GAS•TRAC® FMD

FIXED METHANE DETECTOR

OPERATION & CONFIGURATION GUIDE

READ AND UNDERSTAND INSTRUCTIONS BEFORE USE.

SENSIT Technologies

851 Transport Drive • Valparaiso, IN 46383 (USA)
Phone: 219.465.2700 • www.GasLeakSensors.com

CONTENTS

WARNINGS

⚠ **WARNING**   **Do not deploy the unit immediately. Be sure to first perform an incoming inspection within a controlled environment (e.g. Laboratory or office).**

⚠ **WARNING**   **Turn off the unit before unplugging the sd card. Failure to do so will result in sd card errors.**

⚠ **WARNING**   **When installing the unit, ensure the notch on the ultrasonic anemometer base, the 'n' on the 3d anemometer, and the shaft of the analog anemometer is facing north. Never rotate the anemometer from the top or severe damage will occur.**

⚠ **WARNING**   **After verifying functionality, remove the usb cable. If planning to run in usb mode, install a power adapter or a solar panel for long-term deployment applications. Otherwise, power cycle the GAS•TRAC® FMD, then install a power adapter or a solar panel for long term deployment applications.**

⚠ **WARNING**   **Do not disassemble the unit or change any parts without training or approval by sensit. If you wish to be certified for repairs, please contact sensit.**

GENERAL INFORMATION

SIZE	Fully assembled with anemometer and antenna D x W x H (8in x 12in x 24in)
WEIGHT	Base unit: 15 lbs.
OPERATIONAL TEMPERATURE	-20°C to 50°C (-4°F to l 22° F)
OPERATING HUMIDITY	0% and <95% non-condensing
STORAGE TEMPERATURE	40°C to 60°C
BATTERY LIFE	8 Days without Recharging via Solar Panel (depending on instrument configuration)
POWER REQUIREMENT	Built in Rechargeable Battery Maintained by Solar Panel
POWER CONSUMPTION	Less than 2 Watts
ENVIRONMENTAL PRESSURE	68kpa- 115kpa
LASER SAFETY	Class IIIR
ENCLOSURES	NEMA 4X Fiber Reinforced Enclosure
COMMUNICATION INTERFACE	Local USB and Cellular. Local wireless available upon request.
STANDARD KIT	Controller Box Tripod Solar Panel Instruction Manual
OPTIONAL ACCESSORIES	Ultrasonic Anemometer Vane Anemometer Indicator Alarm Light Alarm Siren Calibration Gas

DESCRIPTION

The **GAS•TRAC® FMD** is an advanced air quality monitoring system that detects the presence of methane gas to levels as low as 200 PPB. The instrument also measures humidity and temperature in conjunction with the methane concentration. The **GAS•TRAC® FMD** can be outfitted with an ultrasonic or rotary vane anemometer, which measures wind speed and wind direction. This will help localize the direction by which the methane is coming from.

All collected data can be transmitted via cellular connectivity (AT&T recommended). Domestically in the US, SENSIT does offer connectivity options; internationally, contact your local cellular network provider for connectivity options.

By default, data is sent to SENSIT Connect, where it can be reviewed, plotted, and exported. SENSIT Connect is not required – you are able to change the endpoint to which the instrument is outputting data. Check the data integration APP note for instructions on how to create your own data integration with the **GAS•TRAC® FMD**.

STANDARD FEATURES

- Methane Selective Internal Optical Assembly for Local Detection
- Built-in sampling pump
- Built-in rechargeable battery
- Wireless communication to a secure server
- Continuous data logging

SENSOR INFORMATION

Tunable diode laser absorption spectroscopy (TDLAS) takes advantage of the optical absorption properties of molecules, specifically methane. Each molecule absorbs light of specific colors/wavelengths that correspond to excitation modes within the molecule (i.e., electron excitation, vibrational modes, etc.). A laser tuned to a specific absorption wavelength of methane is introduced to a gas sample (analyte). The gas sample is constantly refreshed within the optical cavity by use of a diaphragm pump. The wavelength of the incident laser is tuned/adjusted through the absorptive region (i.e., no absorption to absorption to no absorption). In this case, the laser wavelength is 1650 nm, which is in the near infrared. This laser intensity is measured using a photodiode/receiver. The signal from the absorptive region is compared to that of the non-absorptive region (see figure below – the absorptive region is labeled "Methane Absorption"). The magnitude of the measured signal loss in the absorptive region is compared against the signal when the system is exposed to a controlled amount of methane. The amount of methane present within the analyte is calculated using this comparison.

TDLAS Operating Principal

IR Laser CH_4 Receiver

Methane Absorption
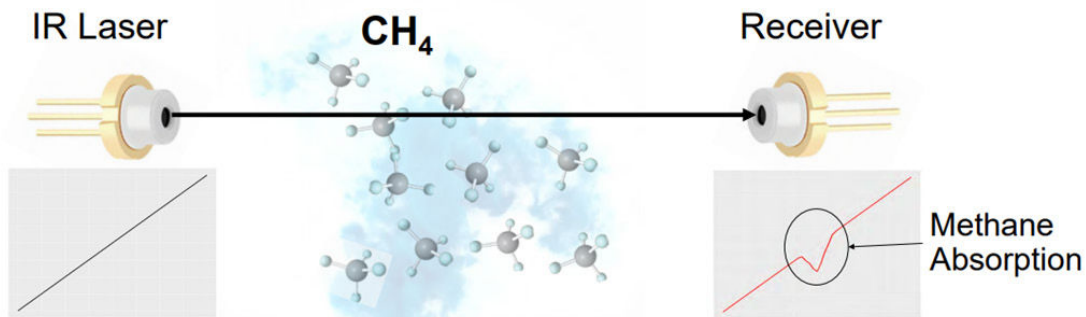
DETECTOR SPECIFICATIONS

PARAMETER	DESCRIPTION
Technologies	Near IR TDLAS with Multi-pass Cell
Wavelength	~1650 nm
Methane Range	0-100 vol. %
Methane Resolution	0.2 PPM (200 PPB)
Methane Accuracy	10% (+/- 0.5 ppm min)
Methane T90	< 10 seconds
Laser Life	> 5 years
Pre-Filter Life	6 months estimated
Internal-Filter Life	6 months estimated
Pump Life	10,000 hours

CELLULAR SPECIFICATIONS

OVERVIEW	PARAMETER
Network Technology	4G CAT M1 and Cat 4, and NB-IoT available.
Carrier	AT&T (recommended), Verizon, T-Mobile
Transport Layer	TCP
Internet Layer	IP
Application Layer	HTTP and MQTT
Data Transfer Method	HTTP POST or MQTT Topics
HTTP Content Type	application/x-www-form-urlencoded
HTTP Body Field Identifiers	&ID, &MODULE, &STAT, &DATA
MQTT Content Type	JSON
MQTT Tags	"deviceId", "time", "iodb"
Post Location	Adjustable in Menu
APN	Adjustable in Menu
TLS/SSL	HTTPS and MQTTS with server authentication

