ALICAT SCIENTIFIC

The Fastest Flow Controller Company in the World!

AFS

Alicat Flow Standard

Operating Manual

Thank you for purchasing an Alicat AFS.

We know you are going to love your new AFS. If you have any questions about operating it, or if something is not working as you had expected, please let us know. We are eager to help you in every way we can.

Alicat Scientific, Inc.
info@alicat.com • alicat.com
7641 N Business Park Drive, Tucson, AZ 85743 USA
1-520-290-6060

Serial Number: _____

Next Calibration: _____

Recalibrate your AFS every year.

Your calibration date is labeled on the back of the AFS. Write that date in the space above. When it's time for your AFS's annual recalibration, contact us by phone, email or live chat to set it up. Or, fill out the Service Request Form at alicat.com/service.

NIST All Alicat devices come with a NIST traceable calibration certificate.

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

CE The Alicat AFS 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.

The Alicat AFS complies with the requirements of the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC.

02/07/2018 Rev.1 DOC-AFSMAN

Welcome to the Alicat way.

You're busy, and the last thing you want to do is waste time wrestling with your flow calibrator. We're here to make your life a little easier so you can do what you do best. It's our pleasure to introduce you to your new AFS:

- **High-accuracy performance for all your gases.** Use your AFS with any of the 98 gases that are part of Gas Select™, ***page 26.***
- **1000 readings per second** make quick work of your calibrations. Collect averaged measurements to smooth out any fluctuations, ***page 18.***
- **Monitor pressure during flow calibrations.** View ambient barometric pressure or internal stream pressure in absolute or gauge units, ***page 20.***
- **Any humidity, at any temperature.** Your AFS is built with live RH sensing, keeping it accurate in high humidity, ***page 13.***
- **Review your last 50 averaged measurements.** Your AFS automatically logs your timed averages internally, ***page 23.***
- **Backlit display with adjustable contrast** is easy to read in direct sunlight. Is your lab dimly lit? Press the Alicat logo to turn on the backlight, ***page 8.***
- **Change your STP** to match any standard temperature and pressure reference, ***page 30.***
- **Accidents happen, like your flow calibrator falling off the table.** We've designed your AFS to survive drops, and likely still be in calibration.
- **Charge it anywhere.** A full charge powers your AFS for up to 12 hours. To recharge, plug the micro-USB cable into any PC or power supply, ***page 10.***
- **Log data to your PC.** Talk to the AFS serially using the micro-USB connector to capture all flow data for logging and analysis, ***page 35.***
- **Nerdy? We are, too.** Read all about the AFS's theory of operation, including humidity, temperature, pressure and flow readings, ***page 13.***

Table of Contents

Setup

We've fully charged your AFS at the factory, so you can use it right away.

- **Tare your AFS.** Before you connect the AFS, ensure that no air is flowing through the device and select **MENU > TARE**.

Note: The AFS is sensitive enough to measure the lightest of breezes, so ensure that one end is plugged before selecting tare.

- **Choose your engineering units.** In Standard Mode, you can touch the button above or below any parameter to enlarge it in the middle of the display. If you touch that same item a second time, you can change the engineering unit for that parameter. You can select units for all of the parameters at once by selecting **MENU > SETUP > BASIC CONFIG > DEVICE UNITS**.

- **Set up your averaging timer.** Select **MENU > SETUP > BASIC CONFIG > AVG TIME** to set the duration of averaged measurements, from 1 sec to as long as almost 10 hours. The AFS will add 1000 measurements to the average for each second.

- **Connect your AFS.** Ensure that flow through the AFS will be in the same direction as the arrow (left to right).

  » Connect to the left (inlet) port of the AFS to calibrate instruments that use pressure, such as a mass flow controller or gas chromatograph.

  » Connect to the right (outlet) port of the AFS to calibrate instruments that use suction, such as a pump or air sampler.

Operation: Flow Verification

- **Monitor live flow readings.** In both Standard Mode and Basic Mode, you can monitor live readings of flow, pressure and temperature by viewing the **Instant** screen. Readings are updated in real time.

- **Capture an averaged reading.** Select **START AVG** in either mode to begin a timed average. The averages update in real-time until the measurement time is complete. In Standard Mode, you can highlight any parameter in the middle of the screen, just as you did on the **Instant** screen.

- **Tare your AFS before your next calibration.** For best results, get a fresh tare when you move the AFS to a new flow source. Select **MENU > TARE**.

Maintenance and Care

- If your gas is clean, your AFS will require no periodic cleaning.

- **Calibrate your AFS annually.** Request an Alicat factory calibration at alicat.com/service or by calling Alicat at 1-888-290-6060.

Getting Started

Unboxing Your AFS

Your AFS was shipped with the items listed below. Please contact Alicat immediately if you find that any item is missing from your AFS shipping box.

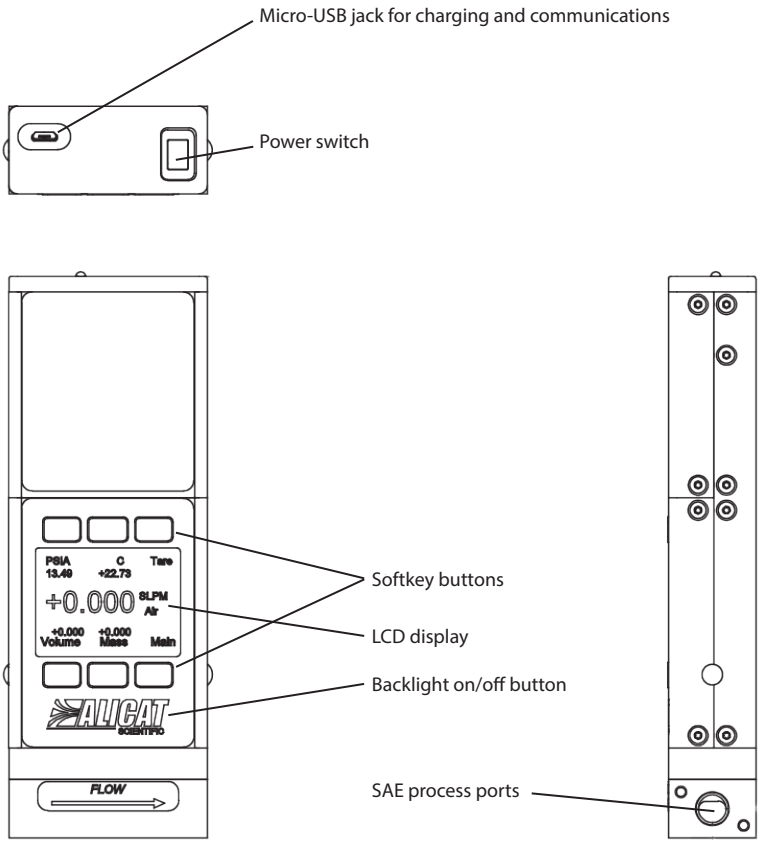
Receiving Inspection

- AFS battery-powered flow calibrator (with flow body caps and connector plugs)
- USB cable, micro-B to type A, for communications and charging
- Universal 2.0A 100-240 VAC to 5 Vdc wall adapter with USB type A connector and international plug shapes
- NIST-traceable calibration certificate
- User manual

Getting to Know Your AFS

The Alicat AFS is a NIST-traceable flow, pressure and temperature calibration standard. It provides accurate readings of both actual volumetric flow and standardized (mass) flow. Your AFS is designed to remain accurate in air temperatures from -10°C (-22°F) to +60°C (+140°F) and at any humidity level, 0-100% RH.

Connectors and Fittings

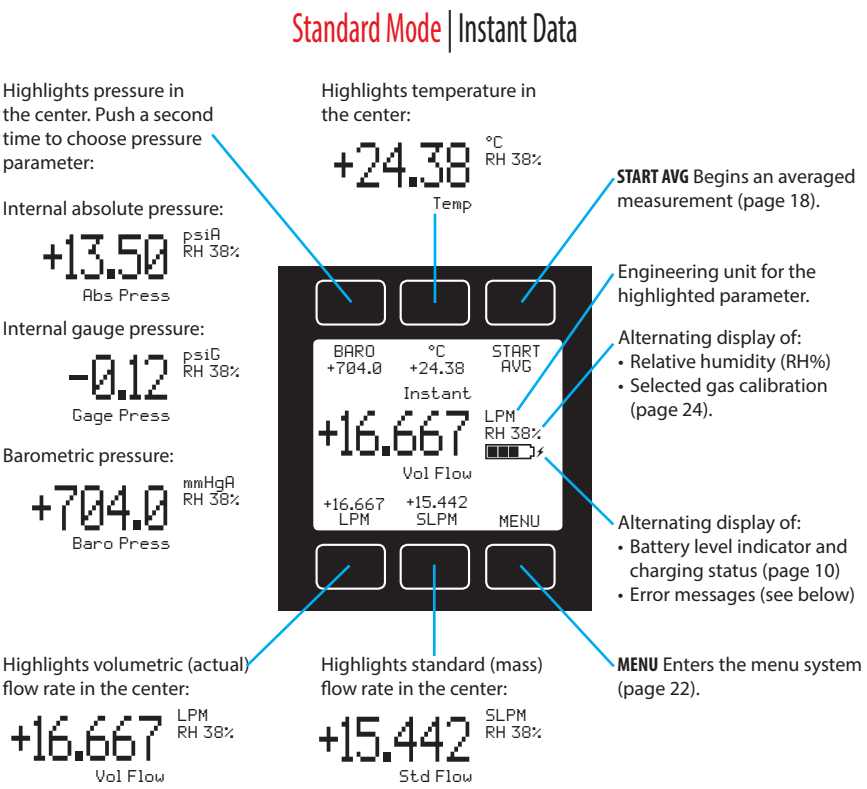


Getting Started

The AFS Display

The figure below identifies the various features of the AFS display when it is in Standard Mode and displaying live flow data. Press the large button with the Alicat logo to toggle the backlight on and off.

For more details, see the Menu Map on page 16 and the menu-by-menu descriptions that follow it.



Error Codes

Analog-digital converter error:	**ADC**
Pressure over range of device:	**POV**
Temperature over range of device:	**TOV**
Volumetric flow over range of device:	**VOV**
Mass flow over range of device:	**MOV**
Totalizer missed out of range flow:	**TMF**
Front display is locked:	**LCK**

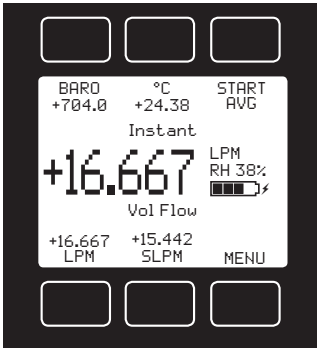
Charging Your AFS

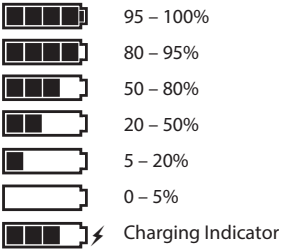
We've fully charged your AFS at the factory, so you can use it right away. Expected battery life of a fully-charged battery is 12 hours of continuous operation when the backlight is off, or 8 hours when the backlight is on.

The battery indicator on the right side of the Main screen in Standard Mode reflects the relative battery level. When the battery indicator is completely empty, only about 15 minutes of battery life remains. Please charge the AFS as soon as possible to maintain full device performance.

Charge the AFS using the supplied USB cable (micro-B to type A) or any similar cable. You may charge the AFS using any USB outlet on a computer or portable power supply, but charging will be fastest (approximately 3.5 hours) when connected to the supplied 2.0A power supply.

Your AFS may be used while it is charging. A small lightning bolt symbol (↯) will appear to the right of the battery symbol while the device is charging. If the battery has been fully depleted, you may need to charge the AFS for a full minute before the device can be turned on.





Warning: If the device is left on until the battery can no longer power it, the charge indicator will fall out of sync with the actual charge. The device can be re-synced by fully charging the battery once.

Warning: The safe charging temperature range is 0° to +45°C. If internal sensors detect temperatures outside of this range, the battery will not charge.

Connecting Your AFS for Flow Measurement

Your AFS has female SAE ports on each end of its flow body for attaching compression or barb fittings.

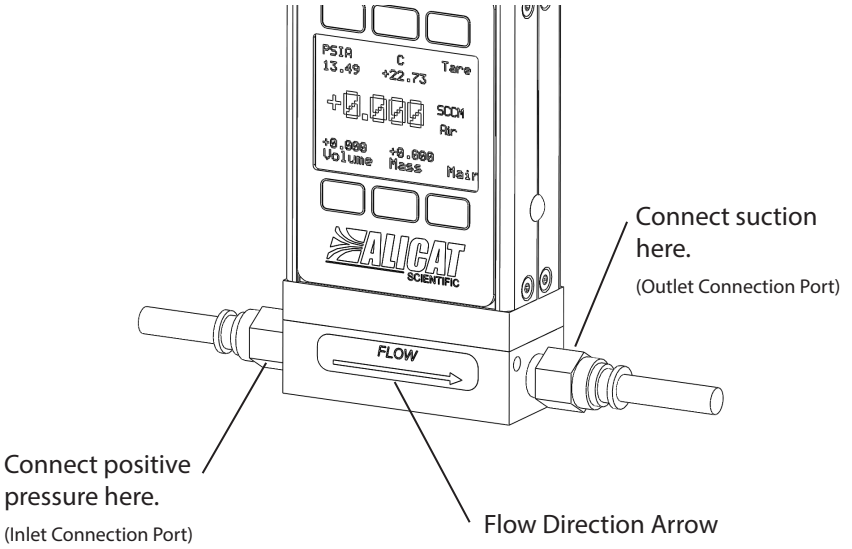
» If you are using a fitting that does not have a face seal, use thread-sealing Teflon tape to prevent leakage around the port threads, but do not wrap the first two threads. This will minimize the possibility of getting tape into the flow stream and clogging the laminar flow elements (LFE).

