration to provide clean air to MicroFID. The filter will remove hydrocarbon contamination from room air to provide zero grade air to MicroFID.

> **NOTE:** *The charcoal filter does not filter methane or ethane. If these compounds are present, you should use a gas bag with a supply of commercial zero air.*

To connect a charcoal filter:

1. Load the Teflon ferrules into the nut. The nut and ferrules are supplied with the filter. See *Figure 17*.

2. Connect the nut to MicroFID's inlet. Do not tighten the nut.

Over-tightening the Teflon ferrules will result in damage to the ferrules.

CAUTION

---

3. Remove the charcoal filter from its plastic bag and insert it into the nut. Finger-tighten the nut onto the inlet. If the filter is not secure, ensure you have inserted the tube stub far enough into nut. Do not over-tighten the fitting.
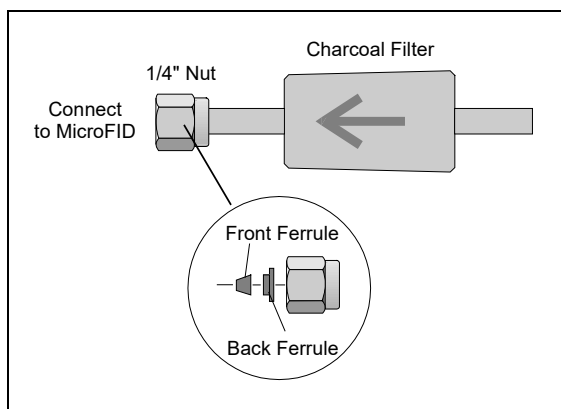
Figure 17   Connecting Charcoal Filter

The charcoal filter will remove hydrocarbon contaminants for up to 4000 ppm hours. This means that the filter will be good for 1 hour

removing 4000 ppm of hydrocarbon contaminants or will last for 4 hours removing 1000 ppm. The exact time will be determined by the operating environment. You will notice an increased hydrocarbon background when the filter requires replacement.

To replace the charcoal filter:

    1.   Loosen the nut on MicroFID's inlet.

    2.   Remove the used filter.

    3.   Insert the new charcoal filter into the nut and finger-tighten the nut onto the inlet. Do not over-tighten the fitting.

When the charcoal filter is not in use, place it in its plastic bag and store it in a clean, dry place.

Installing the Coalescing Filter

To install the Coalescing filter:

    1.   Load the Teflon® ferrules into the nut. The nut and ferrules are supplied with the filter.

    2.   Connect the nut to MicroFID's inlet. Do not tighten the nut.
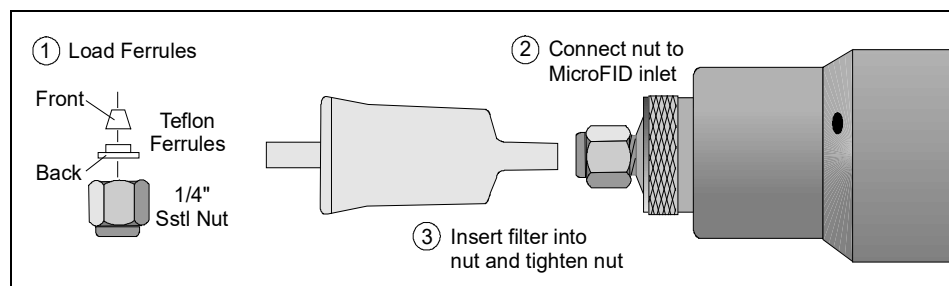
Figure 18   Connecting the Coalescing Filter

3. Remove the filter from its plastic bag and insert it into the nut.

4. Finger-tighten the nut onto the inlet. If the filter is not secure, ensure you have inserted the tube stub far enough into nut. Do not over-tighten the fitting.

Over-tightening the Teflon ferrules will result in damage to the ferrules.

CAUTION

---

5. Calibrate all Cal Memories, that you are using, before continuing operation.

The coalescing filter will remove particulates for up to 5 days of operation. The exact duration will be determined by the operating environment. MicroFID's inlet flow rate and sensitivity decrease when the filer is full.

Serial to Parallel Converter

This device allows MicroFID, which is only capable of serial communication, to communicate with a parallel device. This will be most useful for printing, as most printers utilize parallel communication. Your printer must have a print width of at least 65 characters and a proportionally spaced font.

DIP Switch Settings

The DIP switch settings are very important and must be set correctly in order to correctly communicate with MicroFID. MicroFID will always be the serial device so the data flow direction will be serial to parallel.

To configure the serial port of the converter:

1. Locate the DIP switches located on the side of the converter.

Female Parallel Connector
to Parallel Printer
using Supplied Cable

Power Indicator

AC Power
Jack

DIP Switches

Male DB-25 Serial Connector
to MicroFID using MicroFID printer cable
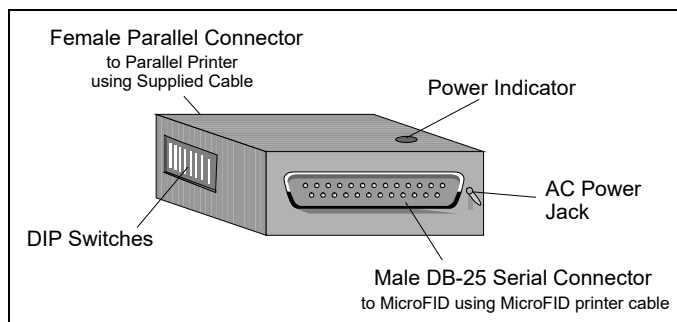
Figure 19   Serial to Parallel Converter

2. Determine the baud rate at which the converter will be receiving data from the instrument. The value you set here must match the value you enter on MicroFID.

3. Use the first three DIP switches to set the baud rate. See *Table 5*.

4. Switch 4 sets the data bits. Off = 7 Bits. On = 8 Bits. Set the data bits to 8.

5. Use Switches 5 and 6 to set the parity. Set Parity = none. See *Table 6*.

Baud Rate	SW1	SW2	SW3
38400	On	On	On
19200	Off	On	On
9600	On	Off	On
4800	Off	Off	On
2400	On	On	Off
1200	Off	On	Off
600	On	Off	Off
300	Off	Off	Off

Table 5   DIP Switch Settings for Baud Rate

Parity	SW5	SW6
None	Off	Off
Odd	On	Off
Even	Off	On
Not Used	Off	Off

Table 6   DIP Switch Settings for Parity

6. Switch 7 sets the Handshake mode. Off = Xon/Xoff.
    On = DTR Mode. Set the Handshake mode to
    Xon/Xoff.

7. Use switch 8 to set the data flow direction to serial to
    parallel. Off = Serial to Parallel. On = Parallel to Serial.

8. Check your settings. It is imperative that you have the correct settings or you will be unable to establish communications. Your settings should match those in *Table 7*.

SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
On	Off	On	On	Off	Off	Off	Off

Table 7   DIP Switch Settings

Using MicroFID with the Serial to Parallel Converter

NOTE: *MicroFID is not classified for use in hazardous locations with printers or with the serial to parallel converter.*

To connect MircoFID to the serial to parallel converter:

1. Turn MicroFID off.

2. Unplug the converter from the AC outlet.

3. Use the printer cable and suitable adapter (Part No. MX396051) to connect the MicroFID I/O connector to the converter.

