

Sierra Series 730 Accu-Mass™ Mass Flow Meters

Instruction Manual

Part Number IM-73-AM
Revision E 05/04



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Customer Notice

Sierra Instruments, Inc. is not liable for any damage or personal injury, whatsoever, resulting from the use of Sierra Instruments standard mass flow meters for oxygen gas. You are responsible for determining if this mass flow meter is appropriate for your oxygen application. You are responsible for cleaning the mass flow meter to the degree required for your oxygen flow application.

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TRADEMARKS

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Revision D: added NEMA 4 enclosure wiring instructions, updated content and format.

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Warnings and Cautions



Warning! All wiring procedures must be performed with the power Off.



Caution! All flow meter connections and fittings must have the same or higher pressure rating as the main pipeline.

Caution! Do not connect power to the 4-20 mA terminals.

Caution! Before attempting any flow meter repair, verify that the line is de-pressurized.

Caution!

Always remove main power before disassembling any part of the flow meter.

Caution! Printed circuit boards are sensitive to electrostatic discharge. To avoid damaging the board, follow these precautions to minimize the risk of damage:

- before handling the assembly, discharge your body by touching a grounded, metal object
- handle all cards by their edges unless otherwise required
- when possible, use grounded electrostatic discharge wrist straps when handling sensitive components

Series 730 Mass Flow Meters

Sierra's Series 730 Accu-Mass™ Flow Meters provide outstanding measurement accuracy and fast 200 millisecond response time. The meters monitor the mass flow rate of air and process gases in ranges from 0 to 250 scfm. They are available in pipe sizes from 1/4-inch to 3 inches. Accu-mass meters are ideal for monitoring flows of non-corrosive gases compatible with the device's wetted materials and applications requiring fast time response.

Sierra's Accu-Mass sensor is a reference-grade platinum resistance temperature detector (RTD) encapsulated in glass. The platinum RTD wire is wound on a rugged ceramic mandrel for strength and stability. The sensor is located at the tip of a 304 stainless steel probe which is inserted in the gas stream. The sensor consists of two sensing elements—a velocity sensor and a temperature sensor which automatically corrects for changes in gas temperature. When power is applied to the flow meter, the transducer electronics heats the velocity sensor to a constant temperature differential above the gas temperature. The cooling effect of the air as it passes over the heated sensor is measured by the bridge voltage. The meter electronics converts this voltage into a linear 0-5 VDC, 0-10 VDC, or 4-20 mA output signal.

The meter electronics are packaged in an anodized aluminum NEMA 2 or a painted cast aluminum NEMA 4 enclosure. The electronics are mounted either directly on the sensing probe or for NEMA 2 enclosures, remotely up to 100 feet (60 meters) away.

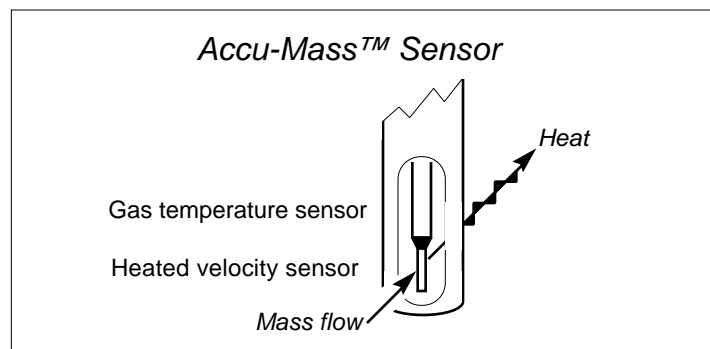


Figure 1. Series 730 Accu-Mass Sensor Probe

Safety Information

We use caution and warning statements in this book to draw your attention to important information.



Warning!

This statement appears with information that is important to protect people and equipment from damage. Pay very close attention to all warnings that apply to your application.



Caution!

This statement appears with information that is important for protecting your equipment and performance. Read and follow all cautions that apply to your application.

