

SAGE THERMAL GAS MASS FLOW METER

User Manual

**For Sage Prism® SCD
Portable Battery Operated
Datalogging Gas Flow Meter**

**DOCUMENT NUMBER 100-0350
REVISION 01 – SCD (SAGE PRISM®)**

**Make the Wise Choice.
Choose Sage Flow Meters.**



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About the Prism

The Prism is a unique, portable meter that measures gas mass flow and has extensive data logging capabilities. The easy to use flow meter offers the ability to periodically measure the mass flow of gas from various locations or perform long-term monitoring at a single location. With a storage capacity of up to 130,000 data points the Prism can be configured to capture a data point manually or at scheduled frequencies.

The Prism comes calibrated for a specific gas. Standard gas calibrations are Air, Biogas (Mix) (50% methane, 50% carbon dioxide) or Natural Gas. The Sage Prism Configuration Software (SPCS) provides the ability to configure the instrument for up to 12 user and 4 factory defined channels for different pipe

sizes, units of measurement, channel name, gas composition of Biogas and Natural Gas, K factor, and other installation variables through this intuitive, easy to use software. Once the data is stored in the Prism memory it will be downloaded to a PC using the SPCS software for analysis or record keeping. The Prism uses a ½" OD probe assembly which can be used in any size pipe or duct which is 1½" in diameter or larger.

The rechargeable Lithium-ion will allow operation of the Prism for up to 10 hours; continuous operation is provided by using the provided power supply.

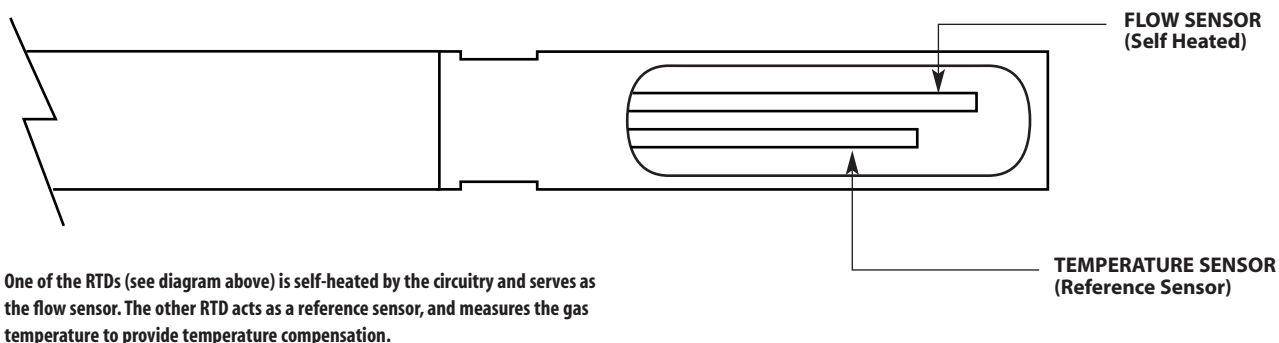
The Prism display module is connected to the probe with a 2 foot (expandable to 10 feet) coiled cable.

MODEL	DESCRIPTION	MAX VELOCITY	CHANNEL A Velocity	CHANNEL B 2" Pipe	CHANNEL C 3" Pipe	CHANNEL D 4" Pipe	CHANNEL E-P
SCD-AIR	AIR FLOW	25000 SFPM	25000 SFPM	500 SCFM	1250 SCFM	2000 SCFM	CONFIGURABLE BY USER
SCD-NG	NATURAL GAS	10000 SFPM	10000 SFPM	250 SCFM	500 SCFM	900 SCFM	CONFIGURABLE BY USER
SCD-MIX	DIGESTER, LFG or BIO GAS	10000 SFPM	10000 SFPM	250 SCFM	500 SCFM	900 SCFM	CONFIGURABLE BY USER

Principle of Operation of the Thermal Mass Flow Meter

Sage Prism has two sensors constructed of reference grade platinum windings (RTDs). The two RTDs are clad in a protective 316SS sheath and are driven by a proprietary sensor drive circuit. One of the sensors is self-heated (flow sensor), and the other sensor (temperature/reference sensor) measures the gas temperature. The pair is referred to as the sensing element, and is installed in an insertion style probe.

As gas flows by the flow sensor, the gas molecules carry heat away from the surface, and the sensor cools down as it loses energy. The sensor drive circuit replenishes the lost energy by heating the flow sensor until it maintains a constant temperature differential above the reference sensor. The electrical power required to maintain a constant temperature differential is directly proportional to the gas mass flow rate and is linearized to be the output signal of the meter.



UNPACKING THE METER

In the shipping box there is the Sage Prism, carrying case, 12 VDC power supply, USB cable, STCF05 Compression fitting, SPCS software and documentation. Check the shipping box for any damage and check the packing slip to insure that nothing is missing.

The documentation includes the calibration certificate. Each flow meter has its own unique calibration. Check the Certificate of Conformance verifying the serial number and gas calibration type.

APPLICATIONS

The Prism is suitable for use as a portable thermal mass flow meter for measurement of air and gas. The meter includes data logging of the flow data which can be taken intermittently or on a set timing schedule. Typical examples include:

- Compressed Air Audits
- Natural Gas flow for energy management
- Check meter to compare against in-place meters
- Biogas flow
- Landfill gas
- Greenhouse gas emissions
- Compliance with local regulatory requirements

SPECIFICATIONS

Accuracy: $\pm 1\%$ of reading plus 0.5% of Full Scale
(based on original calibration gas composition)

Turn-down: 100 to 1

Resolution: Up to 1000 to 1

Repeatability: 0.2% of Reading

Gas Temperature: -40°F to 200°F (-40°C to 93°C)

Ambient Temperature: -4°F to 125°F (-20°C to 52°C)

FACTORY CALIBRATION FOR VARIOUS GASES

CHANNEL	Air	Biogas	Natural Gas
A	25,000 SFPM	10,000 SFPM	10,000 SFPM
B (2" Pipe)	500 SCFM	250 SCFM	250 SCFM
C (3" Pipe)	1250 SCFM	500 SCFM	500 SCFM
D (4" Pipe)	2000 SCFM	900 SCFM	900 SCFM

Installation

The accuracy of any insertion type flow meter is dependent upon the flow profile in the pipe at the point of sampling. Allow a minimum of 15 pipe diameters of straight run up stream and 5 diameters of straight run downstream of the sampling point depending upon conditions. See following table for straight run requirements for various pipe configurations.

Note, obstructions such as valves, blowers, expanders and PVC and HDPE pipes will require additional straight run (contact factory for assistance). Avoid, if possible, installations immediately downstream of bends, fans, nozzles, heaters and especially valves, or anything else installed in the line that may cause nonuniform flow profiles and swirls.