4. Connect the parallel cable to the converter and then to the printer. Use the parallel cable supplied with the converter. If this cable is not suitable, see *Serial to Parallel Converter Troubleshooting* on page 127 for the cable requirements.
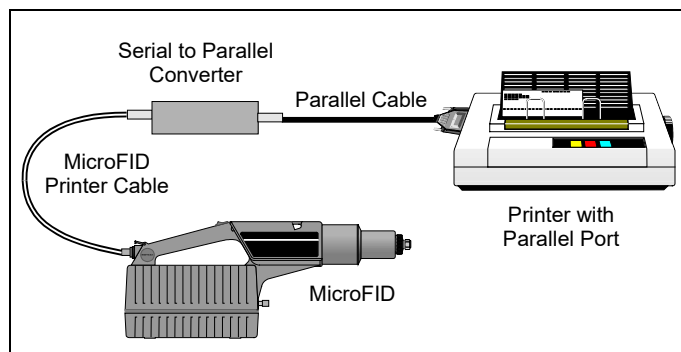
Figure 20   Connecting MicroFID to the Serial to Parallel Converter

5. Plug the converter into an AC outlet.

6. Turn MicroFID on.

7. Ensure the printer has been set up correctly. It must be on-line. Ensure paper is available and has been aligned properly.

8. Press the PRINT or GRAPH key and then the SETUP (*) key to select the desired setup options. See *Tutorial Session* on page 43.

Headset

Use the headset when operating MicroFID in a noisy environment. Audio signals for "LoBatt", "Alarm" and "NoFlm" will be heard through the headset.

To connect the headset:

1. Turn MicroFID off and remove the dust cap.

2. Connect the headset (Part No. MX396053) to the I/O port and tighten the locking nut.

3. Turn MicroFID on and start the flame. Use the volume control on the headset to adjust the volume.

Bar Code Reader

Connecting the Bar Code Reader

You can use a bar code reader to scan bar coded event names or site locations. Use the bar code reader in Method 21 operation to insert location names into the datalogger. This option may only be used if your sites have been bar coded.

The bar code reader must be used with the bar code reader interface module (Part No. MX396056). You cannot connect the bar code reader directly to MicroFID.

To connect the bar code reader:

1. Turn MicroFID off and remove the dust cap.

2. Connect the interface module to the MicroFID I/O port and tighten the locking nut.

3. Connect the bar code reader to the interface module.
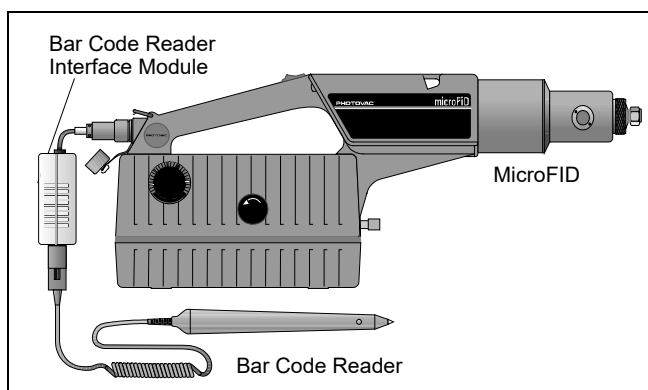
Figure 21   Bar Code Reader and Interface Module

The bar code reader is activated by MicroFID when it is ready to scan a bar code. Operation of the bar code reader is covered in *Bar Code Reader* on page 103.

Replacing the Battery in the Bar Code Reader Interface Module

The bar code reader uses a separate 9 volt battery. Normally, the battery will provide one year of operation. Battery life will depend on usage.

To replace the battery:

1. Remove the four screws in the bottom of the interface unit. Lift the bottom cover off.

2. Remove the 9 V battery and replace it with a new one. The replacement battery must be one of four types: Energizer® No. En22, Kodak® SupraLife, Duracell®, Eveready® Energizer, or Radio Shack® Enercell®. See *Bar Code Reader Control Drawing* on page 152 for details.

3. Replace the bottom cover. The cover incorporates a tongue and groove design. If it does not fit flush, then rotate it 180º and place it on the top cover.

4. Replace the four screws in the bottom cover.

Shoulder Strap

Use the shoulder strap for field operation to facilitate single-handed operation.

To use the shoulder strap:

1. Snap one end of the shoulder strap to the connector on MicroFID's handle. See *Figure 1* for the location of the connectors.

2.   Snap the other end to one of the shoulder strap
     connectors beside the display. The connection point is
     selectable for right or left handed operation.

3.   Adjust the shoulder pad and strap length for comfort.

Long Sample Probe

A two meter (6') extension probe (Part No. MX396018) may be
connected to the MicroFID inlet for remote sampling.

If a sampling location is difficult to reach, use the long sample
probe. Ensure MicroFID is level. If MicroFID is tilted from side to
side, gravity will affect the flame height and cause erroneous
readings.

To use the long sample probe:

1.   Connect the long sample probe to MicroFID's inlet.

2.   To extend the probe, loosen the knurled nut at the top
     of the wand. Pull the extension out and then tighten the
     knurled nut down to lock the extension in place.

3.   To lengthen the probe further, loosen the lower knurled
     nut. Pull the second extension out and then tighten the
     knurled nut down to lock the extension in place.

4.   When you are using the probe, allow at least 10
     seconds for the sample to travel through the probe and
     reach the detector.

NOTE: *When using the long probe, be especially careful not to
        aspirate liquids or solids as they will damage MicroFID.*

5.   To reduce the probe, loosen both knurled nuts and push
     the extensions back into the probe. Tighten the knurled
     nuts down to lock the extensions in place.

Routine Maintenance 5

Battery Charging

A fully charged battery powers MicroFID for approximately 15 hours. If the instrument is to be used for more than 15 hours, carry a spare battery pack (Part No. MX396005 or MX396006). When the first one has been discharged, replace it with the spare. Battery life is reduced if the instrument is turned off and then on again repeatedly.

When the instrument status displays "LoBatt", the battery pack requires charging. When the "LoBatt" status is displayed, you have a few minutes of operation left. MicroFID will turn itself off before the battery pack becomes critically low.

NOTE: *Do not remove the battery pack in a hazardous location.*

Do not connect the battery charger to MicroFID in a hazardous location.

Upon return from field work, charge the battery packs as outlined in Chapter 1. You will need one charger for each battery pack. Use only the MicroFID battery charger.

You can connect the charger to the battery pack without removing the battery pack from the instrument. If you do not require portable operation, you can use MicroFID while the battery pack is connected to the battery charger

NOTE: *Do not leave battery packs uncharged for an extended period of time. This will result in damage to the battery packs.*

The charger automatically charges at a high charge rate until the battery pack is fully charged. It then maintains the full charge with a low continuous charge rate indefinitely so there is no danger of over-charging. A red LED on the battery pack indicates that the battery is charging. When the LED turns green, the battery is fully charged and ready for use.

NOTE: *Leaving MicroFID for more than 3 months without turning it on may result in the loss of recorded data and setup parameters. If MicroFID is not used for long periods of time, turn the instrument on for a few hours every month to avoid loss of data.*

The battery pack is 57% lead. (Pb) by weight. This battery pack must be disposed of properly. Check with local codes for special disposal instructions.

Emptying the Hydrogen Cylinder

When you transport MicroFID, you should empty the internal hydrogen cylinder and then refill it when you arrive at your destination.

If you are traveling by passenger aircraft, you must empty the cylinder.

