



Agilent Precision Gas Flow Meter

Operating Manual

Notices

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Thank You For Your Purchase

If you have any questions about operating it, or if something is not working as expected, please contact support at <https://www.agilent.com/en-us/contact-us/page>. We are eager to help you in any way possible.

Serial Number

Next Calibration (Month/Day)

Recalibrate your flow meter every year

Your flow meter should be calibrated every year to ensure the continued certainty of your readings and extend the Limited Lifetime Warranty.



This device comes with a NIST traceable calibration certificate.



This flow meter conforms to the European Union's Restriction of Use of Hazardous Substances in Electrical and Electronic Equipment Directive 2015/863/EU.



This flow meter 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.



This flow meter complies with the requirements of the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU.

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Safety Information

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General Information

The Precision Gas Flow Meter (5067-0223) conforms to the International Electrochemical Commission (IEC) 61010–1 safety standard.

It also conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):

CISPR 11/EN 55011: Group 1, Class A

IEC/EN 61326-1

AUS/NZ 

This ISM device complies with Canadian ICES-001(A). Cet appareil ISM est conforme a la norme NMB-001(A) du Canada.



The Precision Gas Flow Meter is designed and manufactured under a quality system registered to ISO 9001.

The Agilent Technologies Precision Gas Flow Meter meets the following IEC classifications: Category II, Pollution Degree 2, Class III.

Precision Gas Flow Meter has been designed and tested in accordance with recognized safety standards and is designed for use indoors. If it is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired. Whenever the safety protection of the Precision Gas Flow Meter has been compromised, disconnect it from all power sources and secure it against unintended operation.

Refer servicing to qualified service personnel. Substituting parts or performing any unauthorized modification to the instrument may result in a safety hazard.

Electromagnetic compatibility

This device complies with the requirements of CISPR 11. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.



If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try one or more of the following measures:

- Relocate the radio or antenna.
- Move the device away from the radio or television.
- Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.
- Make sure that all peripheral devices are also certified.
- Make sure that appropriate cables are used to connect the device to peripheral equipment.
- Consult your equipment dealer, Agilent Technologies, or an experienced technician for assistance.
- Changes or modifications not expressly approved by Agilent Technologies could void the user's authority to operate the equipment.

Symbols

Warnings in the manual or on the instrument must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions violates safety standards of design and the intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements. Table 1 lists the safety symbols that may appear.

Table 1 Safety symbols.

Description	Symbol
See accompanying instructions for more information.	
Indicates that you must not discard this electrical / electronic product in domestic household waste.	

Important Safety Warnings

Safety cautions and warnings must be observed during all phases of operation, service, and repair of Precision Gas Flow Meter. Failure to comply with these precautions violates safety standards of design and intended use. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

- The safe charging temperature range is 0–45 °C (32–113 °F). If internal sensors detect temperatures outside of this range, the battery will not charge.
 - Use only a 5V DC, 1.5A USB power source and the supplied USB cable to charge this device.
 - Do not disassemble this device or attempt to replace the battery. This device can only be serviced by authorized Agilent personnel.
 - Read all instructions prior to operation. Any personnel that operate or install this instrument must be trained and qualified.
 - This device is capable of measuring hazardous gases such as acetylene and carbon monoxide. Mishandling of these gases may create a risk of fire, explosion, asphyxiation, or poisoning, even if used within the ratings of the device. The safety of any system incorporating this equipment is the responsibility of the assembler of that system. Ensure that appropriate ventilation and monitoring systems are in place to protect personnel and equipment. Always leak check any system intended to contain a hazardous gas before operation. Do not use this device in ATEX/IECEx classified hazardous locations.
 - Operating this device under conditions which exceed the specifications noted in the manual or specification sheet could lead to equipment damage or injury.
 - Do not attempt to disconnect this device from any system which has been pressurized without independently confirming that all pressure has been safely released and that any hazardous gases which remain in that system have been purged.
-

AVERTISSEMENT

- La plage sûre de températures de charge est de 0 à 45 °C (32–113 °F). Si des capteurs internes détectent des températures en dehors de cette plage, la batterie ne chargera pas.
 - Utilisez uniquement une source d'alimentation USB 5v CC, 1,5 A et le câble USB fourni pour recharger cet appareil.
 - Ne démontez pas cet appareil et n'essayez pas de remplacer la batterie. L'entretien de cet appareil peut uniquement être effectué par un personnel d'Agilent autorisé.
 - Lisez toutes les instructions avant utilisation. Le personnel qui utilise ou installe cet instrument doit être formé et qualifié.
 - Cet appareil peut mesurer des gaz dangereux tels que l'acétylène et le monoxyde de carbone. Une mauvaise manipulation de ces gaz peut créer un risque d'incendie, d'explosion, d'asphyxie ou d'empoisonnement, même s'ils sont utilisés dans les caractéristiques nominales de l'appareil. La sécurité de tout système incorporant cet équipement relève de la responsabilité de l'assembleur de ce système. Assurez-vous que des systèmes de ventilation et de surveillance appropriés soient en place afin de protéger le personnel et l'équipement. Avant utilisation, vérifiez toujours les fuites de n'importe quel circuit destiné à contenir un gaz dangereux. N'utilisez pas cet appareil dans des zones dangereuses classées ATEX/IECEx.
 - L'utilisation de cet appareil dans des conditions qui dépassent les spécifications notées dans le manuel ou la fiche technique peut entraîner des dommages matériels ou des blessures.
 - N'essayez pas de déconnecter cet appareil d'un circuit qui a été pressurisé sans confirmer de manière indépendante que toute la pression ait été libérée en toute sécurité et que tous les gaz dangereux restant dans ce circuit aient été purgés.
-

