



A Halma company



OPERATING MANUAL

FOR MASS FLOW DEVICES

Models IM and IMC

Thank you for purchasing your mass flow device.

If you have any questions, or if something is not working as expected, please contact us. We are eager to help you in any way possible.

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Recalibrate your mass flow controller every year.

Annual calibration is necessary to ensure the continued accuracy of readings, and to extend the Limited Lifetime Warranty. Fill out the Service Request Form at alicat.com/service, or contact us directly when it is time to send in your device for recalibration. For information about our limited lifetime warranty, visit alicat.com/warranty.

Serial #:

Next Calibration:

This device comes with a NIST-traceable calibration certificate.

NIST

This device conforms to the European Union's Restriction of Use of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU.



This device complies with the requirements of the Low Voltage Directive 2014/35/EU and the EMC Directive 2014/30/EU and carries the CE Marking accordingly.

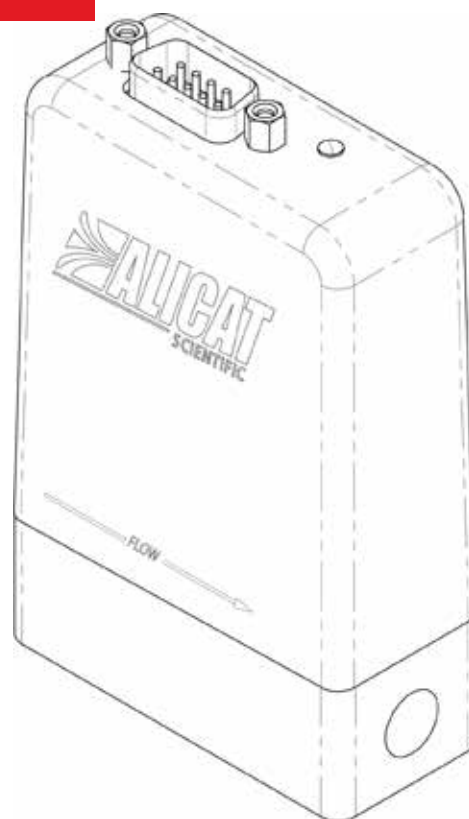
CE

This device complies with the requirements of the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC

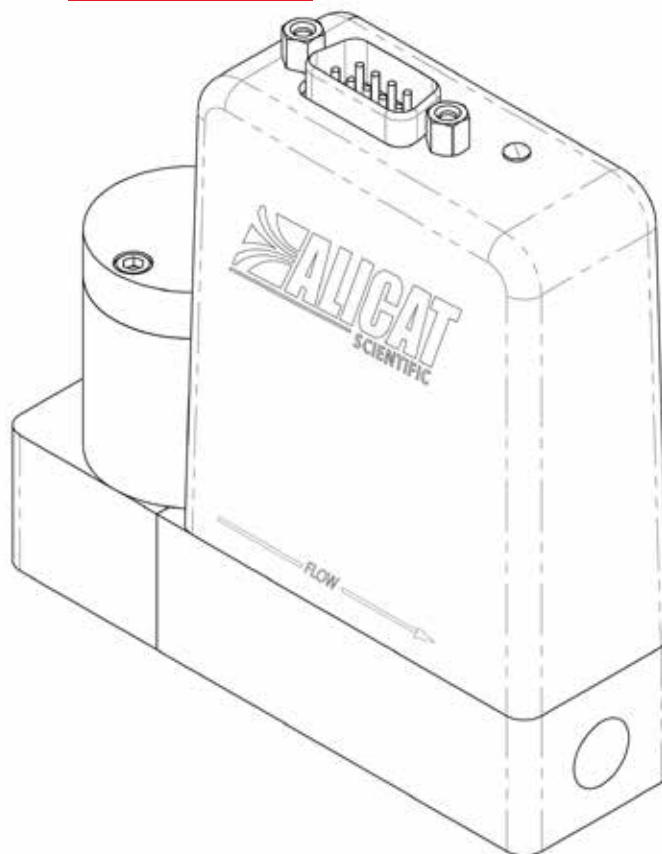


DOC-MANUAL-IMC Rev 0, 2023.11.09

IM FLOW METER



IM FLOW CONTROLLER



Introduction

Your new flow controller has a variety of innovative features:

- **High-accuracy performance for all your gases.** Use your flow controller with any of the 30 calibrated gases
- **1000 readings per second** guarantees high resolution data
- **Monitor live pressure and temperature** during flow control
- **Change your STP** to match any standard temperature and pressure reference
- **Control pressure while monitoring flow rate.** Set the closed loop control algorithm to pressure control
- **Log data to your PC** with a serial data connection to control the device and capture data for logging and analysis.
- **Totalize and batch dispense** flow with high precision
- **Monitor valve position** to maintain your process and identify failures before they occur.