EXTERIOR OVERVIEW
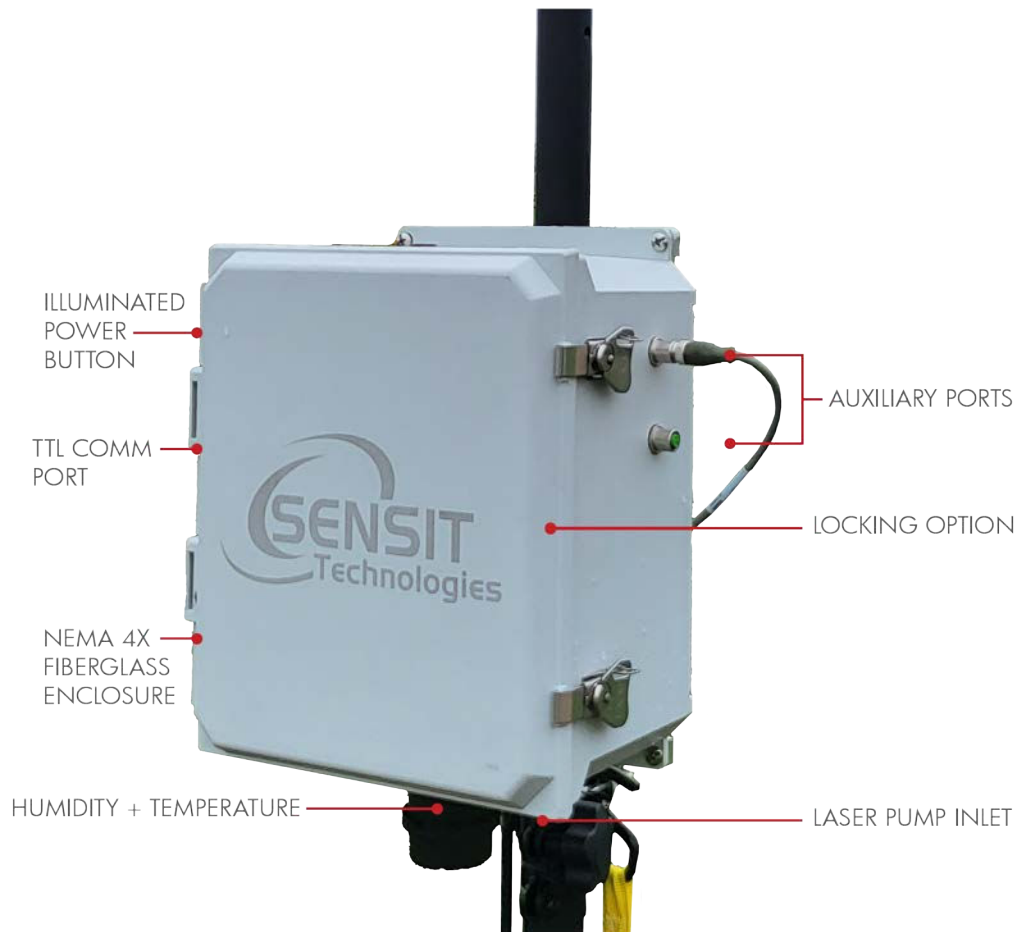
INTERIOR OVERVIEW
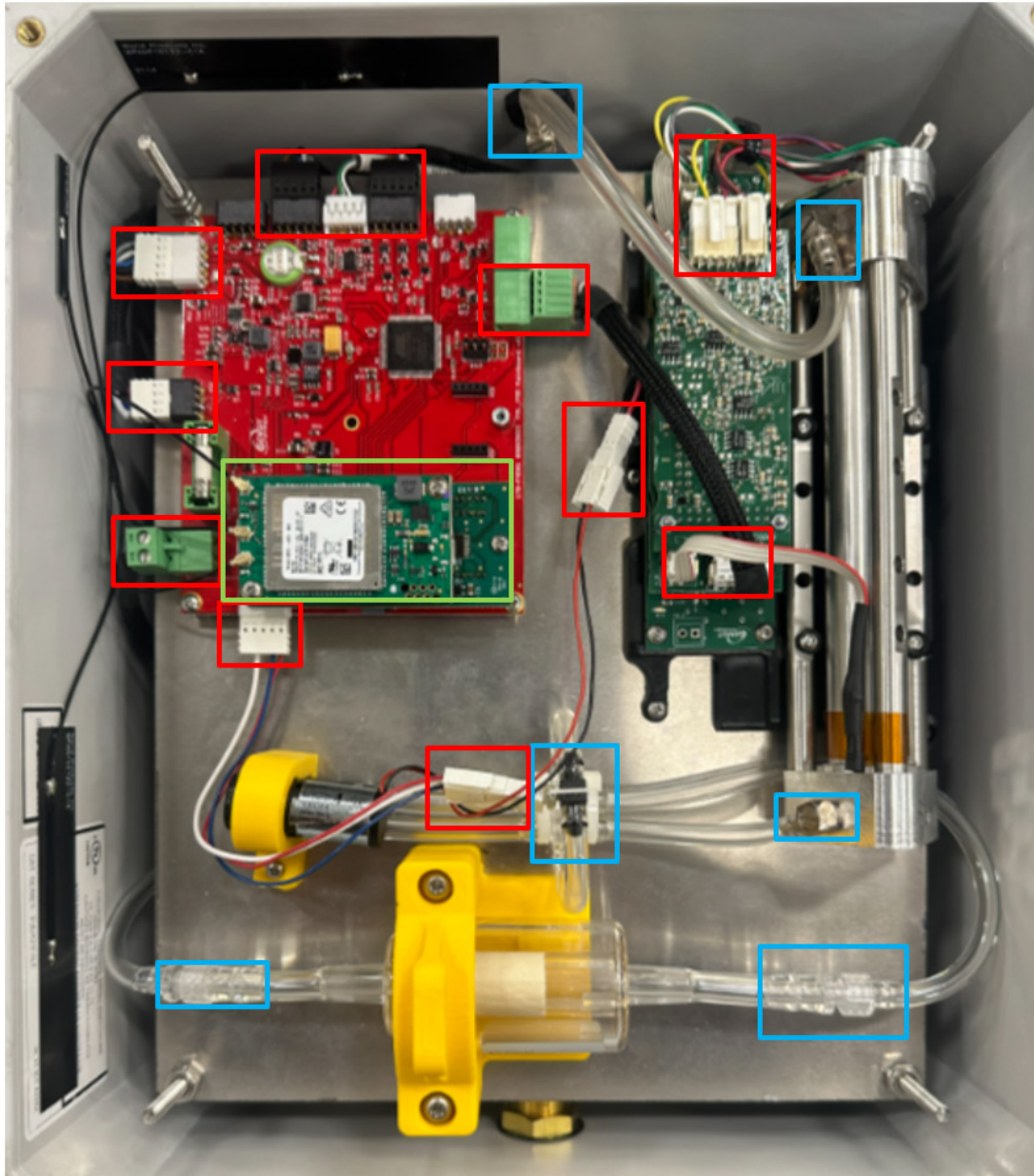
RED: Connectors
BLUE: Plumbing Connections
GREEN: Modem (uFL designators described below).
International version: (left to right) M – Primary LTE, G - GPS, and D - secondary or directivity.

North American version: (left to right) M – Primary LTE, D - secondary or directivity, and D/G - GPS.

DEPLOYMENT GUIDE

⚠ **WARNING**   DO NOT IMMEDIATELY DEPLOY THE **GAS•TRAC® FMD** WITHOUT GOING THROUGH THE INITIAL QUICK START GUIDE.

INCOMING INSPECTION

⚠ **WARNING**   CONDUCT IN A CONTROLLED SETTING (LABORATORY OR OFFICE).

1. Unpack the sensor unit and check for any physical damage or obstructions at the sensor openings, or communication ports (See images below)

2. Open enclosure cover and check for any loose components. Make sure all connectors are securely fastened. (Shown on page 7 in RED).