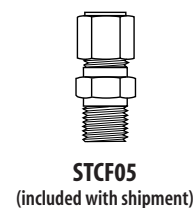
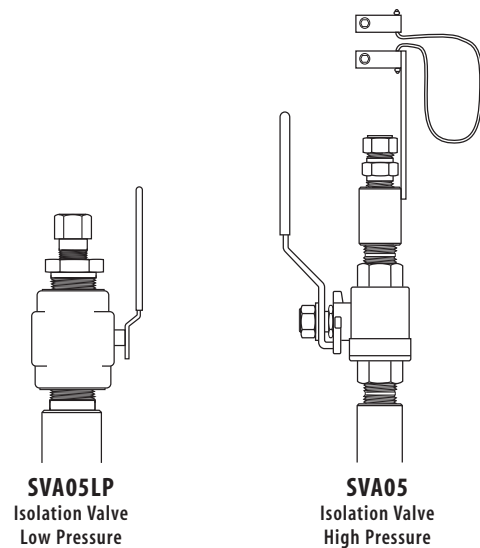
RECOMMENDED PIPE DIAMETERS UPSTREAM	
DISTURBANCE	MINIMUM INDUSTRY RECOMMENDATION ¹
One 90° Elbow	15
Two 90° Elbows in the same plane	20
Two 90° Elbows in different planes	At least 40
4:1 Area Reduction	15
4:1 Area Expansion	At least 30
Multiple Disturbance	To Be Determined

¹ PVC or HDPE require additional straight run

- Check the orientation: Gas flow direction is marked with UPSTREAM on the probe.
- Note direction of gas flow placing the UPSTREAM mark in the proper orientation. Any improper orientation of the sensor in the direction of gas flow can cause error in the flow measurement.

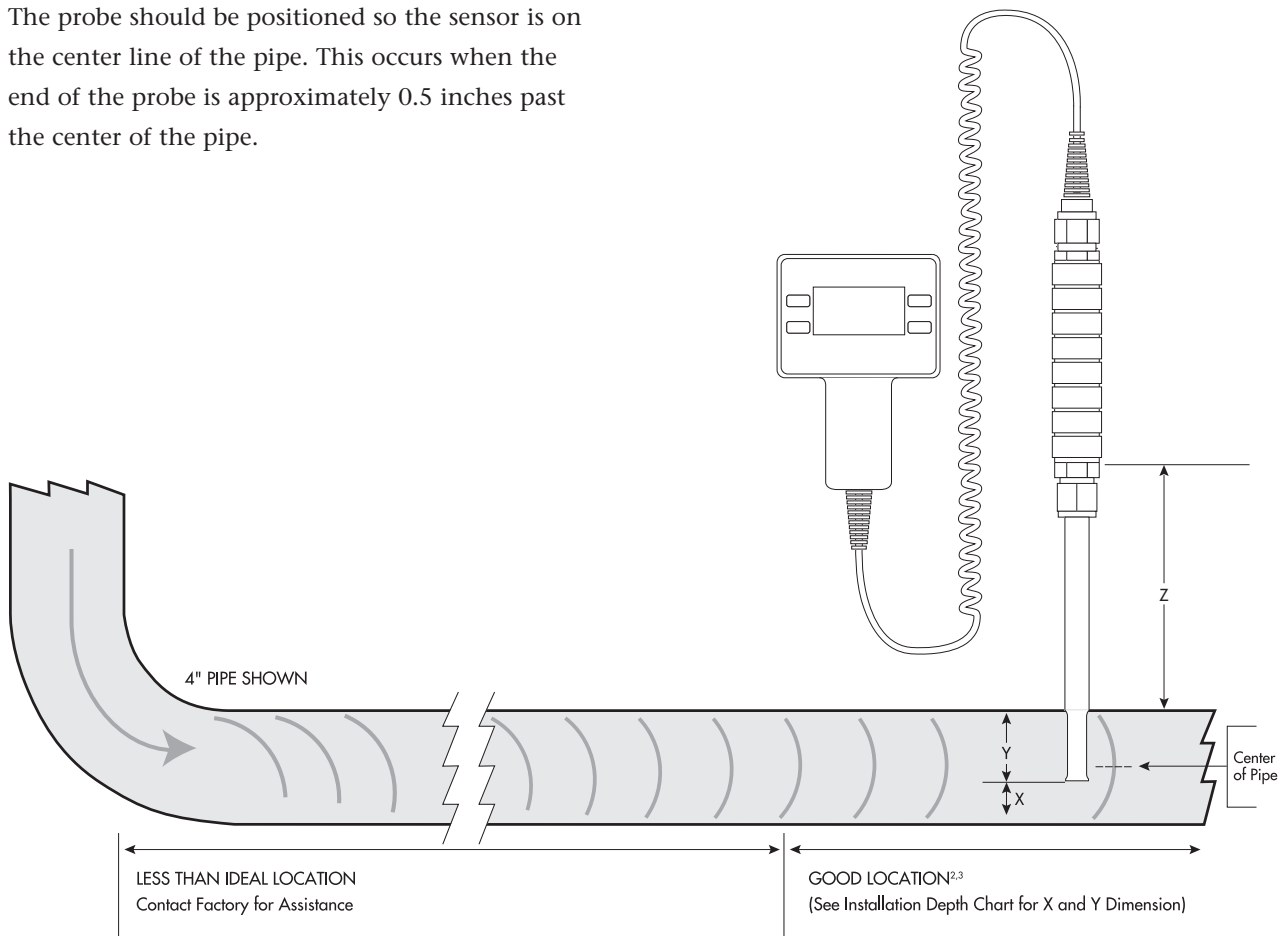
PIPE CONNECTIONS

The use of a compression fitting with a ball valve or compression fitting alone are typical methods for installing the probe into a pipe. Sage can provide optional mounting hardware:



Installation Depth

The probe should be positioned so the sensor is on the center line of the pipe. This occurs when the end of the probe is approximately 0.5 inches past the center of the pipe.