» If you are using a fitting that has a face seal, there is no need to apply Teflon tape to the threads.

Caution: Do not use pipe dopes or sealants on the process connections. These compounds can cause permanent damage to the AFS should they get into the flow stream.

You can use the Alicat AFS to measure flow generated by both positive pressure and suction. You should connect the AFS so that the flow travels in the same direction as the flow arrow, from left to right as you look at the front of the device.

Note: The AFS can measure flow in the opposite direction (right to left), but this is not a calibrated flow direction. Right to left flow is indicated with a minus sign (-).



Connecting to Positive Pressure

Connect your instrument to the left (inlet) port of the AFS to calibrate instruments that use positive pressure, such as a mass flow controller or gas chromatograph. The AFS may be placed in-line with such instruments, provided that the pressure does not exceed 45 psig (60 pisa).

Caution: Using the AFS above 45 psig of internal line pressure, or 15 psi of differential pressure between the inlet and outlet, will result in permanent damage to the internal pressure sensors.

AFS connected to the outlet of a gas chromatograph (positive pressure).

Connecting to Suction

Connect your instrument to the right (outlet) port of the AFS to calibrate instruments that use suction, such as a pump or air sampler. Because volumetric flow increases as the gas pressure decreases, your AFS may flash a **VOV** error, which indicates that the volumetric flow rate has exceeded the measurement range of the AFS. In this case, reduce the flow rate, or add pressure to the system to reduce the volumetric expansion of the gas.

AFS connected to the inlet of an air sampler or gas analyzer (suction).

You can mount or hold the AFS in any position, because it is internally compensated for any changes to its orientation during use. The AFS is also unaffected by vibrations, so you can rest it on top of a vibrating instrument without sacrificing measurement accuracy.

Understanding How the AFS Works

Theory of Operation

Flow is generated by pressure differentials. At its heart, the AFS measures flow by monitoring those differential pressures across an internal restriction, similar to a Venturi flow meter. What sets the AFS apart is that the restriction is a laminar flow element (LFE), which forces all of the airflow into a laminar (non-turbulent) flow regime. This property transforms the Venturi's quadratic relationship between flow and differential pressure (pressure drop across the LFE) into a linear one. This linearity gives the AFS great accuracy across a much wider flow range than is achievable in a Venturi flow meter.

The mathematical equation that reflects this linear relationship is the Hagen-Poiseuille equation:

$$Q = \frac{K\Delta P}{\eta}$$

Where: Q = actual volumetric flow rate

K = a constant based on the restriction's internal geometry

ΔP = differential pressure across the LFE

η = absolute viscosity of air

Gas Viscosity and Relative Humidity

The equation above demonstrates the important role that gas viscosity plays in determining flow rates through the AFS. Because the actual viscosity of a gas varies with changes in temperature (and pressure to a small degree), the AFS continuously updates the viscosity value with live readings of flow stream temperature and pressure.

The presence of water vapor in the air also has a significant impact on the air's viscosity, and this affects the accuracy of flow measurement through LFEs and Venturis both. Your AFS incorporates a live relative humidity sensor within the flow path. The AFS uses this humidity data to continuously update the viscosity value to provide accurate flow readings all the way to 100% RH, at temperatures as high as 60°C.

Stream Temperature Readings

The AFS uses a fast-responding temperature sensor mounted against the flow stream. When holding the AFS flow body by hand or using it in direct sunlight, the temperature of the flow body may become artificially elevated. In these cases, the sensor's position allows it to track any related elevations in the gas temperature as the gas passes through the flow body.

The AFS ships with temperature readings displayed in degrees Centigrade (°C). *See "Choosing Engineering Units from Standard Mode" on page 20 to change the temperature engineering units:*

Ambient vs Internal Pressure Readings

The AFS uses multiple pressure sensors to capture both ambient barometric pressure and internal flow stream pressure. The barometric pressure sensor monitors ambient atmospheric pressure and is housed within the instrument casing above the display. Whenever the AFS is displaying barometric pressure, **BARO** appears above the pressure value at the top left of the screen in Standard Mode. To view barometric pressure, touch the button above the pressure display in Standard Mode and select **Show baro pressure**. Barometric pressure is always referenced to absolute vacuum.

The internal flow stream pressure sensor monitors pressure inside the AFS's flow body and is actually a suite of four pressure sensors that work in concert to generate flow and pressure readings. This sensor package monitors both differential pressure and absolute pressure within the flow stream directly. This absolute pressure sensor has a broader range (0-30 psia, or 0-1551 mmHg) than the barometric pressure sensor (375-825 mmHg). Because of this, taring the AFS (by selecting **MENU > TARE**) also tares the absolute pressure sensor against the current value reported by the barometer.

Whenever the AFS is displaying internal stream pressure, the pressure engineering unit appears above the pressure value at the top left of the screen in Standard Mode. This engineering unit is appended with the letter **A** for readings of absolute pressure or **G** for readings of gauge pressure. These readings indicate the same actual pressure, but whereas absolute pressure is referenced to absolute vacuum, gauge pressure is referenced to current barometric pressure. To view internal stream pressure, touch the button above the pressure display in Standard Mode and select **Show abs pressure** to display internal pressure with an absolute vacuum reference, or select **Show gauge pressure** to display internal pressure with an atmospheric pressure reference.

The AFS ships with pressure readings displayed in millimeters of mercury (mmHg). Pressure engineering units for absolute and gauge pressure always match, but barometric pressure units can be different. *See "Choosing Engineering Units from Standard Mode" on page 20 to change the pressure engineering units:*

Actual vs Standardized Flow Readings

The AFS uses the raw data from the multiple pressure, temperature and humidity sensors to calculate both actual (volumetric) and standardized (mass) flow readings a thousand times every second. The following are brief descriptions of each of the types of flow readings you will see on the AFS.

- **Actual (volumetric) flow.** The AFS references the raw internal volumetric flow readings to temperature using the internal temperature sensor, and to pressure using the absolute pressure sensor in the flow path. This actual volumetric flow rate reflects the actual volume of air that passes through the meter per unit of time.

- **Standardized (mass) flow.** Because actual volumetric flow rates change with temperature and pressure, comparisons are made easier when these actual readings are converted into standardized flow readings.

The standardized flow rate is reported in volumetric units that reflect the equivalent volume of air that would have passed through the meter per unit of time if the defined standard temperature and pressure conditions had been met. The volumetric flow rate and standardized flow rate will equal each other when the current ambient temperature and pressure equal the STP or NTP values selected on the AFS. Standardized flow always appears at the bottom center of the AFS screen in Standard Mode. The displayed engineering unit will be prefixed with the letter **S** for readings of standard flow (STP) or the letter **N** for readings of normal flow (NTP).

See "Choosing Engineering Units from Standard Mode" on page 20 to change the volumetric and standard flow engineering units:

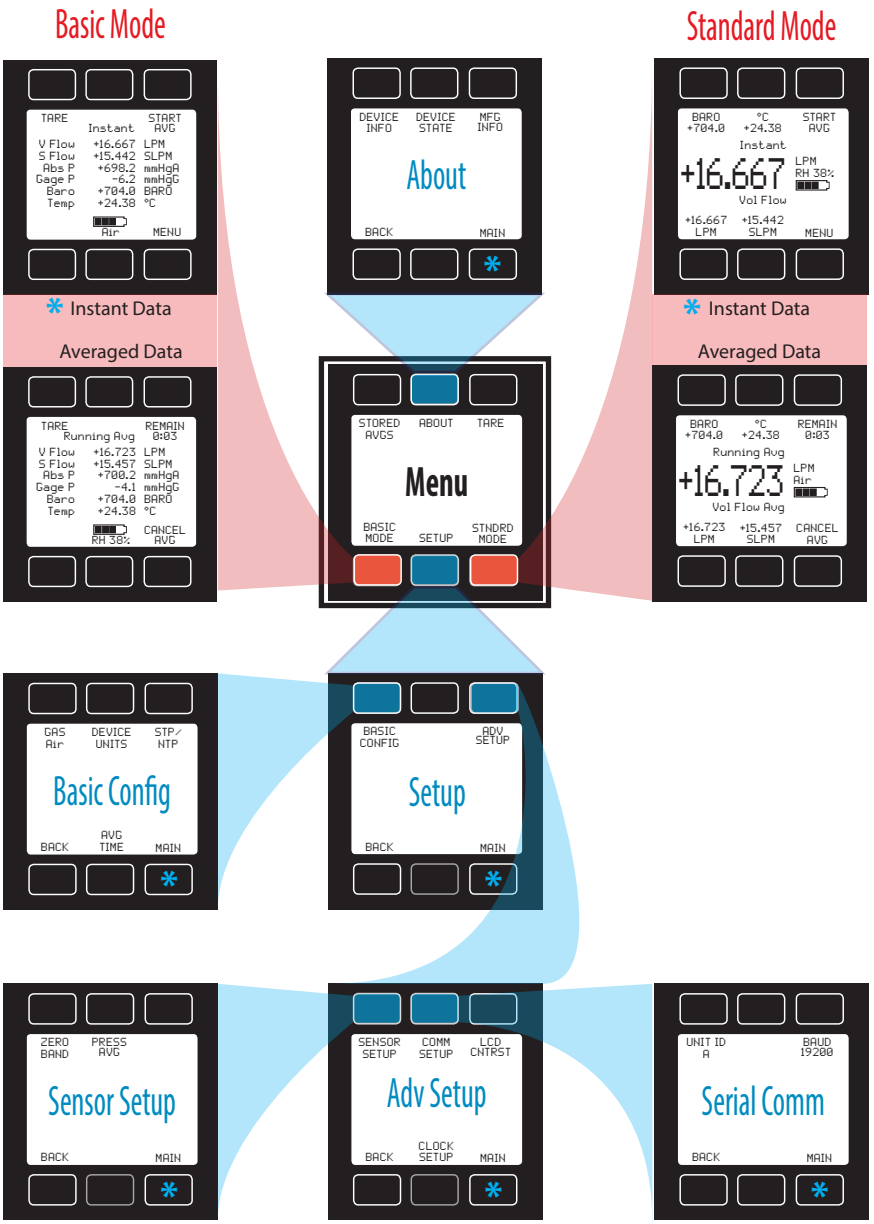
***Note: The AFS ships with a default STP (standard temperature and pressure) of 25°C and 1 atm for standardized (mass) flow readings. The AFS also stores a default NTP (normal temperature and pressure) of 0°C and 1 atm. To make any changes, select* MENU > SETUP > BASIC CONFIG > STP/NTP.** The following table summarizes the temperature and pressure reference values used by the AFS when providing flow readings:

Parameter	Temperature Reference	Pressure Reference
Volumetric (actual) flow	Flow path temperature reading	Flow path absolute pressure reading
Standardized (mass) flow	STP or NTP chosen temperature value	STP/NTP chosen pressure value

Navigating and Customizing Your AFS

AFS Menu Map

* Pressing **MAIN** returns you to the Instant Data screen of either Standard Mode or Basic Mode, whichever was last used.



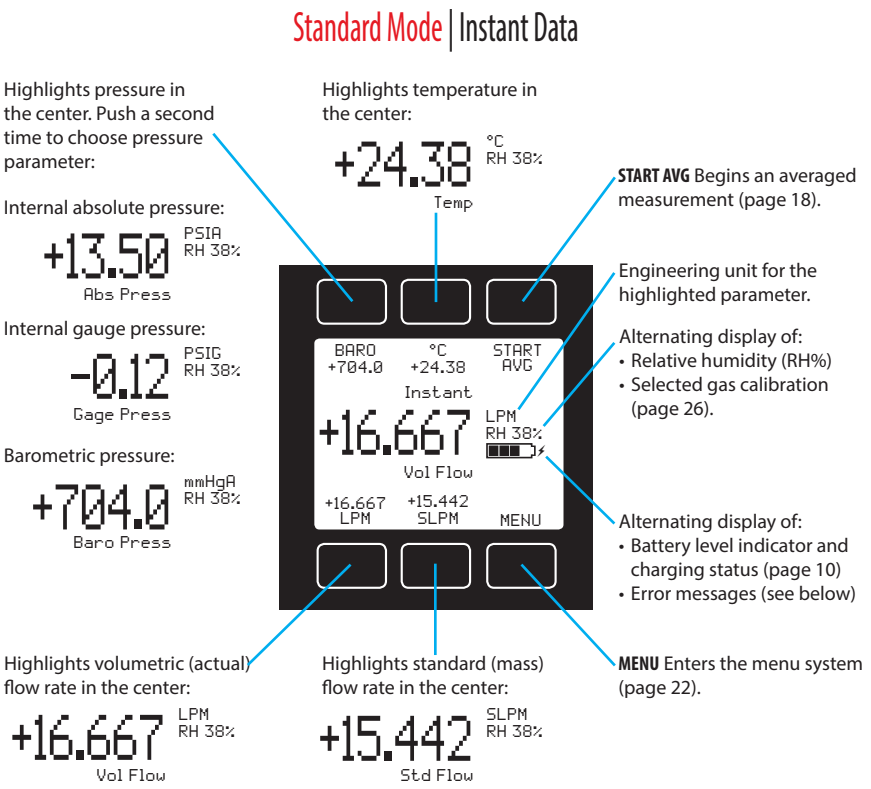
Collecting Data in Standard Mode

Standard Mode is the default data collection mode for the AFS. Standard Mode has three primary functions:

- Collecting instant temperature, pressure and flow data (this page, below)
- Collecting averaged temperature, pressure and flow data (page 18)
- Changing engineering units for temperature, pressure and flow (page 20)

Instant Data in Standard Mode

The **Instant** screen of Standard Mode displays live data for all flow parameters simultaneously. Live data is measured 1000 times every second and refreshed a bit slower on the display. Press the button above or below any of the four flow parameters to highlight its value in the center of the screen. Press the same button again to enter the engineering unit selection menu for that parameter (page 25).