3. Check to make sure all internal plumbing is properly connected. (Shown on page 7 in BLUE).

4. Ensure antenna / GPS connections are established on the modem ordered. (Shown on page 7 in GREEN).

5. You are now ready to begin QUICK START setup.

QUICK START

1. Screw the filter silencer into the bottom of the unit. This item will come packaged separately with shipment to avoid damage.

2. Connect the USB cable between the **GAS•TRAC® FMD** and computer to establish the communication link in the terminal software (**NOTE**: See HARDWARE AND SOFTWARE INSTALLATION GUIDE FOR USB CABLE section for more information.)

3. Power on unit by pressing the power button.

4. Verify that the proper startup sequence occurs, the SD card was detected, and initialized. If you wish to enter the ROOT MENU type 'YES'. Below is an example of the startup sequence (NOTE: Depending on your configuration, some settings may be different).

```
Sensor ID: FMD01001
With Analog MET, Filter: 10
System DATE,01/02/24 20:11:30
Network Time: Enabled, UTC
Battery Voltage: 13.58
Power Source: Solar Power
Output Mode: Streaming
Standard SD Rate
Output Data Rate: 10
Output Data Ratio: 30
Server Address: https://api.sensitconnect.net/sensors-data/addSensorsData
Communication Mode: Cellular, Unlocked
Network Selection: Automatic,Roaming Disabled
Cellular Protocol: CSV Periodic HTTP Always On with TLS
Access Point Name: zipitwireless.com.attz
GPS Mode: Disabled
Baseline: Auto-Adjust Disabled, Constrained
Laser Offset: -6.20 SlopeAdj: 1.00
Sampling Disabled

Defining Pins...Complete

SD Card Detected...SD Card Initialized

Type 'YES' To Enter Menu
10
9
8
7
6
5
4
3
2
1
```

5. Configure the unit to your preferred settings. Configuration mode allows access to configuration settings and system settings. The menus are all text-based and easy to follow. The table below contains all the adjustable within the menu. If you are configuring your unit, please see the (DETAILED ROOT MENU INFORMATION) section for additional information.

MENU ITEM	DESCRIPTION	LOCATION
Cellular	Common setting	Root Menu
Default	System Default Settings	Root Menu
Display	Prints Current Settings	Root Menu
GPS	GPS Settings	Root Menu
Output	Sensor Output Behavior	Root Menu
Power	Power Settings	Root Menu
Time	Time Setting	Root Menu
System	System Setting	Root Menu
Exit	Exit Menu	Root Menu

6. Verify the sensor outputs are reasonable or trending toward reasonable values keeping in mind the stabilization time for TDLAS laser system. Type 'EXIT' from the ROOT MENU for data collection to begin. Additionally, it may take up to 30 seconds for the ultrasonic anemometer to report valid environmental data. Below is an example of proper data, See: (REFERENCE - USB OUTPUT HEADINGS AND DESCRIPTION) for additional information. The colors in the small data output below correspond to the other colored boxes on this page.

```
FMD01001 DATE,01/02/24
20:11:19 CH4,0.00,T,22.10,RH,28.79 P,0.00,WS,0.00,WD,375.00 VBATT,13.56,CHRG,0.00 RUN,132.00,LASER,245.00,5.77,1.29,24.92,23.53,2.2081 50,0 55,0,11.19,CONC,5.14,47.88,5.14,48.72 LAT,0.00000,LON,0.00000 CRC,2742
20662
```

Verify that CH4 is reading positively when in presence of Methane. If the value is '0'; and the pump is not running, there may be an issue with the laser. Verify that RH is congruent with the current relative humidity.

```
DATE,01/02/24
CH4,0.00,T,22.10,RH,28.79
```

Verify that WS, and WD are reading the current wind speed, and wind direction IF the anemometer is installed. IF a digital anemometer is installed, verify that P is reading the current pressure. Analog and 3D MET's do not record pressure. These units will not change if there is no anemometer.

```
P,0.00,WS,0.00,WD,375.00
```

Verify that VBATT is at an appropriate battery voltage. If the battery is charging, CHRG will change showing the charging current. If you are charging and CHRG remains '0', there may be an issue with the battery.

```
VBATT,13.56,CHRG,0.00
```

Verify that the highlighted section in the LASER section reads either 40,0 or 50,0. This will be the 7th and 8th point in the dataset below, NOTE: the second value may display a value slightly larger than '0'for brief intervals of time. Ensure that it reverts back to '0' within a few seconds.

```
,LASER,245.00,5.77,1.29,24.92,23.53,2.2081 50,0 55,0,11.19,CONC,5.14,47.88,5.14,48.72
```

Verify that the LAT and LON readings correspond to the latitude and longitude of the unit. These will only change IF GPS is enabled.

```
LAT,0.00000,LON,0.00000,
```

7. Your unit is now ready for deployment. Please see the (DEPLOYMENT INSTRUCTIONS) section for additional and optional setup steps. Make sure to pack and transport the FMD to the deployment site properly and safely.

DEPLOYMENT INSTRUCTIONS

⚠️ **WARNING**   PERFORM THE FOLLOWING STEPS IN THE FIELD 'ON SITE' AT THE DEPLOYMENT LOCATION ONLY.

1. Unpack the FMD and all accessories that were observed in the inspection.

2. Mount the unit to the desired surface. If you are not mounting to a stationary surface, are using a SENSIT tripod, are using a solar panel, and/or an ultrasonic anemometer is installed; continue with the following steps.

3. If the unit is being installed on a tripod, follow the (TRIPOD SETUP AND INSTALLATION (OPTIONAL)) section.

4. If a solar panel is being installed, follow the (SOLAR PANEL SETUP & INSTALLATION (OPTIONAL)) section.

5. If the solar panel is being installed on the tripod, follow the (POLE MOUNT SOLAR PANEL SETUP & INSTALLATION (OPTIONAL)) section.

6. If the unit is being installed on the tripod, follow the (TRIPOD SETUP & ANCHOR KIT INSTALLATION (OPTIONAL)) section.

7. If an ultrasonic anemometer is installed on the unit, follow the (ANEMOMETER (IF INSTALLED)) section.

8. Power on unit by pressing the power button.

9. Ensure that the pump is running, and data is being gathered within the method of data collection of your choosing. The device is now operational.

TRIPOD SETUP AND INSTALLATION (OPTIONAL)

1. Find level surface with minimum 5 foot diameter of clearance to place tripod.

Fig 1

Parallel to Ground

2. Fully extend tripod base such that leg supports are parallel to the ground [Fig 1]

3. Extend tripod pole to desired height off the ground. A minimum pole length of 14" is required for mounting the FMD and longer lengths are required if deploying anemometer on top of pole. It is recommended to use locking pin [Fig 2] when installing pole to prevent pole from slipping downward.

Fig 2

Locking Pin
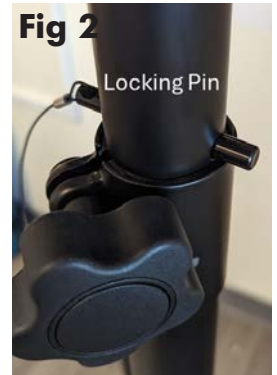
Fig 3

4. High wind or long-term deployments require additional security to prevent the tripod from tipping.

   Options include:

   a. Earth anchor securing tripod to ground
   b. Saddle sandbags on all legs [Fig 3]
   c. or standard sandbags on the outer edge of all legs. Minimum 100 pounds total weight recommended. Contact SENSIT if more information is needed.