AVVERTENZA

- L'intervallo di temperatura più appropriato per la ricarica è compreso tra 0 e 45 °C (32–113 °F). Qualora i sensori interni rilevassero temperature al di fuori di questo intervallo, la batteria non si ricaricherà.
 - Utilizzare esclusivamente un'alimentazione USB pari a 5v CC, 1,5A e il relativo cavo USB fornito per ricaricare il presente dispositivo.
 - Non smontare il dispositivo o tentare di sostituire la batteria. La manutenzione di tale dispositivo può essere effettuata soltanto dal personale Agilent.
 - Leggere tutte le istruzioni prima del funzionamento. Tutto il personale che aziona o installa questo strumento deve essere addestrato e qualificato.
 - Questo dispositivo può misurare gas pericolosi come acetilene e monossido di carbonio. L'uso improprio di questi gas può creare un rischio di incendio, esplosione, asfissia o avvelenamento, anche se utilizzato entro i valori nominali del dispositivo. La sicurezza di qualsiasi sistema che incorpora questa apparecchiatura è responsabilità dell'assemblatore del sistema stesso. Assicurarsi che siano in funzione sistemi di ventilazione e monitoraggio appropriati per proteggere il personale e le apparecchiature. Controllare sempre le perdite di qualsiasi sistema destinato a contenere un gas pericoloso prima del funzionamento. Non utilizzare questo dispositivo in aree pericolose classificate ATEX/IECEx.
 - L'utilizzo di questo dispositivo in condizioni che non rientrano nelle specifiche indicate nel manuale o nella scheda tecnica potrebbe causare danni alle apparecchiature o infortuni.
 - Non tentare di scollegare questo dispositivo da qualsiasi sistema pressurizzato senza verificare in modo indipendente che tutta la pressione sia stata scaricata in modo sicuro e che qualsiasi gas pericoloso rimasto in tale sistema sia stato scaricato.
-

WARNUNG

- Der sichere Ladetemperaturbereich liegt bei 0–45 °C (32–113 °F). Wenn die internen Sensoren ermitteln, dass die Temperatur außerhalb dieses Bereichs liegt, wird der Akku nicht aufgeladen.
- Verwenden Sie zum Laden dieses Geräts nur eine USB-Stromversorgung mit 5 V DC und 1,5 A sowie das mitgelieferte USB-Kabel.
- Versuchen Sie nicht, dieses Gerät auseinanderzunehmen oder den Akku zu wechseln. Dieses Gerät kann nur von autorisiertem Agilent Personal gewartet werden.
- Lesen Sie vor dem Betrieb alle Anweisungen. Personen, die dieses Instrument bedienen oder installieren, müssen entsprechend geschult und qualifiziert sein.
- Dieses Gerät kann gefährliche Gase wie Azetylen und Kohlenmonoxid messen. Ein unsachgemäßer Umgang mit diesen Gasen kann zu einem Brand, einer Explosion, Erstickung oder Vergiftung führen, selbst wenn sie innerhalb der Nennwerte des Geräts verwendet werden. Die Sicherheit jedes Systems, das diese Ausrüstung enthält, liegt in der Verantwortung des Montagearbeiters dieses Systems. Stellen Sie sicher, dass geeignete Belüftungs- und Überwachungssysteme zum Schutz von Personal und Ausrüstung vorhanden sind. Überprüfen Sie vor dem Betrieb stets alle Systeme, die gefährliche Gase enthalten sollen, auf Undichtigkeiten. Verwenden Sie dieses Gerät nicht in explosionsgefährdeten Bereichen der ATEX-/IECEx-Klasse.
- Der Betrieb dieses Geräts unter Bedingungen, die die im Handbuch oder im Datenblatt angegebenen Spezifikationen überschreiten, kann zu Schäden am Gerät oder Verletzungen führen.
- Versuchen Sie nicht, dieses Gerät von einem druckbeaufschlagten System zu trennen, ohne unabhängig davon zu überprüfen, dass der gesamte Druck sicher abgelassen wurde und dass alle in diesem System verbleibenden gefährlichen Gase gereinigt wurden.

ADVERTENCIA

- El rango de temperatura para una carga segura se sitúa entre 0 y 45 °C (32–113 °F). Si los sensores internos detectan temperaturas fuera de dicho rango, la batería no se cargará.
- Para cargar este dispositivo, use solamente una fuente de energía USB de 1,5 A a 5 V DC y el cable USB suministrado.
- No desmonte este dispositivo o trate de sustituir la batería. El mantenimiento o la reparación de este dispositivo solo puede ser llevado a cabo por personal autorizado por Agilent.
- Lea completamente las instrucciones antes de operar. Este instrumento solo debe ser operado o instalado por personal formado y cualificado.
- Este dispositivo puede medir gases peligrosos como el acetileno y el monóxido de carbono. La manipulación incorrecta de estos gases puede provocar un riesgo de incendio, explosión, asfixia o intoxicación, incluso si se usan dentro de las proporciones del dispositivo. La seguridad de cualquier sistema que incorpore estos equipos es responsabilidad del montador de dicho sistema. Asegúrese de que existen sistemas de ventilación y control adecuados para proteger al personal y al equipo. Compruebe siempre las fugas de cualquier sistema destinado a contener un gas peligroso antes de su funcionamiento. No utilice este dispositivo en lugares peligrosos clasificados como ATEX/IECEx.
- El uso de este dispositivo en condiciones que superen las especificaciones indicadas en el manual o en la hoja de especificaciones podría provocar daños al equipo o lesiones.
- No intente desconectar este dispositivo de ningún sistema que haya sido presurizado sin confirmar de forma independiente que toda la presión ha sido liberada de forma segura y que cualquier gas peligroso que permanezca en ese sistema ha sido purgado.

