MassSense® Density Meter
for Gases and Liquids

Installation and Operation Manual

MassSense LDM model with display; other models available

ISSYS
INTEGRATED SENSING SYSTEMS

Contents

1 Introduction

The MassSense® instrument measures the density and temperature of a liquid, or the density and pressure of a gas. It is available as a liquid density measurement (LDM) or gas density measurement (GDM) model. For binary liquids and gases, the MassSense software can convert measured density, pressure, and temperature into a concentration measurement.

The compact MassSense instrument continuously monitors the density of fluids and gases used in industrial applications. The instrument measures liquid density between 0.6 to 1.3 g/cc and gas density between 0 to 30 kg/m3 with six digits of resolution (±0.000001 g/cc). The operating temperature range of the fluid is from -20°C to 60°C. The maximum operating pressure is 300 psig.

1.1 Applications

The LDM and GDM models are used in many industrial and laboratory environments. These applications range from in-line, real-time process applications to sampling in laboratories.

Application	Application Types
Fuels	• Diesel fuel • Jet fuel • Refinery fuel gas • Gas used to electrically insulate high-voltage switchgear
Concentration	• Alcohol concentration in water • Glycol concentration in water • Salt concentration in water • Sugar concentration in water
Gases	• Liquefied petroleum gases • Gas blending systems • Methane-rich natural gas • Hydrogen-rich fuel gas • LPG/air blends for synthetic gas • Vapor in inert gas • Gas blends composed of hydrogen and nitrogen used as forming gas • Liquid petroleum gas vapor density
Other	• Vaporized liquid samples prior to a gas chromatographic analysis • Hydrogen-rich gases in recycle compressors • Gas blending • Binary fluid detection

1.2 Technology Overview

The MassSense instrument measures fluid density based on the Coriolis principle.The sensor oscillates at a very high frequency (>20kHz) and is not affected by any vibrations transmitted through the

mechanical mount. Installation and system integration is simple because the measuring cell and control electronics are housed in one package.

Technical Specifications

GENERAL	
Gas Density Range	0 - 0.03 g/cc GDM, 0.6 - 1.3 g/cc LDM
Accuracy	Digital Density: 0.0001 g/cc Analog Density: +/- 0.1% of full scale Temperature: 0.6 °F (0.3 °C)
Repeatability	0.00003 max g/cc
Max Pressure	300 psig (21.7 bar) standard
Operating Temperature	-4 to 140 F (-20 to 60 C)
Sample Rate	100 mS
Fittings	5/16 straight thread, O-ring seal; standard fitting 1/4" Swagelok™ compression
Bypass	GDM: 0.050" (0.127 cm) standard, 0.076" (0.193 cm) optional LDM: 0.027" (0.07 cm) standard, 0.050" (0.127 cm) optional
Mounting	(4) 1/4" 20 UNC (M6) bolts
Materials	Housing: painted aluminum Wetted parts: SS, Silicon, Epoxy, Glass
Dimensions	6.3" x 2.63" x 4" (15.7 cm x 6.3 cm x 10 cm)
Weight	2.5 lb (1135 g)
POWER	
Power Supply	5 VDC, 500 mW USB or 8-30 VDC
Consumption	400 mW
ELECTRICAL	
Outputs	(2) 4-20mA analog, optional
Communication	USB, standard RS-232, optional RS-485, optional
Display	2x16 standard character, adjustable LCD backlit, optional
Memory	2 Gb internal data logger
OPTIONS	
	Display IP67 Modbus NIST Certificate
APPROVAL	
	EX IIC, AEx, CUL, UL (Class 1 Div 1, Group ABCD)

Sample Nameplates for MassSense (Variations May Occur Based on Product Options)
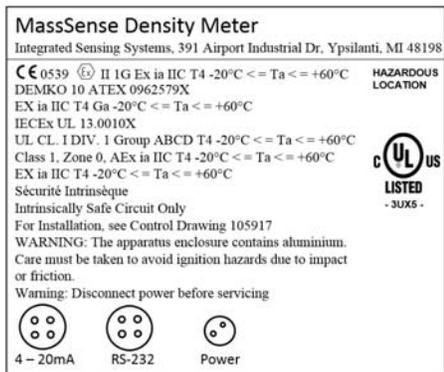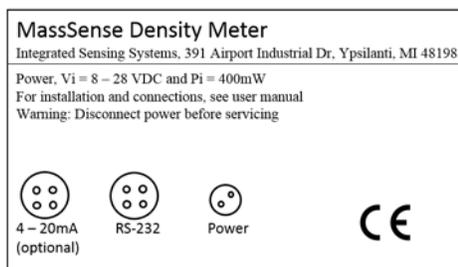

Figure 1: MassSense RS-232 Hazardous Location Nameplate.

Figure 2: MassSense RS-232 Nonhazardous Location Nameplate.

1.3 Order Code

Product	Bypass Size	Fittings *	Analog output	Digital Output	Haz location	Case Type				Memory	Sensor Port	External sensor	Advanced Density			Fluid Ingress			Modbus		
GDM	X	X	X	X	X	X	0	0	1	X	P	X	X	0	0	X	0	2	X	0	0
	1 = 0.027"	1 = 1/4"	0 = None	U = USB	0 = No	0 = None				0 = No	P=Pressure	1=300psi	0 = No			0 = No			0 = No		
	2 = 0.050"	2 = 1/8"	1 = (2) 4-20mA	R = RS-232	1 = Yes	1 = Display				1= Yes		2=100psi	1 = Yes			1 = IP67			1 = Modbus		
	3 = 0.076"			4 = RS-485								3=30psi									

Product	Bypass Size	Fittings *	Analog output	Digital Output	Haz location	Case Type	Flow Switch			Memory	Sensor Port	External sensor	Advanced Density			Fluid Ingress	Viscosity option		Modbus		
LDM	X	X	X	X	X	X	X	0	1	X	X	X	X	0	0	X	X	2	X	0	0
	1 = 0.027"	1 = 1/4"	0 = None	U = USB	0 = No	0 = None	0 = No			0 = No	0 = None	1=300psi	0 = No			0 = No	0 = No		0 = No		
	2 = 0.050"	2 = 1/8"	1 = (2) 4-20mA	R = RS-232	1 = Yes	1 = Display	1= Yes			1= Yes	T= Temp	2=100psi	1 = Yes			1 = IP67	1 = Yes		1 = Modbus		
	3 = 0.076"			4 = RS-485							P=Pressure	3=30psi									

Standards: GDM and LDM include 5/16 straight thread, 0-ring and 1/4" Swagelok compression fittings with the unit; MassSense computer software, power connector with 16.4' (5 m) of power cable.

1.4 Certifications and Approval

For instruments that include hazardous approvals, certificates and approval documents are supplied with the instrument. The MassSense GDM and LDM instruments are available with UL, cUL, and ATEX (EX IIC, AEx, Class 1 Division 1 Group ABCD) approvals.

MassSense instruments approved for use in hazardous areas are labeled accordingly on the nameplate. Relevant national regulations must be observed when operating the instrument in hazardous areas. Observe the installation regulations, power connection data, and safety instructions provided in the Ex documentation. For UL, cUL, and ATEX certified instruments, using safety barriers is required to ensure intrinsic safety.

2 General Safety

2.1 Safety Conventions

Please note the following safety conventions:

⚠️ **WARNING! Indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.**

⚠️ *Caution: Indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.*

Note: Indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

2.2 Operational Safety Considerations

MassSense is designed to meet state-of-the-art safety requirements. Every MassSense instrument has been thoroughly tested and leaves the factory in a safe, operable condition. The device complies with the applicable standards and measurement in accordance with EN 61010-1.

⚠️ **WARNING! Incorrectly applying this instrument can result in property damage or personal injury. Before installing and operating this instrument, read this User Manual.**

When using this product in hazardous environments it must be accompanied by Atex, UL, or CUL Documentation. Strict compliance with the installation instructions and ratings as stated in this document is a requirement for hazardous area installations. The symbol on the front of the supplementary Ex Document indicates the approval and certification body.

Internal components and any hot process fluids passing through the sensor can cause the MassSense instrument's external surface temperature to get hot. Additional precautions should be taken with high fluid process temperatures to make sure the maximum operating temperature of the instrument is not exceeded.

The manufacturer reserves the right to modify technical specifications and installation instructions without prior notice. Contact your local agent or go to http://www.metersolution.com.