5. Use the shorter ¼" long screw to attach pole mount to back of **GAS•TRAC® FMD**

6. Use the longer 1 ¼" long screw + nut to tighten on pole

7. Tighten sufficiently to prevent rotation

8. Place GAS•TRAC® FMD on pole and allow sufficient clearance at top of pole for anemometer.

Install Pole Mount Brackets
(1/4" Long 1/4-20 Screws)
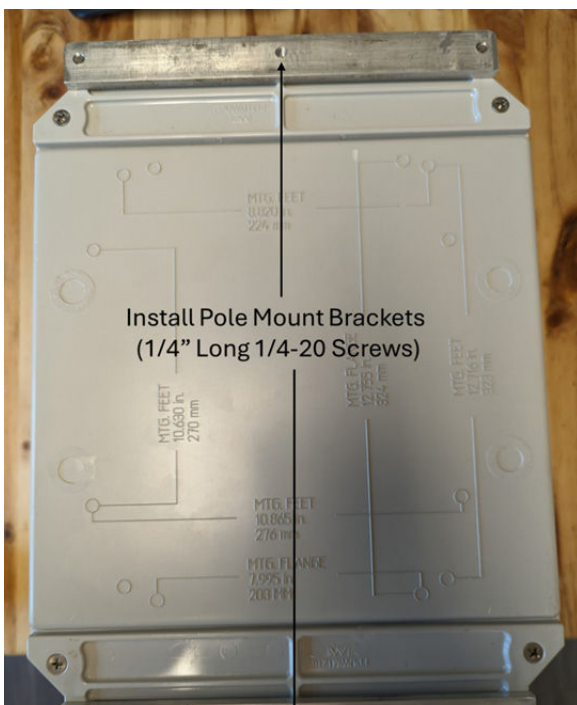
GROUND MOUNT SOLAR PANEL SETUP & INSTALLATION (OPTIONAL)

1. Lift up on side with 2 knobs to unfold panel

2. Fold down angular supports on both sides and remove 2 knobs on bottom

3. Reattach knobs vertical angular supports on both sides (flat washer, lock washer, wing nut)
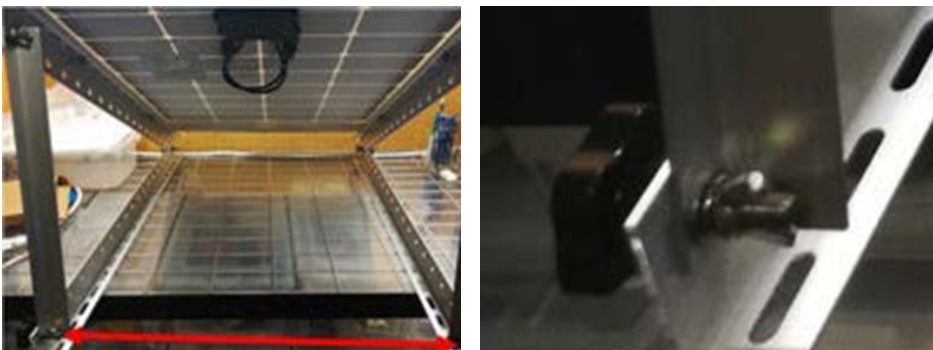
4. Place solar panel on ground and fasten to ground or add ballast if possible (recommended to avoid wind damage and theft)

5. Avoid shadowing on panel as much as possible as this will drastically reduce panel output power and efficiency

6. Route cable to **GAS•TRAC® FMD** unit.

7. Plug cable into **GAS•TRAC® FMD** "Power/USB" connection.

8. Power on **GAS•TRAC® FMD** unit.

NOTE: Alternative solar mounts and solar panel extension cables can be purchased from SENSIT. Please contact SENSIT for more information if your application requires an alternative solar mounting setup.

POLE MOUNT SOLAR PANEL SETUP & INSTALLATION (OPTIONAL)

1. Place solar panel on lower tripod pole or another suitable pole.

2. To place on tripod open worm gear clamps and install as shown to the right. Lift panel mount up sufficiently to keep panel off the ground. If high weeds or deep snow are present, consider increasing the height off the ground.

3. Adjust angle according to season and latitude or if heavy snowfall is anticipated. To adjust angle, loosen the 4 bolts (2 on each side) until the panel can tilt up and down freely. After the correct angle is set, tighten the 4 bolts fully.

4. Avoid shadowing on panel as much as possible as this will drastically reduce panel output power and efficiency

5. Route cable to **GAS•TRAC® FMD** unit

6. Plug cable into **GAS•TRAC® FMD** "Power/USB" connection

7. Power on **GAS•TRAC® FMD** unit

TRIPOD SETUP & ANCHOR KIT INSTALLATION (OPTIONAL)

1. Adjust tripod to desired position and fully extend legs

2. Screw in earth anchor in the center of tripod footprint and thread ratcheting rope through anchor as shown. The 2 metal hooks should attach to tripod legs as shown and a loop of rope should go around the remaining leg passing through the eyelet at top of anchor. Note that a different tripod is pictured and modifications to rope placement will be required for the FMD.
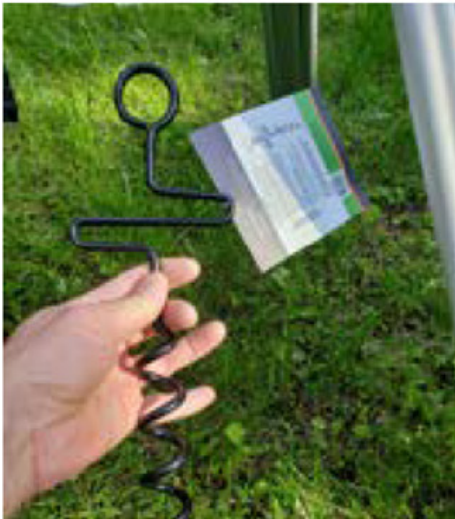
ANEMOMETER (IF INSTALLED)

3. When installing the unit, ensure the alignment notch of the weather sensor is pointing North (see image below). Failure to do this will result in error in the wind direction measured by the anemometer. The North direction is indicated with a notch on the ultrasonic anemometer base. Never rotate the anemometer from the top or severe damage will occur.

   CAUTION: To accurately measure the wind direction and humidity, the alignment notch on the Weather Station Instrument must be pointed correctly.

   a. Moving -The alignment notch must point forward and be parallel to the centerline.
   b. Stationary surface-It is recommended that the alignment notch point toward true north.

4. Tighten or align the Weather Station Instrument by grasping the lower housing below the reflector plate. Hand tightens only.

   a. Do not rotate the cap. Turning It may sever internal connections and void the warranty.

   CAUTION: If you use a thread lock, use Teflon pipe-thread tape. Do not use a liquid thread lock as it may weaken the plastic, causing it to swell and crack. CAUTION: The Weather Station Instrument must be installed upright and vertical, not tilted to one side. It must be level and plumb. If the Weather Station Instrument is tilted from the horizontal plane, it may introduce errors in the compass and wind readings.

   CAUTION: The reflector plate and the waterproof film found in the wind channel of the Weather Station Instrument are essential to its operation. Be careful not to scratch the plate, puncture the film, or damage them in any way.

3D (left) Analog (middle) Ultrasonic (right)

USB COMMUNICATION & CONFIGURATION MODE GUIDE

The **GAS•TRAC® FMD** units allow for the reconfiguration of several parameters pertaining to the operation of the system. Adjustment of these parameters is only accessible for a brief period after powering on the sensor (~10s). These parameters are stored in non-volatile memory and are retained during subsequent power cycling. Documentation of these parameters is listed below.