Navigating and Customizing Your AFS

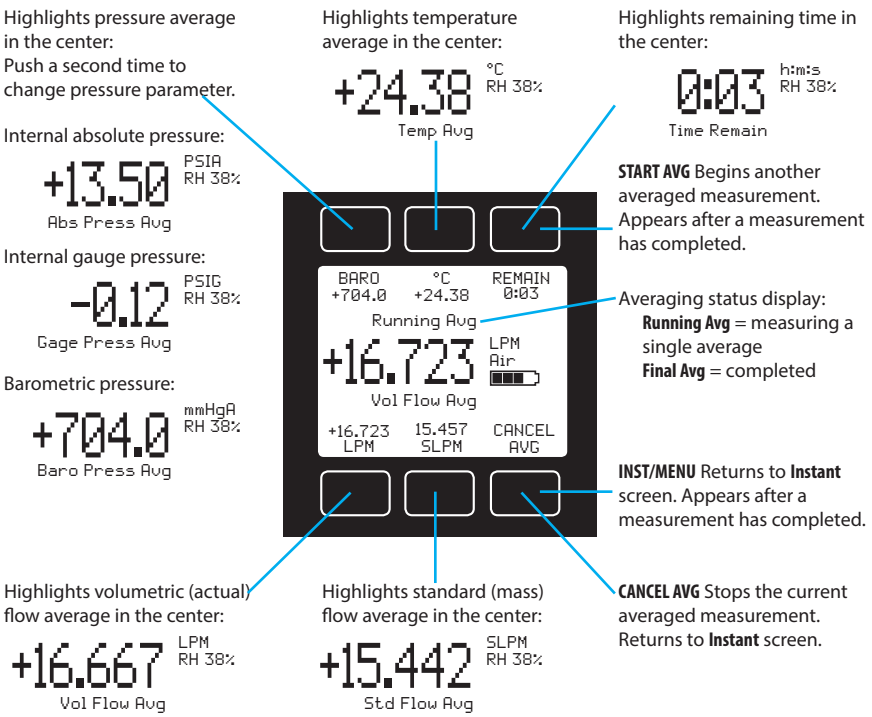
Averaged Data in Standard Mode

The averaging screen of Standard Mode displays averaged data for all flow parameters simultaneously. Flow data is measured at a rate of 1000 readings for every second of measurement time. Press the button above or below any of the four flow parameters to highlight its value in the center of the screen, even after an averaged measurement has finished.

- When an average is running, the screen displays **Running Avg** at the top, and all parameter values update in real time until the average has completed. When the countdown timer stops, the screen displays **Final Avg** at the top.

Note: If you have chosen the time remaining to be highlighted in the center of the display, this parameter will disappear once the averaged measurement is finished, just as its smaller counterpart in the top right of the display disappears and becomes* START AVG. *The time remaining parameter will reappear in the center when you start a new average.

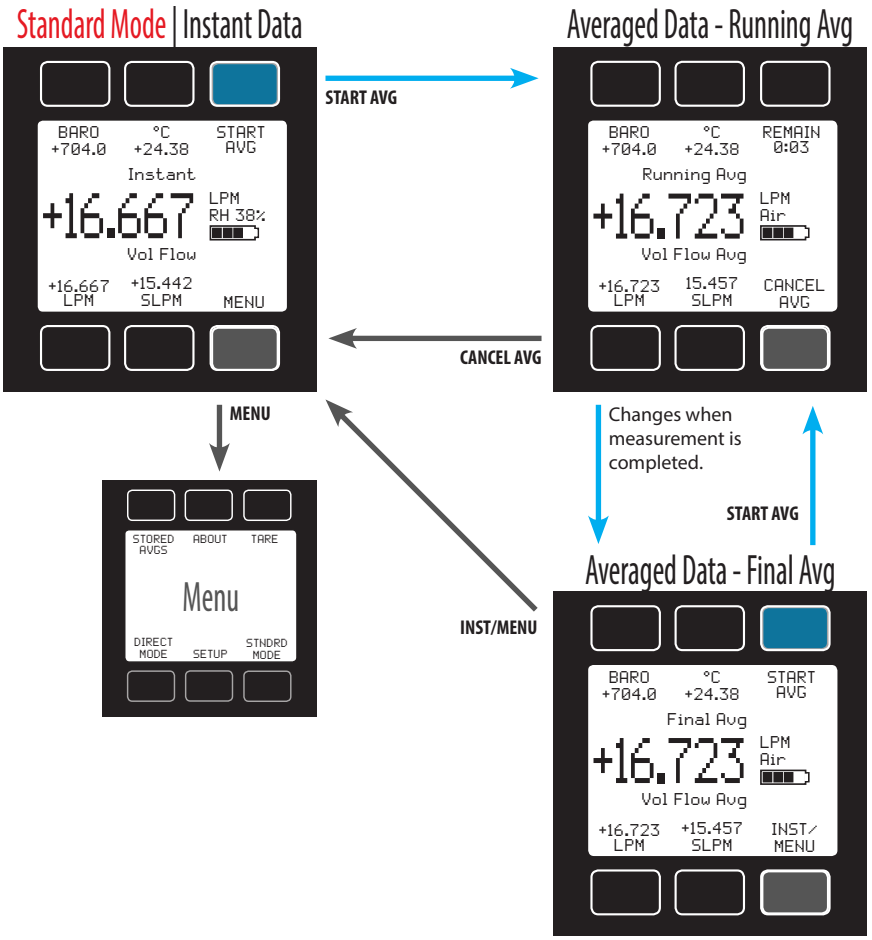
Standard Mode | Averaged Data



Navigating and Customizing Your AFS

Instant vs Averaged Data in Standard Mode

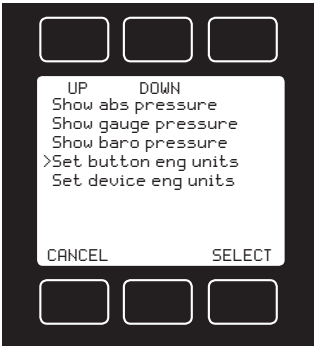
When you are done taking averaged measurements, press **INST/MENU** to resume live readings. Press the button again to enter the menu system.



When taking an averaged measurement, a single average is taken. The resulting measurement remains on the **Final Avg** screen until you press **START AVG** or **INST/MENU**.

Choosing Engineering Units from Standard Mode

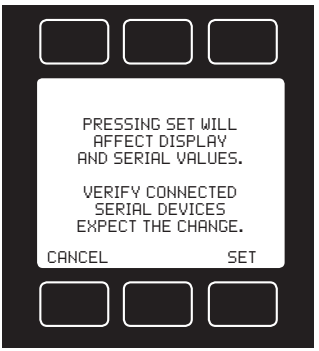
Press the button above or below any of the four flow parameters twice to enter its unit selection menu. You can change units in two ways:



Button engineering units alter the display only, not the serial data frame:

- Select **Set button eng units** and press **SELECT** to change the engineering unit on the display only. Use the **UP** and **DOWN** keys to move the > cursor to the desired unit, and then press **SET**. This does not alter the AFS data frame.

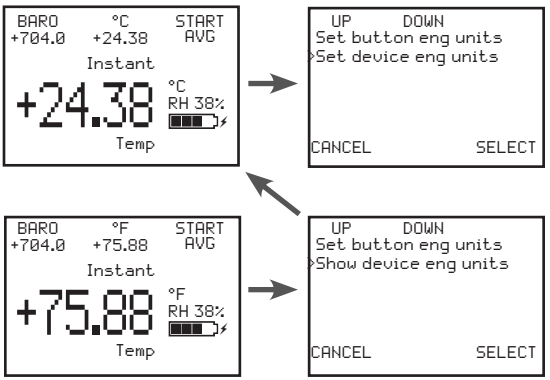
Device engineering units alter both the display and the AFS data frame:



- Select **Set device eng units** and then choose the engineering unit as above. An additional confirmation screen asks you to confirm the serial change.
- If the button engineering unit is different than the device engineering unit, **Set device eng units** will not appear. First select **Show device eng units** to return the button unit to the existing device unit, and then enter the unit selection menu again to change the device engineering unit.

Note: Changing button or device engineering units in the* Pressure *unit menu changes the units for absolute and gauge pressure readings.

Examples of changing device engineering units:



Changing device units:
°C is the existing device engineering unit, so the unit selection menu displays **Set device eng units**.

Changing device units:
°F is not the existing device engineering unit, so the unit selection menu displays **Show device eng units**.
Enter the unit selection menu again to change the device engineering units.

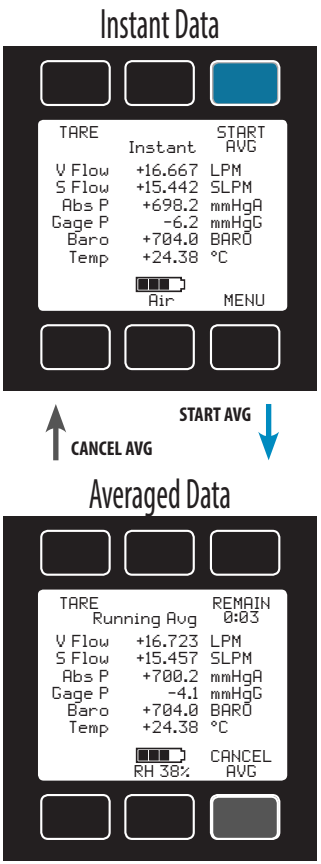
Collecting Data in Basic Mode

Basic Mode is a simplified view that presents the same data as Standard Mode, but in a single list. It lacks the option to highlight parameters or change engineering units, but it provides direct access to the **TARE** function.

» Enter Basic Mode by selecting **MENU > BASIC MODE**.

Like Standard Mode, Basic Mode allows you to collect both instant and averaged flow data.

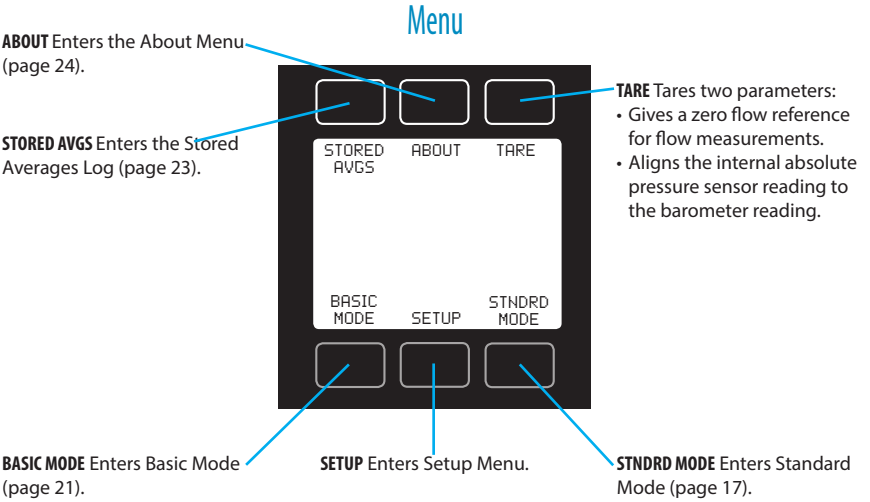
Basic Mode



Navigating and Customizing Your AFS

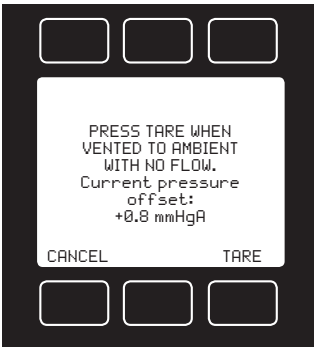
Menu

You can enter the AFS menu system from either Standard Mode or Basic Mode by pressing the **MENU** button.



Taring Your AFS

Taring is an important practice that ensures that your AFS is providing the most accurate measurements possible. This function gives the AFS a good zero reference for flow measurements and also aligns its internal absolute pressure sensor with the barometric pressure reading (see page 14).



How to tare

1. Ensure that no air is flowing through the device. The AFS is sensitive enough to measure a light breeze, so be sure to plug one end, and keep the other open to atmosphere.