This manual covers the following instruments:

- **IMC-Series:** gas mass flow controllers
- **IM-Series:** gas mass flow meters.

For support or questions regarding the use or operation of this device, please contact us using the information on [page 2](#).

Alicat offers many combinations of device sizes, accessories, connections, and configurations. These custom solutions can meet a variety of application challenges brought forth by users pushing the boundaries of our standard offerings. If you have an idea for a new process or a challenging application, contact Alicat for specialized engineering and application support.

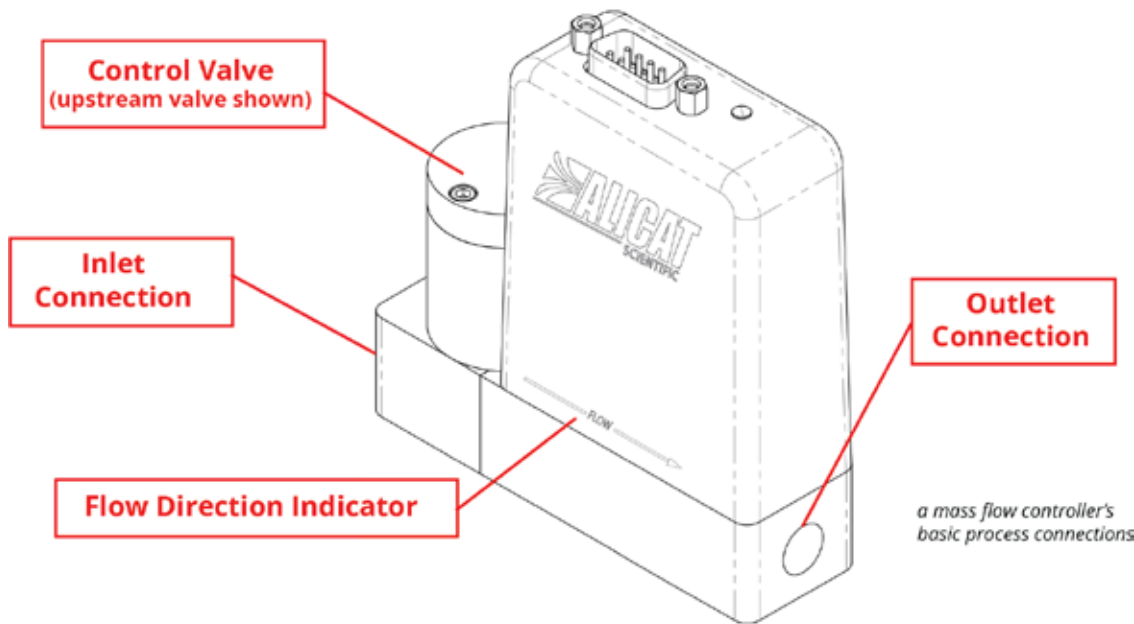
This manual covers the general operation of factory OEM devices. Custom setups may not be covered by this document. If you need further assistance, please contact Alicat support.

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Getting Started

The major device components are shown in the diagram below.



Most communication with the device is completed through digital communication or analog signals, as described later in this manual. The LED on the top of device provides the following feedback:

- **Solid Green:** Power is applied
- **Flashing Green:** Power is applied, serial activity is occurring
- **Solid Red:** Valve override command received
- **Flashing Red:** Error state (mass overrange, temperature overrange, pressure overrange, totalizer overrange, etc.)

Mounting

The flow controller can be mounted in any position, including upside-down. Mount the device so that flow passes through the flow body in the direction shown by the flow arrow.

The dimensions of your device and positions of the mounting holes are detailed in the Factory OEM Mass Flow Devices specification sheet at alicat.com/imc.

Filters

When pressure drop is not a concern, use in-line sintered filters to prevent large particulates from entering the flow body of the controller. Suggested maximum particulate sizes are as follows:

- **5 microns** for units with flow ranges ≤ 1 SCCM.
- **20 microns** for units with flow ranges between 1 SCCM and 1 SLPM.
- **50 microns** for units with flow ranges ≥ 1 SLPM.

Gas Connections

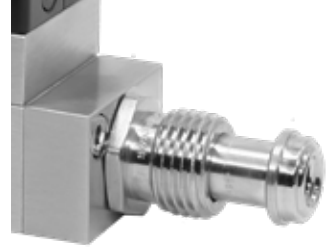
IM-Series mass flow controllers/meters do not require straight runs of pipe upstream or downstream.

Devices ship with plastic plugs seated in the processing ports. To decrease the chance of contaminating the flow stream, do not remove these plugs until you are ready to install the device.