Receipt of Components

When receiving a Sierra mass flow meter, carefully check the outside packing carton for damage incurred in shipment. If the carton is damaged, notify the local carrier and submit a report to the factory or distributor. Remove the packing slip and check that all ordered components are present. Make sure any spare parts or accessories are not discarded with the packing material. Do not return any equipment to the factory without first contacting Sierra Customer Service.

Technical Assistance

If you encounter a problem with the flow meter, review the configuration information for each step of the installation procedure. Verify that the flow conditions are consistent with factory recommendations. Refer to *Troubleshooting* for specific information and recommendations.

If the problem persists after following the troubleshooting procedures outlined in this manual, contact Sierra Instruments by fax or by E-mail (service@sierrainstruments.com); or, visit the Sierra website at www.sierrainstruments.com for further assistance. For phone support you may call (800) 866-0200 or (831) 373-0200 between 8:00 a.m. and 5:00 p.m. PST. In Europe contact Sierra Instruments b.v. at +31 20 6145810. When contacting Technical Support, make sure to include this information:

- the flow range, serial number, Sierra order number and model number (all marked on the meter nameplate)
- the problem you are encountering and any corrective action taken
- application information (gas, pressure, temperature and piping configuration)

Installation Overview

When selecting an installation site, make sure that:

1. Line pressure and temperature will not exceed the flow meter rating. Temperature should not vary more than 120°F (50°C) from the calibration temperature. Line pressure should not vary more than 50 psi (3.4 bar) around the calibrated pressure.
2. The ambient temperature falls within the limits of: 32°F (0°C) to 120°F (50°C).
3. The location meets the required minimum number of pipe diameters upstream and downstream of the sensor head (see Figure 2).
4. Safe and convenient access with adequate clearance. Also, verify the meter is located where the gas is clean and dry and the meter is calibrated for the gas to be measured.
5. For remote installations, verify the supplied cable length is sufficient to connect the flow meter sensor to the remote electronics. (Do not extend or shorten the supplied cable between the probe and the electronics.)

Also, before installation check your flow system for anomalies such as:

- leaks
- valves or restrictions in the flow path that could create disturbances in the flow profile that might cause unexpected flow rate indications
- heaters that might cause rapid excursions in the measured temperature

Unobstructed Flow Requirements

Select an installation site that will minimize possible distortion in the flow profile. Valves, elbows, control valves and other piping components may cause flow disturbances. In order to achieve accurate and repeatable performance install the flow meter using the recommended number of straight run pipe diameters upstream and downstream of the sensor given in Figure 2.