REFERENCE - USB OUTPUT HEADINGS AND DESCRIPTION

USB HEADING	DESCRIPTION	UNITS/FORMAT
GAS•TRAC® FMD	Serial Number	1000-63535
DATE	Local Date and Time	MM/DD/YY HH:MM: SS (24H)
CH4	Methane Concentration	PPM
T	Temperature	°C
RH	Relative Humidity	%
P	Pressure	mBar
WS	Wind Speed	m/s
WD	Wind Direction	Degrees
VBATT	Battery Voltage	Volt
CHRG	Charging Current	mA
RUN	Operating Current	mA
LASER	Laser Status	Contact SENSIT
CONC	Concentration	Contact SENSIT
LAT2	GPS Latitude	Degrees
LON2	GPS Longitude	Degrees
CRC	Checksum	Data Integrity Bytes

REQUIRED COMPONENTS

- **GAS•TRAC® FMD** Unit
- USB data cable
- Computer with a serial port terminal software program (e.g., CoolTerm)

NOTES:

1. The control circuit board is designed to support a second sensor. Additional parameters will show up in the output if a dual sensor unit is configured by the factory.

2. GPS is not enabled on all units. Please follow detailed information below to enable GPS configuration.

DETAILED ROOT MENU INFORMATION

MENU ITEM	DESCRIPTION	LOCATION
Cellular	Common setting	Root Menu
Default	System Default Settings	Root Menu
Display	Prints Current Settings	Root Menu
GPS	GPS Settings	Root Menu
Output	Sensor Output Behavior	Root Menu
Power	Power Settings	Root Menu
Time	Time Setting	Root Menu
System	System Setting	Root Menu
Exit	Exit Menu	Root Menu

CELLULAR: Contains all settings associated with the cellular modem. This is required for communication with any online servers.

DEFAULT: Resets all options to the factory default. Not recommended without consulting SENSIT. This will remove all custom settings including cellular information.

DISPLAY: Displays all current settings in the terminal window. An example print out is shown below. Please note that system settings may differ from device to device depending on the application.

GPS: "ENABLE" or "DISABLE" the GPS. Depending on the cellular data protocol and output mode, the user may be presented with additional options. If cellular output is disabled or if PERIODIC protocol is selected the GPS mode will default to SINGLE (see below). If cellular output is enabled and MQTT or HTTP protocol are enabled the user can select between the following GPS settings:

- "CONSTANT": GPS is always on and fixing position (Highest power draw)
- "INTERVAL": GPS turns on at and interval determined by "RATIO"x"ODR"
- "SINGLE": GPS turns on at power up and remains off until system is reset

OUTPUT: This menu contains settings that modify the output characteristics of the sensor.

POWER: Select "SOLAR" and "AC" power. NOTE: Changing this setting with not influence the unit. The firmware within the unit is shared with the SENSIT SPOD. Please contact SENSIT for more information.

TIME: Set the system date and time. If cellular is available and automatic date and time is enabled, this will happen automatically when the device connects. Note that the initial data may have the wrong date and time until the clock adjusts.

SYSTEM: Adjustment of the sensor and system operation parameters.

EXIT: Leave the root menu and starts system operation

DETAILED CELLULAR MENU INFORMATION

MENU ITEM	DESCRIPTION	LOCATION
APN	Carrier APN Setting	Cellular Menu
Credentials	MQTT Username and Password	Cellular Menu
Host	Server Location Address	Cellular Menu
Network	Cellular Network Configuration	Cellular Menu
Protocol	Data Transfer Protocol	Cellular Menu
Ratio	Number of Samples to Buffer	Cellular Menu
Signal	Apply settings and check signal	Cellular Menu
TLS	Activate TLS, Load Server Cert	Cellular Menu
Topics	MQTT Topics	Cellular Menu
Exit	Exit Cellular Menu	Cellular Menu

APN: Set the required APN for data access on the installed sim card. Please note that the APN text entry might be case sensitive for your network provider.

BAND: Select and scan available bands to verify cellular connection and select the most suitable band. Also features CARRIER band selection in the United States for AT&T, T-Mobile, and Verizon. This is an advanced feature and is not recommended to be used without guidance of SENSIT.

CREDENTIALS: Set the required USERNAME and PASSWORD required for MQTT data access. This menu will prompt the user to type "USERPASS" or "AZUREHUB". To manually configure username and password type "USERPASS". If using Azure IoT hub, type "AZUREHUB" to send SAS token. The **GAS•TRAC® FMD** will parse the relevant connection parameters from the SAS token. The SAS token must have the following parameters to be accepted:

SharedAccessSignature sr=<HOSTNAME>%2Fdevices%2F<DEVICEID> &sig=<URI of the resource being accessed, HASH > &se=<Token Expiry Time, Epoch Time>

HOST: Set the server address to send the data to. The target server must be configured to accept the data.

NETWORK: Define network behavior of the cellular module. AUTO mode is enabled by default and under most circumstances will work well. If required it is possible to force the modem to only look for "CAT M1", "GLOBAL", "NB IoT", or "2G" service instead of scanning for all network options. It is required to run "SIGNAL" option after adjusting network settings. Contact Sensit for more information and do not make changes to this parameter unless directed.

PROTOCOL: Set the cellular data communication protocol to the following options:

"DATATYPE": Select CSV or JSON data packet to be communicated over wireless data connection. JSON tag delimiters can be provided by SENSIT. JSON datatype not supported by SENSIT Connect.

- "HTTP": Transfers data using HTTP Post protocol constantly at interval determined by the output data rate (ODR)

- "MQTT": Transfers data using MQTT publish constantly at interval determined by the output data rate (ODR)

- "PERIODIC": Buffers data according to the "RATIO" setting at the output data rate. After the required number of samples has been collected the modem will turn on, post all data, and then turn off. The interval of cellular cycles is determined by "ODR" x "RATIO"

RATIO: Set the number of required samples between cellular cycles for the "PERIODIC" cellular protocol. This value also influences GPS signal acquisition interval for certain modes. See information of GPS for more info.

SIGNAL: Acquire cellular signal strength and network registration status. This option also programs the modem with any changes to the NETWORK mode. After 10-15 seconds the serial terminal should display "CSQ: A, B REG Status: C, D, E" Data Status: F"

Advanced cellular network information will follow if applicable. A description of A, B, C, D, E, and F follows below.

A: (0-31,99) defines the signal strength
B: (0-7, 99) defines the data error rate

C: (0-5) defines the general network registration status
D: (0-5) defines GPRS network registration status
E: (0-5) defines LTE network registration status

To form a data connection, D and/or E must show a registration status of 1 or 5

F: ONLINE/OFFLINE Indicates if unit can make data connection.

Unit must show ONLINE for it to transmit data via cellular. SIGNAL check should be completed before deployment.