After removing the plugs, immediately connect the device to upstream and downstream plumbing, leak-tight. Verify that the flow matches the direction indicated on the device body. Standard gas flow controllers/meters have female inlet and outlet ports. Options for connections include NPT, SAE, BSPP, and VCR®-compatible (some of these fittings may have male connections).

If you are using a fitting that does not have a face seal, use thread-sealing Teflon tape to prevent leakage around the port threads, **but** do not wrap the first two threads entering the device. This will minimize the possibility of tape entering the flow stream and clogging the laminar flow elements.

Face seal fittings can be installed without Teflon tape applied to the threads.



A mass flow controller with male VCR®-compatible connections.



Caution: Pipe dopes or sealants are not recommended on the process connections. These compounds can cause permanent damage to the controller should they get into the flow stream.

Maximum Pressure

The maximum common mode pressure is **200 PSIA**. Common mode pressure is the maximum pressure that may be applied simultaneously to both sides of the instrument without causing damage.



Warning: Using the flow controller above the maximum specified common pressure will permanently damage the internal pressure sensors. If the line pressure is above these limits, use a pressure regulator upstream of the device to reduce the pressure below 200 PSIA.

Maximum Flow

The maximum flow is 25 times the full-scale flow rating of the instrument. Exceeding this may cause permanent damage to the internal differential pressure sensor.

Commanding a non-zero setpoint prior to applying the pressure will cause the valve to be fully open and will expose the sensor to any instantaneous changes in pressure, such as from a snap-acting solenoid valve. For meters and controllers with downstream valves, install a flow restriction upstream of the device to limit large, instantaneous changes in pressure.

Power and Signal Connections

Power is supplied to the controller through the DB9 connector on the top of the device. The table below indicates how to connect the device to power and communication. If your device was built with a different configuration, please refer to the corresponding pinout found at alicat.com/pinouts.

The device power requirement for Factory OEM mass flow devices is: 12–24 VDC, 250 mA for the standard device, or 290 mA if equipped with 4–20 mA output.



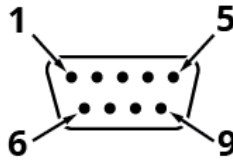
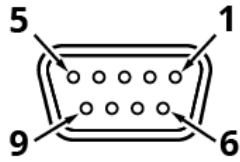
Warning: Do not power the device until all necessary pins have been properly connected.



Warning: Only connect power to pin 7. Connecting power to other pins can permanently damage the device.



Note: Power requirements vary based on analog configuration and valve type. Please reference to the Factory OEM Mass Flow Devices specification sheet at alicat.com/imc for power requirements.



Female Connector: Device Male Connector: Cable

Pin	Function
1	Ground to force the valve to close
2	Ground to force the valve to open
3	Rx or B (+): Receives RS-232 (Rx) or RS-485 B (+) signals
4	Analog Setpoint Input (meters: Ground to tare)
5	Tx or A (-): Sends RS-232 (Tx) or RS-485 A (-) signals
6	Analog Signal Output: 0-5 Vdc output signal.
7	Power in: Powers the device
8	Ground: Common ground for power, digital, communications, analog signals and alarms
9	Ground by default; alarm signal if unit has optional alarm page 14

* The above pinout is applicable to all factory OEM devices with the DB9 connector. The availability of different output signals depends on the options ordered. Optional configurations are noted on the unit's calibration sheet.

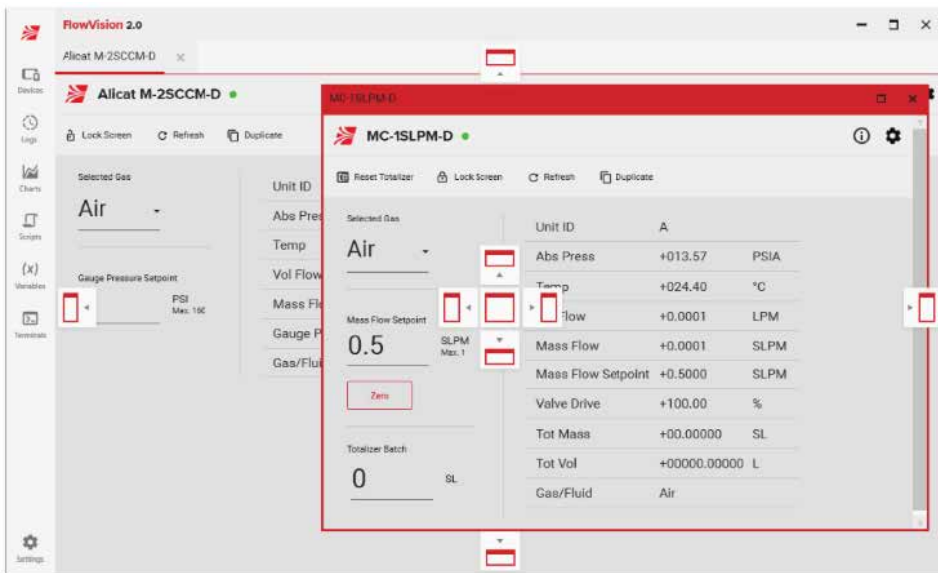
Control

IM Series controllers and meters can be operated using digital or analog communication. Digital communication can be performed using Alicat FlowVision™ 2.0 software, ASCII serial commands, Modbus-RTU, or analog signals.