⚠️ WARNING	*Do not vent the hydrogen cylinder in a hazardous location. Move to an open, well ventilated area away from possible ignition sources before emptying the cylinder.* *Hydrogen gas is a fire and explosion hazard when exposed to heat or flame. The lower explosive limit is 4%.*

To empty the cylinder:

1. Turn MicroFID off and open the hydrogen shut-off valve.

2. Remove the battery pack as outlined in Chapter 1.

3. Locate the purge outlet. It is located on the underside of the instrument.

4. Use the MicroFID multi-tool to turn the screw counter clockwise. Loosen the screw but do not remove it.

Hydrogen Purge Outlet
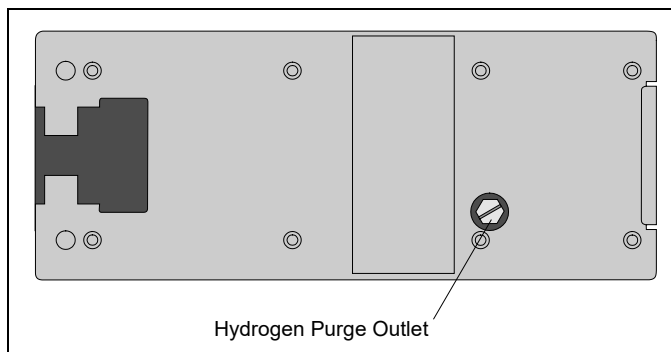
Figure 22   Hydrogen Purge Outlet

5. Leave the instrument so that the purge outlet is facing up. If the purge outlet is facing down, hydrogen will vent into MicroFID's case.

6. If the cylinder is full, it will take approximately 15 minutes to empty.

7. Watch the Contents Gauge. When the cylinder is empty, close the purge outlet. Use the MicroFID multi-tool to turn the screw clockwise.

8. Replace the battery pack as outlined in Chapter 1.

Replacing the Sample Inlet Filter

MicroFID is equipped with a combined dust and water filter to reduce detector contamination. As the filter collects dust, MicroFID's inlet flow rate and sensitivity decrease. The filter will not allow water to pass through, but the filter will not stop all solvents.

NOTE: *Do not aspirate liquid samples with MicroFID!*

Replace the filter on a weekly basis, or more frequently if MicroFID is used in a dusty or wet environment. You must replace the filter if MicroFID has been exposed to liquid water. The pump will sound labored when the filter requires replacement.

NOTE: *Do not replace the inlet filter in a hazardous location.*

1. Turn the instrument off. Unscrew the filter housing from the detector housing. Be careful not to lose the O-ring seal. See *Figure 23*.
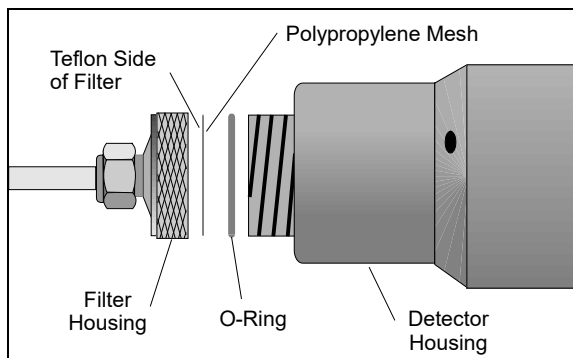
Figure 23   Inlet Filter

2. Remove the Teflon/Polypropylene filter and install the new filter (Part No. MX396020 or MX396015). Place the filter in the filter housing with the Teflon side facing down in the filter housing and the mesh side facing the MicroFID. Handle the filter disk only by the edges. The mesh may be damaged or contaminated by excessive handling. Use forceps if possible.

NOTE: *Each filter is protected by a piece of blue plastic. Remove the plastic before installing the filter in MicroFID.*

3. Replace the filter housing.

4. Calibrate all Cal Memories, that you are using, before continuing operation.

NOTE: *Do not operate MicroFID without an inlet filter.*

Troubleshooting 6

General Information

If you have a service related question about MicroFID, consult this manual first. If you cannot find the answer in this documentation, contact the Service Department.

When you call you should have your MicroFID in front of you. You should also have this manual at hand.

Lastly, please have the following information ready:

1. A description of what happened and what you were doing when the problem occurred.

2. Any corrective action that has been taken.

3. The exact wording of any messages that appeared on the display.

NOTE: *Do not service MicroFID in a hazardous location.*

MicroFID Fault Messages

When the "Check" status is displayed, MicroFID's operation is compromised. Press the TUTOR key for a two-line description of the fault. One exception is the flame out fault. When a Flame out fault occurs, the instrument status changes to "NoFlm".

Fault: Detector flame has gone out.

Cause: The hydrogen gas has run out.

Action: Ensure the shut-off valve is open.

Action. Check the hydrogen Contents Gauge on the side of the instrument and refill the hydrogen cylinder if necessary. See *Filling the Hydrogen Cylinder* on page 33.

Action: Ensure the cylinder purge outlet has been closed. See *Emptying the Hydrogen Cylinder* on page 110.

Cause: Oxygen supply is deficient.

Action: Ensure there is an adequate supply of oxygen, If you are sampling very high concentrations it is possible you are sampling above the flame out concentration. The flame out concentration for methane is approximately 52,000 ppm (5.2% methane in air).

A minimum of 17% oxygen is required to start the hydrogen flame. The oxygen is supplied from the sample as it is drawn in by the pump. A minimum of 10% oxygen is required to maintain the hydrogen flame

Flame out may also occur when sampling enclosed or confined spaces where vapors and gases cannot escape. Watch for indications of increased flame height such as erratic readings or sudden high concentrations followed by a flame out fault.

If you will be using the MicroFID in a highly contaminated area where it is possible that the oxygen content is below 10%, watch for indications of reduced flame height such as lowered detection limits or a flame out fault.

Cause: High concentrations of flammable gases (gases within their flammable range) are present. High concentrations of flammable gases can act as an additional fuel source. When this happens, the flame height may increase beyond the confines of the combustion chamber. The hydrogen supply will then be cut off and the flame will go out.

Action: Move to a location where there is an adequate supply of air and restart the flame. See the information above. Watch for indications of increased flame height such as erratic readings

or sudden high concentrations followed by a
flame out fault.

Cause: Exhaust port is blocked.

Action: At low temperatures, water vapor, a by-product
of the hydrogen flame, may condense at the
exhaust port. At sub-zero temperatures the
water vapor will freeze and obstruct the
exhaust port. If the exhaust port becomes
obstructed, pump operation will be inhibited.
Flame out may also result. Operate MicroFID
within the operating temperature range 5 to
40°C (41 to 104°F).

Action: The flame arrestor has become plugged.
Contact the Service Department.

Cause: Sample line is blocked.

Action: Ensure the sample line is not obstructed in any
way. If you are using the long sample probe,
ensure flow is maintained through the entire
length of tubing.

Cause: Inlet filter is plugged.

Action: Replace inlet filter. See *Replacing the Sample
Inlet Filter* on page 111.

Fault: Signal from zero gas is too high.

Cause: Contamination of sample line or fittings before the
detector.

Action: Clean or replace the sample line or the inlet
filter. See *Replacing the Sample Inlet Filter*
on page 111.

Cause: Span gas and zero air mixed up.

Action: Ensure clean gas is used to zero MicroFID.
Mark the calibration and zero gas bags
clearly.

Cause: Ambient air is contaminated.

Action: If you are unsure about the quality of the ambient air, use a charcoal filter or a supply of commercial zero grade air.