A VALUE		
CSQ	DBM	MEANING
0	<-113	Absolutely no Signal
1	-111	Very Weak Signal
2-10	-109 to -93	Weak Signal
10-20	-81 to -73	Moderate Signal
21-30	-71 to -53	Strong Signal
31	>-51	Very Strong Signal
99	?	Unknown/Not Detected

B VALUE	MEANING
0-3	Reliable Data Link 4-5
4-5	Occasional Dropped Posts
6-7	Unreliable Data Link
99	Unknown/Not Detected

C, D, E, VALUE	MEANING
0	Not registered, Not Searching
1	Registered Successfully

2	Not registered, Searching
3	Registration Denied
4	Unknown Status
5	Registered Successfully, Roaming

TLS: Enable or disable TLS encryption for HTTPS or MQTTS.
TOPICS: Set the publish and subscribe topic used for MQTT cellular protocol.
EXIT: Leave the cellular configuration menu and enter the root menu

DETAILED DEFAULT MENU INFORMATION

DEFAULT: Resets all options to the factory default. Not recommended without consulting SENSIT. This will remove all custom settings including cellular information.
      • Default Settings Initialized

DETAILED DISPLAY MENU INFORMATION

DISPLAY: Displays all current settings in the terminal window. An example print out is shown below. Please note that system settings may differ from device to device depending on the application. For example:

```
FMD_124

Upgrade Already Performed

Sensor ID: FMD01038
With Analog MET, Filter: 22
System DATE,12/19/23 12:06:56
Network Time: Enabled, UTC
Battery Voltage: 13.00
Power Source: Solar Power
Output Mode: Streaming
Standard SD Rate
Output Data Rate: 30
Communication Mode: XBee
Baseline: Auto-Adjust Disabled, Constrained
Laser Offset: 0.00 SlopeAdj: 1.00
Sampling Disabled

Defining Pins...Complete

SD Card Detected...SD Card Initialized

Type 'YES' To Enter Menu
10
9
8
7
6
5
4
3
2
1

Type CELLULAR, DEFAULT, DISPLAY, GPS, OUTPUT, POWER, TIME, SYSTEM or EXIT
```

DETAILED GPS MENU INFORMATION

- GPS - "ENABLE" or "DISABLE" the GPS.
  - → ENABLE - Depending on the cellular data protocol and output mode, the user may be presented with additional options. If cellular output is disabled or if PERIODIC protocol is selected the GPS mode will default to SINGLE (see below). If cellular output is enabled and MQTT or HTTP protocol are enabled the user can select between the following GPS settings:
    - CONSTANT – GPS is always on and fixing position (Highest power draw).
    - INTERVAL – GPS turns on and interval determined by "RATIO" x "ODR".
    - SINGLE – GPS turns on at power up and remains off until system is reset.
  - → DISABLE
  - → EXIT - Leave the output configuration menu and enter the root menu.

DETAILED OUTPUT MENU INFORMATION

MENU ITEM	DESCRIPTION	LOCATION
Mode	Output Mode Settings	Output Menu
ODR	Data Rate Setting	Output Menu
POLL	Output When Polled (any char)	Output Menu
STREAM	Output Continuously	Output Menu
SD	SD Rate and Format	Output Menu
EXIT	Exit Output Menu	Output Menu

MODE: Sets the communication mode of the **GAS•TRAC® FMD**. The following options are possible:

- "Cellular": Sends data with cellular modem at ODR and USB/Power port every 1 seconds
- "USB": Sends data with USB/Power Port every 1 seconds and turns of wireless
- "Wi-Fi": Sends data with Wi-Fi modem at ODR and USB/Power port every 1 seconds
- "XBEE": Sends data with XBEE (optional) at ODR and USB/Power port every 1 seconds

ODR: Sets the output data rate of the cellular modem or XBEE wireless device. The USB port will always show data output at 1Hz

POLL: Disable streaming over USB/Port and XBEE. **GAS•TRAC® FMD** will return data when receiving any character from control device.

STREAM: Continuous USB and XBEE data output at 1Hz.

SD: Select SD data rate and format card.

- "RATE": How fast data is saved to the SD card
  - → 'STD': Saves SD data at same frequency as cellular data.
  - → 'FAST': Saves SD data at maximum speed. **WARNING**: produces large data files and increases the likelihood of SD corruption.
- "FORMAT": Used to recover from card corruption errors. All data will be lost during format. If the card fails to initialize during format, it should be replaced.

EXIT: Leave the output configuration menu and enter the root menu

DETAILED POWER MENU INFORMATION

Select "SOLAR" and "AC" power. If "SOLAR" is selected the unit will try to charge the batteries whenever power is present. If "AC" is selected the system will maintain the battery voltage in the middle of its range to extend battery life. It is important that "SOLAR" is selected for remote power application.

NOTE: Changing this setting with not influence the unit. The firmware within the unit is shared with the SENSIT® SPOD. Please contact SENSIT for more information.

DETAILED TIME MENU INFORMATION

MENU ITEM	DESCRIPTION	LOCATION
AUTOTIME	Enable/Disable Autotime	Time Menu
TIMEZONE	Select LOCAL or UTC Time zone	Time Menu
SET	Set Date and Time	Time Menu

AUTOTIME: Autotime sync uses the network time provided by the cellular module if available. For some cellular network SIM card combinations, the provided time can be incorrect and should be disabled to avoid time errors.

TIMEZONE: "LOCAL" or "UTC" The time can be reported as local time according to the location of the device or UTC time.

SET: Allows user to manually set date and time. The indicated format must be followed exactly with no exceptions and all numbers must be padded with 0's as required. The specified format is:

MM/DD/YY HH:MM: SS (e.g., 01/01/20 00:00:01)

DETAILED SYSTEM MENU INFORMATION

MENU ITEM	DESCRIPTION	LOCATION
CAL	Zero/Baseline Cal, Adjust, Display	System Menu
LASER	Debug with Hex Modbus	System Menu
MET	Enable/Disable MET	System Menu
POWER	Solar or AC	System Menu
SENSOR	Set Replace Error and Type	System Menu

CAL:
(Previously BASELINE) Adjustment of the sensor zero/baseline up or down by a constant value or automatic   baseline adjustment to track baseline downward as sensor ages.

- "CALADJ": Used to provide offset and/or slope correction to the calculated sensor data.

- "CONSTRAIN": Used to limit the minimum sensor value to 0 and not allow negative readings.

- "DISPLAY": View calibration values. This may also reprint all FMD settings including the PID Offset value/settings for older version of firmware

LASER: Will start up laser systems. HEX MODBUS commands can be sent to debug the laser cell. DO NOT use this function unless instructed to by a SENSIT employee. Contact SENSIT for more information. Type EXIT to leave the menu.

MET: Enable, disable, or turn MET detection to AUTOMATIC. If MET detection fails it is recommended to enter this menu, disable MET, enable MET, and then restart SPOD. This menu also provides the ability customize the MET filter period to smooth out wind data.

POWER: Select "SOLAR" and "AC" power. If "SOLAR" is selected the unit will try to charge the batteries whenever power is present. If "AC" is selected the system will maintain the battery voltage in the middle of its range to extend battery life. It is important that "SOLAR" is selected for remote power application.

SENSOR: Allows the user to manually "SET" the number of operating hours, "REPLACE" a sensor and reset the hour counter or define the "ERROR" threshold for a sensor error and set the "TYPE" of sensor installed.