Installation Depth Chart

METHODS FOR PROBE INSERTION TO PIPE CENTER

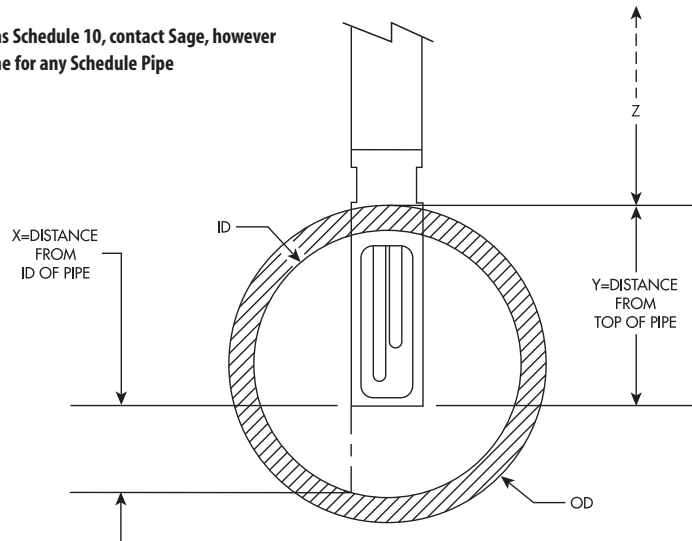
METHOD 1

Using charts below, select pipe size (column 1), determine X. Insert probe until the end touches the bottom of the pipe (ID), mark probe as it exits top of fitting. Lift probe distance X and tighten compression fitting.

METHOD 2

Using charts below¹, select pipe size (column 1), determine Y. Subtract Y from the factory supplied probe length (which is typically 18" for the Sage Prism). That difference, Z, should be outside of the pipe, and is measured from the bottom of the Prism handle to pipe OD.

¹ For other Pipe Schedules, such as Schedule 10, contact Sage, however the Y dimension will be the same for any Schedule Pipe



SCHEDULE 40 PIPE ²					
PIPE SIZE	OD	ID	X	Y	PIPE AREA
1.5"	1.900	1.610	.20"	1.56"	0.0141
2"	2.375	2.067	.40"	1.82"	0.0233
2.5"	2.875	2.469	.60"	2.07"	0.0332
3"	3.500	3.068	.90"	2.38"	0.0513
4"	4.500	4.026	1.40"	2.86"	0.0884
6"	6.625	6.065	2.40"	3.95"	0.2006
8"	8.625	7.981	3.40"	4.90"	0.3474
10"	10.750	10.020	4.40"	6.00"	0.5476
12"	12.750	11.938	5.50"	7.00"	0.7773
14"	14.000	13.124	6.00"	7.50"	0.9394
16"	16.000	15.000	7.00"	8.60"	1.2272
18"	18.000	16.876	8.00"	9.60"	1.5533
24"	24.000	22.625	10.75"	12.60"	2.7919

SCHEDULE 80 PIPE ²					
PIPE SIZE	OD	ID	X	Y	PIPE AREA
1.5"	1.900	1.500	.15"	1.56"	0.0123
2"	2.375	1.939	.35"	1.82"	0.0205
2.5"	2.875	2.323	.55"	2.07"	0.0294
3"	3.500	2.900	.80"	2.38"	0.0459
4"	4.500	3.826	1.30"	2.86"	0.0798
6"	6.625	5.761	2.25"	3.95"	0.1810
8"	8.625	7.625	3.25"	4.90"	0.3171
10"	10.750	9.750	4.25"	6.00"	0.5185
12"	12.750	11.374	5.13"	7.00"	0.7056
14"	14.000	12.500	5.70"	7.50"	0.8522
16"	16.000	14.312	6.60"	8.60"	1.1172
18"	18.000	16.124	7.50"	9.60"	1.4180
24"	24.000	21.562	10.25"	12.60"	2.5357

Installation Instructions and Considerations

INSTALLATION INSTRUCTIONS

1. Insert probe into the compression fitting supplied with meter. The use of a Teflon ferrule has been supplied to permit easy removal of probe.
2. Insure that the probe is inserted in the correct orientation with the UPSTREAM mark facing the direction of flow.
3. Insert the probe to the correct point per the PROBE INSERTION GUIDELINE DRAWING AND CHART.
4. Tighten the nut to prevent any leakage between the probe and ferrule.

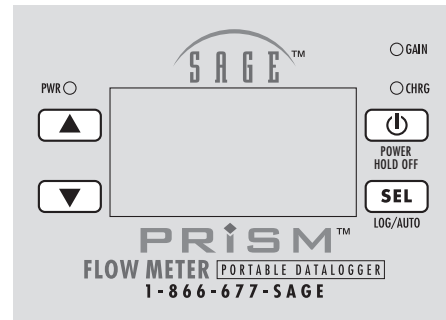
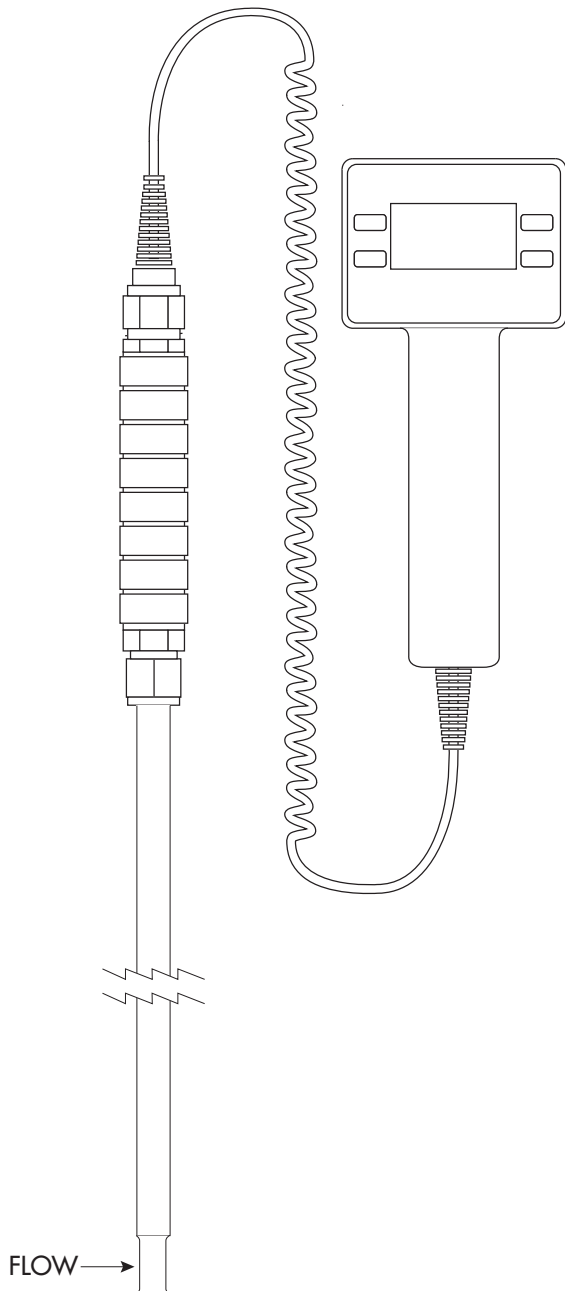
CONSIDERATIONS

- The Prism can be used as a “check meter” to verify the performance of an existing installed flow meter. Preferred method is to remove existing flow meter and locate Prism in same location. Optionally, the Prism may be installed in series with the existing flow meter although performance may be affected by differences in flow profile. If the installed flow meter is used with a flow conditioner the Prism should be calibrated in a similar manner.
- Check the orientation: Gas flow direction is marked with UPSTREAM on the probe.
- Note direction of gas flow placing the UPSTREAM mark in the proper orientation. Any improper orientation of the sensor to the direction of gas flow can cause error in the flow measurement.