2.3 Electrical and Mechanical Safety Considerations

Mechanical installation, connection to the electricity supply and outside electronics, and routine maintenance of the instrument must be carried out by a trained, qualified technician authorized to perform such work by the facility's owner/operator. The technician must have read and understood this user manual and follow the instructions for safe operation of the instrument.

The installer must ensure that the system is correctly wired in accordance with the wiring diagrams (provided separately).

> ⚠ **WARNING! Follow operational specifications for providing power to the instrument as voltage. Frequency ranges outside of the specifications will damage the instrument.**

> ⚠ **WARNING! Do not connect the MassSense instrument to any gas supply that could possibly contain helium. Helium will damage the silicon MEMS sensor.**

The user is liable for wetted material chemical compatibility in a specific application. Consult the factory for any concerns with the process chemical properties that will contact the instrument's wetted materials.

> ⚠ **WARNING! Do not use the instrument for grounding in welding conditions. The sensor temperature must always remain within operational specifications.**

Do not place the instrument under any sort of mechanical shock, such as dropping. This could cause permanent damage to the instrument. Process pressure spikes over 300 psi (20 bar) and rapid pulsating pressures can damage the instrument.

> ⚠ **WARNING! Vapor condensation, liquid freezing, and solute crystallization can permanently damage or change the readings from the instrument. To prevent clogging the sensor, it is recommended to ensure adequate filtration of particles of the incoming fluid.**

3 Handling and Storage

3.1 Unpacking and Handling

Every MassSense instrument is shipped with a calibration certificate and a CD-ROM that contains the User Manual and PC software. Additional certificates are provided based on the selected options at time of order.

Inspect the package and contents to ensure that no damage has occurred during shipping. Contact the factory if damage has occurred or is suspected prior to installation.

On receipt, inspect the packaging and package contents for any damaged or missing items.

If additional shipping is required, always transport the instruments in the containers in which they are delivered.

⚠️ *Caution: The MassSense instrument is supplied with plastic caps fitted to the process connections to prevent damage and sensor contamination. Do not remove these caps until immediately before installation.*

3.2 Storage

When storing the MassSense instrument, pack the instrument to protect it against damage while in storage.

The storage temperature range is -4°F to 176°F (-20 to 80°C). Protect the instrument from direct sunlight during storage to avoid high surface temperatures.

4 Installing the MassSense Instrument

4.1 Mechanical Installation

4.1.1 Mounting

To avoid stressing the fluid path ports, your MassSense instrument should be securely mounted using the mounting holes in the housing enclosure. It is recommended to use (4) 1/4" 20 UNC (M6) bolts.
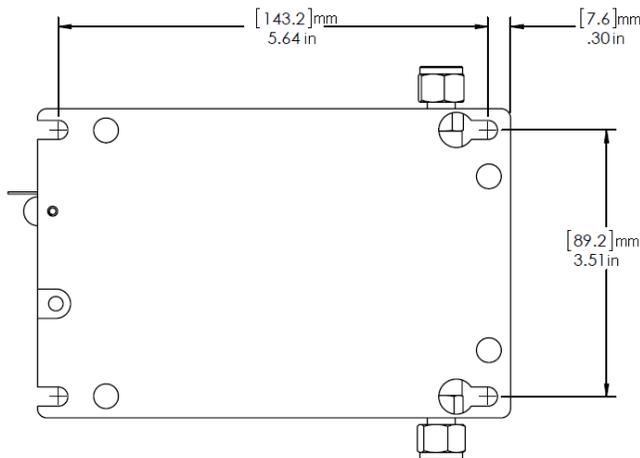

Figure 3: Mounting hole pattern. Use socket head cap screws. Mounting hole thread size = 1/4" or M6.

As long as no cavitation occurs, there are no special precautions for designing or locating the upstream or downstream fittings (valves, elbows, T-pieces, etc.), which might create turbulence in the fluid. There are no requirements for upstream or downstream pipe lengths.

When installing tubing into the supplied compression fittings on the meter, follow the guidelines from the compression fitting supplier for correct torque on the fitting. Be sure not to over-tighten the fittings.

When installing the unit outdoors, it is recommended to mount it in a location that is protected from direct sunlight and precipitation.

If mounting the MassSense on a hard surface that generates heat, it is recommended to use a thermal insulation pad between the meter, bracket, and mounting surface.

⚠ **WARNING! Do not support MassSense by the process tubing. Doing so can cause a shift in the measurement and cause possible damage to the unit.**

⚠ *Caution: Filtration to at least 60 microns or finer is recommended to prevent clogging the MEMS sensor.*

4.1.2　　Process Connection

The primary concern with gas density measurement is to keep the pressure at the orifice close to the measured pressure. This requires control of the gas flow through the meter.

Note: For accurate pressure measurement, it is recommended that the meter be powered by an 8 - 30 VDC power supply adapter rather than the USB power supply. Not all computer USB power supplies consistently provide 5 VDC. The meter has a self-check; if the USB power is below 5 VDC, the red LED on the meter will flash. Operating the device below 5 VDC creates error in pressure measurement, which will affect calculations such as specific gravity, average molecular weight, and reference density.

Avoid exceeding the published operating pressure specification for the instrument. Ensure that cavitation does not occur in the line that feeds the instrument.

No special measures need to be taken for fluids that have a vapor pressure similar to water under normal conditions. For liquids with a high vapor pressure (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important that the line pressure does not drop below the vapor pressure; otherwise, the liquid will flash.

It is important to ensure that dissolved gases that occur naturally in many liquids do not outgas. Outgassing can be prevented when line pressure is sufficiently high.

The following installation locations are generally preferred:

- Downstream from pumps (no danger of vacuum)
- At the lowest point in a vertical pipe.

Liquid pressure spikes exceeding 300 psi (20 bar) can damage the instrument. These spikes can occur due to water hammer. Be careful of installations where a valve is used to control the back pressure of the liquid line—these valves can open and close rapidly, resulting in a rapid wave of high pressures. In this case, a pressure spike suppression device can be installed.

Figure 4: Pressure spike suppression device.

⚠ *Caution: Special measures must be taken when measuring the gas density of vapors originating from liquids with low vapor pressure. There can be possible liquid condensation in the sensor. The most common vapor is water, which is very problematic. When measuring vapors mixed with inert gases at high gas pressure and low temperature, the vapors can condense. If the vapors condense in the sensor, it will create a shift in density measurement. Consider lowering the pressure of the gas or increasing the temperature of the gas. If you suspect liquid is condensing on the surface of the sensing tube, the tube must be cleaned. Follow the instructions in chapter 8.*

4.2 Electrical Setup

4.2.1 Power Connections

The connectors for external power are shown in Figure 5. Ensure that the plugs are properly wired before installing the unit. Additional connector cables can be purchased separately from the factory.

Connector cables are supplied with the unit for UL (US and Canada) ATEX certified instruments. For intrinsically safe requirements, a barrier must be used.

Figure 5: Power connectors. Left: Mini USB connector for downloading data in non-hazardous locations. Right: Power connector (DC 8-30 V).

4.2.2 Providing Power to the Instrument

The power supply for the instrument can be an 8 - 30 VDC 1A power adapter or 5 VDC, 500mW (100ma) USB, depending on whether the instrument is in a hazardous or non-hazardous location.

USB Power Supply (Non-Hazardous Locations Only)

If you are using a USB power supply, use the supplied cable to connect the instrument to a PC. Any USB power supply adapter can be used (including battery-powered USB supplies) if the supply has a 5 VDC 500mW (100ma) rating. If the proper levels of power are not available, the instrument display will dim or the LED will flash.

In non-hazardous locations the instrument can be simultaneously powered by an 8 - 30 VDC 1A power adapter with the USB power supply; this will not damage the unit.

DC Adapter Power Supply (Hazardous and Non-Hazardous Locations)

Power can be supplied to the instrument using an 8 - 30 VDC 1A power supply to the provided power connector.

DC Adapter Power Supply (Hazardous Locations)

⚠️ **WARNING! If you are operating the MassSense instrument in a hazardous location, the instrument is not approved for power to be supplied via USB.**

For hazardous locations: If you want to connect to the computer via USB to access setup or download data, the instrument must be removed from the hazardous location.

To interface with the computer:

1. Remove the DC power supply and ensure that the instrument is in a non-hazardous location.
2. Remove the locking tab and cap to expose the USB port on the instrument.