Cause: Hydrogen supply is contaminated

Action: Hydrogen may react with the carbon, in the steel, inside the tank to produce methane. This will only occur if the cylinder is in poor condition and if the hydrogen has a high moisture content. Replace the hydrogen tank. Empty and refill the MicroFID internal cylinder with fresh hydrogen.

Fault: Signal from span gas is too small.

Cause: Span gas and zero air mixed up.

Action: Ensure calibration gas is used to calibrate MicroFID. Mark the calibration and zero gas bags clearly.

Action: Ensure the span gas is of a reliable concentration.

Fault: Detector field voltage is low

Cause: Internal fault in the electronics.

Action: Contact the Service Department.

Troubleshooting

Problem: No instrument response detected, yet compounds are known to be present.

Cause: MicroFID has not been calibrated properly.

Action: Ensure calibration gas is of a reliable concentration and then calibrate the instrument as outlined in Chapter 3. After the instrument has been calibrated, sample the bag of calibration gas. A reading equivalent to the calibration gas should be displayed. If not, contact the Service Department.

Action: When calibrating MicroFID, ensure the instrument is level. If MicroFID is tilted side to side, gravity will affect the flame height and cause erroneous readings. See *CAL Key* on page 53.

If a sampling location if difficult to reach without tilting the instrument, use the long sample probe to reach the sample and ensure MicroFID is level.

Cause: Background contamination from the hydrogen.

Action: It is possible that the hydrogen has become contaminated and is contributing a high background signal. If the hydrogen supply tank is more than 6 months old it should be replaced with a new cylinder. When ordering hydrogen specify ultra high purity hydrogen, 99.999% pure. Empty the MicroFID hydrogen cylinder and then refill it with hydrogen from a new tank.

Cause: There is an undetermined problem.

Action: Contact the Service Department.

Problem: Date and time settings are not retained.

Cause: MicroFID has not been used for 3 months or more and the internal battery (not the external battery pack) has been discharged.

Action: Turn MicroFID on and allow it to run until a "LoBatt" status appears. This will take approximately 15 to 16 hours. Remove the battery pack and recharge it overnight. Repeat this procedure for 3 or 4 days. While MicroFID is running the internal battery is charging.

Problem: Cannot fill the internal hydrogen cylinder to 1800 psig.

Cause: Supply tank has less than 1800 psig of pressure. You can only fill the internal cylinder to a pressure of less than or equal to the tank pressure.

Action: Fill the internal cylinder to the pressure of the tank or replace the tank with a full one.

Cause: The hydrogen purge outlet is open.

Action: Close the outlet and fill the cylinder. See *Emptying the Hydrogen Cylinder* on page 110 for details.

Cause: There is a problem with the refill adapter.

Action: Contact the Service Department.

DO NOT modify or disassemble the refill adapter! If you have any problems, the unit must be returned for repair or replacement.

WARNING

Problem: Instrument status shows "Over".

Cause: Rapid change in signal level. The detector electronics have been momentarily saturated.

Action: Wait a few seconds for the status to return to "Ready".

Cause: The detector has become saturated.

Action: Move MicroFID to a location where it can sample clean air. Sample zero air until the reading stabilizes around 0. If you were using Low Range, switch to High Range. Calibrate the Cal Memory you were using when the "Over" status appeared.

Action: If you were using High Range, there may be an electronic problem. Contact the Service Department.

Problem: Display contrast bars are on or display is blank

Cause: Battery pack is critically low.

Action: Recharge battery pack or connect MicroFID to the battery charger.

Cause: The battery pack is not connected to the instrument properly.

Action: Ensure the battery pack has been aligned correctly. Ensure the battery pack is secured by the retainer at the rear of the instrument. Check the screws holding the battery pack to the instrument. See Chapter 1.

Problem: Sample flow rate varies from 600 ml/min. +/- 10%.

Cause: Inlet filter has not been installed.

Action: Install an inlet filter into the inlet filter cap. See *Replacing the Sample Inlet Filter* on page 111.

Cause: Inlet filter cap has not been tightened onto the detector cap.

Action: Finger-tighten the filter cap. See *Replacing the Sample Inlet Filter* on page 111.

Cause: Inlet filter is plugged.

Action: Replace the inlet filter See *Replacing the Sample Inlet Filter* on page 111.

Cause: Pump has been damaged.

Action: Contact the Service Department.

Cause: Exhaust port is blocked.

Action: At low temperatures, water vapor, a by-product of the hydrogen flame, may condense at the exhaust port. At sub zero temperatures the water vapor will freeze and obstruct the exhaust port. If the exhaust port becomes obstructed, pump operation will be inhibited. Flame out may also result. Operate MicroFID within the

operating temperature range 5° to 40°C (41° to 104°F).

Action: The flame arrestor has become plugged. Contact the Service Department.

Problem: Flame will not ignite.

Cause: The hydrogen gas has run out.

Action: Ensure the shut-off valve is open.

Action. Check the hydrogen contents gauge on the side of the instrument and refill the hydrogen cylinder if necessary. See *Filling the Hydrogen Cylinder* on page 33.

Action: Ensure the hydrogen purge outlet is closed. See *Emptying the Hydrogen Cylinder* on page 110. Refill the hydrogen cylinder if necessary. See *Filling the Hydrogen Cylinder* on page 33.

Cause: Oxygen supply is deficient.

Action: Ensure there is an adequate supply of oxygen, Do not attempt to ignite the flame in a location where there is greater than 10,000 ppm methane or the equivalent concentration of a flammable gas. Move to a location where there are lower concentrations and start the flame and then begin sampling higher concentrations.

If the flame goes out while you are sampling very high concentrations, it is possible that you are sampling above the flame out concentration. The flame out concentration for methane is approximately 52,000 ppm (5.2% methane in air).

A minimum of 17% oxygen is required to start the hydrogen flame. Oxygen is supplied from the sample as it is drawn in by the pump. A minimum of 10% oxygen is required to maintain the hydrogen flame.

If you will be using the MicroFID in a highly contaminated area where it is possible that the oxygen content is below 10%, watch for indications of reduced flame height such as lowered detection limits or a flame out fault.

Cause: Exhaust port is blocked.

Action: At low temperatures, water vapor, a by-product of the hydrogen flame, may condense at the exhaust port. At sub zero temperatures the water vapor will freeze and obstruct the exhaust port. If the exhaust port becomes obstructed, pump operation will be inhibited. Flame out may also result. Operate MicroFID within the operating temperature range 5° to 40°C (41° to 104°F).

Action: The flame arrestor has become plugged. Contact the Service Department.

Cause: Hydrogen supply lines are full of air.

Action: If MicroFID has not been used for some time, it is possible that the hydrogen supply lines contain air. Fill the hydrogen cylinder and then open the hydrogen shut-off valve. Allow the hydrogen to purge the system for about 5 minutes and then turn MicroFID on and start the flame.

Cause: Hydrogen supply lines are blocked.

Action: Contact the Service Department.

Problem: Liquid has been aspirated.

Cause: MicroFID has been exposed to a solvent that can pass through the Teflon/Polypropylene filter.

Action: Contact the Service Department.

Problem: In Method 21 operation, the next event is not displayed after you have recorded background and sample readings for the current event.

Cause: Duplicate events are present in the datalogger.

Action: Print the contents of the datalogger to ensure the duplicate events are unused. Use the "Delete" option under the EVENT key to remove the duplicate event from the datalogger.

Printer Troubleshooting

Problem: Printer will not print.

Cause: Printer is not connected properly.