2. Select **MENU** > **TARE**.

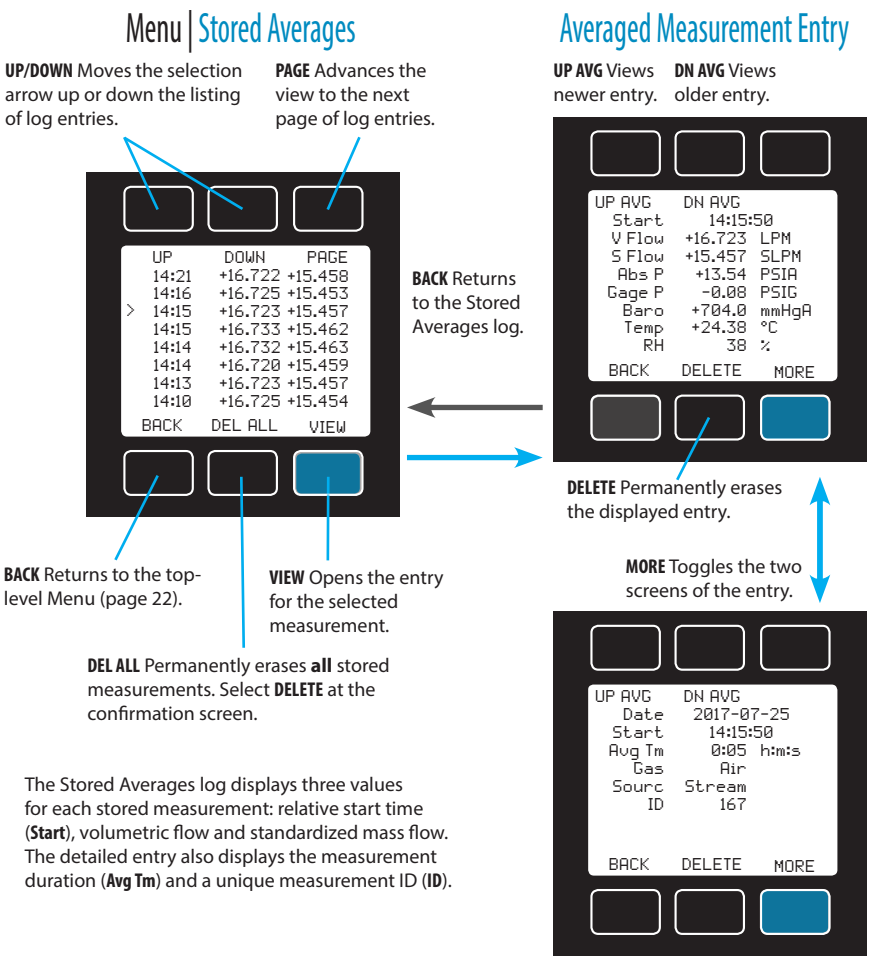
3. At the confirmation screen, press **TARE**.

When to tare

- Before every flow check, audit or calibration.
- Before calibrating the next instrument.
- After significant changes in temperature or atmospheric pressure.
- After dropping or bumping the AFS.

Reviewing Averaged Measurements

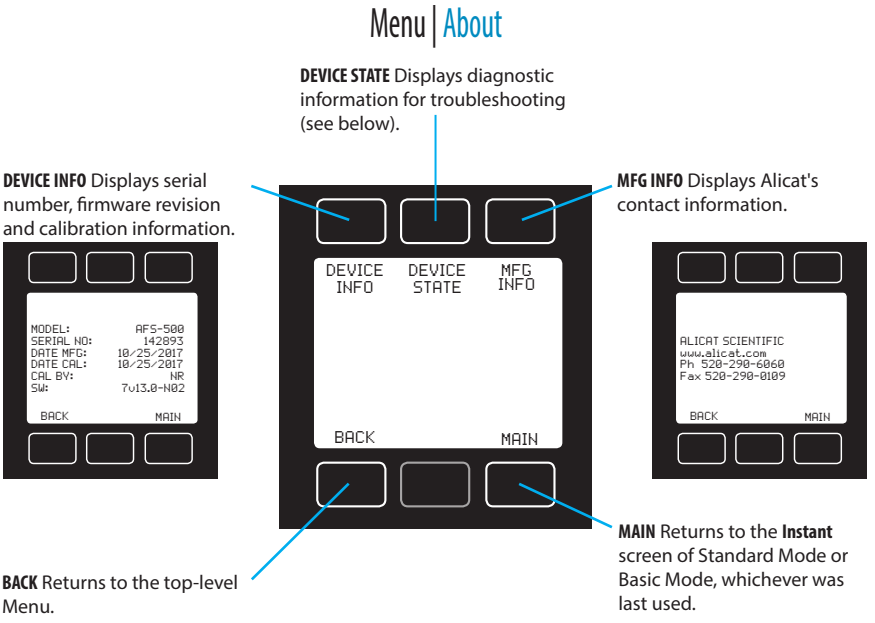
Your AFS stores the 50 most recent timed averages in its internal Stored Averages log, with the most recent measurement at the top. When the AFS has stored the maximum number of measurements, each new measurement displaces the oldest measurement. You can manually delete a single measurement or all of them at once. These functions are also accessible via serial commands (see page 38).



The Stored Averages log displays three values for each stored measurement: relative start time (**Start**), volumetric flow and standardized mass flow. The detailed entry also displays the measurement duration (**Avg Tm**) and a unique measurement ID (**ID**).

Note: Log entries always reflect the current AFS device engineering units. If you select a new unit from the* DEVICE UNITS *menu, all existing logged measurements will be converted to your newly chosen unit.

Navigating and Customizing Your AFS

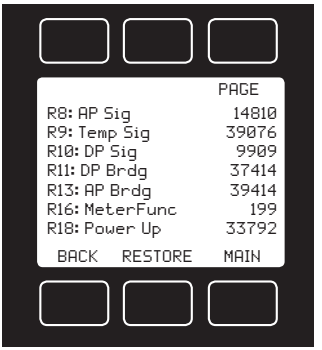


About

We hope you don't run into trouble using your AFS, but if you do, the **ABOUT** menu contains information that can make the troubleshooting process easier. Select **MFG INFO** to look up Alicat's phone number and web address. **DEVICE INFO** shows you the serial number and firmware version (**SW:**) for your specific device. It also gives you the original manufacturing date and the last calibration date, as well as the initials of the Alicat calibrator.

Diagnostic Information

The **DEVICE STATE** screen displays live register values for internal registers. Many of these values can help an Alicat applications engineer diagnose operational issues over the phone. Some register values clearly distinguish between hardware and operational problems, which speeds up the troubleshooting process.



Within the **DEVICE STATE** screen, press **PAGE** to advance to the next page of register values.

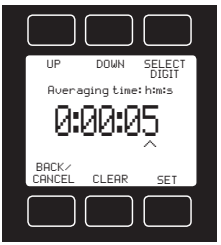
Select **RESTORE** to reset your AFS to factory configuration and calibration settings. Push **SET** to confirm.

Basic Configuration Menu

The Basic Configuration Menu contains options for choosing the duration and time format for the averaging function, as well as device engineering units.

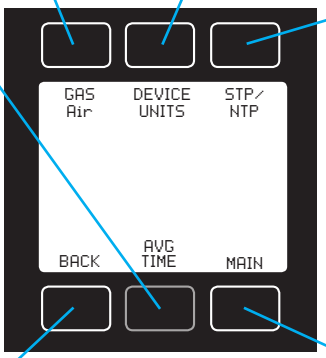
Setup | Basic Configuration

AVG TIME Sets the duration for averaged measurements, up to 9h:59m. Use the **SELECT DIGIT** and **UP/DOWN** buttons to choose the length of the timer countdown. Press **SET** to accept the new value. The time format is chosen in **MENU > BASIC CONFIG > DEVICE UNITS > Time**.



GAS Enters Gas Select and COMPOSER menus (page 26).

DEVICE UNITS Changes device engineering units for any parameter:
Standard Mass Flow - Volumetric Flow - Pressure - Baro Pressure - Temperature - Time



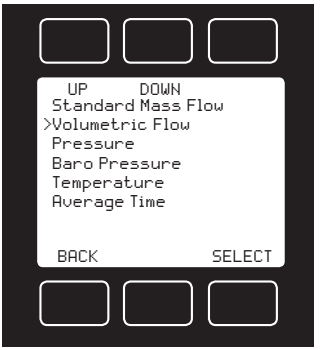
STP/NTP Defines standard (STP) and normal (NTP) temperature and pressure conditions (page 30).

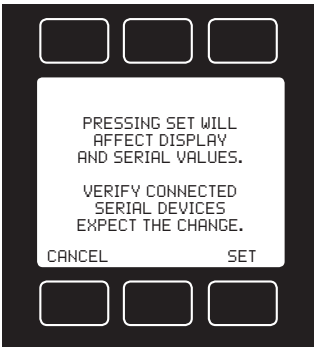
MAIN Returns to the **Instant** screen of Standard Mode or Basic Mode, whichever was last used.

BACK Returns to the top-level Menu (page 22).

Choosing Device Engineering Units from the Basic Configuration Menu

Changing device engineering units alters both the display and the data frame. First choose the parameter whose unit you want to change, and then choose your desired engineering unit. Confirm the change on the last screen. Changing engineering units in the **Pressure** unit menu changes the units for both absolute and gauge pressure readings, but not barometric pressure.





Navigating and Customizing Your AFS

Gas Select™

Your AFS was physically calibrated on air at Alicat's factory. Gas Select™ allows you to reconfigure the AFS to flow a different gas without sending it back to Alicat for a physical recalibration.

To use Gas Select, simply choose a gas or gas mix from one of the listed categories. As soon as you press **SELECT** from the gas listing, your AFS will adjust itself for your chosen gas. There is no need to restart the AFS.

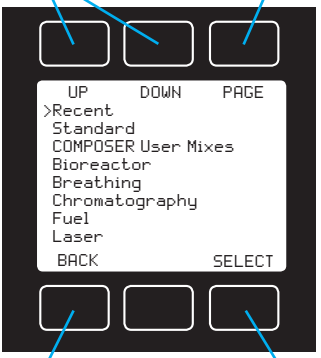
Your current gas selection appears just above the battery icon on the **Instant** and **Averaging** screens. It alternates with the current humidity reading:

Gas Select set to Nitrogen (**N2**).

Gas Select - Category Listing

UP/DOWN Moves the selection arrow up or down the listing of gas categories.

PAGE Advances the view to the next page of categories.



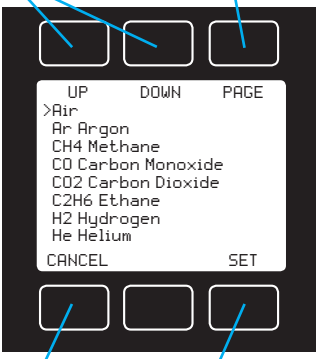
BACK Returns to the top-level Menu (page 22).

SELECT Opens the category to view its gases.

Gas Select - Gas Listing

UP/DOWN Moves the selection arrow up or down the listing of gases.

PAGE Advances the view to the next page of gases.



CANCEL Returns to the listing of gas categories.

SET Loads the gas properties data for the selected gas and returns to the **Instant** screen..

Gas Select™ Gas List

Your AFS is preloaded with complete gas properties data for the following gases. The headings indicate their Gas Select categories. See page 46 for the gas properties data (viscosity, density and compressibility) for these gases.

Pure Gases

- **Acetylene** C2H2
- **Air**
- **Argon** Ar
- **iso-Butane** iC4H10
- **normal-Butane** nC4H10
- **Carbon dioxide** CO2
- **Carbon monoxide** CO
- **Deuterium** D2
- **Ethane** C2H6
- **Ethylene** (Ethene) C2H4
- **Helium** He
- **Hydrogen** H2
- **Krypton** Kr
- **Methane** CH4
- **Neon** Ne
- **Nitrogen** N2
- **Nitrous Oxide** N2O
- **Oxygen** O2
- **Propane** C3H8
- **Sulfur Hexafluoride** SF6
- **Xenon** Xe

Bioreactor Gas Mixes

- 5% CH4
- 10% CH4
- 15% CH4
- 20% CH4
- 25% CH4
- 30% CH4
- 35% CH4
- 40% CH4
- 45% CH4
- 50% CH4
- 55% CH4
- 60% CH4
- 65% CH4
- 70% CH4
- 75% CH4
- 80% CH4
- 85% CH4
- 90% CH4
- 95% CH4

Chromatography Gas Mixes

- P-5
- P-10

Welding Gas Mixes

- C-2
- C-8
- C-10
- C-15
- C-20
- C-25
- C-50
- C-75
- He-25
- He-50
- He-75
- He-90
- A1025
- Stargon CS

Stack/Flue Gas Mixes

- 2.5% O2+10.8% CO2+85.7% N2+1% Ar
- 2.9% O2+14% CO2+82.1% N2+1% Ar
- 3.7% O2+15% CO2+80.3% N2+1% Ar
- 7% O2+12% CO2+80% N2+1% Ar
- 10% O2+9.5% CO2+79.5% N2+1% Ar
- 13% O2+7% CO2+79% N2+1% Ar

Breathing Gas Mixes

- EAN-32
- EAN-36
- EAN-40
- Metabolic Exhalant
- EA-40
- EA-60
- EA-80
- Heliox-20
- Heliox-21
- Heliox-30
- Heliox-40
- Heliox-50
- Heliox-60
- Heliox-80
- Heliox-99

Laser Gas Mixes

- 4.5% CO2+13.5% N2+82% He
- 6% CO2+14% N2+80% He
- 7% CO2+14% N2+79% He
- 9% CO2+15% N2+76% He
- 9.4% CO2+19.25% N2+71.35% He
- 9% Ne+91% He

Oxygen Concentrator Gas Mixes

- 89% O_2+7% N_2+4% Ar
- 93% O_2+3% N_2+4% Ar
- 95% O_2+1% N_2+4% Ar

Fuel Gas Mixes

- **Coal Gas** 50% H2+35% CH4+10% CO+5% C2H4
- **Endothermic Gas** 75% H2+25% N2
- **HHO** 66.67% H2+33.33% O2
- **LPG HD-5** 96.1% C3H8+1.5% C2H6+0.4% C3H6 +1.9% n-C4H10
- **LPG HD-10** 85% C3H8+10% C3H6+ 5% n-C4H10

Natural Gases

- 93% CH4+3% C2H6+1% C3H8+2% N2+1% CO2
- 95% CH4+3% C2H6+1% N2+ 1% CO2
- 95.2% CH4+2.5% C2H6+0.2% C3H8+0.1% C4H10+1.3% N2+0.7% CO2

Synthesis Gases

- 40% H2+29% CO+20% CO2+11% CH4
- 64% H2+28% CO+1% CO2+7% CH4
- 70% H2+4% CO+25% CO2+1% CH4
- 83% H2+14% CO+3% CH4

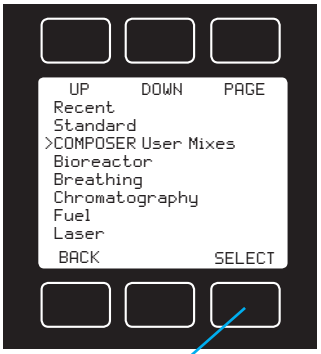
Using COMPOSER™ personalized mixed gas compositions

To remain accurate, your AFS needs to know the viscosity of the gas you are flowing through it. What happens when you are flowing a gas mixture that is not included in the Gas Select database of 98 gases and gas mixes? In this case, the more closely you can define your actual gas composition, the more accurate your AFS flow readings will be. Alicat's COMPOSER is the feature of Gas Select that lets you define new mixed gas compositions to reconfigure your AFS on the fly.