3. Connect the instrument via USB to the computer.

4. After communicating with the computer, reinstall the cap and the locking tab.

5. Reapply DC power to the MassSense instrument.

Note: Refer to control drawing 105918 (included with the MassSense meter) for installation details when using the MassSense instrument in a hazardous location.

5 Device Communication

5.1   Analog Output

When the MassSense instrument is ordered with the analog output option, a connector cable is included with the order.

Two isolated 4-20 mA current loops are available as an option, in which the output value is directly proportional to the current (e.g., linear between 4 and 20 mA; the lower measured range value is set to 4 mA and the upper measured range value is set to 20 mA).

The loop electronics that condition the digital signal (12 bit) from the sensor micro controller are powered by the current loop. They are passively powered and have no active option. They are isolated by optical isolators from the internal IS circuits.

Unshielded cabling can be used as long as there is a 12 VDC supply.

⚠️ *Caution: For hazardous locations when a 24 VDC supply is used, the current loops must be separately shielded pairs.*

Several alarm conditions can be programmed to cause the current loops to be set for high and low current. The parameters are defined in chapter 7.

5.1.1   Testing 4-20 mA Current Loops

To test the circuit outside of the instrument with a 24 VDC supply and 250 ohm current measurement system, a 1 K ohm test resistor should give 20 mA, a 2 K ohm resistor should provide about 10 mA, and 5 K ohm should provide 4-5 mA.

When the circuit is connected correctly, a floating volt meter should read a voltage output. See Figure 6 for details.
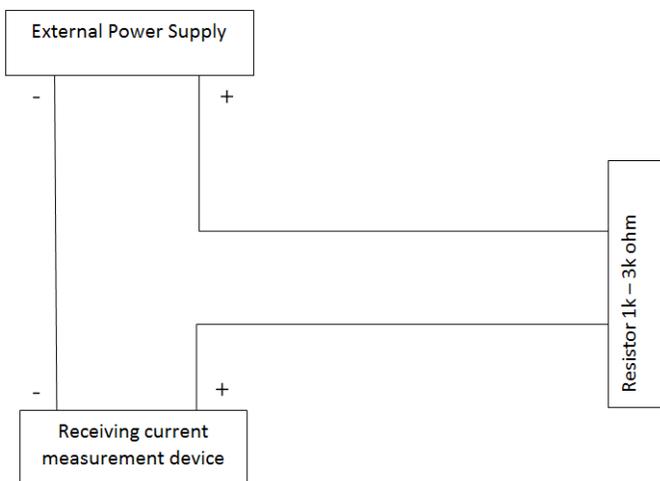

Figure 6: 4-20 mA wiring for current loop testing.

Pin	Description
Channel 1	1,2 (polarity +- or -+, passive)
Channel 2	3,4 (polarity insensitive)

5.2   Digital Output

There are several models available for digital communications, including RS-232, USB, and RS-485. The type of digital communication is determined during the ordering process.

5.2.1   USB Connector

A USB data connector is available on USB models. This is a standard USB connection cable. The connector is an IP67 Mini B USB connector (see Figure 7).

Figure 7: Mini-USB connector for downloading data in non-hazardous locations.

System power is supplied from the USB connector or from an external power source. See section 6.1 for more information.

Note: The USB port is used for configuring the instrument and data download in a non-hazardous location only. Normal operation in a hazardous location requires DC power supply and the factory supplied cap over the USB port.

5.2.2   RS-232 Connector

RS-232 Pin Layout

Pin	Description	Reference DB9 Connector
1	Common	5
2	TX out	2
3	RX in	3
4	Shield	Shield

There are two data lines (RX and TX) through a dual AC barrier. A 3-pin M12 connector is available on RS-232 models. These two types of cables are shielded.

5.2.3 RS-485 Connector

Pin	Description
1	Common
2	Data A
3	Data B
4 =	Shield

Custom protocol and Modbus protocol are available on RS-485 models.

6 Getting Started

6.1 Powering Up the MassSense Instrument

To start up the instrument:

1. Connect the MassSense instrument to a power source (DC power adapter or USB) to begin startup.
2. During startup, the LCD panel runs through a power-up cycle (display models only). At the end of startup, real time density and temperature values (or the values selected at the time of order) are displayed on the LCD screen.

   For units with no LCD display: the LEDs will turn on green.
3. Allow the unit to warm up for 5 minutes before taking measurements.

The instrument can be configured at the factory for the application, including:

- Density units
- Temperature units
- 4-20mA process variables and ranges
- Flow alarm
- Any additional alarms

This setup is specified on the order form.

6.2 The Display Menu

You can customize your instrument for LDM or GDM application using the menu in the LCD panel.

Note: To access the display menu you will need the access code: 0020.

To customize the instrument:

1. Press the **E** button on the unit. The LCD panel will display the following message:

Access Code
0***

2. Use the following controls to enter the access code:
   - **-** and **+**—Changes the numerical value of the selected digit in the code.
   - **E**—Enters the value and moves to the next digit.

3. Press **E** to enter the access code. Once the code has been entered successfully, the LCD panel will display:

```
Access Code
Programming code enbl
```

The next message will display the following:

```
Measured Variabl
User Interface
```

4. Begin customizing your instrument:
    *   Use the **-** and **+** controls to continue through the list and press **E** to select a menu item to modify.
    *   Select a parameter from the submenu and use the **-** and **+** controls to modify the parameter value. Press **E** to enter the change.
5. To exit the menu or submenu, press and hold the **-** and **+** buttons at the same time to go up one level. Repeat as necessary.

LCD Panel Menu

Menu	Options
Meaured Variabl	• Measuring Var AAA • System Units ACA • Special Units AE
User Interface	• Control • Top Line • Bottom Line
4-20mA	• Current Out1 • Current Out2
Basic Function	• Proces Prmtr GIA • System Prmtr GLA
Special Function	• Density Fcts HAA
Supervision	• System JAA

7   MassSense Software

7.1   Installing MassSense Software

To install the MassSense software, you must have a windows-based PC, available USB port that can power the instrument at 5 V power (otherwise, power the device using the power adapter), and the MassSense software CD.

1. Insert the MassSense CD in the computer drive.
2. When prompted, click **OK**.
3. Open the CD folder using My Computer or the Windows Start Menu.
4. Double-click on the Setup application file.
5. Follow the instructions in the Installation Wizard.
6. After installation is finished, restart the computer.
7. Plug in the USB cable.
8. Open the ISSYS MassSense program under the Windows Start Menu.

If the software locates the instrument, the installation is complete and you can begin operating the software.

If a message appears indicating there is a problem with the USB port, follow the instructions in the "Installing Drivers" or "Troubleshooting the Driver/Com Port" section below.

7.1.1   Installing Drivers for Windows 7 and 8

To install the USB driver on a Windows 7 computer:

1. Insert the MassSense CD into the PC.
2. Connect the MassSense instrument to the computer via USB cable.
3. When prompted to download and install the driver for your USB controller, click **OK**.
4. Click the Windows **Start** button and go to **Control Panel > System and Security > System > Device Manager**.
5. In the Device Manager, expand **Other devices** and find FT-232 Emulation Demo. There should be a yellow flag next to the device name. Double-click on the device name.
6. In the FT-232 Emulation Demo Properties window, go to the General tab and click **Change Settings**.
7. Click **Update Driver**.
8. Click **Browse my computer for driver software** and browse to **Computer > CD drive**. Select win2k_winxp and cick **OK**.
9. In the Update Driver Software window, click **Next**.
10. When prompted, click **Install**.

11. When installation is complete, close the installation windows and return to the Device Manager.

    The new Comm port will be in the Device Manager list as Communications Port X (where X is the new port).

12. You can easily see which port is the assigned port by watching the Device Manager list while unplugging the USB port for a few seconds then replugging it in. The list will update as you unplug and replug the device.

The USB port will be established as a communications port with a specific com port number for that USB connector (i.e., Com5 or Com12d). This configuration will remain even after reboot.

If the instrument is connected to a different USB port, follow the same procedure as above. On most computers, the installation CD will not be required for other port installations.

Note: The driver for the port is in the folder named "win2k_winxp" on the installation CD.

7.1.2   Installing Drivers for Windows XP

To install the USB software on a Windows XP computer:

1. Insert the installation CD in the PC.

2. Connect the MassSense instrument to the computer via USB cable.

3. When prompted to connect to Windows Update to search for software, click **NO not at this time** and click **Next**.

4. Select **Install the software automatically** and click **Next**.

5. If a message states that the hardware communications port has not passed Windows Logon testing, select **Continue Anyway**.