- FlowVision 2.0: [page 8](#)
- ASCII Serial Communication: [page 9](#)
- Modbus RTU: [page 13](#)
- Analog Signals: [page 13](#)

FlowVision 2.0

FlowVision™ 2.0 is Windows-based software that enables easy collection and analysis of data from Alicat controllers and meters. FlowVision controls the device, runs scripts, and logs and charts data. It also provides easy access to select the gas, amount of flow averaging, and PID loop tuning to adjust response speed and stability for some applications.



Establishing Communication

To connect your device to FlowVision 2.0:

1. Download FlowVision 2.0 from alicat.com/flowvision and install.
2. With the device turned on and connected to the computer, start FlowVision 2.0.
3. Click Devices in the top left corner.
4. Click the green plus sign to add your controller/meter.
5. Select Wired for the connection type.
6. Specify the connection settings. By default, the Device ID is A, and the Baud Rate is 19200. The Port is dependent on which COM port the device is connected to.
7. Specify a Name if desired. FlowVision 2.0 generates a name if the field is blank.
8. Click Add to complete the process.

Please see the FlowVision 2.0 manual at alicat.com/flowvision for detailed instructions on operating your device through FlowVision.

ASCII Serial Communication

Alicat's Serial Terminal is a pre-configured program for serial communication via the device's DB9 port. Download Serial Terminal for free at alicat.com/drivers.

The section below outlines several common commands. For more detailed information on using the ASCII interface, please see the Serial Primer manual at alicat.com/manuals.

Establishing Communication

Connect the device to a computer through a COM port or virtual COM port, noting the COM port number. Up to 26 devices can be connected to a single COM port.

The following are the default connection settings:

- Baud: 19200
- Data bits: 8
- Parity: none
- Stop bits: 1
- Unit ID: A

Unit ID

Each device has a unique, single-letter ID using the standard 26-letter English alphabet (e.g., A, B, C, etc.). The default ID is "A". If more than one device on a COM port has the same ID, data and commands become corrupted and do not report or execute properly. When connecting multiple devices on the same COM port, connect one device at a time. Provide a unit ID command for each device before connecting the next device.

To give the most recently connected device an unused ID:

Change the unit id command: (`unit_id@ desired_id`)

Taring the Device

Taring gives the device a zero reference for flow measurements, ensuring that the device provides its most accurate measurements. It is recommended to tare the device:

- After installation
- When changing the device's orientation
- If the device is hit with any significant impact
- After any significant changes to the temperature or pressure.

Tare the device: (`unit_idV`)

It is possible for the sensor zero to shift with changes in temperature and pressure. This is most often indicated by the device not reading zero flow when at a 0 setpoint. The autotare algorithm will automatically zero the device any time a 0 setpoint is given, after a small delay (flow range dependent). For most flow ranges, the tare will execute in 2 seconds or less after receiving a 0 setpoint. See the Serial Primer at alicat.com/manuals for more on autotare.

Collecting Data

Live flow data can be collected in either Polling or Streaming mode.



Note: Before collecting flow data, be sure to tare your controller. If autotare is enabled, this can be accomplished by providing a setpoint of 0 and waiting for the flow readings to reach zero.

Polling Mode

Polling the device returns a single line of data each time you request it. Your device was shipped in polling mode with a unit ID of A, unless requested otherwise. To poll your device,

simply enter its unit ID (see the Data Format on [page 10](#)).

Poll the device: `unit_id↵`

Example: `a↵` (polls unit A)

You can change the unit ID of a polling device by typing:

Change the unit ID: `current_unit_id@=desired_unit_id↵`

Example: `a@=b↵` (changes unit A to unit B)

Streaming Mode

In streaming mode, your device automatically sends a line of live data at regular intervals. (see the Data Format on [page 10](#)).

Only one unit on a given COM port may be in streaming mode at a time. To put your device into streaming mode, type:

Begin streaming: `unit_id@=@↵`

Example: `a@=@↵` (puts device A into streaming mode)

This is equivalent to changing the unit ID to “@”.

To take the flow controller out of streaming mode, assign it a unit ID by typing:

Stop streaming: `@=@desired_unit_id↵`

Example: `@=@a8` (stops and assigns unit ID of A)

When sending a command to a device in streaming mode, the flow of data will not stop while the user is typing. This may make the commands you type unreadable. If the device does not receive a valid command, it will ignore it. If in doubt, hit `↵` and start again.