警告

- 安全に充電できる温度範囲は 0 ~ 45 °C です。内部温度センサーにより範囲外の温度が検出されるとバッテリーは充電されません。
- 付属の USB ケーブルを使用し、必ず DC 5 V、1.5 A の USB 電源に接続して充電してください。
- バッテリーを交換するためにデバイスを分解しないでください。このデバイスのサービスが許可されているのはアジレントの認定エンジニアのみです。
- 操作を行う前にすべての内容をお読みください。この機器の設置および操作は適切な訓練を受け操作について熟知している担当者のみが行ってください。
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- 本書または仕様書に記載されている仕様の範囲外の条件でこのデバイスの操作を行うと機器の破損や人身への障害を招くおそれがあります。
- 加圧されたシステムからこのデバイスを切り離すときは、すべての加圧部が安全に減圧されていることを個別に確認し、システムに残存している可能性のある有害ガスがすべて排気されていることを、必ず確認してください。

警告

- 安全充電温度范围为 0–45 °C (32–113 °F)。如果内部传感器检测温度超出此范围，电池将不会充电。
- 只能使用 5v DC，1.5A USB 电源和提供的 USB 线对此设备充电。
- 不要拆解此设备或尝试更换电池。此设备只能由 Agilent 授权的人员进行维修。
- 操作之前请先阅读所有说明。任何操作或安装此仪器的人员都必须经过培训并获得资格。
- 该设备可以测量乙炔和一氧化碳等有害气体。即使在设备的额定值范围内使用这些气体，处理不当也可能造成火灾、爆炸、窒息或中毒的风险。包含该设备的任何系统的安全性由该系统的组装商负责。确保适当的通风和监控系统到位，以保护人员和设备。在操作之前，务必检查任何打算使用危险气体的系统。请勿在 ATEX/IECEX 分类的危险场所使用此设备。
- 如果不遵守手册或规范表中的操作规范，可能会导致设备损坏或人身伤亡。
- 必须单独确认所有压力已安全释放且系统中残留的任何危险气体已被吹扫干净，否则请勿尝试将本设备与任何已加压系统断开连接。

AVISO

- A faixa de temperatura para carregamento seguro é de 0–45 ° C (32–113 ° F). Se os sensores internos detectarem temperaturas fora dessa faixa, a bateria não carregará.
- Use apenas uma fonte de alimentação USB 5V DC, 1,5A e o cabo USB fornecido para carregar este dispositivo.
- Não desmonte este dispositivo nem tente substituir a bateria. Este dispositivo só pode ser reparado por pessoal autorizado da Agilent.
- Leia todas as instruções antes da operação. Qualquer pessoa que opere ou instale este instrumento deve ser treinado e qualificado.
- Este dispositivo pode medir gases perigosos, como acetileno e monóxido de carbono. O manuseio incorreto desses gases pode criar risco de incêndio, explosão, asfixia ou envenenamento, mesmo se usados dentro das classificações do dispositivo. A segurança de qualquer sistema que incorpore este equipamento é de responsabilidade do montador desse sistema. Certifique-se de que os sistemas de ventilação e monitoramento adequados estejam instalados para proteger as pessoas e o equipamento. Sempre verifique se há vazamentos em qualquer sistema que contenha gases perigosos antes da operação. Não use este dispositivo em locais perigosos classificados na ATEX/IECEX.
- Operar este dispositivo em condições que excedam as especificações observadas no manual ou na folha de especificações pode causar danos ao equipamento ou ferimentos.
- Não tente desconectar este dispositivo de qualquer sistema que tenha sido pressurizado sem confirmar de forma independente que toda a pressão foi liberada com segurança e que todos os gases perigosos que permaneceram naquele sistema foram purgados.

ПРЕДУПРЕЖДЕНИЕ

- Диапазон безопасной температуры зарядки составляет 0–45 ° C (32–113 ° F). Если внутренние датчики обнаруживают температуру за пределами этого диапазона, аккумулятор не будет заряжаться.
- Для зарядки устройства используйте прилагаемый кабель USB и источник постоянного тока 5 В, 1.5 А.
- Не разбирайте это устройство и не пытайтесь заменить аккумулятор. Это устройство может обслуживать только уполномоченный персонал Agilent.
- Перед началом работы прочтите все инструкции. Любой персонал, который работает или устанавливает этот прибор, должен быть обучен и квалифицирован.
- Это устройство может измерять опасные газы, такие как ацетилен и окись углерода. Неправильное обращение с этими газами может создать риск возгорания, взрыва, удушья или отравления, даже если они используются в пределах номинальных характеристик устройства. Ответственность за безопасность любой системы, включающей это оборудование, несет сборщик этой системы. Убедитесь, что имеются соответствующие системы вентиляции и мониторинга для защиты персонала и оборудования. Перед работой всегда проверяйте герметичность любой системы, предназначенной для содержания опасного газа. Не используйте это устройство в опасных зонах, классифицированных ATEX / IECEx.
- Эксплуатация этого устройства в условиях, выходящих за пределы технических характеристик, указанных в руководстве или листе технических характеристик, может привести к повреждению оборудования или травмам.
- Не пытайтесь отсоединить это устройство от любой системы, находящейся под давлением, без независимого подтверждения того, что все давление было безопасно сброшено, и что все опасные газы, оставшиеся в этой системе, были удалены.

Sound emission certification for Federal Republic of Germany

- Sound pressure – $L_p < 70$ dB am according to DIN EN ISO 7779.
- Schalldruckpegel – $LP < 70$ dB am nach DIN EN ISO 7779.

Recycling the Product

For recycling, contact your local Agilent sales office.

Introduction

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Intended Use

The Agilent Precision Gas Flowmeter is a hand-held, battery powered, multivariate flow meter and is designed for use with GC instruments in laboratory and field settings. This product is not designed for use in hazardous locations or as a safety device.

Your new flow meter has a variety of innovative features:

- 1 High-accuracy performance for all your gases. Use your flow meter with any of the 98 or more gases that are part of **"Gas Select"** on page 42.
- 2 1,000 readings per second ensures high resolution data, **page 31**.
- 3 Monitor pressure and temperature during flow measurement. View internal stream absolute pressure and temperature, **page 19**.
- 4 Backlit display with adjustable contrast is easy to read in direct sunlight. In dimly lit areas, press the large center button to turn on the backlight, **page 19**.
- 5 Change your STP to match any standard temperature and pressure reference, **page 49**.
- 6 Log data to your PC. Talk to the flow meter serially to capture all flow data for logging and analysis, **page 56**.