6. Allow the installation to continue. When installation has completed, click **Finish**.

7.1.3   Viewing the Comm Port Assignment (Optional)

If you want to view the communication port to find its number:

1. Open **Control Panel > System > Hardware tab > Device Manager**.

2. In the list of devices, expand **Ports (Com & LPT)**. There will be a list with "Communications Port (Com1)", "Communications Port (ComX)" where ComX is the established USB port. If there are other devices connected as Comm ports, they will be listed here as well.

3. To see what port the MassSense instrument is connected to, unplug the instrument for a few seconds and reconnect the plug. The com port that reappears will be the one connected to the meter.

7.1.4   Troubleshooting the Driver/Com Port

If the communication port has not been successfully established:

1. Follow the procedure for "Viewing the Comm Port Assignment."

2. If there is a yellow caution indicator next to FT-232, double-click the row to open the Communications Port properties page.

3. Select the Driver tab.
4. Select **Update Driver** and navigate to the folder titled X:\win2k_winxp on the installation CD (where X is the letter of the CD drive).

The USB port will be established as a Communications port with a specific com port number for that USB connector (i.e. Com5 or Com12). This configuration will remain even after reboot.

If the instrument is connected to a different USB port, select that port from the dropdown menu. On most computers, the installation CD will not be required for other port installations.

Note: The driver for the port is in the folder named "win2k_winxp" on the installation CD.

7.2　Operating the MassSense Software

The MassSense software interface contains four main tabs:

- **Param**—Used for configuring and customizing the MassSense instrument's settings in real time.
- **RT Data**—Allows you to graph the data in the software window and store data in the PC memory.
- **Internal Data**—Allows you to record and save the data file containing the measuring data.
- **Adjust**—Allows you to perform field calibration and set the zero point adjustment.

You can switch interface styles between the tabbed layout and a simple view that shows only what is displayed on the unit.

- To view a simple interface, select **Display > Simple Interface**.
- To view the tabs and options, select **Display > Advanced Interface with Config**.

7.2.1　Configuring Settings

The Param tab is the operating menu for the instrument. It is used for configuring and customizing the MassSense instrument's settings in real time.

The MassSense instrument is customizable and configurable for your application. The default parameters are set from the factory according to the order form.

The Param tab contains two main areas:

- Parameter Selection Tree—Lists all of the instrument's parameters in an expandable tree menu.
- Parameter Settings View—Main area of the interface that displays the selected parameters from the tree menu and allows you to change the settings in the connected instrument.
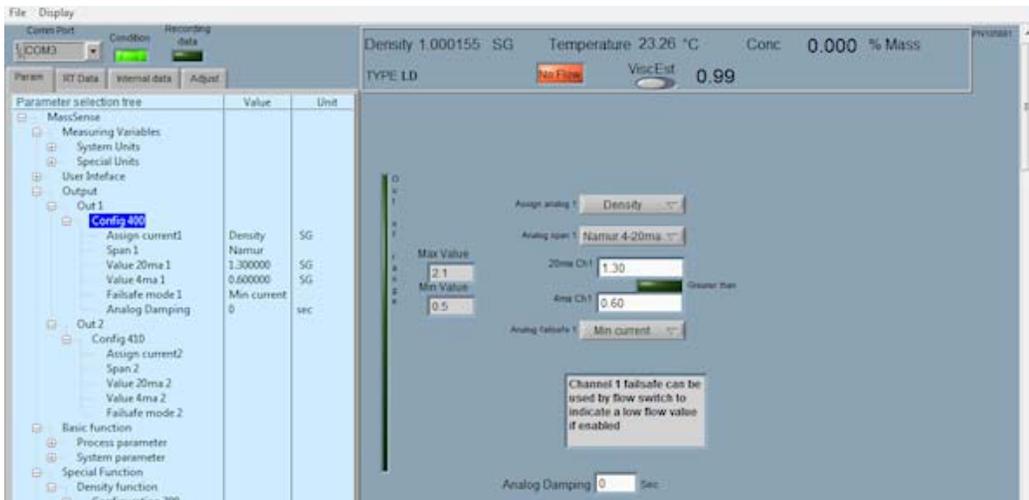

Figure 8: Param tab of the MassSense software.

The Param Tab displays various menus and options based on the model. The software automatically recognizes which features are available based on the instrument that is connected. Some descriptions of various options are provided below:

Advanced Density Option Details: Under the advanced density option, either Reference Density or Concentration can be selected and programmed.

Reference Density is available for both LDM and GDM models.

- The LDM uses thermal expansion coefficients of the measurement liquid to correct the density readout to a constant temperature than the measured temperature. The coefficients can be either linear or a second-order polynomial fit. The data must be in density g/cc (Y-axis) and degrees C (X-axis). This can be calculated from published or from empirical (measured) data. Use a curve fitting routine such as Excel.
- The GDM uses the Ideal Gas Law to correct a measured pressure to a constant temperature and constant pressure. The pressure and temperature are entered in the user-selected units.

Note: Because the reference density measurement is an estimation based on a calculation, the greater the difference between the process pressure and temperature from the constant value, the greater the error that the reference density will indicate.

Concentration is also available for both LDM and GDM models.

The measured density and temperature are used to calculate the concentration of a binary liquid mixture (LDM) or a gas (GDM) by also including pressure. Mathematical coefficients supplied from the factory on request (up to four different sets) are programmed using the MassSense computer software to output concentration directly in percentage.

This section lists the menus in the Parameter Selection Tree and describes the parameters that are displayed in the Parameter Settings View.

Menu: Measuring Variables > System Units > Configuration042 > Unit density

Controls in this dropdown define measurement: units

- **g/cm3**
- **g/cc**
- **kg/L**
- **kg/m3**
- **Lb/ft3**
- **Lb/gal**
- **YYYY**—Special density units that are user-defined.
- **SG**—Specific gravity

Note: Specific gravity for liquid is defined as the measured liquid density of the fluid at the measured temperature, divided by the density of pure water at the same temperature. SG_{liq} = density(liquid) /density of water at same temperature. Dry Air density = PressureIn*6.895/287.07*(Temp MEMS+273.15). Example: Density of air at 25 C and 15 psi absolute = 0.0012083 grams/cc. GAS: Specific gravity for gas = density(gas sample)/density of dry air at same pressure and temperature.

Menu: Measuring Variables > System Units > Configuration042 > Unit ref density

Controls in this dropdown change the units of reference density:

- **g/cm3**
- **g/cc**
- **kg/L**
- **kg/m3**
- **Lb/ft3**
- **Lb/gal**
- **API**—American Petroleum Institute

API gravity is a measure of how heavy or light a petroleum liquid is compared to water. If its API gravity is greater than 10, it is lighter and floats on water; if it is less than 10, it is heavier and sinks. API gravity

is thus an inverse measure of the relative density of a petroleum liquid and the density of water, but it is used to compare the relative densities of petroleum liquids.

API = (141.37265/ ReferenceDensity) - 131.5. Reference density is corrected back to whatever reference temperature the user selects and also must enter the expansion coefficient of the fuel type. The formula to obtain API gravity of petroleum liquids, from relative density (RD), is: API gravity = 141.5/ RD - 131.5. Conversely, the relative density of petroleum liquids can be derived from the API gravity value as RD at 60 F = 141.5/(API gravity + 131.15). A heavy oil with a relative density of 1.0 (at 60°F) would have an API of 141.5/1.0 = 131.5 = 10.0 degree API. When converting between density and relative density, it is important to use the correct density of water, according to the standard conditions used when the measurement was made. The official density of water at 60°F according to the 2008 edition of ASTM D1250 is 999.016 kg/m3. The 1980 value is 999.012 kg/m3. In some cases the standard conditions may be 15°C (59°F) and not 60°F (15.56°C), in which case a different value for the water density would be appropriate.