Action: Make sure that you have the correct cable for your instrument. Ensure that the printer and instrument cables are properly connected. If you are using the serial to parallel converter ensure the cables are properly connected to the converter, the instrument and to the printer. Turn the converter and the instrument off before connecting the cables.

Cause: Mechanical problem with the printer.

Action: Make sure that the printer is plugged in and turned on.

Action: Make sure that the printer is on-line, as shown on its control panel.

Action: Check the ribbon, the print wheel or cartridge, and the paper supply.

Cause: The serial to parallel converter is not turned on.

Action: Ensure the serial to parallel converter is connected to the AC adapter and the adapter is plugged into an AC outlet. The red LED on the top of the converter will be on.

Cause: Printer cable is not configured correctly.

Action: If you are sure that you have set up your printer is correctly, then you may have to

modify the cable. In order to modify the existing printer cable, the pinout information for the printer connector is required. Refer to the printer user's manual for specific details. The pinouts for the MicroFID printer cable are listed in *Table 8*. If modifying the cable is not possible, take the electrical and pinout information to a computer store where a suitable adapter may be obtained.

I/O Connector (8 pin) Pin #	Signal	MicroFID Printer Cable (DB-25) Pin #
1	Analog	—
2	Audio	—
3	Analog GND	20
4	GND	1 & 7
5	RXD	5
6	TXD	3
7	CTS	2
8	Audio GND	—

Table 8   MicroFID I/O Port Pinouts

Cause: Printer is not configured properly.

Action: Ensure your printer has a print width of at least 65 characters and you are using a proportionally spaced font.

Action: Many printers have a set of configuration (DIP) switches. Generally, these instruments expect these switches to be set in the factory default settings.

Many printers have switches for enabling automatic line feeds when receiving a carriage return. These switches should be set to carriage returns only, which is normally the factory default setting.

Some printers have switches or control panels that enable you to set the printer for different modes, such as sans serif, letter quality, or compressed text. Do not use these controls. If you do use them, you may cause your tabular or graphed output to be printed incorrectly.

The baud rate and parity options on the printer are not used for parallel communication. However, you must ensure the baud rate and parity options on the serial to parallel converter match the settings of your instrument.

Cause: Serial card is installed in the printer.

Action: If a serial card is installed in your printer, you do not need the serial to parallel converter. Disconnect the converter and connect the instrument directly to the printer.

Problem: Data are printed or downloaded correctly at first but become garbled.

Cause: Baud rate may be set too high.

Action: Ensure the baud rate set on your instrument matches the baud rate of the converter.

Action: If the baud rate is correct it is possible that the transfer rate is too high and information is being lost. Lower the baud rate of the instrument and the serial to parallel converter (DIP switch settings).

Serial to Parallel Converter Troubleshooting

You must use the correct type of cable to ensure trouble free data transmission. The length of the cable at the parallel side must not exceed 15 feet. On the serial side, use the MicroFID printer cable.

When you are connecting the parallel side of the converter to a Centronics 36 pin, female connector, use a straight wired cable with 36 conductors and a Centronics 36-pin, male connector at each end. This cable is supplied with the converter.

When you are connecting the parallel side of the converter to a Centronics 36 pin, male connector, use a straight wired cable with 36 conductors and a Centronics 36 pin, female connector at one end and a Centronics 36-pin, male connector at the other end.

If you are connecting the parallel side of the converter to a female DB-25 pin connector use a straight wired cable with a DB-25 pin, male connector on one end and a 36-pin, Centronics, male connector on the other end. The pin assignments for all parallel port signals are listed below.

Pin #	Name	I/O Parallel to Serial	I/O Serial to Parallel
1	/Strobe	In	Out
2-9	Data0-Data7	In	Out
10	/Acknlg	Out	Not Used
11	Busy	Out	—
12	PE	Pull Low	Pull High
13	Select	Pull High	Pull Low
14	/Auto FF	Not Used	Not Used
15	NC	Not Used	Not Used
16	Ground	—	—
17	NC	Not Used	Not Used
18	NC	Not Used	Not Used
19-30	Ground	—	—
31	/Init	Not Used	Out
32	/Error	Pull High	Pull High
33	Ground	—	—
34	NC	Not Used	Not Used
35	NC	Not Used	Not Used
36	/Slct In	Not Used	Not Used

Table 9   Parallel Port Signals

The pin assignments for all serial port signals are listed below.

Pin #	Name	I/O Parallel to Serial	I/O Serial to Parallel
1	Frame Gnd	—	—
2	TXD	Out	Out
3	RXD	In	In
6	DSR	In	—
7	GND	—	—
20	DTR	—	Out

Table 10   Serial Port Signals
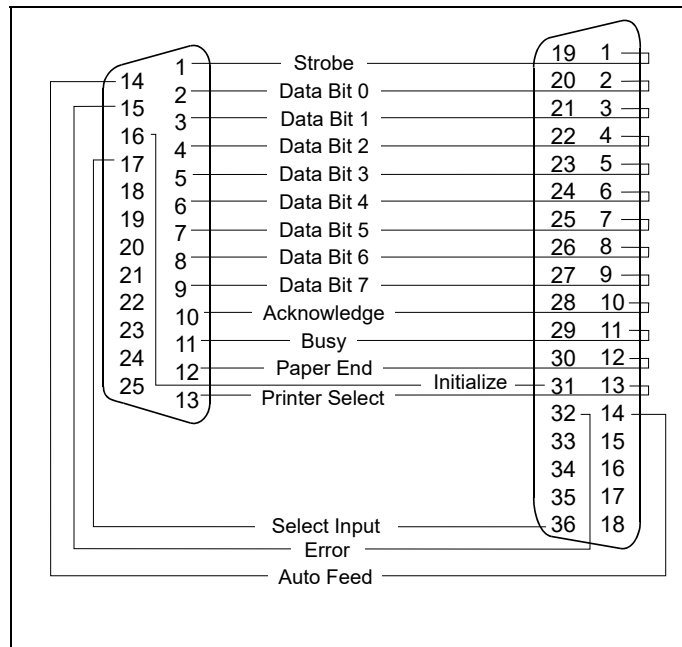
Figure 24   Parallel Port Signals

Establishing Computer Communications

If, after having followed the procedure in *Computer* on page 88, communications cannot be established with a computer, the problem may lie with the hardware connections or the printer cable configuration.

To connect MicroFID to your computer:

1. Ensure MicroFID is connected to the serial port of the computer.

    The serial port will usually be a male connector, typically 9 pins on most computers. The serial port may also be a 25 pin connector on computers

    The 25 (or more) pin female connector is usually a parallel port. However, there are exceptions to this rule. MicroFID cannot be connected to a parallel port unless you are using the serial to parallel converter.

    If you do not have a free serial port on you computer and you want to connect MicroFID to the parallel port you will need the serial to parallel converter. Connect MicroFID to the serial port on the converter and then connect the printer to the parallel port. If the port on computer is anything other than a female, 36-pin Centronics connector you will need an adapter in order to use the cable supplied with the converter. See *Serial to Parallel Converter* on page 98 for more details.