SCD Series Mass Flow Meter

COILED CABLE STYLE PROBE (SCD)

Standard probe length is 18". Probe connects to 2 foot coiled cable that stretches to 10 feet. The other end of the cable is fastened at the base of Prism Flow Meter.



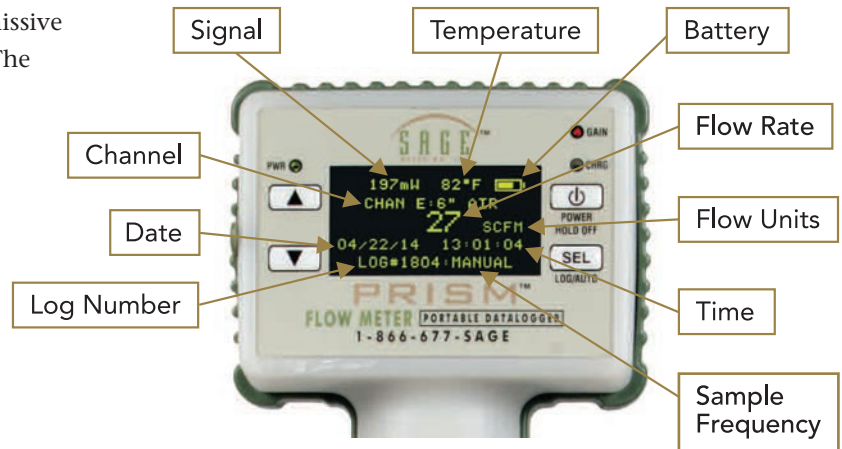
Detail of Prism Faceplate.

Prism Display

SAGE PRISM DISPLAY

The Sage Prism has a high contrast, photo-emissive graphical display, readable even in sunlight. The display provides real time measurement of:

- Log number of the captured data
- Date of the measurement
- Time of measurement
- Channel tag
- Signal value
- Gas temperature
- Battery strength indicator
- Flow units
- Flow value
- Sample frequency or manual



DISPLAY LEDs

The front plate of the Prism has several LEDs which indicate the status of the instrument:

- The green LED marked PWR indicates the power status of the Prism. When this LED is green the Prism is turned on.
- Gain LED glows red when the instrument is operational and readings can be taken.
- The Charge LED indicates that the charger is attached to the unit and the Prism is being charged. The red LED will turn off when the battery is fully charged. If the red LED is blinking disconnect the charger from the Prism and then reconnect to restart the charging process.



Operation

CHARGING THE PRISM



Meter Shown with PowerPak for Charging

The Prism Flow Meter is supplied with a **12 VDC charger** that plugs into the Mini-USB mating receptacle on the side of the Flow Meter. **CAUTION: Do not use this power supply with any other device, or serious damage will occur!** The Charging LED (CHRG) will be lit, and the meter will recharge the Lithium-ion battery. It takes about 3 to 4 hours for the battery to be fully recharged, at which point the red Charging LED turns off. If the Charger LED is blinking, the charger must be disconnected and reconnected to restart the charging process. A fully charged battery will last approximately 8 to 10 hours. For longer term operation the charger can remain connected.

Do not charge using the USB port of the computer. The 5VDC power is insufficient to charge the Prism.

POWERING UP THE METER

Depress the Power key to turn on the Prism. The green PWR LED located on the upper left side will turn on. A splash screen will briefly display SAGE Metering, the firmware version and the serial number of the instrument. A second Start Up splash screen will briefly appear.

This second splash screen identifies functions of the different buttons.

Press top left button marked “CHAN” and the menu will cycle between BATTERY, SET CLOCK, SET DATE, ERASE LOGS

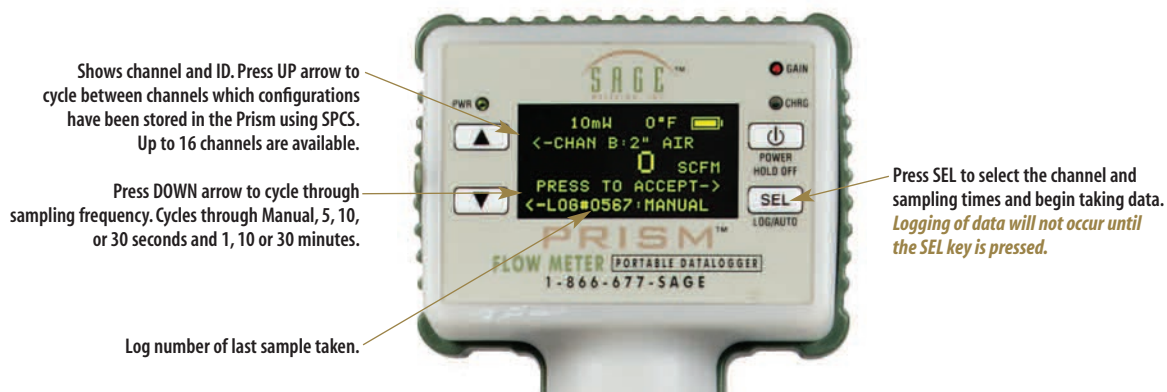
BATTERY: For proper operation of the battery bar, the user must indicate that the Prism is fully charged. If the Prism is charged (red CHAN light is off), then press SEL and then press top left button for Yes or bottom left button for No.

SET CLOCK: The Sage Prism Configuration Software (SPCS) can synchronize the time in the Prism with the time in the computer. The user can change the time by using the up and down arrow to select the hours, then press SEL to access the change minute screen. Note that time is always given in a 24 hour format.