Menu: Measuring Variables > System Units > Configuration042 > Unit temperature

Controls in this dropdown define the temperature units:

- **C**—Celsius
- **K**—Kelvin
- **F**—Fahrenheit
- **R**—Rankine

Menu: Measuring Variables > System Units > Configuration042 > Unit pressure

Allows you to select the units of pressure, in absolute and gauge pressures:

- **Bar A**—Bar
- **Bar G STP**—Bar with standard temperature and pressure at 32 °F (0 °C)
- **PSI A**—PSI
- **PSI G STP**—PSI with standard temperature and pressure at 32 °F (0 °C)
- **kPa A**—Kilopascal (a conversion from Bar)
- **kPa G STP**—Kilopascal with standard temperature and pressure at 32 °F (0 °C)

Note: The absolute pressure sensor from the factory is supplied in absolute pressure units with a reference to vacuum. If gauge pressure is selected in this menu, the average atmospheric pressure reading is programmed into the meter to subtract from the measured pressure to arrive at gauge pressure reading. It may not read 0 pressure at atmospheric pressure, depending on elevation.

Menu: Measuring Variables > System Units > Special Units > Arbitrary Unit 060

Creates a user-defined unit of measurement. This unit can be selected for use in the Configuration 042 screen:

- **Text Arbitrary Density**—Enter any four characters to create a custom density unit. This unit replaces the YYYY in the Unit Density dropdown menu.

- **Factor Arb. Density**—Use the arrow keys to adjust to a custom density calculation to arrive at a unique final number for density.

- **Text Arb. Concentration**—Enter any four characters to create a custom concentration unit. This unit replaces the YYYY in the Unit Density dropdown menu.

- **Factor Arb. Concentration**—Use the arrow keys to adjust to a custom concentration calculation to arrive at a unique final number for concentration. This is a multiplier to the density value.

Menu: User Interface > Control > Basic Confg 200

Adjusts the contrast and brightness (in %) of the LCD panel on the MassSense meter.

Note: It is possible to fully saturate the LCD, making it difficult to read. It is recommended to keep the LCD contrast at 50 for indoor environments.

Menu: User Interface > Top Line > Config 220

Selects the measurement that is displayed on the top line of the LCD panel.

- **Off**—Turns the top line off; the meter displays NOTHING SELECTED in the top line.

- **Flow**—(Optional) Flow condition when flow is moving through the sensor. If there is no flow, the meter reads FLOW IND = 0%.

- **Density**—Density reading and unit of density selected.

- **Concentration**—(Optional with advanced density) Concentration reading and concentration or reference density unit.

- **Temperature**—Temperature reading from the internal temperature sensor.

- **Viscosity Centistoke (cSt)**—(Optional with advanced density. LDM only.) Viscosity measurement as it changes from a point where zero viscosity is set. See "Calibrating and Adjusting Offsets" on page 31 for more information.

- **Viscosity Centipoise (cP)**—(Optional with advanced density. LDM only.) Actual calculated viscosity based on factory calibration.

Menu: User Interface > Top Line > Multiplex 222

Configures the top line to cycle between two measured variables.

Menu: User Interface > Bottom Line > Config 240

Selects the measurement that is displayed on the bottom line of the LCD panel. Options are the same as the Top Line options.

Menu: User Interface > Bottom Line > Multiplex 242

Configures the bottom line to cycle between two measured variables.

Menu: Output > Out 1 > Config 400

Defines the parameters for the 4-20 mA analog outputs for Channel 1. The 4-20 mA communication is an optional feature defined on the order information. This channel communicates the condition of the flow switch.

- **Assign Analog 1**—The measured variable transmitted with channel 1.

- **Analog Span 1**—NAMUR 4-20mA or NON NAMUR 4-20mA. **Note:** The NAMUR NE43 uses 3.8 to 20.5 mA signal range for measurement information. The MassSense meter outputs 2 mA for fail low alarm and 23 mA for fail high alarm conditions.

- **20 mA Channel 1**—Range of 4-20 mA where setting 20 mA in CHANNEL 1 is full scale output. MassSense can convert calculated values to an analog output based on the digital value.

- **4 mA Channel 1**—Range of 4-20 mA where setting 20 mA in CHANNEL 1 is minimum or low scale output. **Note:** Max and min values are displayed on the left for the variable selected for the 4 - 20 mA output. These are set at the factory based on the capabilities of the sensor.

- **Analog Damping**—Analog damping period in seconds. Any damping period > 0 slows the response of the meter for a control application.

- **Analog Failsafe**—min Current, Max Current, Hold Value, or Actual Value. The Channel 1 Failsafe can be used by the flow switch to indicate a low flow value if enabled.

  - **Min Current**—2 mA
  - **Max Current**—22 mA
  - **Hold Value**—Holds the last value before the fault.
  - **Actual Value**—Value displayed during the fault.

Menu: Output > Out2 > Config 410

Defines the parameters for the 4-20 mA analog outputs for Channel 2. The 4-20 mA communication is an optional feature, defined on the order information.

Out2 provides the same options and menus as Out1. All instructions should be followed as for Channel 1 except for the Failsafe Mode: For Channel 2 the Failsafe Mode can be set to indicate an error condition if one of the following occurs:

- Tube not resonating
- Density out of range
- Flow rate limit (LDM only)

The error condition can be selected in the Supervision screen (see Supervision Menu, below). If the selected condition occurs, the system sends a signal based on the value selected for the Failsafe Mode 2 option.

Menu: Basic Function > Process parameter > Flow SW Config (LDM only)

Optional. Sets the LED and display alarms for the flow switch for the defined condition:

- **Arrow on LCD**—Places an arrow on the display.
- **LED Red Steady**—Keeps the red LED in the on mode, with no flow.
- **LED Red Flashing**—Sets the red LED to remain flashing, with no flow.
- **Density Blank LCD**—Yes or No

  Note: Also prevents recording to data logger memory when there is no flow.
- **Density Data Out Flag**—Alternates a"no flow" output in the data stream, in place of density.
- **CH 1 Analog Failsafe**—Channel 1 failsafe can be used by flow switch to indicate a low flow value.

Menu: Basic Function > Process Parameter > Pressure correction

The pressure of the fluid inside the tube affects the vibration frequency of the sensor. MassSense has an internal compensation equation for changes in process pressure when calibrated at the factory. This compensation can be a fixed adjustment if the process pressure is around a steady value. For processes with great variance in pressure, the meter can be purchased with an external pressure sensor for automated pressure compensation. This is important for those applications requiring high accuracy such as concentration measurements.

The **Pressure Compensation** dropdown has two options:

- **Off**—No pressure correction.
- **Pressure Fixed**—Define the typical process pressure in the **Fixed Pressure Correction** field. The max and min pressure compensation range is stated, which are in the pressure units as specified in the Configuration 042 section for Unit Pressure.
- **Pressure Sensor**—(GDM models) When pressure is attached, defaults to this position.

Menu: Basic Function > System parameter > Configuration 660

Sets flow direction for the instrument for a positive flow indication (important for Flow Switch!).

- **Install Direction**—The directional references are when the instrument is in vertical or horizontal position; the electrical connectors are to the left and the flow tube is to the right. UP flow = Flow goes from the bottom of the instrument to the top. DOWN = Flow goes from the top of the instrument to the bottom.
- **Digital Damping**—Refresh rate (in sec) for the LCD display and digital output. **Note:** This does not impact the analog damping of the analog output response. This relates only to the refresh rate on the display and digital output.

Menu: Special Function > Density Function > Configuration 700

Programs the thermal expansion equation coefficients for fixed concentration.

- **Off**—No additional concentration formulas will be computed in the instrument.

- **Ref Density**—The reference density boxes must be populated with the correct coefficients.

- **Concentration**—Customizes the concentration names. Define the following values:

  o **Concentration Selector**—List of the concentration conversion equations programmed into the device. Select one to enable converting measured density and temperature and pressure for GDM models into a concentration.

  o **Concentration Names**—Selects the name of the concentration measurement. Up to four equations can be programmed at a time. Each has coefficients entered into A0, A1, A2, A3, A4, B1, B2, and B3 (for LDM) and A0, A1, A2, A3, and A4 (for GDM). These are determined by fitting a polynomial to density, concentration, and temperature data that is generated using published or experimentally derived data. You can generate a new name by selecting an unfilled box and entering coefficients. Converting data into coefficients requires a separate specialized program. Consult the factory for more information.

  o **Density Mode**—This is a label only. *% Mass, % Volume,* and *Other* are available. *Other* is a 4-character label set up in Arbitrary Concentration Menu.

- **Display Precision**—Sets the resolution for the calculated concentration. Consider the calculated accuracy of the concentration based on available data. The resolution should reflect the accuracy of the concentration information.

- **Concentration Offset**—Offset added to the calculated concentration.