2. Ensure the cable being used is compatible with the device.

    A computer with a 9 pin serial connector will first require a null modem to switch pins 2 and 3. Next a gender changer that converts the male DB-25 connector on the printer cable from male 25 pins to female 9 pins is required. These two adapters have been combined into one, which is supplied with the MicroFID printer cable.
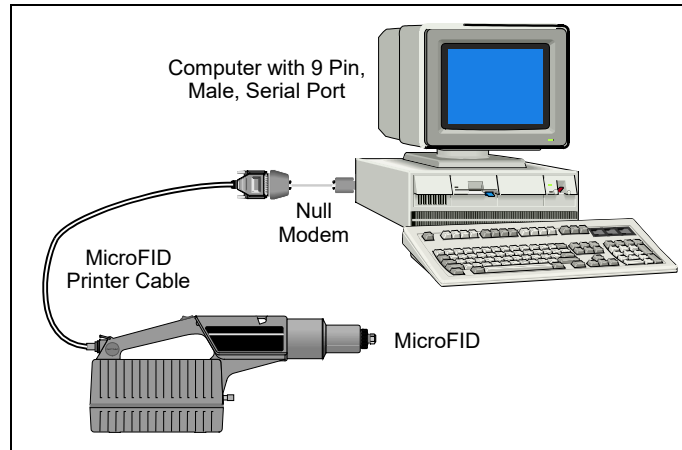
Figure 25   Connecting MicroFID Using the Null Modem Cable

A computer with a 25 pin serial port should not require a null modem but will require a gender changer. A gender changer will convert the male DB-25 connector on the printer cable to a female connector. A gender changer is supplied with the MicroFID printer cable.
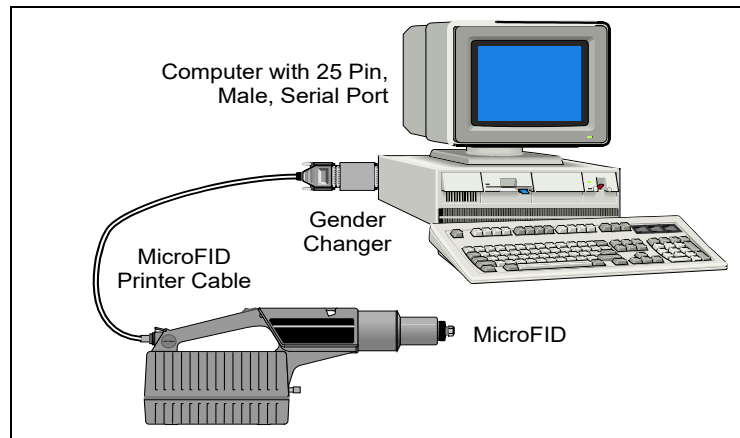
Figure 26   Connecting MicroFID Using the Gender Changer Cable

The pin definitions of interest are listed in *Table 11*. Only pins 2 and 3 are shown since these are the problem pins:

Pin #	MicroFID	9-pin	25-pin
2	RXD	RXD	TXD
3	TXD	TXD	RXD

Table 11   Pin Definitions

Pins 2 and 3 should be mismatched between MicroFID and the computer. Ensure this is the case. It is also possible that the cable being used may switch pins 2 and 3, even if it is not necessary. The cable may be a null modem.

3. Ensure all hardware is working properly.

Use a printer to test both MicroFID and the computer. Connect MicroFID to the printer and ensure that this arrangement produces the desired results. If the correct printout is obtained, then the MicroFID and the printer cable are okay.

Now connect the computer to the printer and ensure this works. If the desired printout is obtained this ensures the computer is sending data correctly.

Technical 7
Description

Flame Ionization Detector

The MicroFID uses a flame ionization detector for the measurement of combustible organic compounds in air at parts-per million levels. The permanent air gases (argon, carbon dioxide, nitrogen, oxygen, water vapor, etc.) are not ionized by the flame.

When MicroFID is turned on, the display prompts you to turn on the hydrogen. The internal pump draws air in through MicroFID's inlet. This sample air provides the oxygen necessary for combustion in the hydrogen fed flame.
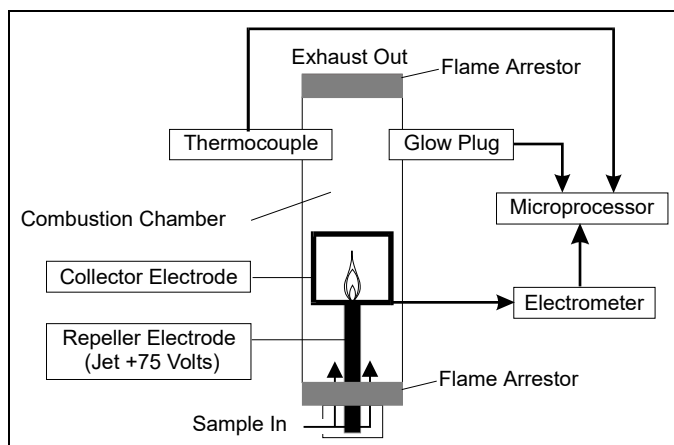
Figure 27   Flame Ionization Detector

When the proper ratio of hydrogen to air is present in the combustion chamber, the flame is started automatically with a glow plug. A thermocouple is used to monitor the status of the flame.

When the sample passes through the flame the combustible organic compounds in the sample will be ionized. After the compounds have been ionized by the flame, the ionized particles are subjected to a continuous electric field between the repeller electrode at the jet (+75V) and the collector electrode.

The ions move in the electric field, generating a current, which is proportional to the concentration of the ionized molecules in the ionization chamber. An electrometer circuit converts the current to a voltage that is then fed to the microprocessor.

After the sample passes through the flame and has become ionized it is vented from the detector through a flame arrestor. The flame arrestor prevents the flame from igniting any flammable gases present in the sampling location.
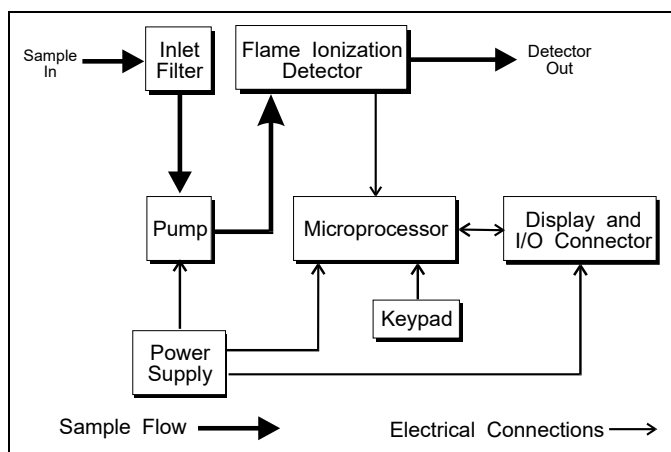
Figure 28   Block Diagram

Detector Response

MicroFID is strictly an organic compound detector. It does not respond to inorganic compounds. MicroFID's sensitivity is highly dependent on chemical structure and bonding characteristics. The combustion efficiency of a compound determines its sensitivity.

Simple saturated hydrocarbons (methane, ethane etc.) possess high combustion efficiencies and are among the compounds that produce the highest MicroFID response. Organic fuels (acetylene, refined petroleum products), burn easily and are also extremely well detected.

The presence of substituted functional groups (amino, hydroxyl, halogens) on a simple hydrocarbon reduces its combustion efficiency and thus MicroFID's sensitivity to the compound. Methanol and chloromethane, for example are detectable with MicroFID but not as well as methane. A greater number of carbon atoms can offset this loss of sensitivity due to substitution. For example, MicroFID is more sensitive to n-butanol than it is to methanol. See *Response Factors* on page 148 for a list of the response factors of compounds detectable with MicroFID. The information in this list is not a complete list of detectable compounds. Contact the Applications Group for more information.