COMPOSER uses the Wilke method to define a new gas mixture based on the molar (volumetric) ratios of the gases in the mixture. You can define these gas compositions to within 0.01% for each of up to five constituent gases in the mixture. Once you define and save a new COMPOSER gas mix, it becomes part of the Gas Select system and is accessible under the gas category COMPOSER User Mixes. You can store 20 COMPOSER gas mixes on your AFS.

Note: COMPOSER does not physically mix any gases for you. It reconfigures your AFS to report flow readings more accurately based on the constituents of your defined gas mixture.

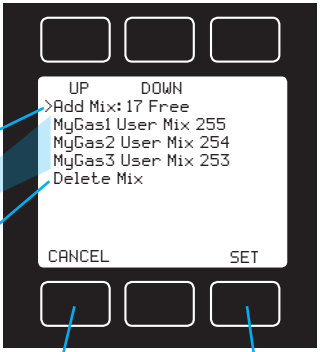
Gas Select - Category Listing



SELECT Enters the COMPOSER Menu.

To access COMPOSER, select **COMPOSER User Mixes** from the Gas Select category listing. Select any existing mix to reconfigure your AFS to flow that gas mixture. Select **Delete Mix** to choose a gas mix to remove.

Gas Select | COMPOSER Menu



Add Mix Creates a new COMPOSER gas mix.

COMPOSER Mixes Select an existing gas mix to use.

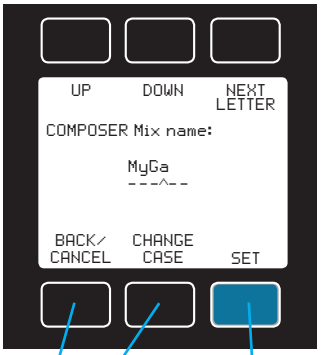
Delete Mix Deletes an existing gas mix. (Option appears if at least 1 mix exists.)

CANCEL Returns to the Gas Select Menu (page 26).

SET Confirms your selection.

Adding a new mixed gas composition to COMPOSER

Generate and store a new COMPOSER mix in 3 easy steps.

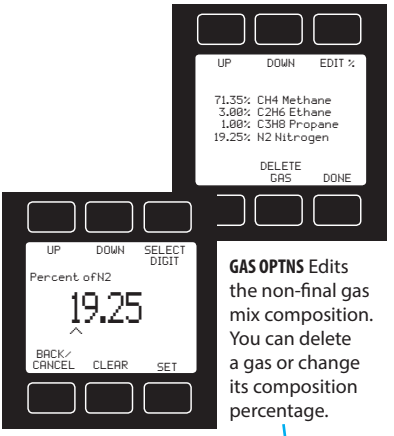


1 Name the mix.

CHANGE CASE Toggles upper/ lower case.

SET Accepts the name.

BACK/CANCEL Exits to the COMPOSER Menu.



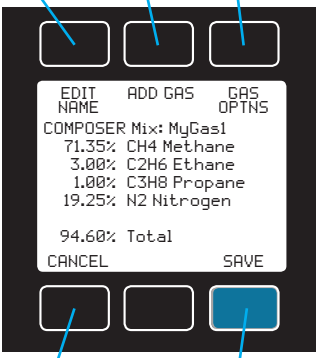
GAS OPTNS Edits the non-final gas mix composition. You can delete a gas or change its composition percentage.

ADD GAS Enters Gas Select listing to choose a gas. Then asks you to set its composition percentage.

EDIT NAME Returns to Step 1.

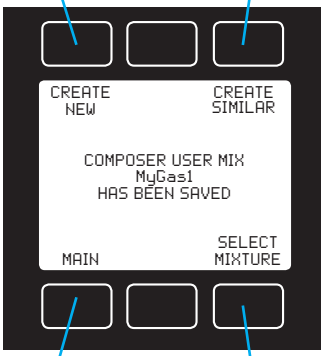
CREATE NEW/SIMILAR Restarts at Step 1. After saving a name, **CREATE SIMILAR** duplicates the mix you just saved. ***Note:* CREATE SIMILAR *is not accessible after leaving this screen.***

2 Define the mix.



CANCEL Exits to the COMPOSER Menu.

SAVE Adds the new mix to COMPOSER.

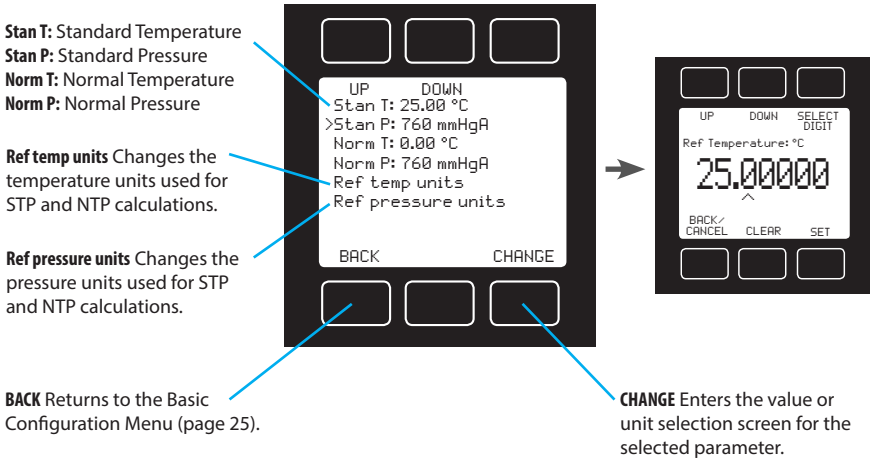


3 Save the mix.

Exits to **Instant** screen. **SELECT MIXTURE** also activates the new COMPOSER mix. **MAIN** keeps your gas selection.

Note: You cannot save your mix until the total is 100%. Saved gas compositions cannot be changed.

Basic Configuration | STP/NTP



Defining STP/NTP Reference Values

Standardized flow rates are reported in "standard" or "normal" volumetric flow units that reference a given temperature and pressure combination (see "Actual vs Standardized Flow Readings" on page 15). This reference is called an STP (standard temperature and pressure) or, typically in Europe, an NTP (normal temperature and pressure).

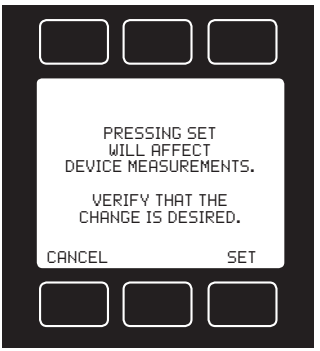
The AFS ships with an Alicat default STP of 25°C and 1 atm, and a default NTP of 0°C and 1 atm. Using the **STP/NTP** menu, you can change the temperature or pressure references for both STP and NTP separately.

To make changes, follow these steps:

1. Select the temperature or pressure reference you wish to change using the **UP** and **DOWN** buttons. Press **CHANGE**.

2. The current temperature or pressure value will appear. Change the value, or press **CLEAR** to restore the Alicat default. When ready, press **SET**.

3. At the confirmation screen, press **SET** again to confirm your desired change.



Advanced Setup

The Advanced Setup Menu leads to the following advanced functions:

- **SENSOR SETUP** sets sensor averaging and the zero band size (page 32).
- **COMM SETUP** sets up serial communications (page 34).

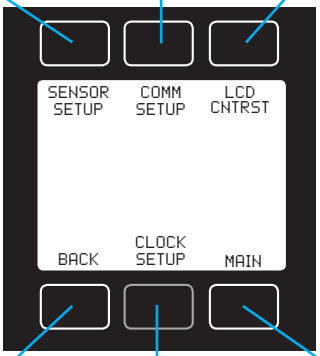
In addition, the Advanced Setup Menu allows you to adjust the contrast of the AFS screen (**LCD CNTRST**).

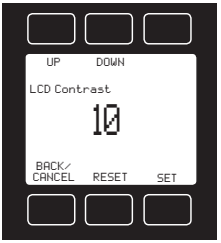
Setup | Advanced Setup

SENSOR SETUP Enters the Sensor Setup Menu (page 32).

COMM SETUP Enters the Communications Menu (page 34).

LCD CNTRST Sets the contrast level of the AFS display. Use the **UP/DOWN** buttons to choose the contrast level up to a maximum of 31.





BACK Returns to the Setup Menu.

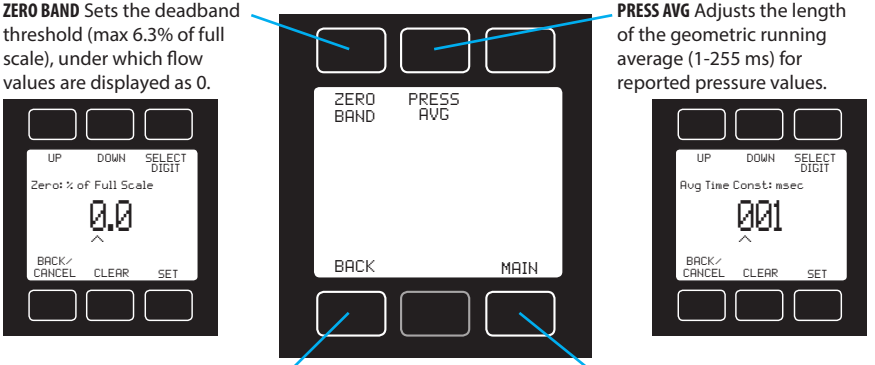
CLOCK SETUP Enters the Clock Setup Menu (page page 33).

MAIN Returns to the **Instant** screen of Standard Mode or Basic Mode, whichever was last used.

Note: Increasing the number under* LCD CONTRST *increases the contrast level. The maximum contrast level is 31. Press* RESET *to revert to the default contrast level (10).

Navigating and Customizing Your AFS

Advanced Setup | Sensor Setup



Sensor Setup

The **SENSOR SETUP** menu contains advanced settings that govern how the flow and pressure sensors report their data.

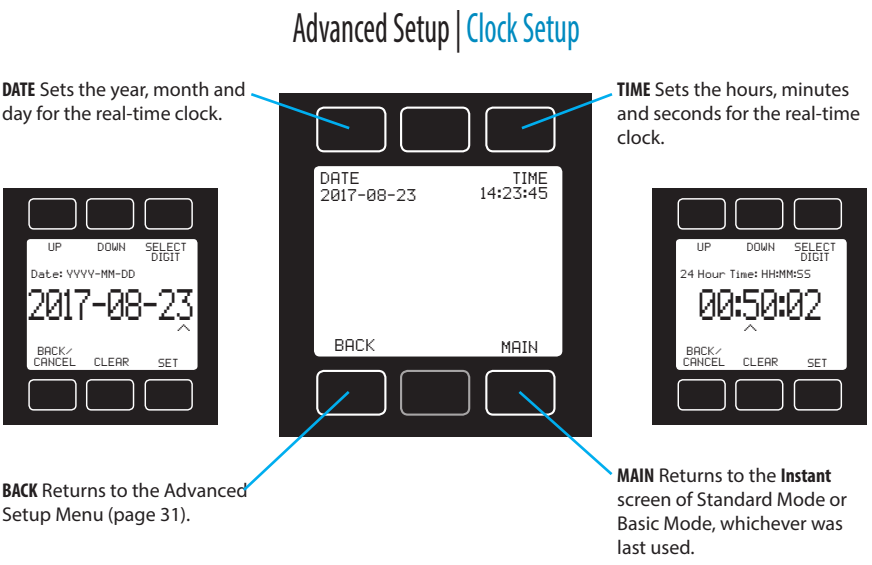
PRESS AVG changes the length of the geometric running average for pressure readings. Values roughly correspond to the time constant (in milliseconds) of the averaged values. Higher numbers generate a greater smoothing effect on quickly fluctuating readings (default is 255, full averaging).

ZERO BAND is the deadband threshold, a value below which the AFS displays all flow readings as 0 (no flow). This function also applies to gauge pressure readings from the internal pressure sensor. The AFS ships with a **ZERO BAND** value of 0.0%, which means that all flow values are reported, no matter how tiny. Increasing this value effectively chops off the bottom end of the device's flow range. This can be useful if you want to disregard all flow rates below the turndown range of the instrument, and so they display as zero flow.