- **Compressibility—**Fluids are compressible. Compressibility PPM/bar depends on the type of liquid. The liquid in the sensor can be compressed. This setting allows the internal computer to compensate for either a fixed operating pressure or variable operating pressure if the optional external pressure sensor is installed.

Menu: Supervision > System > Configuration 800

Sets alarms and items for MassSense to supervise for the Channel 2 Analog Output. Additional conditions are available in the instrument once the Supervision options have been selected.

- **Select Failure Mode For Channel 2**— Identifies which errors will trigger the analog output 2 to go high or low if the condition is met. One or all can be selected.

- **Tube Not Resonating**—There are certain operating conditions where the sensor tube will not resonate. YES = when the tube is not resonating an alarm will appear. **Note:** The unit will remain in error mode and out of service until the error is attended and the unit is put back into service. NO = this will not be the error condition for the analog output Channel 2.

- **Density Range**—YES = the density range alarm occurs if the calculated density is above 0.5 g/cc for GDM and below 0.5 g/cc for LDM. NO = the density range will not cause the unit to alarm for Channel 2 output.

● **Flow Rate Limit**—(LDM only. Optional.) YES = the Channel 2 output will alarm when the instrument is outside of the set flow rate parameters. NO = Channel 2 output will not alarm for this condition.

7.2.2   Viewing and Logging Data in Real Time

The RT Data Tab allows you to graph any parameter data in real time. You can also log selected parameters and save them to a comma-separated text file.

Note: Graphed data is not saved to a file. The graph only provides a real-time view of the data.
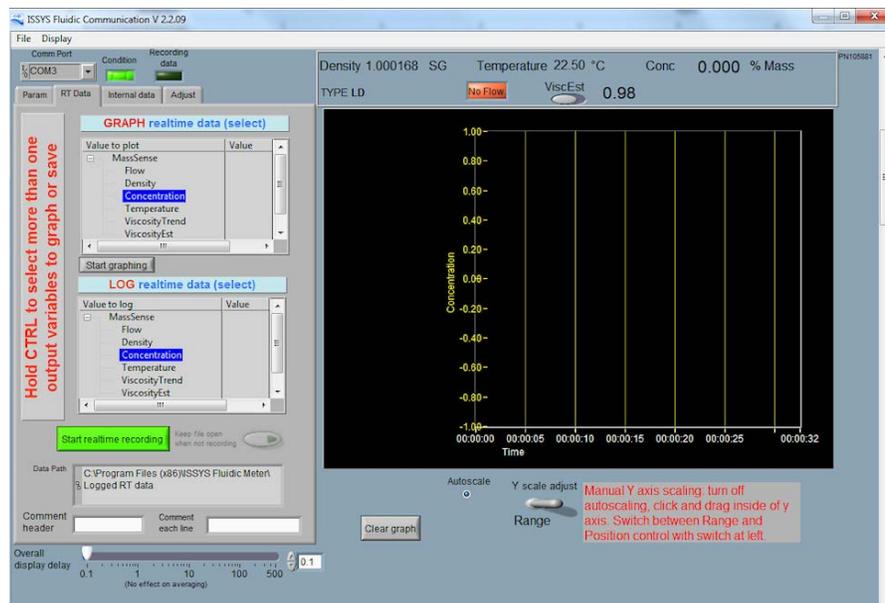

Figure 9: Viewing data in the RT Data tab of the MassSense software.

Viewing Graphed Data

To view data in real time:

1. In the Value to Plot list, select up to three parameters to be plotted on the graph. Select multiple parameters by holding down the **Shift** or **Ctrl** key.
2. Select the **Start Graphing** button to view the graph in the main window.
3. Initially, the plotting will start in Auto Scale mode. To adjust the scale, click the **Autoscale** button on the lower left-hand side of the data graph. The Y-axis scale or position can be changed by clicking and dragging the cursor over the Y-axis.

To clear the chart and begin again, click **Stop Graphing** and **Clear Graph** to erase the graphed data.

Recording and Saving Data to a File

You can record the data and save it to a CSV file on the computer's hard drive.

1. In the LOG Realtime Data list, select the parameters to record. You can select multiple (or all) parameters by holding down the **Shift** or **Ctrl** key.

2. Click the **Start Realtime Recording** button to begin the recording.

3. Stop recording by clicking the **Stop Realtime Recording** button.

4. When prompted, name the file. A directory on the computer's hard drive is created (x:\Program Files\ISSYS Fluidic Meter\Logged Data). This file can be amended rather than starting a new file by clicking the **Keep File Open** button.

7.2.3   Recording Data Internally on the MassSense Instrument

If you ordered the internal memory option, the MassSense instrument has 2GB of internal memory for internally recording data. The recording rate is 10 seconds per point; several years of data can be recorded on the instrument.

To read the recorded values from the instrument:

1. Go to the Internal Data tab.

2. In the Internal Storage Data list, select the parameters to be saved in memory. Hold the **Shift** or **Ctrl** key on the keyboard to select multiple parameters.

3. Define the start and end date and times for the recording.

4. Download data from the MassSense instrument onto your computer. To download the data, do the following:

   • When all selections have been made, click the **Get Data** button.

   • When prompted, set the destination file name and location. The data is downloaded to the selected file.

   • If you need to interrupt the download, press the **Abort** button to stop the process and return the unit to normal operation.

   Note: During the download, the instrument will not be able to perform any measurements; the internal processor will dedicate its resources to sending data to the computer.

Changing the Sampling Rate

You can adjust the internal sampling rate from 1 to 3600 seconds (1 hour) by entering the desired rate in the text box. The default is 10 seconds. The data will be averaged over this time.

7.2.4   Calibrating and Adjusting Offsets

The density calibration or flow indicator offset may need to be adjusted at startup or during the life of the meter. These adjustments are made in the Adjust tab. All instruments are calibrated under reference operating conditions at the factory. It is generally not necessary to perform a density adjustment. The

density accuracy may drift with time due to normal wear or coating the flow channel. It is recommended to clean the instrument if drift is noticed.
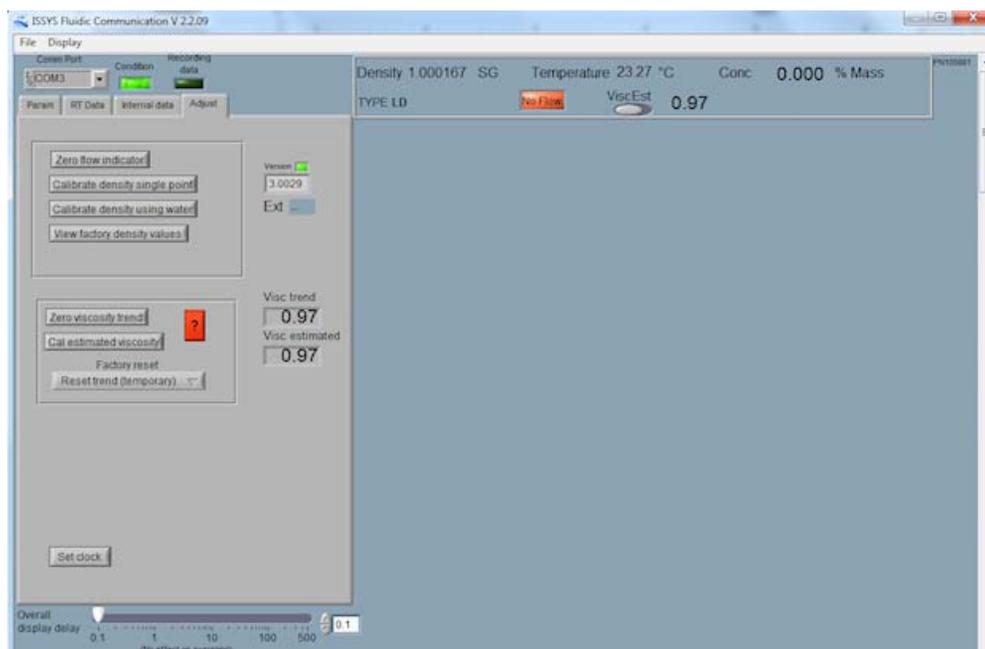

Figure 10: The Adjust tab (example screen from the LDM model).

To verify correct measurement, and to correct if necessary:

1. Clean the flow channel with an appropriate solvent, flushing in both directions, if possible. Completely dry the channel with pressurized clean air or nitrogen for best results.
2. Go to the Adjust tab and enter the access code: 0020. (This is the same access code used to access the display on the measuring instrument.)
3. Click **OK**.