This manual covers the Precision Gas Flow Meter (5067-0223).

Quick Start Guide

Setup

- 1 Connect your flow meter. Ensure that flow through your device will be in the same direction as the arrow on the flow body (usually left to right).
- 2 Tare your flow meter. Before you connect the flow meter, ensure that no gas is flowing through the device and select **TARE FLOW** from the Main Display.
- 3 Choose your engineering units. Press the button above or below any parameter to enlarge it in the middle of the display. If you select that same item a second time, you can change the engineering unit for that parameter. You can choose units for all of the parameters at once by selecting **MENU/BASIC CONFIG/DEVICE UNITS**.

Operation: flow verification

- 1 Monitor live flow readings. You can monitor live readings of flow, pressure and temperature by viewing the screen. Readings are updated in real time. See [“Collecting Live Flow Data”](#) on page 31.
- 2 Tare your flow meter before you begin another round of measurements. Ensure that no flow is passing through your meter, and select **TARE FLOW**. See [“Taring your flow meter”](#) on page 36.
- 3 (Optional) Capture a totalized reading. The totalizer option displays the total flow that has passed through the device since the last time the totalizer was reset. Press **TOTAL/MENU** to access the totalizer. See [“Collecting Totalized Flow Data”](#) on page 34.

Backlight

The monochrome display comes equipped with a backlight. To toggle its power, press the bottom-center button on the front of your device.

Product specifications

Table 2 Agilent Precision Gas Flow Meter specifications.

Parameter	Value
Flow Range	0 to 500 SCCM
Accuracy	±0.6% of reading or ±0.1% of full scale, whichever is greater
Operating Temperature	-10 to 60 °C
Storage Temperature	-10 to 60 °C
Humidity Range	0 to 95%, non-condensing
Display	160 by 128 pixels, monochrome LCD screen
Ingress Protection	IP40
Wetted Materials	302, 303, 304, and 316L stainless steel; FKM, alumina ceramic, glass, gold, heat-cured epoxy, heat-cured silicone rubber, polyamide, silicon

Maintenance and care

- 1 Flow meters will require no periodic cleaning for clean gases. Read more on **“Cleaning”** on page 71.
- 2 Calibrate your flow meter annually.

Getting Started

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Getting to Know Your Mass Flow Meter

Connectors and buttons

The drawings below represent typical configurations of a standard battery-powered mass flow meter.

Flow meter display

Figure 1 identifies the various features of the flow meter display. Press the large button to toggle the backlight on and off. For more details, see **"Main Menu"** on page 30 and the menu-by-menu descriptions on the pages that follow.

Engineering units are used by the meter in its serial communications and calculations. These can be different from button units, which are the units being displayed. These are individually configurable. See **"Choosing Engineering Units"** on page 32.

- 1 Highlights pressure in the center of the meter. Push a second time to choose the pressure parameter (if available), or to select pressure engineering units.
- 2 Highlights temperature. Push a second time to select temperature engineering units.
- 3 TARE FLOW tare the flow rate (see **"Taring flow"** on page 37).
- 4 Highlights volumetric (actual) flow rate. Push a second time to select volumetric flow rate engineering units.
- 5 Highlights mass flow rate. Push a second time to select mass flow (normal mass flow) or true mass flow engineering units.
- 6 **TOTAL/MENU** Accesses the optional flow totalizer (**"Totalizer"** on page 34). **MENU** enters the Menu system (**"Menu"** on page 36).
- 7 Toggles the backlight flow totalizer (**"Totalizer"** on page 34).

Status messages

Status messages are shown to the right of the main readout number, in the example above as OVR.

Table 3 Status messages.

Code	Description
ADC	Analog-digital converter error
LCK	Front display is locked
OVR	Totalizer rolled over to zero
POV	Pressure over range of device
MOV	Mass flow over range of device
TMF	Totalizer missed out of range flow
TOV	Temperature over range of device
VOV	Volumetric flow over range of device

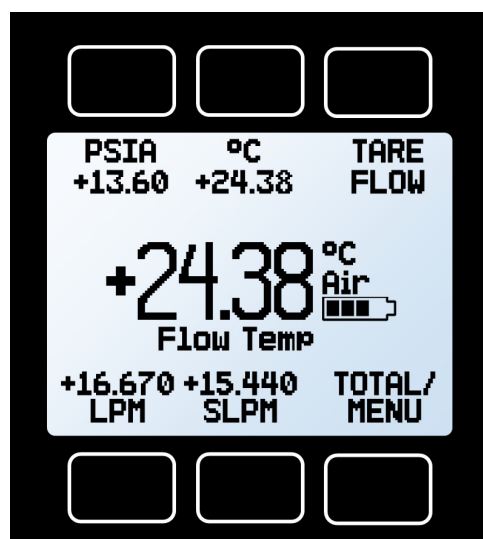


Figure 1 The flow meter display.

Charging Your Portable Flow Meter

If you purchased a portable meter, it comes fully charged from the factory, so it can be used right away. Typical battery life of a fully-charged battery is 18 hours with a monochrome display when the backlight is set to 10. Dimming the backlight will increase battery life.

The battery indicator on the right side of the Main Display reflects the relative battery level. When the battery indicator is completely empty, approximately 15 minutes of battery life remains. Please charge the flow meter as soon as possible to maintain full device performance.

Charge the meter using the supplied USB cable (micro-B to type A). You may charge the flow meter using a standard 5V USB outlet on a computer or portable power supply.

The red indicator LED on top of the device lights up red to indicate that the unit is charging. The red LED turns off when the battery is charged.