The default streaming interval is 50 ms. This can be increased by changing Register 91 while the device is in polling mode:

Set streaming interval: `unit_idW91=number_of_ms↵`

Example: `aW91=500↵` (streams new data every 500 ms)

Data Format

Each line of data for live flow measurements appears in the format below, but the unit ID is not present in streaming mode.

Controller

A	+15.542	+24.57	+16.667	+15.444	+15.444	+81.23	22741.4	N2
ID	Abs. Pressure	Temp.	Vol. Flow	Mass Flow	Setpoint	Valve Drive	Totalizer	Gas

Meter

A	+15.542	+24.57	+16.667	+15.444	22741.4	N2
ID	Abs. Pressure	Temp.	Vol. Flow	Mass Flow	Totalizer	Gas

Single spaces separate each parameter, and each value is displayed in the chosen device engineering units. You can query the engineering units of the serial data frame by typing:

Query live data info: `unit_id??D*↵`

Example: `a??D*↵` (returns the data frame descriptions)

Additional columns may be present to the right of the Gas Label column.

Changing the Setpoint

The setpoint is the flow rate that the controller attempts to achieve and maintain by

proportionally changing the position of the valve.

Use the setpoint command (`unit_idSnew_setpoint_value`) with the desired value in the current engineering units. The data frame returns the new setpoint value when it has been accepted as a valid setpoint.

To send the desired setpoint value as a floating point number in the engineering units selected:

New setpoint: `unit_idSfloating_point_number_setpoint↵`

Example: `aS15.44↵` (setpoint of +15.44 SLPM)

Use the power-up setpoint command (`unit_idSPUE setpoint_value`) to create a new power-up setpoint. Use a value of 0 as the `setpoint_value` to disable the power-up setpoint.

Additional setpoint options are described in the Serial Primer manual (alicat.com/manuals).

Totalizer

The controllers/meter totalizer can measure the total flow that has passed through the device since it was powered on or since it was last reset. Totalizer counts are reset if power to the device is lost.

To read the totalizer, poll the device (`unit_id`) using its current unit ID. For information on reading the data line, see the Data Format on [page 10](#).

To reset the totalizer, use the reset totalizer command (`unit_idT`).

Additional Totalizer functions and options are available in the Serial Primer manual (alicat.com/manuals).

Batch Dispensing

For controllers, batch dispensing flows a set volume of gas, after which the valve closes and the flow stops. You can repeat batches. To utilize batching, at least one totalizer must be enabled. Batch functions and options are described in the Serial Primer manual (alicat.com/manuals).

Changing the Gas

Factory OEM devices are calibrated to measure any of a selection of 30 gases. The gas list is customizable and varies between devices. To find which gases are available on the device, use the ASCII query gas list command (`unit_id??G*`). The query gas list command also lists their gas number.

To reconfigure your flow controller to flow a different gas, look up its gas number ([page 18](#)). Here are the commands:

Choose a gas: `unit_idGgas_number↵`

Example: `aG8↵` (reconfigures to flow nitrogen)

Control Loop

The controller can control the flow rate or the pressure in your process. Selectable control loop variables include mass flow, volumetric flow, absolute pressure, and valve drive. The loop can also be tuned to improve performance in some applications. Control loop functions and options are described in the Serial Primer manual (alicat.com/manuals).

Command Quick Reference

Serial commands are not case-sensitive. The commands are capitalized below to differentiate them from the variables.

General Commands for All Devices

Change the unit ID:	<code>unit_id@desired_id↵</code>
Tare flow:	<code>unit_idV↵</code>
Tare gauge pressure:	<code>unit_idP↵</code>
Tare absolute pressure:	<code>unit_idPC↵</code>
Poll the live data frame:	<code>unit_id↵</code>
Begin streaming data:	<code>unit_id@@↵</code>
Stop streaming data:	<code>@@desired_unit_id↵</code>
Set streaming interval:	<code>unit_idNCS number_of_ms↵</code>
Query live data info:	<code>unit_id??D*↵</code>
Manufacturer info:	<code>unit_id??M*↵</code>
Firmware version:	<code>unit_idVE↵</code>

Controller Commands

New setpoint:	<code>unit_idS setpoint_value↵</code>
Hold valve at current position:	<code>unit_idHP↵</code>
Hold valve closed:	<code>unit_idHC↵</code>
Cancel valve hold:	<code>unit_idC↵</code>

Mass Flow Gas Select™

Query gas list info:	<code>unit_id??G*↵</code>
Choose a different gas:	<code>unit_idG gas_number↵</code>



Note: For more information on our serial communication commands, please see the Serial Primer at alicat.com/manuals.