UNIT FIRMWARE UPDATE

FIRMWARE UPDATE: Units connecting to the SENSIT Connect platform can update over the air once updated firmware and bootloader have been installed. Information on manual firmware and bootloader updates can be found in this section.
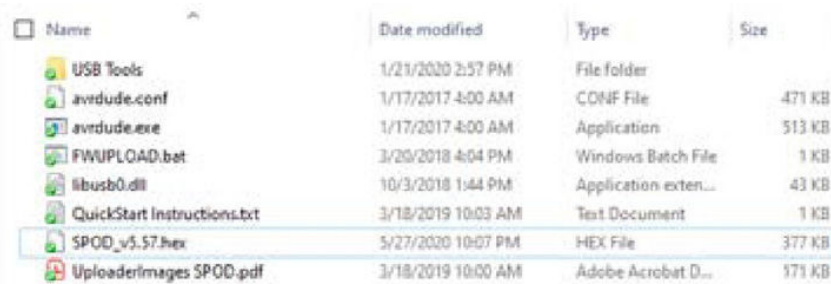
Main Unit Firmware Upgrade

Required Materials:
- Black USB Configuration Cable
- Laptop with Firmware Tools

1. Power down **GAS•TRAC® FMD** and hook up black USB cable. Use CoolTerm to determine the COM port number of the USB cable. (e.g., COM34). After determining port number make sure CoolTerm connection is disconnected (i.e., only one program can control serial port)
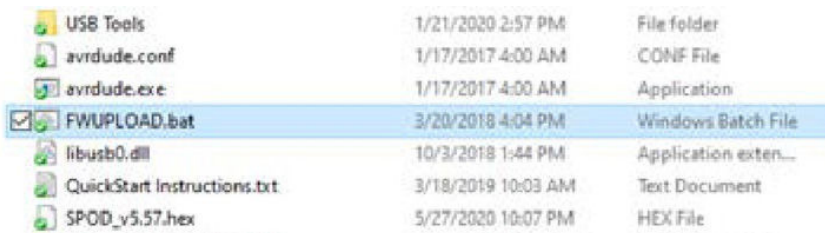
   COM34 / 9600 8-N-1
   Disconnected
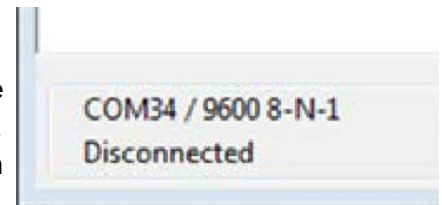
2. Open firmware folder provided by Sensit. Verify the correct version of the HEX file is found inside the folder.

Name	Date modified	Type	Size
USB Tools	1/21/2020 2:57 PM	File folder	
avrdude.conf	1/17/2017 4:00 AM	CONF File	471 KB
avrdude.exe	1/17/2017 4:00 AM	Application	513 KB
FWUPLOAD.bat	3/20/2018 4:04 PM	Windows Batch File	1 KB
libusb0.dll	10/3/2018 1:44 PM	Application exten...	43 KB
QuickStart Instructions.txt	3/18/2019 10:03 AM	Text Document	1 KB
SPOD_v5.57.hex	5/27/2020 10:07 PM	HEX File	377 KB
UploaderImages SPOD.pdf	3/18/2019 10:00 AM	Adobe Acrobat D...	171 KB

3. Power on **GAS•TRAC® FMD** and double click the "FWUPLOAD.BAT" file. A cmd window will open and prompt for a COM port. Type in the com port number determined from CoolTerm (e.g., "COM34" or "com34")

USB Tools	1/21/2020 2:57 PM	File folder
avrdude.conf	1/17/2017 4:00 AM	CONF File
avrdude.exe	1/17/2017 4:00 AM	Application
FWUPLOAD.bat	3/20/2018 4:04 PM	Windows Batch File
libusb0.dll	10/3/2018 1:44 PM	Application exten...
QuickStart Instructions.txt	3/18/2019 10:03 AM	Text Document
SPOD_v5.57.hex	5/27/2020 10:07 PM	HEX File

4. The cmd window will show the progress of the firmware upload. The program will perform 3 steps:

   a. Read device type and configuration (< 1sec)

   b. Write new firmware (~40 seconds)

   c. Verify new firmware (~40 seconds)

5. The program should report all bytes verified and show no errors. If any errors are found verify the following:

   a. Cable hooked up

   b. No other programs using serial port

   c. **GAS•TRAC® FMD** turned on

6. Close cmd window and connect using CoolTerm. Firmware should report the latest version number during startup.

7. Type "YES" to enter menu when prompted

8. Type "UPGRADE". The **GAS•TRAC® FMD** will print out "Upgrade Parameters Sent". Any addition UPGRADE commands will result in "Upgrade Already Performed"

9. Follow any other instructions provided by Sensit. There is a quick start instructions text file found in the uploader folder for easy reference.

HARDWARE INSTALLATION GUIDE FOR AVR PROGRAMMER

1. Download firmware tools provided by Sensit

2. Plug in blue USB programmer into computer and let windows attempt to install the driver. Most often, windows either fail to find the driver or installs the wrong driver.

3. Open "Zadig" utility

4. If Windows failed to install a driver, the "mkII" should show up in the drop-down list. You will need to select it and click install the "libusb-win32" driver (please note version may be newer).

5. If Windows managed to install some driver, you will need to select "Options" and click "List All Devices". Now the mkII should show up. Select the mkII and replace or upgrade the driver with "li- busb-32" (please note version may be newer).

6. It is recommended to unplug the programmer and restart the computer but might not be necessary

7. If installed correctly the programmer should show up as "libusb-win32 devices -> AVRISP mkII" inside the device manager. If you see any error inside device manager or a different name do not proceed until the driver issue is resolved.

HARDWARE AND SOFTWARE INSTALLATION GUIDE FOR USB CABLE

1. Download drivers for FTDI Serial Adapter and install drivers

   http://www.ftdichip.com/Drivers/VCP.htm

2. Open serial terminal program of your choice. CoolTerm is recommended and instructions for using CoolTerm are found below. CoolTerm is available for Windows, Mac, and Linux. CoolTerm can be downloaded for free from here:

   http://freeware.the-meiers.org/

3. Extract 'Software_CoolTerm' to the directory of your choosing. To avoid certain permissions issues do not extract into "Program Files". It is recommended to extract to the desktop if possible.

4. Open the 'CoolTerm' application. You may receive an error indicating that no serial ports are found depending on what is hooked up to the computer. Click okay to continue.


5. Click 'Options' as shown below

   • 'Serial Port' options should open by default. If not, select Serial Port options from the list of available options as shown below. All default options should be correct but please verify. Click on 'Port' dropdown list and make note of any available ports.
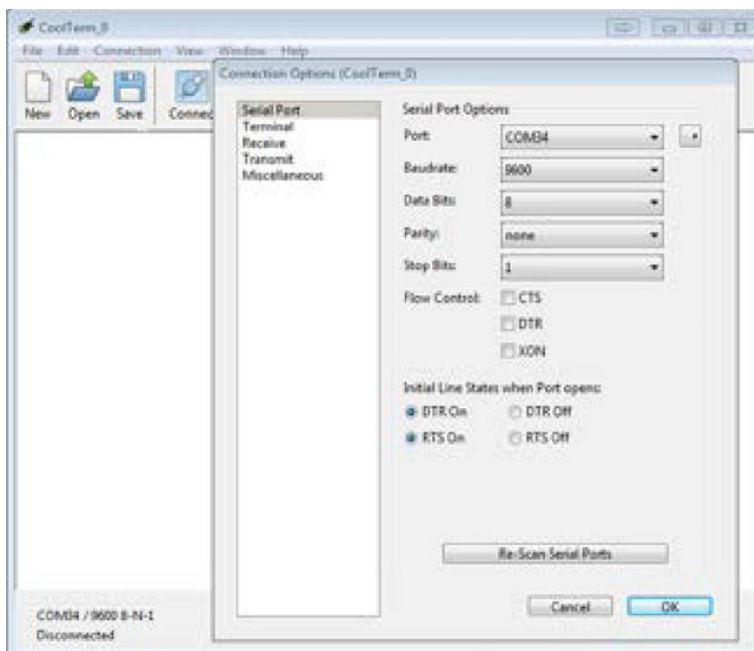

   • Plug in the USB cable and wait for hardware installation to finish. Click "Re-Scan Serial Ports". The newly added port is the USB cable. Select this port.