Zero Flow Indicator (LDM only)

⚠ *Caution: This procedure is for LDM or liquid density meters only! All instruments are calibrated under reference operating conditions. The zero point adjustment is generally not necessary. In some cases it may be necessary or recommended by the factory to complete a zero point adjustment.*

⚠ **WARNING! Before completing a zero point adjustment, verify that no gases or solids are present; the flow channel must be completely filled and at zero flow (v = 0 m/s). This can be achieved using shutoff valves upstream or downstream of the sensor, or by using existing valves.**

To adjust the zero point:

1. Operate the instrument until all operating conditions have settled.
2. Stop the flow (v=0 m/s).

3. Check the shutoff valves for leaks.
4. In the Adjust tab, click **Zero Flow Indicator**.
5. When prompted, confirm that you want to continue. MassSense adjusts the zero point.

Calibrating Density Single Point

The instrument can be calibrated for specific density if the density is a known parameter. This requires that the sensing tube is full of the material being measured. The temperature reading should also match the temperature of the sample or flow material. If all these conditions are met, you can set the density point.

1. In the Adjust tab, click the **Calibrate Density Single Point** button.
2. Enter the density value and click **OK**.

Calibrating Density Using Water (LDM only)

Follow the cleaning instructions (see chapter 8), then calibrate density using water after the cleaning. Fill the flow channel with the degassed, demineralized water, read the density, and compare this value to published values. If the density accuracy is out of specification, perform a density adjustment. This instrument has a one-point density adjustment function available using pure water.

Note: This function overwrites the field density calibration.

1. Ensure the instrument is at a stable temperature and not exposed to direct sunlight or other heat sources during this adjustment.
2. Inject or flow de-ionized or distilled water.
3. In the Adjust tab, select **Calibrate Density Using Water** button. A new calibration is completed and stored.

Calibrating Density Using Air (GDM only)

1. Follow cleaning instructions for the sensor tube (see chapter 8), then calibrate density using air.
2. Allow the flow channel to fill with clean, dry air and press the **Calibrate Density Using Air** button.
3. Click **Continue** and the instrument will be adjusted

Viewing Factory Density Values

To see the original factory values, click **View Factory Density Values** in the Adjust tab. This view is temporary until the meter is restarted or recalibrated.

Setting the Internal Clock (for use with internal memory)

You can set the internal clock by entering the date and time in the Adjust tab and clicking the **Set Clock** button.

8   Cleaning the MassSense Instrument

8.1   Sensor Tube Cleaning

8.1.1   Condensing Vapor

If you suspect a liquid is condensing on the surface of the sensing tube, the tube must be cleaned. To clean the tube:

1. Flush the instrument with dry air; a gas density measurement indicates if liquid was present.
2. Clean the sensor with a solvent. Dry with air.

Note: Particle contamination can be confused with liquid contamination

8.1.2   Aqueous Materials

To clean the flow tube after testing the density of an aqueous solution:

1. Use only deionized water to rinse the flow channel several times, followed isopropyl alcohol rinse.
2. Gently blow the flow channel with nitrogen or dry compressed air.

⚠️ *Caution: Do not use organic solvents to clean or rinse out aqueous (water-based) fluids or solutions. The instrument's flow channel may be clogged and damaged by the resulting solute crystallization.*

8.1.3   Organic Materials

To clean after using with mineral oils, organic solvents or organic solutions:

1. Rinse out the flow channel several times with acetone, followed by isopropyl alcohol. Alternatively, the sensor can be rinsed with methanol, toluene, or hexane.
2. Gently blow out the flow channel.
3. To verify that the flow channel is sufficiently clean, fill with deionized water and confirm that the density reading is correct.

⚠️ *Caution: Take special precautions when using the instrument to measure the density of slurries. Particles can clog the flow channel. Filter incoming slurries that may contain large particles or large cellular clumps or clots.*

8.1.4   Coating Materials

Any liquids that can solidify, coagulate, clot, or coat must be rinsed immediately with an appropriate solvent to prevent flow channel clogging. Clogging and/or coating of the flow channel in the sensor voids

the factory warranty. When using Teflon pipe tape or pipe dope, be careful that no tape breaks loose that could clog the sensor flow channel.

⚠️ **WARNING! Do not use highly acidic or highly alkaline solutions to clean the flow channel. These solutions may damage the flow channel and affect the performance of the instrument.**

8.2   Exterior Cleaning

The MassSense instrument housing can be cleaned as part of regular maintenance. When cleaning the exterior of the instrument, always use cleaning agents that do not attack the surface of the housing and the seals. It is recommended to use a dry towel to remove dust and environmental debris. To remove marks, use a soft cotton towel dipped or dampened in isopropanol.
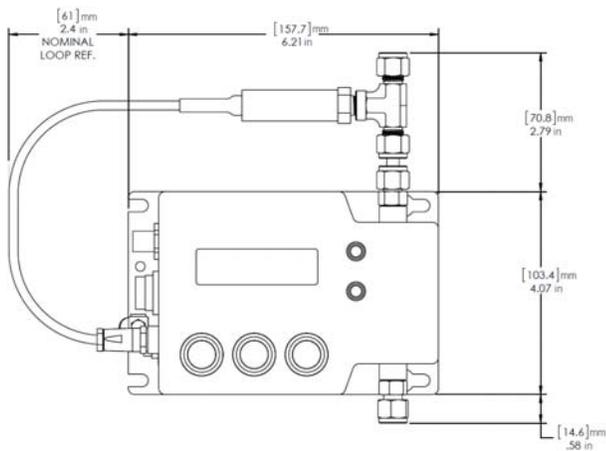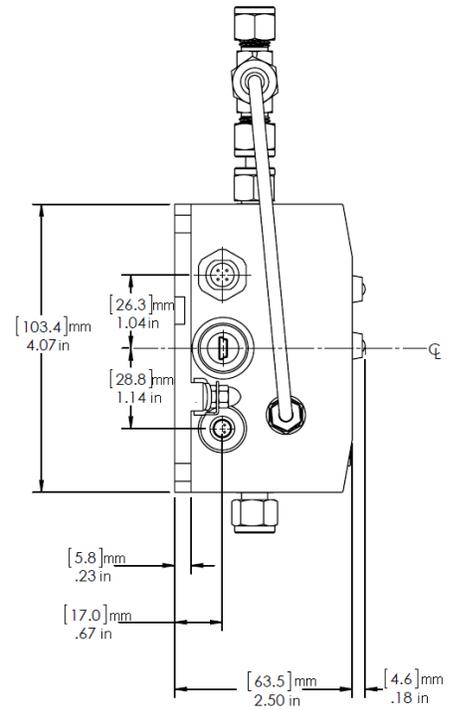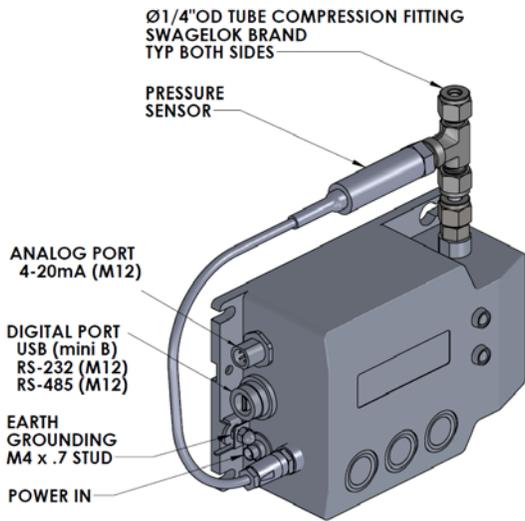
⚠️ *Caution: The instrument should not be soaked or saturated in any cleaning agent. This will compromise the instrument's seals.*
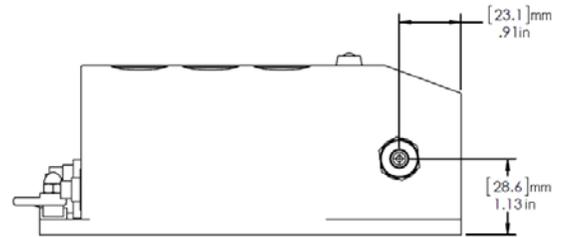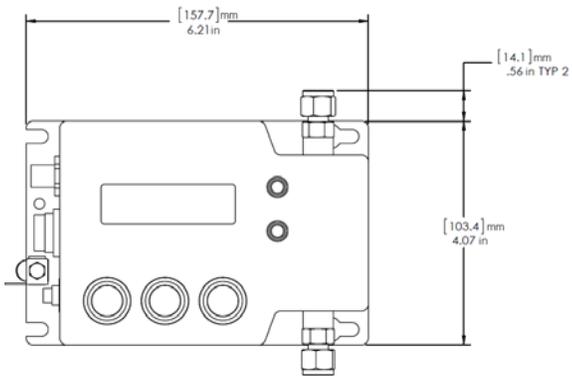
9 Dimensional Drawings