Advanced ASCII Commands

The command set on IM devices has been reduced for space. The following commands are listed in the Serial Primer but are **not available** with IM Series devices:

General commands

E: Exhaust

GRH: Set / query relative humidity

GRHE: Set / query humidity information

L: Lock display

P1: Tare primary pressure sensor

P2: Tare secondary pressure sensor

TCP: Totalizer pulse configuration

U: Unlock display

Liquid properties commands

QLD, QLEG, QLEV, QLR, QLV

Omitted parameter values

All barometer statistics

All statistics related to secondary pressure

All statistics related to humidity / dew point / water vapor

The FPC command will not return any values related to the display

Support for a secondary analog output

Support for a second valve (for closed loop control or for on/off purposes).

Modbus-RTU

Modbus is an application-layer messaging protocol that formats data for communications over serial RS-232 or RS-485. The controller/meter supports Modbus-RTU protocol, with data transmitted through Pin 3 of the DB9 connector.

Modbus-RTU can be used to control:

- taring
- data collection
- setpoint control
- totalizer
- batch dispensing
- changing the gas
- control loop adjustment.

For more information on Modbus-RTU communication commands, please see the the Modbus FAQ at alicat.com/using-your-alicat/faq-modbus/ and the Modbus RTU manual at alicat.com/manuals.

Communicating Via Modbus-RTU

The following Modbus commands are supported:


- 3** Read holding register
- 6** Write single register
- 16** Write multiple registers


Use the device registers to interact with the device.

Modbus commands are written to register addresses 1001 and 1002. The command arguments are written to 1003 and 1004. The command arguments are variables that influence how the commands modify the device.

Analog Signals

Alternative to the digital communications described above, the device can be controlled using analog signals transmitted through the DB9 connector (see [page 6](#)).

 **Warning:** Do not supply power to the device until all necessary pins have been properly connected.

 **Note:** Power requirements vary based on analog configuration and valve type. Please reference the Factory OEM Mass Flow Devices specification sheet at alicat.com/imc for power requirements.

The following section describes some functions that can be completed using analog signals.

Taring the Device (METERS ONLY)

Taring gives the meter a zero reference for flow measurements, ensuring that the meter provides the most accurate measurements. It is recommended to tare the meter:

- After installing
- Before every new flow measurement cycle
- After significant changes in temperature or pressure
- After dropping or bumping the flow controller
- After changing the device's orientation.

To tare the device, ground pin 4 (analog in) of the DB9 connector. This feature is only available on the IM meter (not the IMC controller). When the connection is closed, the device tares. Operation resumes when the connection is opened.

Taring flow should only be done in a true zero-flow condition. Taring pressure should be done when the device is open to the atmosphere.



Note: *Performing a tare interrupts any current measurements.*

Changing the Setpoint

Manage the setpoint using the analog Input signal (Pin 4 of the DB9 connector). The voltage sent to the controller is proportional to the full range of the device. For example, to set the setpoint to the maximum value for a controller with an input of 0-5 Vdc, apply 5 volts. To set it at half of the full-scale range, use 2.5 Vdc.

Reading the Flow

The analog output signal (Pin 6 of the DB9 connector) is linear over its entire range. For ranges that start at 0 Vdc, a no-flow condition is output at approximately 0.010 Vdc. The full scale of the device is output by the top of the range: 5 Vdc for 0–5 Vdc, 10 Vdc for 0-10 Vdc, or 20 mA for 4–20 mA signals.

Some devices have an optional 4–20 mA current output signal, which requires 290 mA power.



Warning: *Do not connect 4–20 mA devices to “loop-powered” systems, as this damages portions of the circuitry beyond repair and voids the warranty. If the device must work with existing loop-powered systems, use a signal isolator and a separate power supply.*

Valve Overrides

To force the valve to remain closed, ground Pin 1.

To force the valve to remain open, ground Pin 2.

Only one of the two pins should be grounded at a time.

Alarm Output Option

Some devices include an optional alarm output (5VDC, 12VDC, 24VDC) that can output a signal on Pin 9 when certain parameters are reached. The voltage of the alarm is determined at the time of production. For more information on configuring the alarm output, see the alarm tutorial at alicat.com/using-your-alicat/alarm-function-ale-command-tutorial/.

Troubleshooting

If you run into trouble with installation or operation, get in touch with support ([page 2](#)).

General Use

Issue: *My device does not turn on or has trouble staying on.*

Action: Check power and ground connections ([page 6](#)). Please reference the technical specifications to ensure you have the proper power for your model.

Issue: *The analog output signal indicates values lower than expected.*

Action: Analog signal voltage degrades over long distances. You can minimize this effect by using wires with a heavier gauge, especially in the ground wire.