Your flow meter 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 (see [Figure 2](#)). If the battery has been fully depleted, you may need to charge the flow meter for a full minute before the device can be turned on.

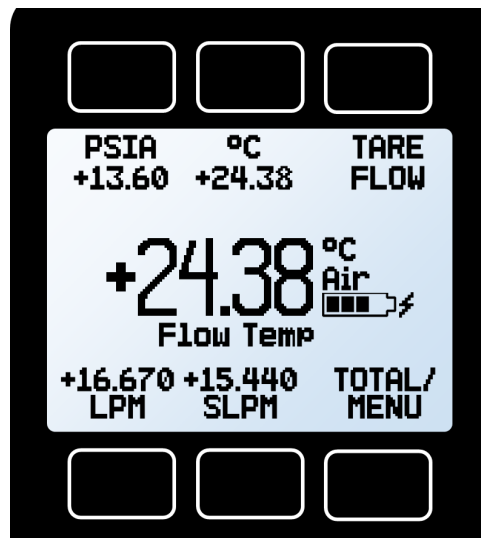


Figure 2 Charging flow meter display.

Mounting

No straight runs of pipe are required upstream or downstream of the meter. For most flow meters, you can mount or hold the meter in any position, because it is internally compensated for any changes to its orientation during use. Your flow meter is also minimally affected by vibrations, so you can rest it on top of a vibrating instrument with little impact to measurement accuracy.

Device Ports

Your flow meter has been shipped with plastic plugs fitted into its ports. To lessen the chance of contaminating the flow stream, do not remove these plugs until you are ready to install the device.

Standard gas flow meters have female inlet and outlet ports.

- 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, as these compounds can cause permanent damage to the meter should they get into the flow stream.

Filters

When pressure drop is not an issue, use inline sintered filters to prevent large particulates from entering the flow meter. Suggested maximum particulate size is 20 microns.

Connecting Your Gas Flow Meter

Your flow meter can measure flow generated by positive pressure and suction. Connect the meter so that the flow travels in the same direction as the flow arrow, usually from left to right as you look at the front of the device.

Max Common Mode Pressure	Max Differential Pressure
175 psia	75 psid

CAUTION

Confirm that your process is compatible with all the wetted materials listed in the product specification section.

Navigation and Customization

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Flow Meter Menu Outline

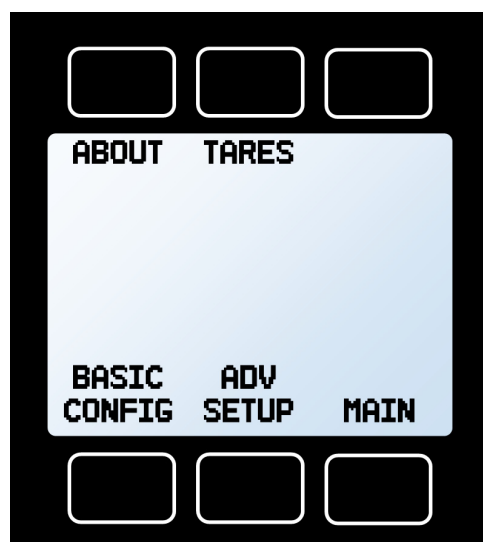


Figure 3 The main menu.

Main Menu

Accessible from **MENU** on the Main Display, see **Figure 3**.

About (**page 38**)

- Device information
- Device state
- Manufacturer information

Tares (**page 36**)

- Tare flow

Basic config (**page 40**)

- Gas configuration
- Gas categories and gases
- COMPOSER mix creation and management
- Device units
- Mass flow
- Volumetric flow
- Pressure
- Temperature
- STP/NTP

Advanced setup (**page 51**)

- Sensor setup
- Display as zero (zero band)
- Significant digits
- Flow and pressure averaging
- Communication setup
- Unit ID
- Baud
- Display setup
- LCD contrast
- Power-up light
- Display rotation

Main display (**page 31**)

Collecting Live Flow Data

The Main Display has two primary functions:

- Collecting live temperature, pressure, and flow data
- Changing engineering units for temperature, pressure, and flow ([Changing the engineering units](#) on page 32)

This screen displays live data for all flow parameters simultaneously. Live data is measured 1,000 times per second and typically displayed 10 times per second on the device LCD screen. Press the button next to any of the four flow parameters once 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 ([Choosing Engineering Units](#) on page 32).

Main display

- 1 Highlights pressure in the center of the meter. Push a second time to select engineering units or the pressure parameter:
 - Internal absolute pressure
- 2 Highlights temperature.
- 3 Push a second time to select temperature engineering units.
- 4 **TARE FLOW** Tares the flow rate (see [page 36](#)).
- 5 Highlights volumetric (actual) flow rate. Push a second time to select volumetric flow rate engineering units.
- 6 Highlights mass flow rate. Push a second time to select mass flow engineering units and switch between standardized, normalized, and true mass flow.
- 7 **TOTAL** Accesses flow totalizer ([page 34](#)). **MENU** enters the Menu system ([page 36](#)).

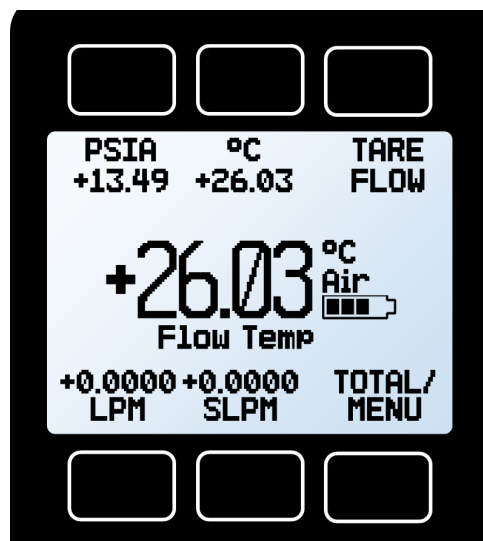


Figure 4 The main display.