9.1 GDM Model

9.2   LDM Model

Ø1/4"OD TUBE COMPRESSION FITTING SWAGELOK BRAND TYP BOTH SIDES

ANALOG PORT 4-20mA (M12)

DIGITAL PORT USB (mini B) RS-232 (M12) RS-485 (M12)

EARTH GROUNDING M4 x .7 STUD

POWER IN

[103.4] mm 4.07 in
[26.3] mm 1.04 in
[28.8] mm 1.14 in
[5.8] mm .23 in
[17.0] mm .67 in
[63.5] mm 2.50 in
[4.6] mm .18 in

[157.7] mm 6.21 in
[14.1] mm .56 in TYP 2
[103.4] mm 4.07 in

[23.1] mm .91 in
[28.6] mm 1.13 in
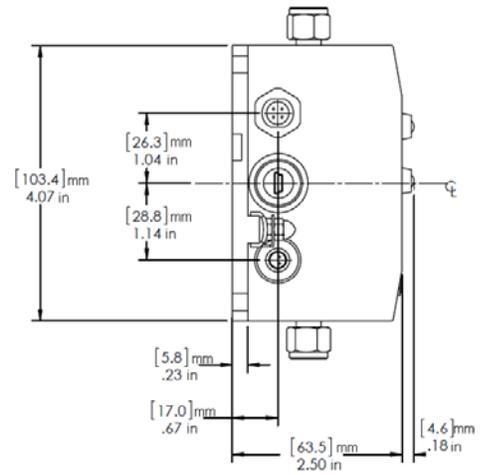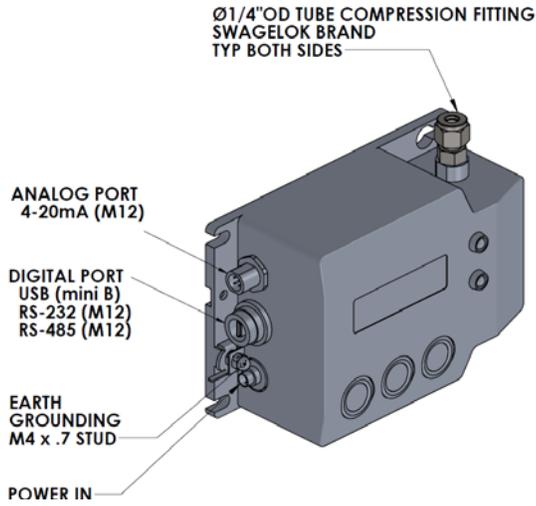
10 Troubleshooting

Symptom	Possible Cause	Solution	Note
Tube is not oscillating	Sensor tube has both liquid and gas (bubble or droplet)	LDM: Flow more bubble-free fluid through the sensor to dislodge the bubble. GDM: Flow dry air through the sensor to evaporate condensate.	LDM: Rinse the flow channel with an appropriate solvent. Flush in both directions to dislodge air bubbles or particles. To avoid particles that could clog the flow channel, a 60 micron filter is recommended. Flow rate in the bypass meter must be high enough in normal operation to dislodge air bubbles That may be in the fluid. The minimum flow rate will vary with the fluid type. GDM: If condensate (droplets) are suspected, a coalescing filter, higher temperature or lower pressure may be required.
Density Range	LDM: Gas is in the sensor (<0.5 g/cc). GDM: Liquid is in the sensor (> 0.5 g/cc).	LDM: Ensure liquid is flowing through the sensor. GDM: Ensure gas is flowing through the sensor (no liquid).	
The red LED on the front panel is blinking (no flow switch).	Power supply voltage is too low	DC power must be 8-30 VDC at the power connector on the meter. Check the voltmeter while connector is powering the meter. If USB power is too ow (<5VDC), use a different USB port or a powered USB hub.	

Symptom	Possible Cause	Solution	Note
For a liquid density meter (LDM), the data does not appear to be accurate or reliable.	The liquid contains micro gas bubbles or the sensor tube is coated.	Heat or boil the liquid (water). Also measure before a pressure reducing device to keep the gas from coming out of the solution. Clean the sensor element with a solvent.	
The process has rapid and significant temperature variations (> 4°C/min).	The instrument needs some time to settle to the new temperature. During the transition, the temperature compensation of the instrument will lag and therefore will not be as accurate during the transition period.	If the ambient temperature is different from the fluid temperature, insulate the sensor to avoid effects on the temperature measurement. In most application extremes, insulation or heat tracing might be a possibility. If the fluid temperature changes with a steep gradient, the accuracy of the density measurement can be temporarily affected.	

11 Returning the Instrument

If you need to return the MassSense instrument for repair or calibration, follow this procedure:

1. Contact the manufacturer for a Return Merchandise Authorization (RMA) number prior to sending the instrument back.
2. Download an RMA form from the website, complete the form and include a copy of the RMA form inside the shipping container.
3. Enclose special handling instructions, if applicable (e.g., a material safety data sheet for chemicals used in the instrument as per Regulation (EC) No. 1907/2006 REACH).
4. Clearly print the RMA number on the outside of the shipping box.

All RMA instructions must be adhered to for proper handling.

12 Certificates and Approvals

For UL, CUL, ATEX certified instruments, intrinsically safe barriers must be installed by properly trained personnel to insure intrinsic safety. Please refer to control drawing for installation parameters.

12.1   EC Declaration of Conformity

Integrated Sensing Systems, Inc.
391 Airport Industrial Drive
Ypsilanti, Michigan, 48198, USA

EC Declaration of Conformity

To Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres

ATEX 94/9/EC Manufacturer: Integrated Sensing Systems, Inc.

Manufacturer's Address: 391 Airport Industrial Drive, Ypsilanti, Michigan, 48198, USA Instrument/s: MassSense

Description: A fluid (liquid or gas) measurement system for monitoring density, specific gravity, flow rate, chemical concentration, temperature and /or viscosity.

EC Product Class: Ex ia IIC T4 Ga, II 1 G

Standards: EN 60079-0:2006, EN 60079-11:2007, EN 60079-26:2007, EN 61326-1:2006
EC Declaration of Conformity

Integrated Sensing Systems, Inc. declares that devices (MassSense) listed on the attached Device Schedule conforms to the relevant provisions and all essential safety requirements of the EC Council ATEX Directives 94/9/EC dated 23 March 1994 and EN 61326-1:2006 and is in accordance with EN 13980:2002 and ISO 9001:2008 Quality Management System, as implemented by the European Union's Regulations as verified by Notified Body UL International DEMKO A/S NB Number: 0539, PO Box 514, Lyskaer 8, DK-2730 Herlev, Denmark. For provisions of the Directive fulfilled by the devices please refer to the individual certificates.

Integrated Sensing Systems, Inc. conforms that no other application has been lodged with another Notified Body for the same device related to Quality Management System.

Integrated Sensing Systems, Inc. agrees to develop, implement and maintain a formally-recognized Quality Management System to ensure continued adequacy and efficiency.

Integrated Sensing Systems, Inc. agrees to develop, implement and maintain a documented post-production experience monitoring process, including the notification of reportable events under the European Directive Guidelines.

Integrated Sensing Systems, Inc. agrees to inform the appointed Notified Body of any planned or unplanned substantial change to the Quality Management Systems.

12.2   Legal Disclaimer

ISSYS assumes no responsibility for infringement of patents or rights of others based on ISSYS applications, assistance or product specification since ISSYS does not possess full access concerning the use or applications of customers' products. ISSYS also assumes no responsibility for customer' product designs and the impact of the design on the device or other components in the products or samples being tested or monitored by the product and interactions between these items.

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12.3   Patents Covering MassSense

This device is protected by pending US and International patents and the following granted patents: US Patents 6,477,901, 6,923,625, 7,059,176, 7,228,735, 7,351,603, 7,381,628, 7,568,399, 7,581,429, 7,628,082 and Jap. Patent 4,568,763.