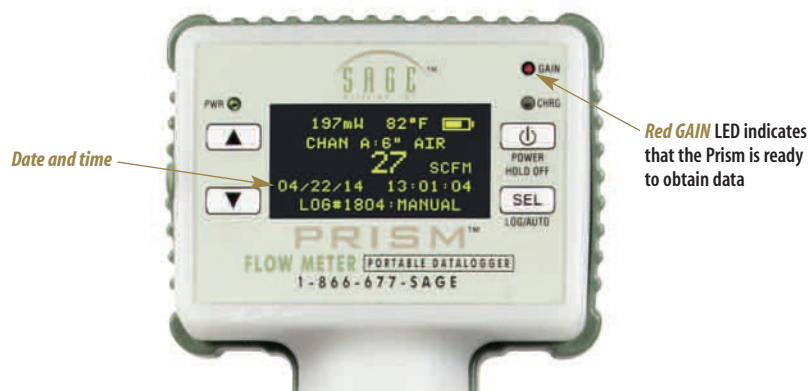
SET DATE: The Sage Prism Configuration Software can synchronize the date in the Prism with the date in the computer. The user can change the month, date and year by using the up and down arrows to change value and press SEL to accept the displayed value.

ERASE LOGS: The values stored in the Prism can be cleared by either using the SPCS or by selecting this option. Press the top left button for *Yes (clear memory)* or bottom left button for *No (do not clear memory)*. Make sure that the data stored in the Prism is downloaded to the computer using SPCS before the data is cleared.

After the Start Up splash screen the display will show:



After the SEL key is pressed, the Prism will start taking data. The display will change to:



After pressing the SEL key the date and time are shown and data is being collected. **If the date and time are not shown on the display the Prism is not**

collecting data even though the flow rate and temperature are indicated on the display. The display will flash every time a data point is taken.

POWERING DOWN THE METER

Hold the Power key (upper right) until the Prism turns off. This may take 5 seconds. The display will be blank and the green PWR light will be off. The

Prism will also turn off after 15 minutes of inactivity. The Auto Off feature is only activated when the sample period is set to Manual.

SPCS Software

Prior to using the Prism to obtain flow data it is necessary to configure the Prism for the specific locations where the Prism will be used.

The Sage Prism is provided with the PC based Sage Prism Configuration Software (SPCS). This software permits the user to configure up to 12 independent channels. In addition there are 4 factory configured channels.

Install the software by placing the DVD in the drive of the PC. The auto run will automatically install the software and any additional support programs. The software can also be downloaded from our web site Go to SageMetering.com and select Knowledge Base/Software and Guides and select SPCS.zip. The software will be installed at the default location of C:\Sage\SPCS. It will be necessary to retrieve files from this directory if the Prism will be used with multiple computers.

The welcoming screen in SPCS provides specific instructions for connecting the Prism to SPCS.

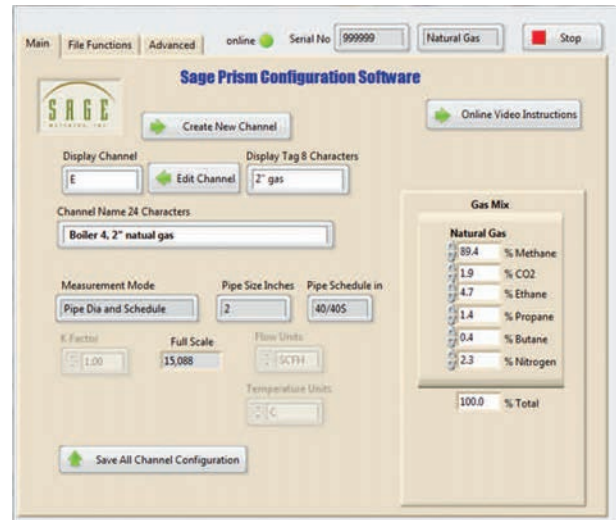


Please follow these and the completion instructions shown on page 16. Failure to follow these instructions may corrupt the configuration data.

Note: Make sure that the Prism is charged before making this connection. The Prism will download the configuration data which is in the instrument to a configuration file on the computer. As channels are added or modified, that data will automatically be uploaded to the Prism.

CHANNEL CONFIGURATION

When running the software the configuration screen will be:



The first four channels (A – D) are factory configured; channel A is configured for units of velocity in SFPM (Standard Feet per Minute) with channels B, C, and D configured for SCFM in a 2" Schedule 40 pipe, 3" Schedule 40 pipe and 4" Schedule 40 pipe. The user is unable to change any of this data. The remaining channels E – P can be individually configured for:

- Channel Tag ID (8 digits) – must be unique
- Channel name (24 digits)
- Pipe size entered as either:
 - Size and schedule
 - Pipe ID in inches
 - Flow area in square feet
- Units of flow measurement
- Units of temperature measurement
- K factor (default = 1)
- Gas composition for Biogas and Natural Gas

IMPORTANT: Download, save, and clear any data in the Prism prior to changing the configuring of any channels. Entering new configuration information will write over the original data which will be lost.

To configure a new channel, click on “Create New Channel”; the user will be prompted to enter pipe size as either:

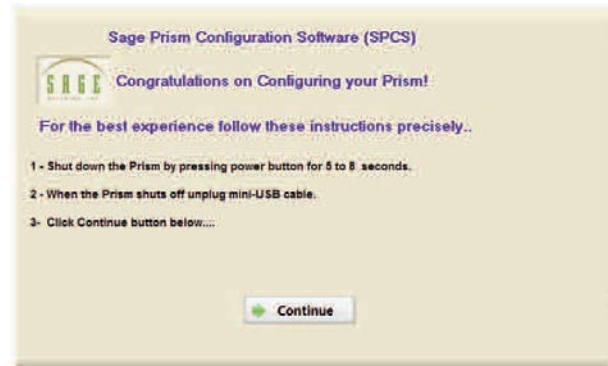
- Pipe size and schedule
- Pipe ID in inches
- Pipe area in square feet
- Measure velocity
- Units of measurement of flow and temperature

After pressing “continue”, the user can enter an 8 digit channel tag and a 24 digit channel name or description of the application. The channel tag must be unique. For units calibrated for Biogas or Natural Gas, the user can enter the gas composition and SPCS will make adjustments for variations in gas composition from the calibration gas.

The information in the user configured channels can be modified by selecting the channel and pressing “Edit Channel”. The data is saved when entered into SPCS and is uploaded to the Prism.

NOTE: While the data is automatically uploaded into the Prism it is necessary that the configuration data be saved to a file (PrismChCfg-xxxxxx.xls – where xxxxxx is the serial number of the Prism) located in the same directory as the SPCS software is installed. After configuring all the channels, click on “Save All Channel Configuration” and click on “Stop”. Unplugging the Prism before either of these operations will result in loss of configuration data.

After clicking on “Stop” the following screen provides instructions for proper disconnection of the Prism from the computer.



Failure to follow these instructions may corrupt the configuration data in the Prism.

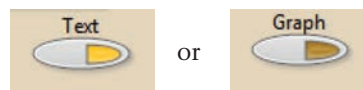
If the Prism will be used on multiple computers (an office computer for configuration and a portable for download of data in the field) it is necessary that the configuration file PrismChCfg-xxxxxx.xls (xxxxxx=Prism Serial Number) be transferred between the computers and stored in the same directory as the SPCS software is installed. This can easily be done using a USB flash drive.