Calibration

Periodic calibration is required to compensate for FID output changes due to inlet filter restriction, ionization chamber cleanliness, sample pump wear and other factors.

During calibration, MicroFID is first exposed to zero air. A small signal is generated. This zero signal is stored by the microprocessor.

MicroFID is next exposed to span gas. This span gas signal is stored by the microprocessor. The microprocessor subtracts the zero signal from the span gas signal and divides the difference by the user-entered span gas concentration. The resulting sensitivity is stored in the selected Cal Memory with the zero signal and the alarm level. This number is then multiplied by the response factor and displayed.

In High Sensitivity or sniff operation, you calibrate MicroFID with zero gas only. The microprocessor subtracts the zero signal from the MicroFID signal, and multiplies the difference by 1000. This number is then displayed.

MicroFID readings are always relative to the calibration gas. After calibration with methane, MicroFID will respond directly in units equivalent to methane. Almost all combustible organic compounds will be detected by MicroFID. It cannot distinguish between methane and other ionizable compounds. A reading of 10 ppm indicates all ionizable compounds that are present have generated

an ion current proportional to 10 ppm of methane. The reading is actually 10 ppm methane equivalent units. MicroFID readings give an indication of the total ionizables present and their concentration relative the calibration gas.

Datalogging

Interval Operation

The microprocessor accumulates all readings in an averaging interval, that you select, and determines the minimum, average and maximum readings. It stores these numbers along with the highest priority instrument status and the most recent time, date and Event that occurred during the interval. MicroFID records these results when the datalogger is turned on. The number of events that are stored in the datalogger will depend on the averaging interval you have selected.

These recorded data can now be played back on MicroFID's display. The display is identical to the numeric or bar graph display, but the instrument status is "Play" indicating that recorded data, not real-time data, are being displayed. During playback MicroFID continues to analyze and record new data.

Recorded data can also be printed as either a table or a graph. For each averaging interval, MicroFID prints the minimum of all the minima, the average of all the averages and the maximum of all the maxima.

Method 21 Mode

In Method 21 operation you log data manually. You must program a monitoring schedule into the instrument and then monitor sites according to the Method 21 documentation.

The Method 21 option first prompts you to locate a specific sampling site and then allows you to record both a background and sample entry in the datalogger. MicroFID stores these numbers along the difference between sample and background, the highest priority instrument status and the most recent time, date and Event name.

Recorded data can now be played back on MicroFID's display. The instrument status is "Play" indicating that recorded data, not real-time data, are being displayed.

Recorded data can also be printed as either a table or a graph. The difference between the sample and background is calculated and shown on the print and graph output.

Appendices **8**

Specifications

Size:	43.5 cm (17.1") long, 9.8 cm (3.85") wide, 18.8 cm (7.4") high
Weight:	3.7 kg (8.1 lb.)
Detector:	Flame ionization
Keypad:	16-key silicone with tactile feedback
Display:	2-line, 16-character dot-matrix, liquid crystal, for alphanumeric and bar graph readouts
Datalogger memory:	30 kilobytes or 750 entries
Chart recorder output:	0 to 1 volt full scale
Serial output:	RS-232, 1200-19200 baud with no parity, for tabular and graphic printouts and connection to an IBM compatible computer
Audio output:	On Alarm, LoBatt and NoFlm
Inlet connection:	1/4" stainless steel compression fitting
Battery type:	Sealed lead-acid, field-replaceable pack
Battery pack lead content:	57% Lead (Pb) by weight.
Charge/discharge time:	8 hr/15 hr
Battery charger:	Automatically charges and maintains full charge in battery pack
Hydrogen cylinder	

capacity:	9.2 liters at 1800 psig
Hydrogen cylinder discharge time:	12 hours
Materials in sample stream:	Stainless steel, Teflon®, Viton®, polypropylene, PEEK, nitrile chorobutadiene rubber
Inlet filter:	Replaceable 1 µm Teflon/Polypropylene,
Inlet flow rate:	600 mL/min. +/- 10%
Operating temperature range:	5° to 40°C (41° to 104°F)
Storage temperature range:	5° to 40°C (41° to 104°F)
Operating humidity range:	0 to 100% relative humidity (non-condensing)
Operating concentration range:	0.5 to 2000 ppm methane equivalent (Low Range), 10 to 50,000 ppm methane equivalent (High Range)
Accuracy:	Methane: (after calibration with zero air and 500 ppm methane span gas): within +/-0.5 ppm or +/-10% of actual methane concentration. (0.5 to 2000 ppm range)
Precision:	+/-0.3 ppm or +/-5% (0.5 to 2000 ppm methane range) and +/-3 or +/-5% (10 to 50000 ppm methane range)
Response time:	Less than 3 seconds (to 90% of full scale response)
Detection limit:	0.5 ppm methane

Warranty

MicroFID is warranted for one year against defects in materials and workmanship.

PerkinElmer warrants that its manufactured product will be free from defects in materials and workmanship for a period of one (1) year from the date of receipt by the Customer. This may be voided if, in the opinion of PerkinElmer, the product has been abused or treated in a negligent manner so as to cause damage or failure. Negligent use includes, but is not limited to, exposure of the internal parts of the equipment to water. Damage caused thereby is expressly excluded from this Warranty. Consumable supplies and parts routinely replaced are not warranted.

PerkinElmer and its vendors disclaim any implied warranty of merchantability or fitness for a particular purpose. PerkinElmer and its vendors will not be liable for any indirect, special, incidental, or consequential damages, irrespective of whether PerkinElmer or the vendor has advance notice of the possibility of such damages.

PerkinElmer's sole liability under this warranty is limited to the repair or replacement of the product at its Service/Repair facility and return to the Customer.

When PerkinElmer is made aware of a problem, which would be eligible for remedy under Warranty, it will issue a Return Authorization Number to the Customer. No return will be accepted unless such authorization has been obtained. The customer is responsible for insurance and shipping to the designated Service/Repair facility.

Contacting PerkinElmer

To place an order, check the status of an order, obtain current pricing and availability	1-800-762-4002 (US) 1-800-561-4646 (Canada)
Service and repair of your instrument	1-800-762-4002 (US) 1-800-561-4646 (Canada)
Applications Department	1-800-762-4002 (US) 1-800-561-4646 (Canada)
Customer Service	1-800-762-4002 (US) 1-800-561-4646 (Canada)
In the Canada and the USA	PerkinElmer Photovac 761 Main Avenue Norwalk, CT 06859-0010 U.S.A. Tel.: 800-762-4000 or (+1) 203-761-5330 Fax.: (+1) 203-761-4228
In Europe	Photovac Europa Sjælsø Allé 7 A P.O. Box 79 DK-3450 Allerød, Denmark Tel.: +45-48-100-400 Fax.: +45-48-100-401
In all other areas contact your representative.	

Table 12   Contact Information

Installing Alternate AC Plug on the Battery Charger

In most cases MicroFID will be shipped with an AC line cord that will fit the AC wall outlet in your area. If this cannot be done, you may need to obtain an AC line cord suitable for the AC receptacle in your area.

The AC line cord, attached plug and receptacle must be marked with your country's certification mark and the cord must have a Harmonization (HAR) mark.

The line cord must be rated for either 100 to 120 VAC at 60 Hz or 220 to 240 VAC at 50 Hz. The voltage rating will depend on the voltage in your area.

Contact your PerkinElmer representative to obtain more information.