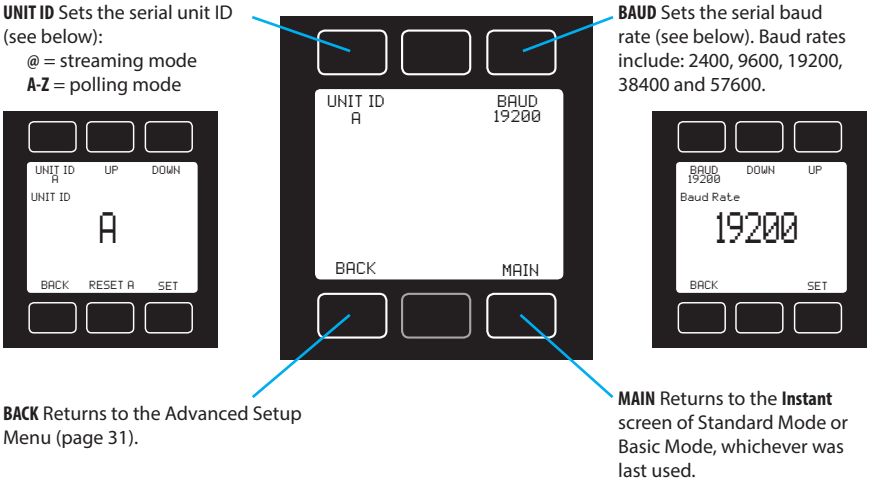
Note:* ZERO BAND *values do not affect the serial data frame.

Setting Up the Real-Time Clock

Your AFS contains an internal battery that powers its real-time clock when the power switch is off. You can set the date and time for this clock in the **CLOCK SETUP** menu.



Comm Setup | Serial Comm



Configuring the AFS for Serial Communications

You can operate the AFS via its micro-USB connector for easy streaming and logging of all calibration data. Before connecting the AFS to a computer, ensure that it is ready to communicate with your PC by checking the options in the **COMM SETUP** menu.

Unit ID

The unit ID is the identifier that a computer uses to distinguish your AFS from other devices when it is connected to a network. Using the unit ID letters **A-Z**, you can connect up to 26 devices to a computer at the same time via a single USB port. This is called polling mode (page 36). Unit ID changes take effect when you select **SET**.

If you select @ as the Unit ID, the AFS enters streaming mode when you exit the menu (page 36).

Baud Rate

Baud rate is the speed at which devices transfer digital information. The AFS has a default baud rate of 19200 baud (bits per second). If your computer uses a different baud rate, you must change the AFS baud rate in the **BAUD** menu to match it. (Alternatively, you can change your PC's baud rate in Device Manager.) Use the **UP/DOWN** buttons to select 38400, 19200, 9600, or 2400 baud. Baud rate changes take effect when you select **SET**.

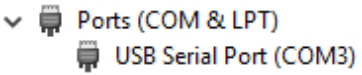
Serial Communications

Connecting your AFS to a computer allows you to log the data that it generates during a flow audit or calibration. You can also begin and record new timed measurements by issuing a simple command. The AFS communicates digitally through its top-mounted micro-USB port and cable, using a virtual COM port on your PC. This section of the manual shows you how to operate the AFS using ASCII commands.

Establishing Serial Communications

In most cases, all you need to do to connect your AFS to a computer is plug in the provided micro-USB cable to the port at the top of the device. Your computer will recognize the AFS as a COM port in the Device Manager of Windows. If it does not, you can download the USB device driver at alicat.com/drivers.

After you have connected the AFS, open the Device Manager, and find the new virtual COM port. It should appear under the "Ports (COM & LPT)" category as "USB Serial Port (COM#)" as you see below:



Write down the COM port number (COM3 in the example above).

Serial Terminal Application

Alicat's Serial Terminal is a preconfigured program for serial communications that functions much like the older HyperTerminal program of Windows. Download Serial Terminal for free at alicat.com/drivers. Once downloaded, simply run SerialTerminal.exe. Enter the COM port number you obtained from Device Manager and the baud rate of the AFS. The default baud rate is 19200, but this is adjustable by entering the **SERIAL COMM** menu on your AFS: **MENU > SETUP > ADV SETUP > COMM SETUP > BAUD** (page 34).

Note: In what follows, <CR> indicates an ASCII carriage return (decimal 13, hexadecimal D). Serial commands are not case-sensitive.

Serial Streaming vs Polling

Polling Mode

Your AFS was shipped to you in polling mode with a unit ID of A. Polling the AFS returns a single line of data each time you request it. To poll your AFS, simply type the unit ID, and then press enter/return **<CR>**:

Poll the AFS: [unit ID]**<CR>**
Example: **a<CR>** (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]**<CR>**
Example: **a@=b<CR>** (changes unit A to unit B)

You can also do this via the AFS menu: **MENU > SETUP > ADV SETUP > COMM SETUP > UNIT ID** (page 34). Valid unit IDs are letters A-Z, and up to 26 devices may be connected at any one time as long as each unit ID is unique.

Streaming Mode

In streaming mode, your AFS continuously sends a line of live data at regular intervals without your having to request the data each time. This mode is not compatible with averaged measurements. Only one unit on a given COM port may be in streaming mode at a time.

To put your AFS into streaming mode, type:

Begin streaming: [unit ID]**@=@<CR>** or ***@=@<CR>**

This is equivalent to changing the unit ID to "@". To take the AFS out of streaming mode, assign it a unit ID (in this case, A) by typing:

Stop streaming: **@@=**[desired unit ID]**<CR>**
Example: **@@=a<CR>** (stops and assigns unit ID of A)

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

Note: The default streaming interval is 50 ms, but this can be increased by changing Register 91 while the device is in polling mode:

Set streaming interval: [unit ID] **w91=**[number of milliseconds]**<CR>**
Example: **aw91=500<CR>** (streams new data every 500 ms)

Taring Serially

Before collecting flow data, be sure to tare your AFS. Whereas the front display has a single button that tares the device, this is accomplished serially through two separate commands. Taring volumetric flow sets the zero flow reading and must be done when no flow is passing through the AFS:

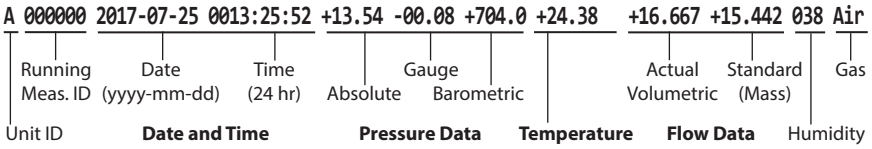
Tare volumetric flow: [unit ID]**v<CR>**
Example: **av<CR>** (sets volumetric flow reading to zero)

The second tare aligns the internal absolute pressure sensor with the current barometer reading and must be done with the AFS open to atmosphere:

Tare absolute pressure: [unit ID]**pc<CR>**
Example: **apc<CR>** (aligns internal pressure to barometer)

Collecting Live Flow Data Serially

Collect live flow data by typing the [unit ID] **<CR>** command ,or by setting your AFS to streaming. Each line of data for live flow measurements appears in the format below, but Unit ID is not present in streaming mode.



Single spaces separate each parameter, and each value is displayed in the chosen device engineering units, which may differ from the engineering units visible on the AFS display (see "Choosing Engineering Units from Standard Mode" on page 20). You can query the engineering units of the instant data frame by typing:

Query live data info: [unit ID]**??d*<CR>**
Example: **a??d*<CR>** (returns the data frame descriptions)

Additional columns, including status codes (see "Error Codes" on page 9), may be present to the right of the gas name. The Unit ID appears in the data frame only when the AFS is in polling mode.

Note: The Running Measurement ID indicates the status of averaged measurements. If no measurement is currently running, this value is 0. If a measurement is running, its ID number appears here.

Taking Averaged Measurements Serially

To begin or stop an averaged measurement, type:

Begin measurement: [unit ID]**mb** [duration in whole seconds]**<CR>**
Example: **amb 5<CR>** (begins a 5-second measurement)

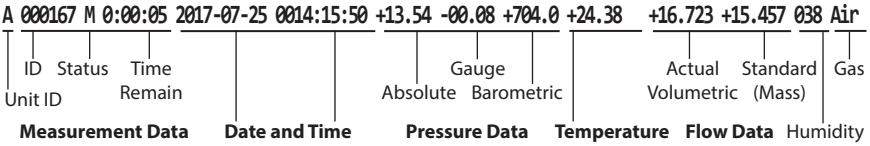
Abort measurement: [unit ID]**ma<CR>**
Example: **ama** (cancels the measurement)

As usual, each second of measurement duration adds 1000 flow readings to the measurement average. When starting an averaged measurement serially, the measurement duration in the **mb** command does not overwrite the duration defined in **MENU > SETUP > BASIC CONFIG > DEVICE UNITS > Average Time**. To use this stored duration to take a timed measurement serially, type [unit ID]**mb** without a duration value, for example: **amb<CR>**.

When the measurement is complete, view the last measurement by typing:

Display measurement: [unit ID]**md<CR>**
Example: **amd<CR>** (displays current/last measurement)

While a measurement is still in progress, the **md** command above displays the running averages in progress and the time remaining.



The measurement time remaining is reported along with an indicator of the measurement status: **M** while the measurement is in progress, **C** if it is complete or **A** if it has been aborted.

Query the engineering units of the averaged data frame by typing:

Query live data info: [unit ID]**??dm*<CR>**
Example: **a??dm*<CR>** (returns the data frame descriptions)

List all of the completed measurement IDs that are stored in your AFS:

Display measurement: [unit ID]**ms<CR>**
Example: **ams<CR>** (lists all stored measurement IDs)

Review a specific completed measurement by including its ID number:

Display measurement: [unit ID]**md** [measurement ID]**<CR>**
Example: **amd 167<CR>** (displays stored measurement #167)

Permanently erase one or more stored measurements by typing:

Erase measurement:	[unit ID]**me** [measurement ID]**<CR>**
Example:	**ame 167<CR>** (erases stored measurement #167)
Erase all:	[unit ID]**me<CR>**
Example:	**ame<CR>** (erases all stored measurements)

Quick Serial Command Guide

Note: Serial commands are not case-sensitive. For simplicity, we assume that the unit ID of the AFS is A in the listing that follows.

Change the unit ID:	[current unit ID]**@=**[desired unit ID]**<CR>**
Tare volumetric flow:	**av<CR>**
Tare abs. pressure with baro:	**apc<CR>**
Poll the live data frame:	**a<CR>**
Begin streaming data:	[unit ID]**@=@<CR>** or ***@=@<CR>**
Stop streaming data:	**@@=**[desired unit ID]**<CR>**
Set streaming interval:	**aw91=**[number of milliseconds]**<CR>**
Begin measurement:	**amb** [duration in seconds]**<CR>**
Abort current measurement:	**ama<CR>**
Display current/last meas.:	**amd<CR>**
Display measurement by ID:	**amd** [measurement ID]**<CR>**
List all stored measurement IDs:	**ams<CR>**
Delete all stored measurements:	**ame<CR>**
Delete measurement by ID:	**ame** [measurement ID]**<CR>**
Query gas list info:	**a??g*<CR>**
Choose a different gas:	**a$$g**[Gas Number]**<CR>**
Create a COMPOSER mix:	**agm** [Mix Name] [Mix Number] [Gas1 %] [Gas1 Number] [Gas2 %] [Gas2 Number]...**<CR>**
Delete a COMPOSER mix:	**agd** [Mix Number]**<CR>**
Query manufacturer info:	**a??m*<CR>**
Query live data info:	**a??d*<CR>**
Query measurement info:	**a??dm*<CR>**
Lock the front display:	**al<CR>**
Unlock the front display:	**au<CR>**

If you have need of more advanced serial communication commands, please contact Alicat.

Using Gas Select and COMPOSER Serially

To reconfigure your AFS to flow a different gas, you first need to look up the Gas Number (see "Gas Properties Data" on page 46). Then type:

Choose a gas:	[unit ID]**$$g**[Gas Number]**<CR>**
Example1:	**a$$g8<CR>** (reconfigures to flow nitrogen)
Example2:	**a$$g206<CR>** (reconfigures to flow P-10)

You select COMPOSER user mixes in the same way. All COMPOSER gas mixes have a Gas Number between 236 and 255.

Choose a user mix:	[unit ID]**$$g**[Gas Number]**<CR>**
Example:	**a$$g255<CR>** (reconfigures for user mix 255)

Defining a new COMPOSER gas mix is even faster using serial commands than it is using the front panel of your AFS. The basic formula for this is:

[unit ID]**gm** [Mix Name] [Mix Number] [Gas1 %] [Gas1 Number] [Gas2 %] [Gas2 Number]...**<CR>**

» [Mix Name] Use a maximum of 6 letters (upper case and/or lower case), numbers and symbols (space, period or hyphen only).

» [Mix Number] Choose a number from 236 to 255. If a user mix with that number already exists, it will be overwritten. Use the number 0 to assign the next available number to your new gas. ***Note: COMPOSER gas numbers are assigned in descending order from 255.***

» [Gas1 %] [Gas1 Number]... For each constituent gas, enter its molar percentage (using up to 2 decimal places) and then its Gas Number. You must have at least 2, but no more than 5, gases in your COMPOSER mix.

After creating your COMPOSER mix, your AFS will confirm the new gas:

Example1: *Create a mix of 71.35% helium, 19.25% nitrogen and 9.4% carbon dioxide as Gas 254, called "MyGas1".*

```
agm MyGas1 254 71.35 7 19.25 8 9.4 4<CR>
```

Response: A 254 71.35% He 19.25% N2 9.40% CO2

Example2: *Create a mix of 93% methane, 3% ethane, 1% propane, 2% nitrogen and 1% carbon dioxide, using the next available gas number, called "MyGas2".*

```
agm MyGas2 0 93 2 3 5 1 12 2 8 1 4<CR>
```

Response: A 253 93.00% CH4 3.00% C2H6 1.00% C3H8 2.00% N2 1.00% CO2

Note: The sum of all gas constituent percentages must equal 100.00%.