FILE FUNCTIONS SCREEN:

The File Functions Screen permits the user to download data from the Prism, clear the data from the Prism and to display the data in text or a graphical format.

First download the data by clicking on the box titled “Download All Data” at the bottom of the page. The user will be given the opportunity to change the file name or location if desired. The default file name is XXXXXX-LOG.CVS. After the data is downloaded the data will be displayed in a text format.

The data can be displayed as text or graphically using the button:



In graph mode both the flow rate and temperature are displayed. It is possible to show each curve independently by clicking on:



While in graph mode the user can scan through the data or select specific data points. **Note: When using these functions the Auto Scale must be turned off. This is done by right clicking anywhere on the chart and deselecting AutoScale X and AutoScale Y**



Selects and moves magnetic cross-hairs

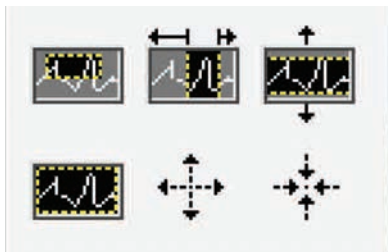
The small diamond shaped icons on the left and right move the cross-hair in that direction. The small icons on the top and bottom will cycle between the flow curve and the temperature curve.



Cursor moves the selected cross hairs



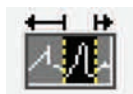
← Pressing this button brings up this icon:



Which permits the viewer to view details of the data in graphical format:



Highlights and zooms in on the selected portion of the graph



Spreads the data on the time (X) axis



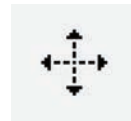
Changes the height scale



Returns the scale to original size



Expand the scale of the chart



Contract the scale of the chart

SAVING THE DATA:

SPCS saves the raw data in a .csv format. In addition SPCS creates another file with the same name but with an .xls extension for use in a spreadsheet. In addition to containing the raw data, the .xls file also includes all the configuration data for each channel. The data from previously saved files can be reviewed at a later date – see following section.

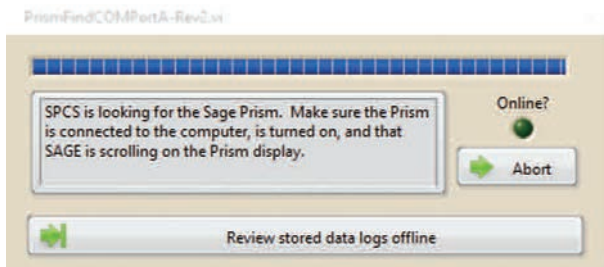
To store or analyze the logged data, go to the default directory where the data is stored (C:\Sage\SPCS) and open the .xls file. Excel will display a warning message indicating that the file format and extension do not match. Ignore this statement and press “yes”. At the top of the page, the configuration data for each channel is shown listed by channel Tag; thus the need for a unique tag name. This provides the historical record of the channel configuration which corresponds with the logged data. If desired, each line of the configuration information can be copied and pasted at the beginning of each set of logged data.

Read Data permits the user to retrieve previous files saved in .csv format for review or analysis.

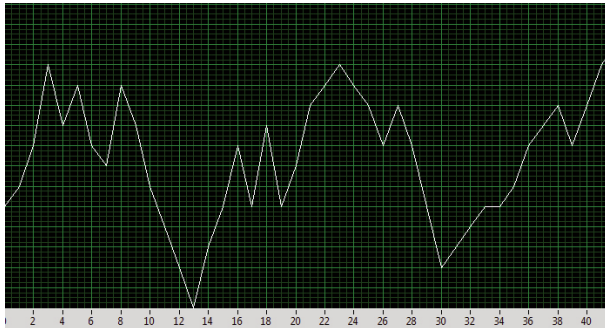
Clear All Log Data clears the flow data from the Prism and from SPCS. Insure that the data is saved prior to clearing the data. Save your files to another directory to maintain a historical record.

REVIEWING PREVIOUS DATA LOGS

SPCS can also be used off line to review the flow data previously collected. If SPCS is started without the Prism attached the following screen will appear:



Simply click on “Review stored data logs offline” and SPCS will open a directory of previously saved files. Browse through these files and select the file to review. The file will be loaded with the data available in both graphic and text format.



ADVANCED CONFIGURATION

The “Advanced” tab permits the selection of infrequently used parameters.

STP Temperature and STP Pressure can be set. These are the reference temperature and pressure used for Standard Conditions. Default is 70°F and one atmosphere pressure (14.69 psia) except for natural gas where standard temperature of 60°F is used (per AGA).

Set Clock Time will synchronize the clock in the Prism with the clock in the PC.

Damping will vary the speed of response. Default is 0.07. This value will range between 0.01 which provide maximum damping to 0.999 which provides no smoothing. Decreasing this value will slow down the response which is helpful for conditions where rapid fluctuations occur. Note that there is non-linear relationship between damping value and response time.