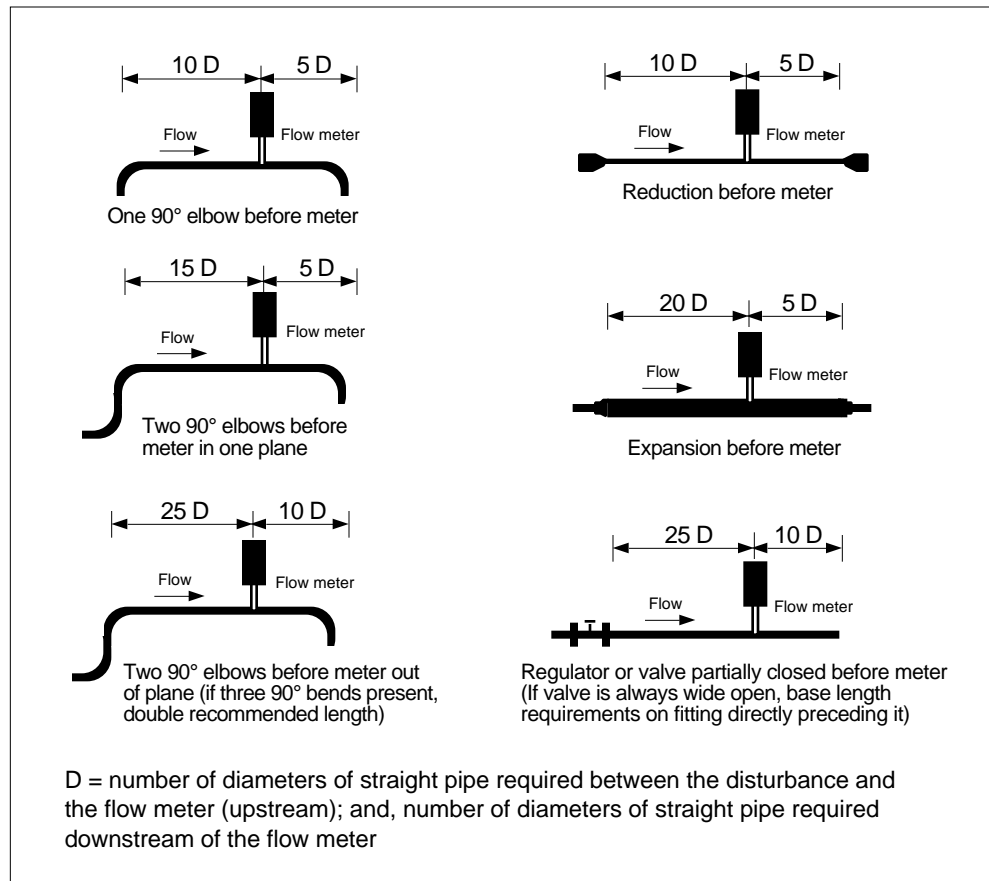


Figure 2. Recommended Pipe Length Requirements for Installation

Installation

The following instructions are general in nature and intended for guideline purposes only.



Caution!

All flow meter connections and fittings must have the same or higher pressure rating as the main pipeline.

1. **Turn off the flow of process gas. Verify that the line is not pressurized.**
2. Confirm that the installation site meets the minimum upstream and downstream piping requirements.
3. Position the meter with the flow direction arrow pointing downstream in the direction of flow.
4. Tighten fittings until leak tight (refer to published standards for specific recommendation).
5. Check the system's entire flow path thoroughly for leaks.

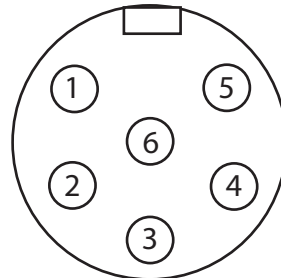


Warning!
All wiring procedures
must be performed
with the power Off.

Wiring Connections - NEMA 2 CE Enclosures

NEMA 2 enclosures are supplied with a 6-pin connector for direct connection to the supplied mating connector. The pin designations are given in Figure 3 below. Connect 15 VDC input power (300 mA load, maximum) to pin 1 and power ground to pin 5. See “Output Signal Wiring” for signal wiring instructions.

- Female Cable Socket Mating Connector (Female Solder Side View)



- 1 Positive power lead (Red)
- 2 Output signal (Wht)
- 3 Signal common (Blk)
- 4 Bridge voltage (Org Not Required)
- 5 Power return (Grn)
- 6 Shield (Not Required)

Figure 3. NEMA 2 CE Enclosure Wiring Connections

Output Signal Wiring

All flow meters are equipped with either a calibrated 0–5 VDC, 0–10 VDC or 4–20 mA output signal. These linear output signals represent 0 to 100% of the flow meter user full scale.

DC Output Wiring

The 0-5 VDC or 0-10 VDC output signal can drive a minimum load of 1000 Ohms. For 0-5 VDC or 0-10 VDC connections, connect to the terminals marked Output signal and Signal ground.

4–20 mA Output Wiring

The 4-20 mA current loop output is self-powered (non-isolated). The maximum loop resistance (load) for the output is 400 Ohms. For a 4–20 mA connection, connect to the terminals marked Output signal and Signal ground.



Caution!

Do not connect power to the 4-20 mA terminals.

Troubleshooting the Flow Meter

Begin hardware troubleshooting by verifying the following facilities issues are correct. These areas impact system operation and must be corrected prior to performing any flow meter inspections.



Caution!