- Select 'Terminal' options from list of available options and select 'Line Mode' as shown below. Line mode adds a text entry bar at the bottom of the screen that is useful for sending commands to the connected sensor.
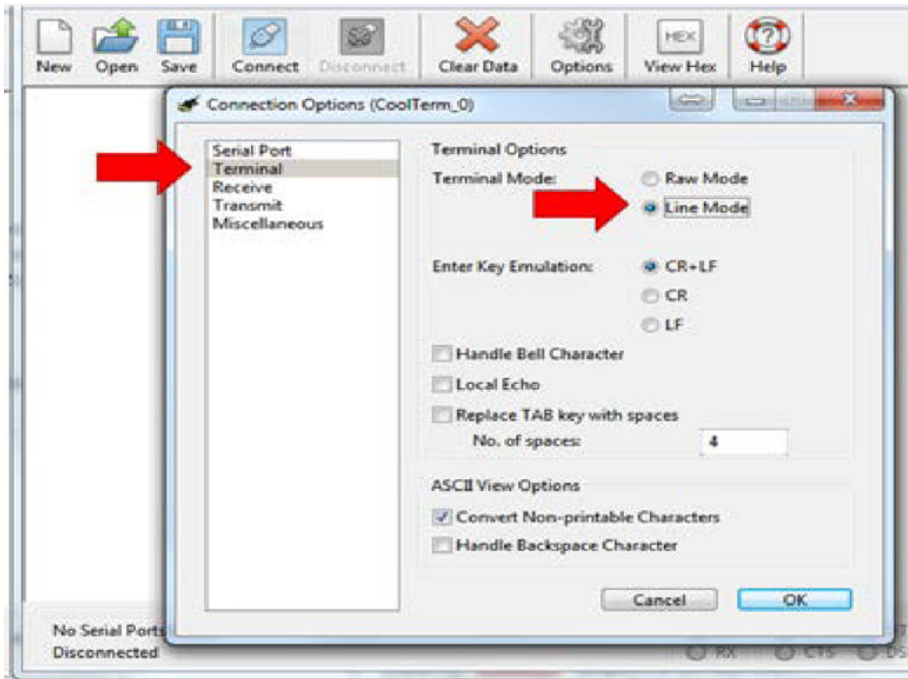

- Select 'Receive' options from list of available options and check "Ignore Receive Signal Errors". Selecting this option reduces the possibility of the serial connection closing upon a received serial error such as connecting or disconnecting the cable or power cycling the unit.

6. To avoid having to configure the terminal every time you open it, you have 2 options to save the configuration as shown in Figure 4.

- Click "Save As" and save the connection settings as a file that you can share or store on the computer
- Click "Save As Default" to change these settings to the default settings when starting the program. If you are running off the CD this option will give you an error as there is no default file.
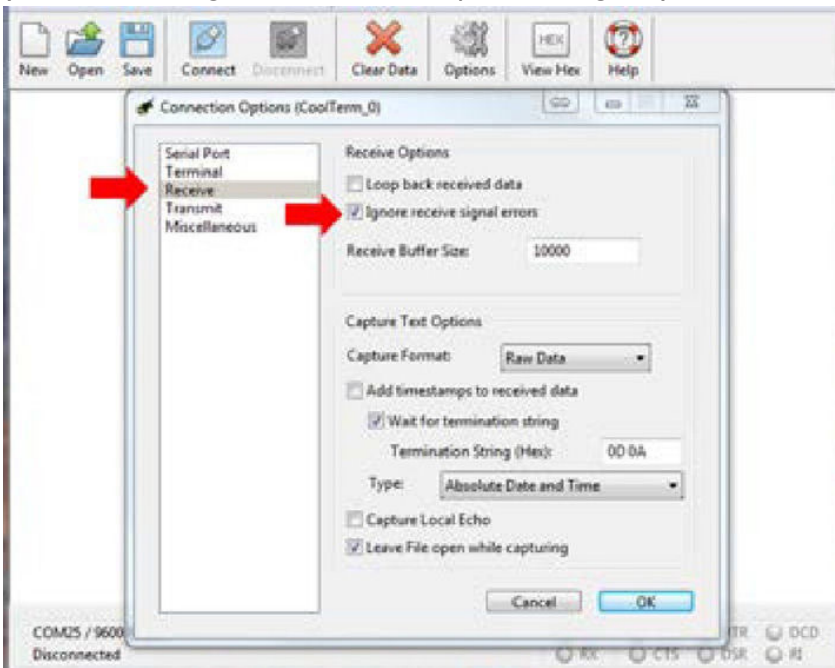
7. CoolTerm can be configured to record all data received over serial. This will be useful for evaluation purposes.

- To start a capture, go to 'Connection' dropdown menu ➔ Capture to Text file ➔ Start or hit Ctrl-R (⌘-R). Enter a file name and click save.
- To stop the capture, navigate back to the menu entry and click stop or hit Ctrl-Shift-R (⌘-Shift-R)

NOTES
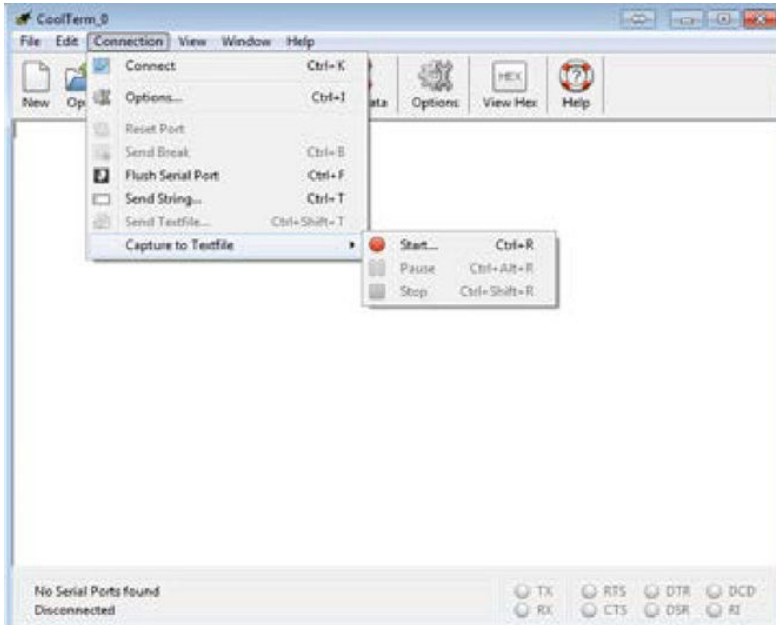
WARRANTY

Your **GAS•TRAC® FMD** is warranted to be free from defects in materials and workmanship for a period of one year after purchase. If within the warranty period, the instrument should become inoperative from such defects the instrument will be repaired or replaced at our option. This warranty covers normal use and does not cover damage which occurs in shipment or failure which results from alteration, tampering, accident, misuse, abuse, neglect, or improper maintenance. Proof of purchase may be required before the warranty is rendered. Units out of warranty will be repaired for a service charge. Internal repair or maintenance must be performed by a Sensit Technologies authorized technician. Violation will void the warranty. Units must be returned postpaid, insured and to the attention of the service department for warranty or repair.

This warranty gives you specific legal rights and you may have other rights which vary from state to state.

851 Transport Drive
Valparaiso, IN 46383-8432
Phone: 219.465.2700
Toll Free: 888.4.SENSIT (473.6748)
Fax: 219.465.2701
Email: info@gasleaksensors.com
Website: www.GasLeakSensors.com

MADE IN THE USA
WITH GLOBALLY SOURCED COMPONENTS