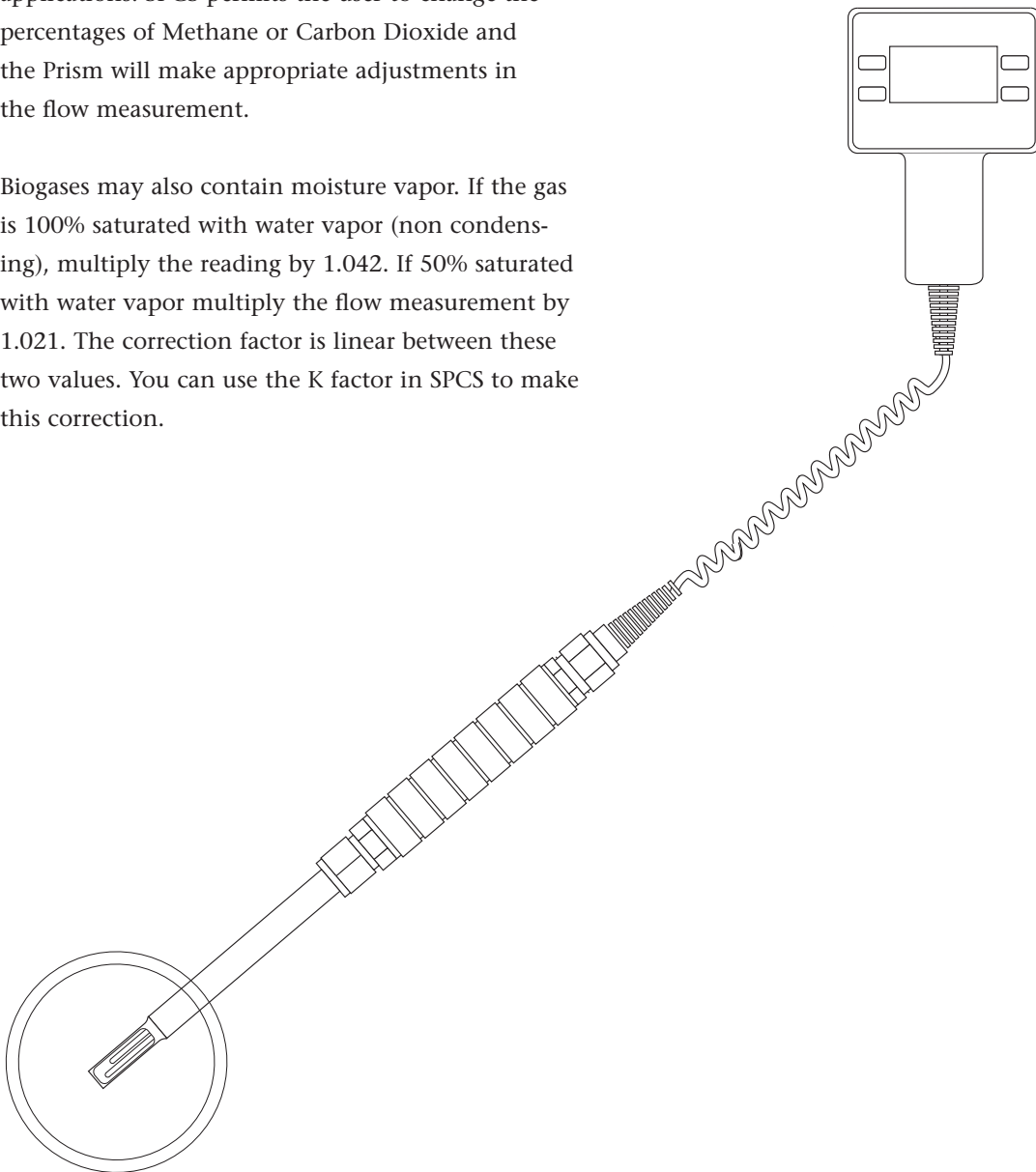
Correction Factors For Variation From Original Digester Gas Calibration

Any Prism specified for Biogas (including Landfill Gas or Digester Gas) is calibrated for a mixture of 50% Methane and 50% Carbon Dioxide. Sage recognizes that this gas mixture may change for different applications. SPCS permits the user to change the percentages of Methane or Carbon Dioxide and the Prism will make appropriate adjustments in the flow measurement.

Biogases may also contain moisture vapor. If the gas is 100% saturated with water vapor (non condensing), multiply the reading by 1.042. If 50% saturated with water vapor multiply the flow measurement by 1.021. The correction factor is linear between these two values. You can use the K factor in SPCS to make this correction.

Installations Where Pipe Condensation May Develop

For applications where condensation may occur on the inside wall of the pipe, Sage recommends mounting the probe at a 45 degree angle. This will avoid droplets from contacting the sensor and causing spikes.



Calibration Verification

Each Sage Metering Thermal Mass Flow Meter is calibrated on a NIST traceable flow calibration system. To verify that the instrument retains the original calibration Sage has developed a simple and easy to perform test to compare field data with the actual calibration data. This test is performed at a no flow condition.

The display shows the signal in mW in the upper left. This represents the amount of power required to maintain the desired overheat between the two sensors. For more information on the principle of operation refer to page 5. Calibration involves measuring the power at multiple known flow rates over the operating range of the instrument. A polynomial curve is then developed for each instrument. The zero flow data point on this curve is important as it defines the curve. In addition it is one data point which can be re-created at some future date.

During calibration a zero flow signal is obtained in ambient air. Unlike Sage Metering's calibration verification test used with other meters where the zero

flow data is obtained in both air and with the gas at specified operating conditions, the test with the Prism is performed only in ambient air. This is due to the variety of different operating conditions which may be encountered with the Prism where the zero flow condition in the application may vary due to variations in pressure, gas composition, or other factors.

The zero flow mW value is obtained during calibration; it is shown on the calibration certificate and also marked on the back of the Prism. The verification test is to simply create a no-flow condition in ambient air, measure the mW on the display and compare this value with the value shown on the Prism. A value less than 10 mW indicates that the meter is in calibration.

Prism Trouble Shooting/Diagnostics

1) BATTERY STRENGTH INDICATOR IS INCORRECT

This can occur if the battery of the Prism becomes fully discharged. To reset the battery strength indicator

- a) Charge the Prism until the red LED goes out
- b) Unplug the Prism from charger
- c) Power up
- d) During start up, press upper hand button – BATTERY will appear on the display
- e) Press lower right button (SEL) to accept
- f) SET FULL CHARGE? will appear
- g) Press lower right button (SEL) to accept – Yes/No will appear on display
- h) Press upper left button to confirm full strength

2) METER RAILING

Displayed flow rate pegged (not increasing) while mW value increases. This will occur if the flow rate exceeds the calibration range of the Prism.

- Find another sampling point in a larger size pipe. Note that the maximum measured flow rate is displayed when using SPCS

3) READING HIGH

The meter is reading higher than expected

- a) Insufficient straight run causing distortion in flow profile – find another sampling location with recommended upstream distance.
- b) Sensor is installed in reverse direction – the probe is marked “upstream”. This mark should be facing the upstream direction.
- c) Incorrect pipe dimensions (pipe smaller than size entered in SPCS) – verify the pipe dimensions entered in SPCS are correct
- d) Moisture droplets condensing out of gas stream causing spiking in flow measurement – find another sampling location.

- e) Moisture condensing on wall of pipe which roll down or hit sensor creating a spike – install the probe at a 45 degree angle (see page 19).
- f) The Prism is being used for a gas other than the gas it was calibrated for (see Prism nameplate).
- g) Prism is being compared to flow meter without pressure or temperature correction. The Prism is measuring mass flow (SCFM, SCFH, NMCH) while other flow meter measuring flow at actual conditions.
- h) Incorrect K factor (K factor greater than one). The K factor is a multiplier to adjust measured flow rate – check configuration in SPCS.

4) READING LOW

The flow meter is reading lower than expected

- a) Insufficient straight run causing distortion in flow profile – find another sampling location with recommended upstream distance.
- b) Sensor is installed in reverse direction – the probe is marked “upstream”. This mark should be facing the upstream direction.
- c) Incorrect pipe dimensions (pipe larger than size entered in SPCS) – verify the pipe dimensions entered in SPCS are correct.
- d) The Prism is being used for a gas other than the gas it was calibrated for (see Prism nameplate).
- e) Sensor is dirty – remove probe from pipe and clean sensor.
- f) Incorrect K factor (K factor less than 1). The K factor is a multiplier to adjust measured flow rate – check configuration in SPCS.