Before attempting any flow meter repair, verify that the line is not pressurized.



Caution!

Always remove main power before disassembling any part of the mass flow meter.

1. Verify the incoming power to the flow meter is present and of the correct voltage and polarity.
2. Check the flow meter wiring for correct connections.
3. Verify the flow meter is installed with the correct number of upstream and downstream pipe diameters as shown in Figure 2.
4. Verify the flow direction indicator is correctly aligned pointing downstream of flow.
5. Make sure there are no leaks in the line being measured.

After verifying the factors above, follow the troubleshooting procedures outlined on the next page. If you need to return the flow meter to the factory, see page 10 for return shipping instructions.

Flow Meter Calibration

Sierra Instruments maintains a fully-equipped calibration laboratory. All measuring and test equipment used in the calibration of Sierra meters are traceable to NIST standards. Sierra is ISO-9001 registered and conforms to the requirements of ANSI/NCSL-Z540 and ISO/IEC Guide 25. If the flow body or electronics have been damaged or you simply want to have the flow meter re-calibrated, contact the factory for return shipping instructions. Calibration must be performed by qualified personnel using NIST-traceable equipment.

Problem	Possible Cause	Solution
Flow measurement is erratic or fluctuating	Very erratic or non-uniform flow	Follow installation requirements shown in Figure 2
	Flow meter installed with less than required minimum pipe diameters upstream and downstream of the sensor	Follow installation requirements shown in Figure 2
	Probe is not secured to a solid base	Secure probe to a non-vibrating solid mount
	Sensor component broken	Return to factory for replacement
	Malfunction in system electronics	Return to factory for evaluation
	Moisture present in gas flow	Install a water trap or filter upstream of the flow sensor
Velocity measurement seems too high or low	Sensor assembly not aligned correctly to flow	Correct alignment with the flow indicator pointing downstream in the direction of flow
No response to flow from sensor assembly	No power	Turn on power to the flow meter
	Flow profile distortions	Try to find another location for the meter
	Extremely turbulent flow	Do not place the meter near a ventilator, static mixer or valve
	Sensor failure	Return to factory for repair
	Malfunction in system electronics	Return to factory for evaluation
System will not zero	Out of calibration	Return to factory for calibration
	Probe tip is broken	Return to factory for repair
4-20 mA output circuit not indicating 4 mA at zero flow	Improper current loop resistance; total current loop resistance must be no less than 150 Ohms and no greater than 450 Ohms	Install load resistor or use larger gauge wire
Output pegs plus or minus	Flow body not plugged in	Plug in both connectors
	Malfunction in system electronics	Return to factory for evaluation

Returning Equipment to Factory

Before returning any mass flow meter to the factory, you must complete a Sierra Calibration/Repair Data Sheet. You may download the data sheet to your computer by visiting the Sierra website at www.sierrainstruments.com. Or, contact Customer Service at:

service@sierrainstruments.com (Email) or,
(800) 866-0200 or (831) 373-0200 in the US,
or +31(0)20-6145810 in Europe.

Return shipments to:

USA Headquarters
Sierra Instruments Service Department
5 Harris Court, Building W
Monterey, CA 93940

European Headquarters
Sierra Instruments b.v. Service Department
Bolstoen 30A
1046 AV Amsterdam, The Netherlands

When returning a component, make sure to include the completed Calibration/Repair Data Sheet with the shipment.

Product Specifications

Operating Specifications

Gases Most non-combustible, non-corrosive gases

Mass Flow Rates

Mass Flow Rate for Air ⁽¹⁾		
NPT Size	Minimum Range	Maximum Range
1/4-inch	0–0.035 scfm	0–4.5 scfm
1/2-inch	0–0.5 scfm	0–12 scfm
3/4-inch	0–1 scfm	0–25 scfm
1 1/4-inch	0–2 scfm	0–50 scfm
2-inch	0–5 scfm	0–125 scfm
3-inch	0–10 scfm	0–250 scfm

(1) Contact factory for ranges of other gases

Gas Pressure 150 psig (10 barg)*
 *Maximum gas pressure is determined by the mechanical process connections, as well as, the application conditions. Mechanical limitations are shown above, please consult factory for application limitations.