Troubleshooting Your AFS

General Use

Issue: ***My Alicat does not turn on.***

Action: The AFS runs on a rechargeable battery, but you can also connect it to a wall outlet or computer using the included micro-USB cable. If the battery has been fully depleted, it may take a minute or so to acquire enough charge to turn back on. If your AFS will not power on after being plugged in for at least 5 minutes, contact Alicat.

Issue: ***The buttons do not work, and the screen shows* LCK *alternating with battery icon.***

Action: The AFS buttons were locked out via a serial command. Press and hold all four outer buttons to unlock the interface.

Issue: ***I can't read the display easily.***

Action: During the day, you can increase the visibility of the display by increasing the contrast (**MENU > SETUP > ADV SETUP > LCD CNTRST**). If you are working under low-light conditions, push the large Alicat button (located under the display) to turn on the backlight.

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

Action: Alicat recommends annual recalibrations, which reflects current US EPA expectations as well. Check your AFS's last calibration date by selecting **MENU > ABOUT > DEVICE INFO**. If it is time to recalibrate, request a recalibration at alicat.com/service.

Issue: ***Can I use the Alicat when it is freezing outside?***

Action: Yes! Even though we at Alicat live under Tucson, Arizona's hot sun, we have vigorously tested the AFS down to -10°C to ensure it remains accurate for our cold-weather friends.

Issue: ***I dropped my Alicat. Is it ok? Do I need to recalibrate?***

Action: Your AFS has no moving parts and was designed to survive drops from a rooftop air monitoring site. If it turns on and appears to respond normally, then it is probably ok. It may or may not need a recalibration. Compare it against a known-good flow standard. If it checks out, keep using it, but tell us about the drop at your next annual recalibration so we can check it out for you.

Issue: ***Water got into my Alicat's flow path. Is it ok? Do I need to recalibrate?***

Action: Prolonged exposure to water can damage the flow sensors over time. That said, your AFS uses the same basic technology that we use in our liquid flow meters, so the occasional ingress of liquid will not destroy it. First, let the AFS dry out; running some pure anhydrous isopropyl alcohol through it can help it dry faster. You can verify the flow path is dry when the humidity sensor shows readings consistent with your

local humidity. If the water was salty and left deposits, you may need a recalibration. Compare it against a known-good flow standard. If it checks out, keep using it, but tell us about the issue at your next annual recalibration so we can check it out for you. If the water was dirty, your AFS may require cleaning at Alicat.

Temperature Readings

Issue: ***How can I see temperature in different units?***

Action: From Standard Mode, push the button above the temperature reading twice, and then choose **Set button eng units**. Use the **UP**/**DOWN** keys to move the > cursor to the desired unit, and then press **SET**.

Pressure Readings

Issue: ***How can I see pressure in different units?***

Action: From Standard Mode, push the button above the pressure reading twice, and then choose **Set button eng units**. Use the **UP**/**DOWN** keys to move the > cursor to the desired unit, and then press **SET**.

Issue: ***How do I know which pressure reading the Alicat is displaying?***

Action: Above the pressure reading in Standard Mode, or to its right in Direct Mode, the AFS displays BARO when the pressure reading is from the barometer. If you have set your AFS to display internal pressure, the pressure unit will end with **A** for absolute pressure (*e.g.* **mmHgA**) or **G** for gauge pressure (*e.g.* **mmHgG**).

Issue: ***When should I use absolute pressure instead of barometric pressure?***

Action: If you want to know ambient atmospheric pressure, you should set the AFS to display barometric pressure readings. Use the internal pressure (with absolute or gauge reference) to monitor the pressure inside the flow path of your AFS and whatever it is connected to.

Issue: ***The internal absolute pressure doesn't match the barometer.***

Action: The absolute pressure reading shows the current pressure inside the AFS. When there is no flow, these should match each other, as long as one port is open to atmosphere. If they do not, perform a tare by pressing **MENU** > **TARE**. When there is flow, the internal pressure sensor will read somewhat lower on account of the small pressure drop induced by the laminar flow stack.

Troubleshooting Your AFS

Flow Readings

Issue: ***How can I see flow in different units?***

Action: From Standard Mode, push the button below the flow reading twice, and then choose **Set button eng units**. Use the **UP**/**DOWN** keys to move the > cursor to the desired unit, and then press **SET**.

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

Action: The AFS is very fast, so it can detect subtle variations in flow that may go unnoticed by your other flow calibrators. This sensitivity can help detect problems with pumps or flow controllers. You can record a single flow reading by collecting an averaged measurement (press **START AVG** from the **Instant** screen).

Issue: ***My flow readings are negative.***

Action: If your AFS is not connected to anything, it may be reading a light breeze that is entering its outlet. Plug one end to see if the flow returns to 0. Under conditions of no flow, a negative flow reading can indicate a poor tare. Ensure that the AFS has no flow passing through it, and select **MENU > TARE** to give it a fresh tare.

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

Action: Yes to both! The AFS is internally compensated for any changes in orientation, so you can use it sideways, on its back, or upside-down.

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

Action: Yes, and yes! The AFS is internally compensated for any changes in orientation, including rapid vibrations.

Issue: ***Volumetric flow readings don't match another flow calibrator I use.***

Action: The AFS accounts for the content of water vapor in the air (relative humidity). The live humidity sensor keeps up with changing humidity levels all the way to 100% RH. The higher the humidity, the more deviation you may see when comparing AFS flow readings to uncompensated flow instruments. When the air is dry, differences in flow readings are likely the result of pressure drop. Every flow meter has some amount of pressure drop, especially those that use differential pressure as the measurement method.

Issue: ***Mass flow readings don't match another flow calibrator I use.***

Action: Check the STP or NTP settings (**MENU > SETUP > BASIC CONFIG > STP/NTP**) to ensure that your standardized temperature and pressure references match those of your other flow calibrator.

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 Alicat to troubleshoot.

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

Action: Yes! Your AFS is designed specifically to work with many different gases at any humidity level, 0-100% RH. Gas Select (**MENU > GAS SELECT**) includes preloaded 98 pure gases and gas mixes, or you can define your own using COMPOSER.

Humidity Readings

Issue: ***Can I use the Alicat in 100% humidity? Even when it is hot?***

Action: Yes! The AFS is the first flow calibrator to be just as accurate in a Miami summer as it is here in Arizona. The live humidity sensor keeps flow readings accurate from 0% RH to 100% RH, even at 60°C. However, take care that moisture is not condensing inside the flow path, as this will negatively affect its measurement accuracy.

Issue: ***The relative humidity reading does not match my humidity standard (or the current weather report).***

Action: The relative humidity sensor is located adjacent to the flow stream in the body of the AFS. It is most accurate when there is a fresh flow of air passing by it. Connect the AFS to an device and check the humidity reading after a couple minutes.

Serial Communications

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

Action: Make sure the COM number matches the one your software is using to connect to the AFS. Check the AFS unit ID (**MENU > SETUP > ADV SETUP > COMM SETUP > UNIT ID**) to make sure you are addressing it properly with your serial commands. Make sure the baud rate your software requires is the one your AFS is using (**MENU > SETUP > ADV SETUP > COMM SETUP > BAUD**).

Still stumped?

Issue: ***None of the above helped. Arrgh!***

Action: We're here to help! It's going to be ok. Give us a call (888-290-6060) during our normal business hours (8am-5pm Arizona time) to get help from a friendly and capable applications engineer. Or, go to alicat.com and start a live chat. Is it after hours? Send an email to info@alicat.com, and we'll get in touch with you as soon as we can.

Maintenance and Recalibration

Cleaning

Your AFS flow calibrator requires no periodic cleaning. It has no moving parts and is built tough to survive drops. If necessary, the outside of the device can be cleaned with a soft dry cloth.

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. This date is also stored inside your AFS and is visible by selecting **MENU > ABOUT > DEVICE INFO**.

When it is time for your AFS's annual recalibration, contact us by phone or live chat to set it up. After hours, send an email to service@alicat.com, or fill out the form at alicat.com/service. We'll ask for your device's serial number and your contact information and send you an email with instructions for returning the AFS to us.

Replacement Parts

Please contact Alicat to reorder any of the following AFS accessories:

Part Number	Description
PVPS5USBU	USB cable, micro-B to type A, with wall adapter

For repair, recalibration or recycling of this product contact:

Alicat Scientific, Inc.
service@alicat.com • alicat.com
7641 N Business Park Drive Tucson, AZ 85743 USA
1-520-290-6060

PURE NON-CORROSIVE GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
14	C2H2	Acetylene	104.44800	1.07200	0.9928000	97.374	1.1728	0.9905
0	Air	Air	184.89890	1.18402	0.9996967	172.574	1.2930	0.9994
1	Ar	Argon	226.23990	1.63387	0.9993656	210.167	1.7840	0.9991
16	i-C4H10	i-Butane	74.97846	2.44028	0.9735331	68.759	2.6887	0.9645
13	n-C4H10	n-Butane	74.05358	2.44930	0.9699493	67.690	2.7037	0.9591
4	CO2	Carbon Dioxide	149.31840	1.80798	0.9949545	137.107	1.9768	0.9933
3	CO	Carbon Monoxide	176.49330	1.14530	0.9996406	165.151	1.2505	0.9993
60	D2	Deuterium	126.59836	0.16455	1.0005970	119.196	0.1796	1.0006
5	C2H6	Ethane	93.54117	1.23846	0.9923987	86.129	1.3550	0.9901
15	C2H4	Ethylene (Ethene)	103.18390	1.15329	0.9942550	94.697	1.2611	0.9925
7	He	Helium	198.45610	0.16353	1.0004720	186.945	0.1785	1.0005
6	H2	Hydrogen	89.15355	0.08235	1.0005940	83.969	0.0899	1.0006
17	Kr	Krypton	251.32490	3.43229	0.9979266	232.193	3.7490	0.9972
2	CH4	Methane	110.75950	0.65688	0.9982472	102.550	0.7175	0.9976
10	Ne	Neon	311.12640	0.82442	1.0004810	293.822	0.8999	1.0005
8	N2	Nitrogen	178.04740	1.14525	0.9998016	166.287	1.2504	0.9995
9	N2O	Nitrous Oxide	148.41240	1.80888	0.9945327	136.310	1.9779	0.9928
11	O2	Oxygen	205.50210	1.30879	0.9993530	191.433	1.4290	0.9990
12	C3H8	Propane	81.46309	1.83204	0.9838054	74.692	2.0105	0.9785
19	SF6	Sulfur Hexafluoride	153.53200	6.03832	0.9886681	140.890	6.6162	0.9849
18	Xe	Xenon	229.84830	5.39502	0.9947117	212.157	5.8980	0.9932

WELDING GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
23	C-2	2% CO2 / 98% Ar	224.71480	1.63727	0.9993165	208.673	1.7877	0.998993
22	C-8	8% CO2 / 92% Ar	220.13520	1.64749	0.9991624	204.199	1.7989	0.9987964
21	C-10	10% CO2 / 90% Ar	218.60260	1.65091	0.9991086	202.706	1.8027	0.9987278
140	C-15	15% CO2 / 85% Ar	214.74960	1.65945	0.9989687	198.960	1.8121	0.9985493
141	C-20	20% CO2 / 80% Ar	210.86960	1.66800	0.9988210	195.198	1.8215	0.9983605
20	C-25	25% CO2 / 75% Ar	206.97630	1.67658	0.9986652	191.436	1.8309	0.9981609
142	C-50	50% CO2 / 50% Ar	187.53160	1.71972	0.9977484	172.843	1.8786	0.9969777
24	C-75	75% CO2 / 25% Ar	168.22500	1.76344	0.9965484	154.670	1.9271	0.995401
25	He-25	25% He / 75% Ar	231.60563	1.26598	0.9996422	216.008	1.3814	0.9999341
143	He-50	50% He / 50% Ar	236.15149	0.89829	0.9999188	220.464	0.9800	1.00039
26	He-75	75% He / 25% Ar	234.68601	0.53081	1.0001954	216.937	0.5792	1.000571
144	He-90	90% He / 10% Ar	222.14566	0.31041	1.0003614	205.813	0.3388	1.00057
27	A1025	90%He/7.5%Ar/2.5%CO2	214.97608	0.31460	1.0002511	201.175	0.3433	1.000556
28	Star29	Stargon CS 90% Ar / 8% CO2 / 2% O2	219.79340	1.64099	0.9991638	203.890	1.7918	0.998798