Choosing Engineering Units

Press the button adjacent to any of the four measurement 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:

Select **Set button eng units** and press **SELECT** to change the engineering unit on the display only. This does not alter the flow meter data frame.

Device engineering units alter both the display and the flow meter 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 revert the button to the current device unit for that parameter. Enter the unit selection menu again to change the device engineering unit.

NOTE

The totalizer's set flow variable (mass flow or volumetric flow) cannot be altered directly. Please contact support at <https://www.agilent.com/en-us/contact-us/page> if you wish to change your totalizer from mass flow to volumetric, or vice-versa.

Changing the engineering units

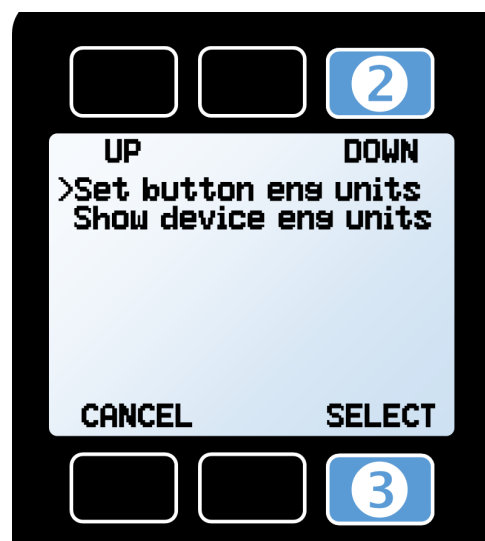


Figure 5 Engineering unit screen.

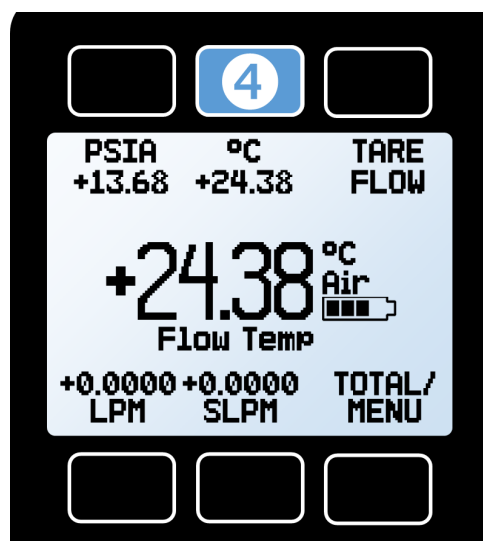


Figure 6 Main display.

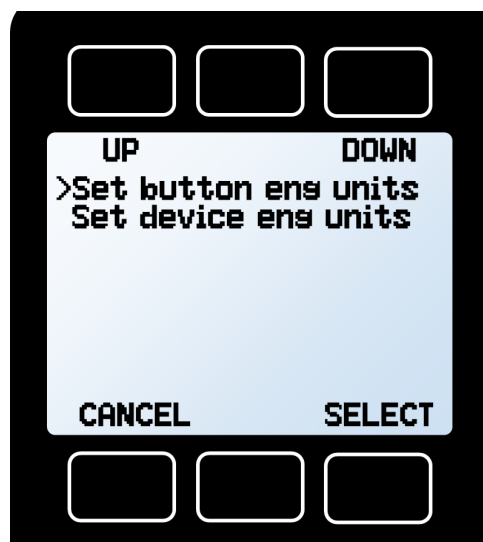


Figure 7 Engineering unit selection.

Collecting Totalized Flow Data

Your flow meter may have been purchased with a flow totalizer. This displays the total amount of mass or volume that has flowed through the instrument since its last reset, like a gasoline pump. You can access the totalizer screen by pressing **TOTAL/MENU** on the Main Display.

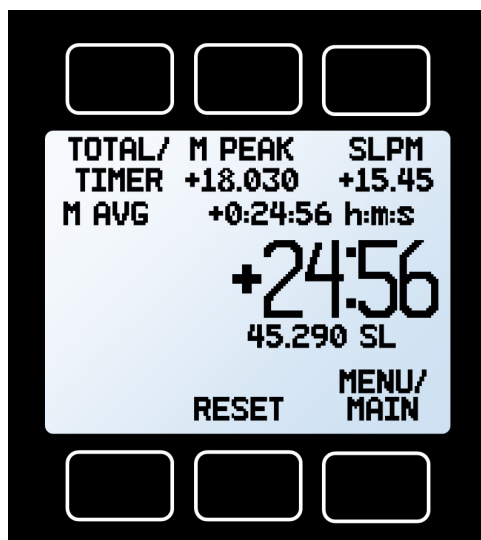


Figure 8 Totalizer with elapsed time.

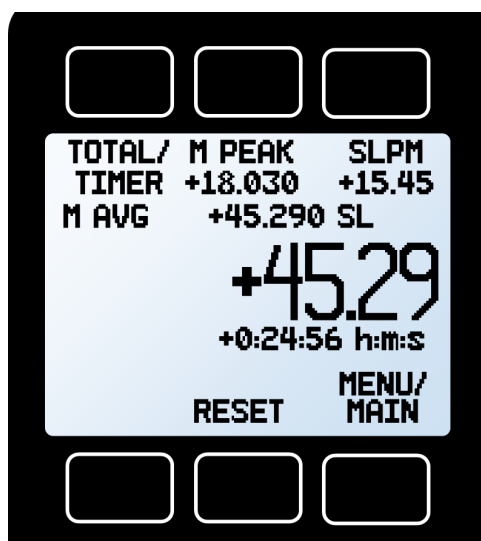


Figure 9 Totalizer with totaled flow.

Totalizer

- 1 **TOTAL/TIMER** toggles between totalized flow and elapsed time as the parameter highlighted in the center
- 2 **M PEAK** or **V PEAK** displays the maximum flow rate since the last reset. Press to select engineering units.