Issue: *How often do I need to calibrate my device?*

Action: Annual recalibration is recommended. Check your device's last calibration date. If it is time to recalibrate, request a recalibration from customer support ([page 2](#)).

Issue: *I dropped my device. Is it OK? Do I need to recalibrate?*

Action: If the device powers up and appears to respond normally, then it is likely OK. It may or may not need a recalibration. Tare the device, and compare it against a known-good flow standard. If it checks out, keep using the device, but tell us about the drop at your next annual recalibration so we can check it out for you.

Flow Readings

Issue: *The live flow readings won't settle down.*

Action: The device is very fast, so it can detect subtle variations in flow that may go unnoticed by your other devices. This sensitivity can help detect problems with pumps or flow controllers. You can lessen this sensitivity by increasing the flow averaging. Controllers use PD or PD²I control loop algorithms to reach the setpoint given. These parameters are adjustable in the field.

Issue: *My controller won't reach its setpoint.*

Action: The flow rate is related linearly to the pressure drop across the device. If there isn't enough of a pressure difference between the inlet and outlet, the controller may not be able to reach setpoint. Often, increasing the inlet pressure will fix this issue. If increasing the pressure doesn't help, check to see if there is a clog. Teflon tape can often get stuck in the flow channel and block flow. Make sure to clean out any loose Teflon tape and never tape the first two threads entering the device to help avoid this issue.

Issue: *My flow readings are negative.*

Action: Under conditions of no flow, a negative flow reading can indicate a poor tare. Set a zero setpoint and see if the flow returns to 0 after 2 seconds.

Issue: *Does the controller work if it is laying down? Will it be accurate?*

Action: Yes to both. The flow controller is internally compensated for any changes in orientation and can be used sideways, on its back, or upside-down.

Issue: *Can I put the flow controller on top of a vibrating device? Will it be accurate?*

Action: Yes you can. However, sensor noise will increase if the flow controller is vibrating.

Issue: *My controller does not agree with another mass flow meter I have in line.*

Action: Check the STP or NTP settings to ensure that your standardized temperature and pressure references match those of your other flow calibrator. Also check that the correct gas is selected ([page 18](#)).

Issue: *My flow readings won't change when flow changes.*

Action: If your flow readings won't change regardless of actual flow, your flow sensor may be damaged. Please contact support to troubleshoot ([page 2](#)).

Issue: *Can I use the controller with other gases?*

Action: Yes! Your flow controller is designed specifically to work with up to 30 preloaded gases and gas mixes. If your desired gas is not listed on [page 18](#), please contact support to ensure compatibility ([page 2](#)).

Serial Communications

Issue: *I can't communicate with the device when it is connected to my PC.*

Action:

1. Make sure the baud rate your software and COM port required is the one your flow controller is using.
2. Check the flow controller unit ID to make sure you are addressing it properly with your serial commands.
3. Check the pinout (see [page 6](#)).
4. Make sure the COM number matches the one your software is using to connect to the flow controller.
5. On the external serial communications device (computer, PLC, etc.), be sure that the flow control (handshaking) settings are correct.

Still experiencing issues? Please contact support. See "Contact Information" on [page 2](#).

Maintenance

Cleaning

Your flow controller does not require cleaning, provided that it has been flowing clean, dry gas. If necessary, the outside of the device can be cleaned with a soft dry cloth.



Caution: *If you suspect that debris or other foreign material has entered your device, do not take apart the flow body to clean it, as this will negate its NIST-traceable calibration. Please contact support for cleaning (page 2).*

Recalibration

The recommended period for recalibration is once every year. A label located on the back of the device lists the most recent calibration date.

When it is time for your device's annual recalibration, contact support (page 2) with your device's serial number and your contact information.

Reference

Gas List by Number

Any of these gases can be used with your mass flow device. If you change the gas species flowing through the device, use the GasSelect commands ([page 12](#)) to update the device's calibration to that gas, to keep your readings accurate.

#	Short Name	Long Name
0	Air	Air (Clean Dry)
1	Ar	Argon
2	CH ₄	Methane
3	CO	Carbon Monoxide
4	CO ₂	Carbon Dioxide
5	C ₂ H ₆	Ethane
6	H ₂	Hydrogen
7	He	Helium
8	N ₂	Nitrogen
9	N ₂ O	Nitrous Oxide
10	Ne	Neon
11	O ₂	Oxygen
12	C ₃ H ₈	Propane
13	nC ₄ H ₁₀	Normal Butane
14	C ₂ H ₂	Acetylene
15	C ₂ H ₄	Ethylene (Ethene)
16	iC ₄ H ₁₀	Isobutane
17	Kr	Krypton
18	Xe	Xenon
19	SF ₆	Sulfur Hexafluoride ¹
20	C-25	25% CO ₂ , 75% Ar
21	C-10	10% CO ₂ , 90% Ar
22	C-8	8% CO ₂ , 92% Ar
23	C-2	2% CO ₂ , 98% Ar
24	C-75	75% CO ₂ , 25% Ar
25	He-25	25% He, 75% Ar
26	He-75	75% He, 25% Ar
27	A1025	90% He, 7.5% Ar, 2.5% CO ₂
28	Star29	Stargon CS (90% Ar, 8% CO ₂ , 2% O ₂)
29	P-5	5% CH ₄ , 95% Ar

¹ Sulfur hexafluoride is a highly potent greenhouse gas monitored under the Kyoto Protocol.