BIOREACTOR GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
145	Bio-5M	5% CH4 / 95% CO2	148.46635	1.75026	0.9951191	136.268	1.9134	0.9935816
146	Bio-10M	10% CH4 / 90% CO2	147.54809	1.69254	0.9952838	135.383	1.8500	0.993893
147	Bio-15M	15% CH4 / 85% CO2	146.55859	1.63484	0.9954484	134.447	1.7867	0.9941932
148	Bio-20M	20% CH4 / 80% CO2	145.49238	1.57716	0.9956130	133.457	1.7235	0.994482
149	Bio-25M	25% CH4 / 75% CO2	144.34349	1.51950	0.9957777	132.407	1.6603	0.9947594
150	Bio-30M	30% CH4 / 70% CO2	143.10541	1.46186	0.9959423	131.290	1.5971	0.9950255
151	Bio-35M	35% CH4 / 65% CO2	141.77101	1.40424	0.9961069	130.102	1.5340	0.9952803
152	Bio-40M	40% CH4 / 60% CO2	140.33250	1.34664	0.9962716	128.834	1.4710	0.9955239
153	Bio-45M	45% CH4 / 55% CO2	138.78134	1.28905	0.9964362	127.478	1.4080	0.9957564
154	Bio-50M	50% CH4 / 50% CO2	137.10815	1.23149	0.9966009	126.025	1.3450	0.9959779
155	Bio-55M	55% CH4 / 45% CO2	135.30261	1.17394	0.9967655	124.462	1.2821	0.9961886
156	Bio-60M	60% CH4 /40% CO2	133.35338	1.11642	0.9969301	122.779	1.2193	0.9963885
157	Bio-65M	65% CH4 /35% CO2	131.24791	1.05891	0.9970948	120.959	1.1564	0.9965779
158	Bio-70M	70% CH4 / 30% CO2	128.97238	1.00142	0.9972594	118.987	1.0936	0.9967567
159	Bio-75M	75% CH4 / 25% CO2	126.51146	0.94395	0.9974240	116.842	1.0309	0.9969251
160	Bio-80M	80% CH4 / 20% CO2	123.84817	0.88650	0.9975887	114.501	0.9681	0.9970832
161	Bio-85M	85% CH4 / 15% CO2	120.96360	0.82907	0.9977533	111.938	0.9054	0.9972309
162	Bio-90M	90% CH4 / 10% CO2	117.83674	0.77166	0.9979179	109.119	0.8427	0.9973684
163	Bio-95M	95% CH4 / 5% CO2	114.44413	0.71426	0.9980826	106.005	0.7801	0.9974957

BREATHING GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
164	EAN-32	32% O2 / 68% N2	186.86315	1.19757	0.9996580	174.925	1.3075	0.9993715
165	EAN	36% O2 / 64% N2	187.96313	1.20411	0.9996401	175.963	1.3147	0.9993508
166	EAN-40	40% O2 / 60% N2	189.06268	1.21065	0.9996222	176.993	1.3218	0.9993302
167	HeOx-20	20% O2 / 80% He	217.88794	0.39237	1.0002482	204.175	0.4281	1.000593
168	HeOx-21	21% O2 / 79% He	218.15984	0.40382	1.0002370	204.395	0.4406	1.000591
169	HeOx-30	30% O2 / 70% He	219.24536	0.50683	1.0001363	205.140	0.5530	1.000565
170	HeOx-40	40% O2 / 60% He	218.59913	0.62132	1.0000244	204.307	0.6779	1.000502
171	HeOx-50	50% O2 / 50% He	216.95310	0.73583	0.9999125	202.592	0.8028	1.000401
172	HeOx-60	60% O2 / 40% He	214.82626	0.85037	0.9998006	200.467	0.9278	1.000257
173	HeOx-80	80% O2 / 20% He	210.11726	1.07952	0.9995768	195.872	1.1781	0.9998019
174	HeOx-99	99% O2 / 1% He	205.72469	1.29731	0.9993642	191.646	1.4165	0.9990796
175	EA-40	Enriched Air-40% O2	189.42518	1.21429	0.9996177	177.396	1.3258	0.9993261
176	EA-60	Enriched Air-60% O2	194.79159	1.24578	0.9995295	182.261	1.3602	0.9992266
177	EA-80	Enriched Air-80% O2	200.15060	1.27727	0.9994412	186.937	1.3946	0.9991288
178	Metabol	Metabolic Exhalant (16% O2 / 78.04% N2 / 5% CO2 / 0.96% Ar)	180.95936	1.20909	0.9994833	170.051	1.3200	0.9992587

FUEL GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
185	Syn Gas-1	40% H2 + 29% CO + 20% CO2 + 11% CH4	155.64744	0.79774	0.9989315	144.565	0.8704	0.9992763
186	Syn Gas-2	64% H2 + 28% CO + 1% CO2 + 7% CH4	151.98915	0.43715	1.0001064	142.249	0.4771	1.000263
187	Syn Gas-3	70% H2 + 4% CO + 25% CO2 + 1% CH4	147.33686	0.56024	0.9991225	136.493	0.6111	0.9997559
188	Syn Gas-4	83% H2 + 14% CO + 3% CH4	133.63682	0.24825	1.0003901	125.388	0.2709	1.000509
189	Nat Gas-1	93% CH4 / 3% C2H6 / 1% C3H8 / 2% N2 / 1% CO2	111.77027	0.70709	0.9979255	103.189	0.7722	0.9973965
190	Nat Gas-2	95% CH4 / 3% C2H6 / 1% N2 / 1% CO2	111.55570	0.69061	0.9980544	103.027	0.7543	0.9974642
191	Nat Gas-3	95.2% CH4 / 2.5% C2H6 / 0.2% C3H8 / 0.1% C4H10 / 1.3% N2 / 0.7% CO2	111.49608	0.68980	0.9980410	102.980	0.7534	0.9974725
192	Coal Gas	50% H2 / 35% CH4 / 10% CO / 5% C2H4	123.68517	0.44281	0.9993603	115.045	0.6589	0.996387
193	Endo	75% H2 + 25% N2	141.72100	0.34787	1.0005210	133.088	0.3797	1.000511
194	HHO	66.67% H2 / 33.33% O2	180.46190	0.49078	1.0001804	168.664	0.5356	1.000396
195	HD-5	LPG 96.1% C3H8 / 1.5% C2H6 / 0.4% C3H6 / 1.9% n-C4H10	81.45829	1.83428	0.9836781	74.933	2.0128	0.9784565
196	HD-10	LPG 85% C3H8 / 10% C3H6 / 5% n-C4H10	81.41997	1.85378	0.9832927	74.934	2.0343	0.9780499

LASER GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
179	LG-4.5	4.5% CO2 / 13.5% N2 / 82% He	199.24300	0.36963	1.0001332	187.438	0.4033	1.000551
180	LG-6	6% CO2 / 14% N2 / 80% He	197.87765	0.39910	1.0000471	186.670	0.4354	1.00053
181	LG-7	7% CO2 / 14% N2 / 79% He	197.00519	0.41548	0.9999919	186.204	0.4533	1.000514
182	LG-9	9% CO2 / 15% N2 / 76% He	195.06655	0.45805	0.9998749	184.835	0.4997	1.000478
183	HeNe-9	9% Ne / 91% He	224.68017	0.22301	1.0004728	211.756	0.2276	1.000516
184	LG-9.4	9.4% CO2 / 19.25% N2 / 71.35% He	193.78311	0.50633	0.9998243	183.261	0.5523	1.000458

O2 CONCENTRATOR GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
197	OCG-89	89% O2 / 7% N2 / 4% Ar	204.53313	1.31033	0.9993849	190.897	1.4307	0.9990695
198	OCG-93	93% O2 / 3% N2 / 4% Ar	205.62114	1.31687	0.9993670	191.795	1.4379	0.9990499
199	OCG-95	95% O2 / 1% N2 / 4% Ar	206.16497	1.32014	0.9993580	192.241	1.4414	0.99904

STACK GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
200	FG-1	2.5% O2 / 10.8% CO2 / 85.7% N2 / 1% Ar	175.22575	1.22550	0.9992625	165.222	1.3379	0.9990842
201	FG-2	2.9% O2 / 14% CO2 / 82.1% N2 / 1% Ar	174.18002	1.24729	0.9991056	164.501	1.3617	0.9989417
202	FG-3	3.7% O2 / 15% CO2 / 80.3% N2 / 1% Ar	174.02840	1.25520	0.9990536	164.426	1.3703	0.9988933
203	FG-4	7% O2 / 12% CO2 / 80% N2 / 1% Ar	175.95200	1.24078	0.9991842	166.012	1.3546	0.9990116
204	FG-5	10% O2 / 9.5% CO2 / 79.5% N2 / 1% Ar	177.65729	1.22918	0.9992919	167.401	1.3419	0.9991044
205	FG-6	13% O2 / 7% CO2 / 79% N2 / 1% Ar	179.39914	1.21759	0.9993996	168.799	1.3293	0.9991932

CHROMATOGRAPHY GASES			25°C			0°C		
Gas Number	Short Name	Long Name	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA	Absolute Viscosity	Density 14.696 PSIA	Compressibilty 14.696 PSIA
29	P-5	5% CH4 / 95% Ar	223.91060	1.58505	0.9993265	207.988	1.7307	0.9990036
206	P-10	10% CH4 90% Ar	221.41810	1.53622	0.9992857	205.657	1.6774	0.99895

Device Units

Your AFS can display your data in the various engineering units listed in the following tables. You can change units from the **Instant** or **Averaging** screens (page 20) or from the **DEVICE UNITS** menu (page 25). Note that only units appropriate to your AFS are available for selection.

Flow Units

Volumetric	Standard	Normal	Notes
uL/m	SuL/m	NuL/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
cm3/h	Scm3/h	Ncm3/h	cubic centimeter per hour
m3/m	Sm3/m	Nm3/m	cubic meter per minute
m3/h	Sm3/h	Nm3/h	cubic meter per hour
m3/d	Sm3/d	Nm3/d	cubic meter per day
in3/m	Sin3/m		cubic inch per minute
CFM	SCFM		cubic foot per minute
CFH	SCFH		cubic foot per hour
	kSCFM		1000 cubic feet per minute
count	count	count	setpoint count, 0 – 64000
%	%	%	percent of full scale

True Mass Flow Units

Label	Notes
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

Device Units

Pressure Units

Absolute/Barometric	Gauge	Notes
PaA	PaG	pascal
hPaA	hPaG	hectopascal
kPaA	kPaG	kilopascal
MPaA	MPaG	megapascal
mbarA	mbarG	millibar
barA	barG	bar
g/cm2A	g/cm2G	gram force per square centimeter
kg/cmA	kg/cmG	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
mmH2OA	mmH2OG	millimeter of water at 4 C (NIST conventional)
mmH2OA	mmH2OG	millimeter of water at 60 C
cmH2OA	cmH2OG	centimeter of water at 4 C (NIST conventional)
cmH2OA	cmH2OG	centimeter of water at 60 C
inH2OA	inH2OG	inch of water at 4 C (NIST conventional)
inH2OA	inH2OG	inch of water at 60 C
atm		atmosphere
m asl		meter above sea level (only in /ALT builds)
ft asl		foot above sea level (only in /ALT builds)
V	volt; no conversions are performed to or from other units	
count	count	setpoint count, 0 – 64000
%	%	percent of full scale

Temperature Units

Label	Notes
°C	degree Celsius
°F	degree Farenheit
K	Kelvin
°R	degree Rankine

Time Units

Label	Notes
h:m:s	Displayed value is hours:minutes:seconds
ms	millisecond
s	second
m	minute
hour	hour
day	day

Limited Lifetime Warranty

Alicat Scientific, Inc. warrants to the original purchaser (hereinafter referred to as "Buyer") that instruments manufactured by Alicat Scientific (hereinafter referred to as "Product") shall be free from defects in materials and workmanship for the life of the Products.
Under this warranty, the Products will be repaired or replaced at manufacturer's option, without charge for parts or labor when the Product is carried or shipped prepaid to the factory together with proof of purchase.
The foregoing shall constitute the exclusive and sole remedy in lieu of other remedies of the Buyer for any breach by Alicat Scientific of this warranty to the maximum extent permitted by law.
This warranty does not apply to any Product which has not been installed or used in accordance with the Product operation and installation specifications provided to Buyer verbally or in writing by Alicat Scientific for the proper and normal use of the Product.
Buyer agrees hereunder that Alicat reserves the right to void any warranty, written or implied, if upon Alicat's examination of Product shall disclose to Alicat's satisfaction that the Product failure was due solely, or in part, to accident, misuse, neglect, abuse, alteration, improper installation, unauthorized repair or improper testing by Buyer or agent of Buyer.
Alicat Scientific shall not be liable under any circumstances for indirect, special, consequential, or incidental damages in connection with, or arising out of, the sale, performance, or use of the Products covered by this warranty.
Alicat Scientific does not recommend, warrant or assume responsibility for the use of the Products in life support applications or systems.
Alicat's warranties as herein above set forth shall not be enlarged, diminished or affected by, and no obligation or liability shall arise or grow out of Alicat's rendering of technical advice in connection with Buyer's order of the Products furnished hereunder.
If Product becomes obsolete, Alicat Scientific, at its own discretion, reserves the right to repair the Product with available replacement parts or upgrade the Product to a current, commercially available version of the original Product. Should upgrading the Product be deemed necessary by Alicat, Buyer hereby agrees to pay an upgrade fee equal to seventy percent of the retail value of the replacement Product. Alicat Scientific hereunder makes no claim that replacement Products will look, function or operate in the same or similar manner as the original product.
When a Product is returned to Alicat Scientific for recalibration this service is considered normal preventative maintenance. Recalibration of Product shall not be treated as a warranty service unless recalibration of Product is required as the result of repairs to Product pursuant to this Warranty. Failure of Buyer to send Product to Alicat Scientific for recalibration on a yearly basis after a period of 36 months from date of manufacture will remove any and all obligations regarding repair or replacement of Product as outlined by this Warranty to Buyer from Alicat Scientific.
This Warranty is in lieu of all other relevant warranties, expressed or implied, including the implied warranty of merchantability and the implied warranty of fitness for a particular purpose, and any warranty against infringement of any patent.
Continued use or possession of Products after expiration of the applicable warranty period stated above shall be conclusive evidence that the warranty is fulfilled to the full satisfaction of Buyer.
Alicat makes no warranty as to experimental, non-standard or developmental Products.
Accessories purchased from Alicat are not covered by this warranty.

Conformity / Supplemental Information:
The product complies with the requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC and carries the CE Marking accordingly. Contact the manufacturer for more information.

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AFS Reference Menu Map

AFS Menu Map

* Pressing **MAIN** returns you to the Instant Data screen of either Standard Mode or Basic Mode, whichever was last used.