Calibration Gas Supplier

The MicroFID calibration kit includes the following items:

1. Gas pressure regulator to fit a calibration gas cylinder with C-10 5/8"-18 UNF fitting.

2. Gas sampling bag.

3. Gas bag adapter to fit gas bag and MicroFID inlet.

The kit does not include a tank of span gas. The recommended span gas is methane in air. 500 ppm methane in air is available from PerkinElmer (Part No. MX396028).

The exact concentration of calibration gas will be determined by your application. Span gases of various concentrations and compounds may be obtained from:

> Scott Specialty Gases Inc.
> 1290 Combermere Street
> Troy, Michigan 48083
> Telephone (within the USA): 1-800-774-9447
> Telephone (outside USA): (810) 589-2950
>
> Fax: (810) 589-2134

If you order your calibration gas from Scott Specialty Gases Inc., specify a Scotty® V Cylinder.

Response Factors

This list of response factors was determined at (nominally) 500 ppm, based on 500 ppm methane calibration gas. Methane will have a response factor of 1.0. The following formula was used for calculation of the response factors:

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

A response factor less than 1.0 indicates a compound response better than that of methane. A response factor greater than 1.0 indicates a lower response than that of methane.

NOTE: *It does not matter which Cal Memory is selected or which response factor is entered, MicroFID's response is not specific to any one compound. The displayed reading represents the total concentration of all ionizable compounds in the sample.*

When using response factors, results are expected to be accurate to +/- 10 ppm or +/- 25%, whichever is greater.

Compound	Response Factor
Acetaldehyde	6.9c
Acetone	2.7G
Acetonitrile (Methyl Cyanide)	1.0c
Acrolein (2-Propenal)	6.9c
Acrylonitrile (Vinyl Cyanide)	1.3c
Allyl Chloride (3-Chloro-1-Propene)	2.7c
Aniline (Benzenamine)	3.0L
Benzene	0.7c
Benzyl Chloride (Chloromethyl Benzene)	1.2L
Bromoform (Tribromomethane)	7.2L
1,3-Butadiene	2.7c
iso-Butane	1.8G
n-Butane	1.9G
n-Butanol	2.6L
n-Butyl Mercaptan (Butanethiol)	2.6L
Carbon Tetrachloride	25.9c
Chlorobenzene	0.8c
Chloroform (Trichloromethane)	3.5L
Cumene (Isopropyl Benzene)	1.0L
Cyclohexane	1.4c
1,2-Dichlorobenzene (ortho-)	0.7L
cis-1,2-Dichloroethylene	2.6c
trans-1,2-Dichloroethylene	2.7c
N,N-Dimethylformamide (DMF)	2.3L
1,4-Dioxane	4.6c
Epichlorohydrin	2.4L
Ethane	1.9G
Ethanol	5.2c

Ethyl Acrylate	2.7ᴄ
Ethylbenzene	1.0ʟ
Ethyl Cellusolve (2-Ethoxyethanol)	4.3ʟ
Ethyl Chloride (Chloroethane)	1.9ᴄ
Ethyl Mercaptan (Ethanethiol)	3.7ʟ
Ethylene	2.2ɢ
Ethylene Dibromide (1,2-Dibromoethane)	2.0ʟ
Ethylene Dichloride (1,2-Dichloroethane)	1.7ᴄ
n-Heptane	1.3ʟ
n-Hexane	1.6ɢ
Isobutylene	2.2ᴄ
Isoprene (2-Methyl-1,3-Butadiene)	2.2ʟ
Isopropanol	2.4ʟ
Methanol	23.8ʟ
Methyl Bromide (Bromomethane)	3.9ᴄ
Methyl Ethyl Ketone (2-Butanone)	1.9ᴄ
Methyl Isobutyl Ketone	1.9ʟ
Methyl Methacrylate	2.8ʟ
Methyl tert-Butyl Ether (MTBE)	2.0ᴄ
Methyl Cellusolve (2-Methoxyethanol)	9.1ʟ
Methylene Chloride (Dichloromethane)	1.4ᴄ
n-Nonane	1.1ʟ
iso-Octane (2,2,4-Trimethylpentane)	1.2ʟ
n-Pentane	1.6ʟ
Propane	1.8ɢ
Propionaldehyde (Propanal)	3.6ᴄ
Propylene	2.6ɢ

Propylene Dichloride (1,2-DCP)	2.0c
Propylene Oxide	2.5c
Styrene	1.2 L
1,1,2,2-Tetrachloroethane	1.8L
Tetrachloroethylene (Perchloroethylene)	2.9c
Toluene	0.9c
1,1,1-Trichloroethane	1.4c
1,2,4 Trichlorobenzene	1.1
1,1,2-Trichloroethane	1.7L
Trichloroethylene (TCE)	2.8c
Triethylamine	1.1L
Vinyl Acetate	4.4L
Vinyl Bromide	1.5c
Vinyl Chloride (Chloroethylene)	2.1c
Vinylidene Chloride (1,1-DCE)	2.6c
ortho-Xylene	1.1L
meta-Xylene	1.2L
para-Xylene	1.2L

Table 13   MicroFID Response Factors

Standards used for determination of these response factors were derived from a variety of sources:

- **c**   Certified gas cylinder, +/- 2% analytical accuracy (Isobutylene +/- 5% analytical accuracy)

- **G**   Standard prepared by dilution of pure gas into zero air, accuracy unknown

- **L**   Standard prepared by addition of pure liquid to zero air, accuracy unknown

Bar Code Reader Control Drawing

1. Intrinsically safe for use in Class I, Division 1, Groups A, B, C, D, Hazardous Locations when used in accordance with control drawing 890047, when powered by Energizer No. EN22, Kodak Supralife, Duracell, Energizer, Radio Shack Enercell, 9.0 V alkaline battery.

2. Read this manual before operating.

3. Sécurité Intrinsèque.?

⚠	*Substitution of components may impair intrinsic safety.*
WARNING	

⚠	*La substitution de composants peut compromettre la sécurité intrinsèque*
Avertissement	
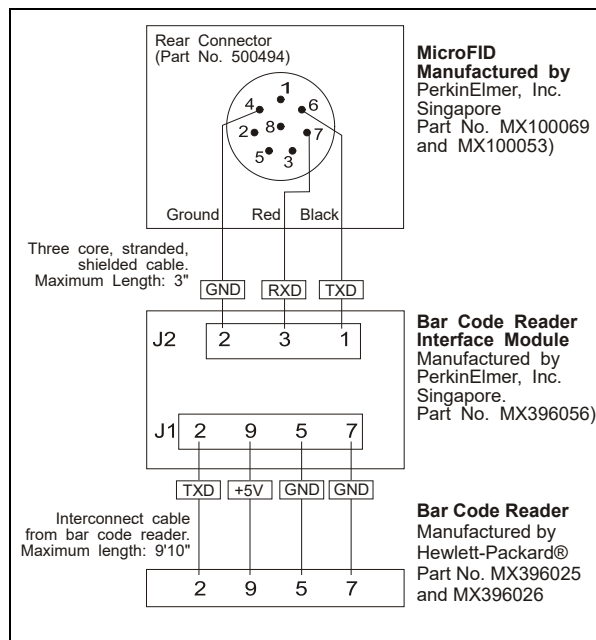
Figure 29   Bar Code Reader Control Drawing 890047

References

1. Maslansky, Carol J. and Steven P. Maslansky. *Air Monitoring Instrumentation.* New York: Van Nostrand Reinhold, 1993.

2. Scott Specialty Gases, Catalog, 1994.

3. American Conference of Governmental Industrial Hygienists. *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (1994-1995).*

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