Engineering Units

Pressure Units

Absolute or Barometric	Gauge	Notes
PaA	PaG	Pascal
hPaA	hPaG	Hectopascal
kPaA	kPaG	Kilopascal
MPaA	MPaG	Megapascal
mbarA	mbarG	Millibar
barA	barG	Bar
g/cm ² A	g/cm ² G	Gram force per square centimeter [†]
kg/cm ² A	kg/cm ² G	Kilogram force per square centimeter [*]
PSIA	PSIG	Pound force per square inch
PSFA	PSFG	Pound force per square foot
mTorrA	mTorrG	Millitorr
torrA	torrG	Torr
mmHgA	mmHgG	Millimeter of mercury at 0°C
inHgA	inHgG	Inch of mercury at 0°C
mmH ₂ O A	mmH ₂ O G	Millimeter of water at 4°C (NIST conventional) [†]
mmH ₂ O A	mmH ₂ O G	Millimeter of water at 60°C [†]
cmH ₂ O A	cmH ₂ O G	Centimeter of water at 4°C (NIST conventional) [†]
cmH ₂ O A	cmH ₂ O G	Centimeter of water at 60°C [†]
inH ₂ O A	inH ₂ O G	Inch of water at 4°C (NIST conventional) [†]
inH ₂ O A	inH ₂ O G	Inch of water at 60°C [†]
atm		Atmosphere
m asl		Meter above sea level
ft asl		Foot above sea level
V		Volt
count	count	Setpoint count, 0–64000
%	%	Percent of full scale

Temperature Units

°C	Degrees Celsius
°F	Degrees Fahrenheit
K	Kelvin
°R	Degrees Rankine

* Displayed as kg/cmA and kg/cmG.

† Superscript and subscript numerals are displayed as lining (normal) numerals.

‡ Instances of μ are displayed as a lower-case u.

Flow Units

Volumetric	Standard	Normal	Notes
μL/m	SμL/m	NμL/m	Microliter per minute [‡]
mL/s	SmL/s	NmL/s	Milliliter per second
mL/m	SmL/m	NmL/m	Milliliter per minute
mL/h	SmL/h	NmL/h	Milliliter per hour
L/s	SL/s	NL/s	Liter per second
LPM	SLPM	NLPM	Liter per minute
L/h	SL/h	NL/h	Liter per hour
US GPM			US gallon per minute
US GPH			US gallon per hour
CCS	SCCS	NCCS	Cubic centimeter per second
CCM	SCCM	NCCM	Cubic centimeter per minute
cm ³ /h	Scm ³ /h	Ncm ³ /h	Cubic centimeter per hour [†]
m ³ /m	Sm ³ /m	Nm ³ /m	Cubic meter per minute [†]
m ³ /h	Sm ³ /h	Nm ³ /h	Cubic meter per hour [†]
m ³ /d	Sm ³ /d	Nm ³ /d	Cubic meter per day [†]
in ³ /m	Sin ³ /m		Cubic inch per minute [†]
CFM	SCFM		Cubic foot per minute
CFH	SCFH		Cubic foot per hour
CFD	SCFD		Cubic foot per day
	kSCFM		1000 cubic feet per minute
count	count	count	Setpoint count, 0–64000
%	%	%	Percent of full scale

True Mass Flow Units

mg/s	Milligram per second
mg/m	Milligram per minute
g/s	Gram per second
g/m	Gram per minute
g/h	Gram per hour
kg/m	Kilogram per minute
kg/h	Kilogram per hour
oz/s	Ounce per second
oz/m	Ounce per minute
lb/m	Pound per minute
lb/h	Pound per hour

Time Units

h:m:s	Hours:Minutes:Seconds
ms	Milliseconds
s	Seconds
m	Minutes
hour	Hours
day	Days

Total Units

μL	MicroLiter [‡]
mL	MilliLiter
L	Liter
US GAL	US gallon
cm ³	Cubic centimeter [†]
m ³	Cubic meter [†]
in ³	Cubic inch [†]
ft ³	Cubic foot [†]
μP	Micropoise, a measure of viscosity [*]
mg	Milligrams
g	Grams
kg	Kilograms
oz	US ounces
lb	US pounds