- 3 Displays live flow rate. Press to select engineering units.
- 4 **RESET** clears all totalized data and immediately resets the timer to 0. Totalization of flow data continues immediately.
- 5 **MENU/MAIN** enters the menu system ([page 36](#)). From there, press **MAIN** to exit to the Main Display of live data.
- 6 **M AVG**: Shows optional totalizer averaging, which displays average flow rate since last reset, updated live.
- 7 Main display shows either time since reset, or totalized flow.

Totalizer rollover functions

Your flow totalizer has been configured to report a maximum of seven digits. By default, the placement of the decimal is the same as the live flow rate. The totalizer can be configured at the time of order for the following behaviors.

- Rollover (default): Totalizer resumes counting from 0 as soon as the maximum count has been reached.
- Freeze: Totalizer stops counting at max count, until it is reset manually.
- Error: Displays OVR status message when maximum count has been reached; compatible with Rollover and Freeze.

The time counter has a maximum value of 9999:59:59 (h:m:s) (416 days, 16 hours). If flow is still being totalized at that point, the timer freezes, regardless of totalized flow settings.

Menu

You can enter the menu system by pressing the **MENU** button from the Main Display.

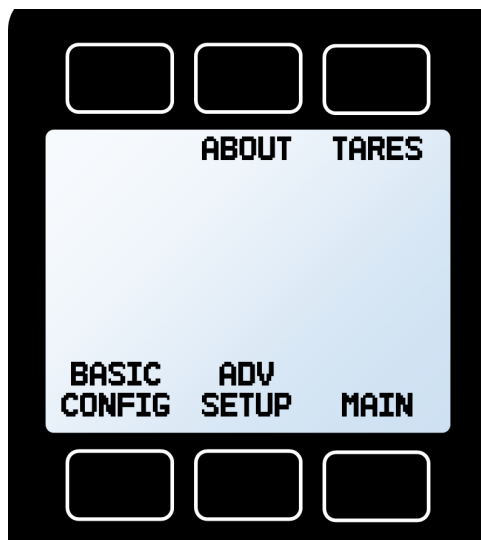


Figure 10 Main menu.

About ([page 38](#)), **Tares** ([page 36](#)), **Basic Config** ([page 40](#)), and **Adv Setup** ([page 51](#)) enter their respective menus.

Main exits to the Main Display ([page 31](#)).

Taring your flow meter

Taring is an important practice that ensures that your flow meter is providing the most accurate measurements possible. This function gives the flow meter a good zero reference for flow measurements. Taring pressure can be used to align the internal absolute pressure sensor with the barometric pressure reading.

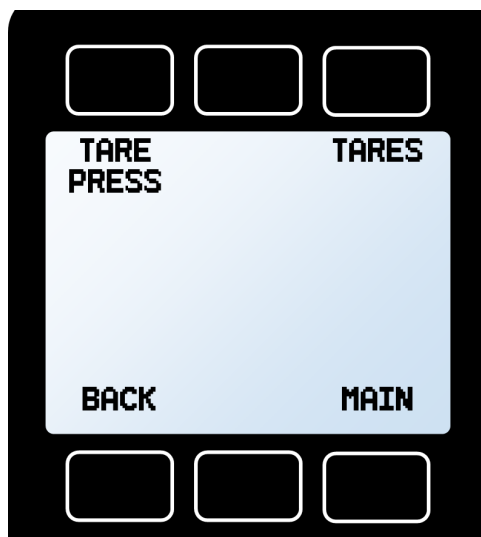


Figure 11 Tare menu.

How to tare

First, ensure that nothing is flowing through the device.

Taring flow

MENU/TARES/TARE FLOW. Flow tares should occur at the expected process pressure, as long as there is no flow. A message, **“ENSURE NO FLOW BEFORE PRESSING TARE”** will be displayed.

Press **TARE** to complete the taring process.

When to tare

- Before every new flow measurement cycle
- After significant changes in temperature or pressure
- After dropping or bumping the flow meter
- After installing the meter in a different orientation

Device Info

If you run into trouble using your flow meter, the **ABOUT** menu contains information that can make the troubleshooting process easier. Select **MFG INFO** to look up the manufacturer 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 calibration technician.

NOTE

The **MFG INFO** screen can be used to find contact information to troubleshoot or set up the device.

Menu/About

- **DEVICE INFO**, displays serial number, firmware revision, and calibration information
- **DEVICE STATE** displays diagnostic information for troubleshooting ([page 38](#))
- **MFG INFO** displays contact information
- **BACK** returns to the top-level menu ([page 36](#))
- **MAIN** exits to the Main Display ([page 31](#))

Menu/About/Device State

Diagnostic Information

The **DEVICE STATE** screen displays live values for the internal device registers. Many of these values can help an 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.

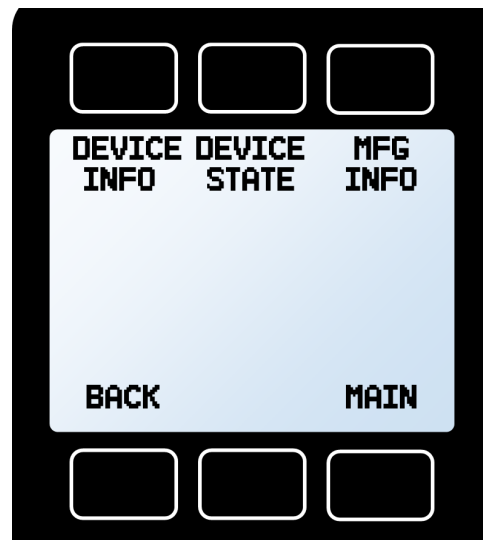


Figure 12 The about (device info) screen.