Pressure Drop Negligible

Gas & Ambient Temperature Gas.....14° to 176°F (–10° to 80°C)
 Ambient.....32° to 120°F (0° to 50°C)

Leak Integrity 1×10^{-2} atm cc/sec of helium maximum

Power Requirements 15 or 24 VDC, 300 mA

Output Signal Linear 0-5 VDC or 0-10 VDC proportional to mass flow rate, 1000 Ohms minimum load resistance; or, linear 4-20 mA proportional to mass flow rate, 400 Ohms maximum resistance

Performance Specifications

Accuracy $\pm 1\%$ of full scale + 0.5% of reading over 32 to 120°F (0 to 50°C) and 5 to 30 psia (0.3 to 2 barg)

Repeatability $\pm 0.2\%$ of full scale

Temperature Coefficient $\pm 0.02\%$ of reading per °F within $\pm 50^\circ\text{F}$ of customer specified conditions
 $\pm 0.03\%$ of reading per °F within $\pm 50^\circ\text{F}$ to 100°F of customer specified conditions
 $\pm 0.04\%$ of reading per °C within $\pm 25^\circ\text{C}$ of customer specified conditions
 $\pm 0.06\%$ of reading per °C within $\pm 25^\circ\text{C}$ to 50°C of customer specified conditions

Pressure Coefficient Negligible within ± 50 psig (3.4 barg) of customer specified conditions (Special calibration required for higher pressures)

Response Time 200 milliseconds to 63% of final velocity value

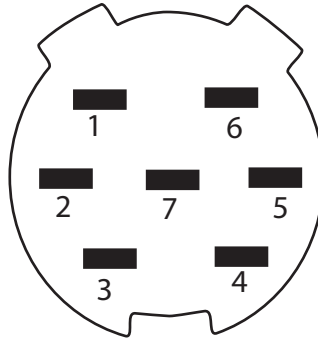
Physical Specifications

Wetted Materials Anodized aluminum or 316 stainless steel flow body
 Glass-coated sensor; epoxy; Viton O-rings

Enclosure Anodized aluminum NEMA 2
 Painted cast aluminum NEMA 4

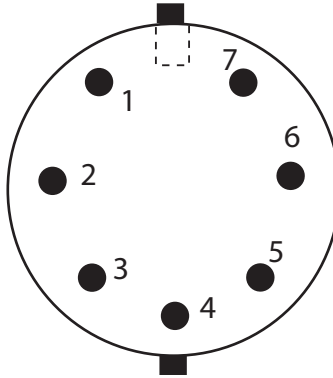
730/600 WIRING CONNECTIONS

No#.	Color	Signal
1	Black	Sig. Ground
2	White	Signal
3	Red	DC input Power
4	N/C	
5	N/C	
6	Green	Power Ground
7	(Brown or Orange)	(Bridge)



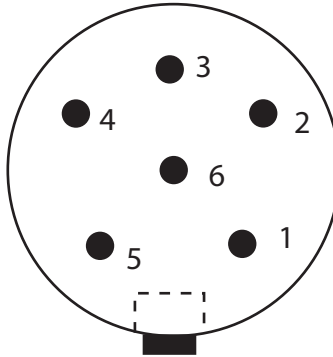
Blue Hi Rose Connector
Female Mating Connector
Solder Side

No#.	Color	Signal
1	Black	Sig. Ground
2	White	Signal
3	Red	DC input Power
4	N/C	
5	N/C	
6	Green	Power Ground
7	(Brown or Orange)	(Bridge)



Black Connector
Female Mating Connector
Solder Side

No#.	Color	Signal
1	Red	DC input Power
2	White	Signal
3	Black	Sig. Ground
4	(Brown or Orange)	(Bridge)
5	Green	Power Ground
6		



Silver Connector
Female Mating Connector
Solder Side