Warranties and Service Work¹

LIMITED WARRANTY

Sage Metering's products are warranted against faulty materials or workmanship for one year from the date of shipment from the factory. Sage's obligation is limited to repair, or at its sole option, replacement of products and components which, upon verification by Sage at our factory in Monterey, California, prove to be defective. Sage shall not be liable for installation charges, for expenses of Buyer for repairs or replacement, for damages from delay or loss of use, or other indirect or consequential damages of any kind. This warranty is extended only to Sage products properly used and properly installed for the particular application for which intended and quoted; and does not cover water damage due to improper use of cord grips or removal of protective caps; and does not cover Sage products which have been altered without Sage authorization or which have been subjected to unusual physical or electrical stress. Sage makes no other warranty, express or implied, and assumes no liability that goods sold to any purchaser are fit for any particular purpose. Transportation charges for materials shipped to the factory for warranty repair are to be paid by the shipper. Sage will return items repaired or replaced under warranty, prepaid. NOTE: No items will be returned for warranty repair without prior written authorization from Sage Metering, Inc. Sage does not warranty damage due to corrosion. Sage does not warranty damage due to improper packing for warranty repair.

GENERAL TERMS AND CONDITIONS

Detailed General Terms and Conditions can be found on the Sage website (www.sagemetering.com) on a link "General Terms" on the Footer of any page on the website.

CANCELLATION / RETURN POLICY

Cancellation or Return: After issuance of a purchase order (by phone, mail, e-mail or fax) or a credit card order (by phone, mail, e-mail or fax), there will be a cancellation fee for any cancelled order. Cancellations must be in writing (by mail, e-mail or fax):

- 1) If credit card order or non-credit card order is cancelled within 7 days of issuance of purchase order or date order was placed (which ever is earlier), there will be a 10% cancellation fee.
- 2) If credit card order or non-credit card order is cancelled after 7 days, but prior to shipment, there will be a 20% cancellation fee. (If order is cancelled due to late delivery, the cancellation fee will be waived. Late delivery is defined as shipping a meter 7 days or later than the delivery date acknowledged by Sage Metering at time of placing order).
- 3) If a credit card customer decides to return the equipment after shipment for credit, credit will not be issued if equipment is damaged or if equipment is returned after four (4) months of shipment. If equipment is not damaged, then equipment can be returned after issuance of a Return Meter Authorization (RMA) by Sage. **Returned package must be insured by customer and must reference proper RMA# on outside of package,** or package may be rejected (i.e., package will be returned unopened). Credit Card customers will be charged a 30% re-stocking fee (70% balance will be credited back). Customer is responsible for return shipping charges and any damage if improperly packaged.

¹ Detailed General Terms and Conditions can be found on the Sage website (www.sagemetering.com) on a link "General Terms" on the Footer of any page of the website.

RETURNING YOUR SAGE METER

A Return Material Authorization Number (RMA#) must be obtained prior to returning any equipment to Sage Metering for any reason. RMA#s may be obtained by calling Sage Metering at 866-677-7243 or 831-242-2030 between 8:00 am and 5:00 pm Monday through Friday.

A Sage RMA Form (see page 24) must be filled out and included with the meter being returned to Sage Metering.

Take special care when packaging your meter for return to the factory. The sensor in particular may easily be damaged if not prevented from shifting around within the package and if the sensor itself is not covered to keep it from contacting other package contents. Any damage resulting from improper packaging is the responsibility of the shipper.

A purchase order is required prior to an RMA being issued. Most repairs or recalibrations can be quoted over the phone. For equipment that must be evaluated, an Evaluation purchase order in the amount of \$150 is required. Once an evaluation is completed and a quote has been issued, you can choose to proceed with the work or have the unit returned with only the evaluation and freight fee billed.

In accordance with the "Right to Know Act" and applicable US Department of Transportation (DOT) regulations, Sage Metering will not accept delivery of equipment that has been contaminated without written evidence of decontamination, and has instituted the following Return/Repair conditions. Strict adherence to these conditions is required. Returned equipment that does not conform to the requirements listed below will not be processed. If Sage Metering finds evidence of contamination, we may, at our option, have the unit returned at your expense. For your ref-

erence, the requirements for packaging and labeling hazardous substances are listed in DOT regulations 49 CFR 172, 178, and 179.

1. The equipment must be completely cleaned and decontaminated prior to shipment to Sage Metering. This decontamination includes the sensor, probe, electronics and enclosures internally and externally. All packaging must be clean and free from contamination.
2. A Material Safety Data Sheet (MSDS) is required for all process fluids and gases that have been in contact with the equipment. This includes fluids or gases used in cleaning the equipment. A Decontamination Statement is also required for each meter returned using a different gas or fluid. Both the MSDS and the Decontamination Statement are to be attached to the OUTSIDE of the shipping container. If both documents are not attached, you will be called, and the equipment sent back to you at your expense.
3. The decontamination Statement must include the following required information
 - A. A list of all chemicals and process fluids used in the equipment, including decontamination fluids or gases.
 - B. The model and serial number of the equipment being returned.
 - C. A company officer or other authorized person's signature on the statement.

Return Shipping Address:

Sage Metering, Inc.
8 Harris Court, Building D1
Monterey, CA 93940

RETURN MATERIAL AUTHORIZATION

RMA # _____

Date _____

RETURN CUSTOMER INFORMATION

Customer's Name _____ Fax # _____

Customer's Contact Name _____ Phone # _____

Email Address _____

CUSTOMER'S RETURN ADDRESS

Bill to: _____ Ship to: _____

RETURN PRODUCT INFORMATION

Model No. _____ Serial No(s). _____

FLOW: MIN _____ NORMAL _____ MAX _____

TEMP: MIN _____ NORMAL _____ MAX _____

PRESSURE: MIN _____ NORMAL _____ MAX _____

GAS _____

REASON FOR RETURN / DESCRIPTION OF SYMPTOMS

(All non-warranty repairs could be subject to a minimum evaluation charge)

Recommended steps to be used to duplicate problem/symptoms _____

Sage Metering Technical Contact _____

Take special care when packaging your meter for return to the factory. The sensor in particular may easily be damaged if not prevented from shifting around within the package and if the sensor itself is not covered to keep it from contacting other package contents. Any damage resulting from improper packaging is the responsibility of the shipper.

SAGE METERING, INC.

8 Harris Court, Building D-1 / Monterey, California 93940

PHONE: 831-242-2030 / FAX: 831-655-4965