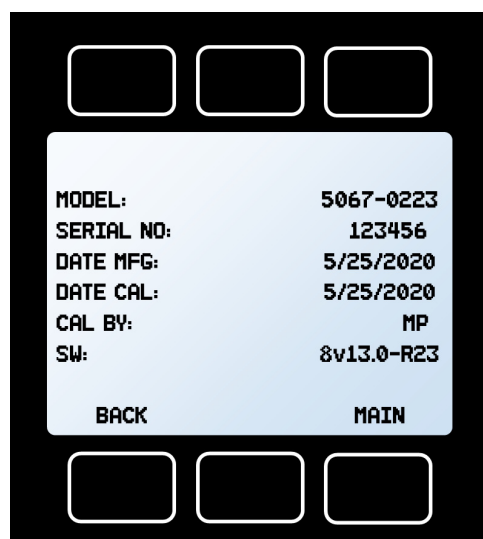


Figure 13 Device info screen.

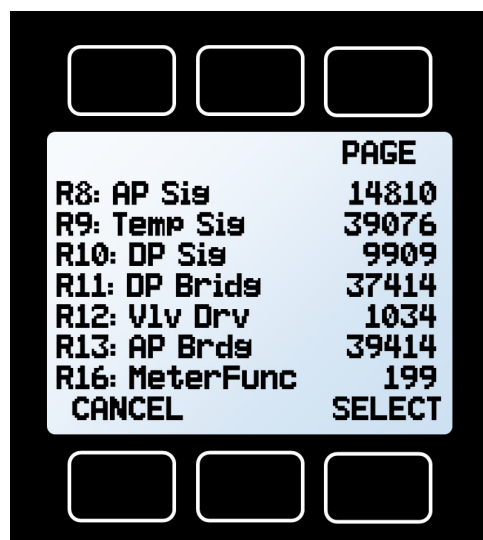


Figure 14 Device state screen.

Basic Configuration Menu

The Basic Configuration Menu contains options for choosing the gas calibration, device engineering units and **STP/NTP** mass flow references.

Menu/Basic Configuration

- **GAS** enters Gas Select and COMPOSER menus ([page 42](#)). The currently-selected gas is displayed below the button.
- **DEVICE UNITS** changes device engineering units for any parameter: flow (mass, volumetric), pressure, temperature, and totalizers (volume, mass and time).
- **STP/NTP** defines standard (STP) and normal (NTP) temperature and pressure conditions ([page 49](#)).
- **BACK** returns to the top-level Menu ([page 30](#)).
- **MAIN** exits to the Main Display ([page 31](#)).

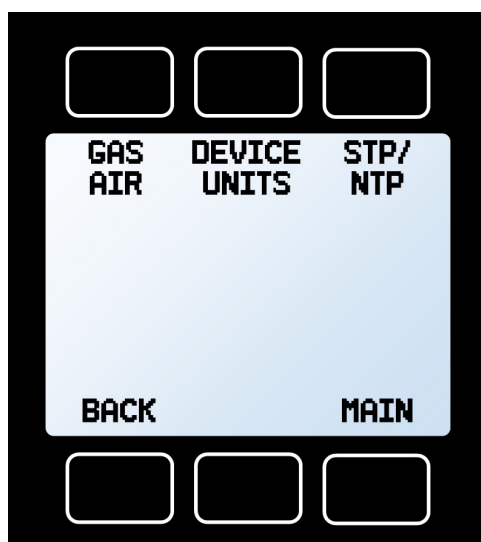


Figure 15 The basic configuration menu.

Choosing 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 select your desired engineering unit, confirming the change on the last screen. If your meter has been configured with a flow totalizer, this screen will also include units for totalized volumetric and mass flow, plus elapsed time.

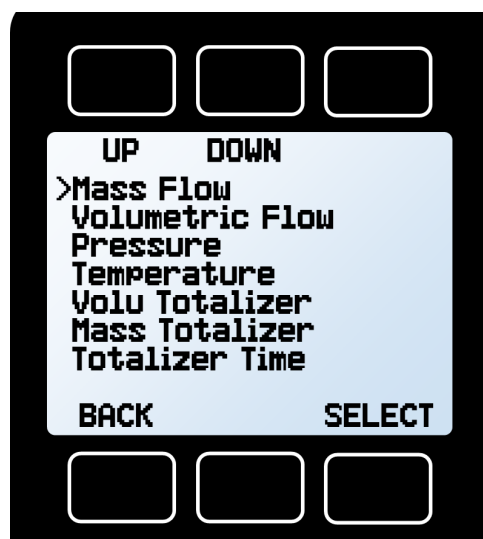


Figure 16 Choosing device units.

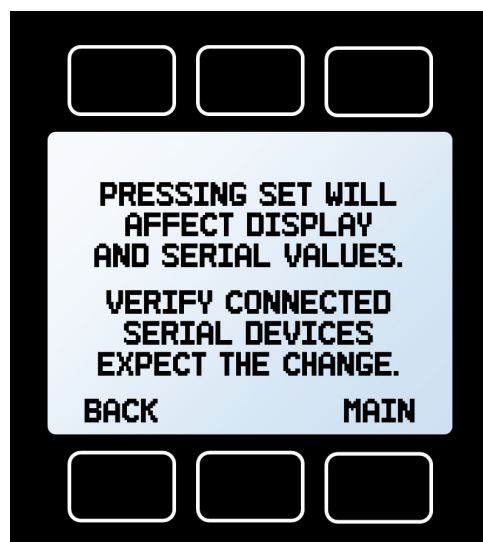


Figure 17 Confirming a unit change.

Gas Select

In most cases, your flow meter was physically calibrated on air at the factory. Gas Select allows you to reconfigure the flow meter to flow a different gas without sending it back 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 flow meter will reconfigure its calculations to flow your chosen gas. There is no need to restart the flow meter.

Your current gas selection appears just below the unit's indicator on the right side of the **Main Display, Menu/Basic Config/Gas**. In **Figure 18**, the gas is set to nitrogen gas (N₂).

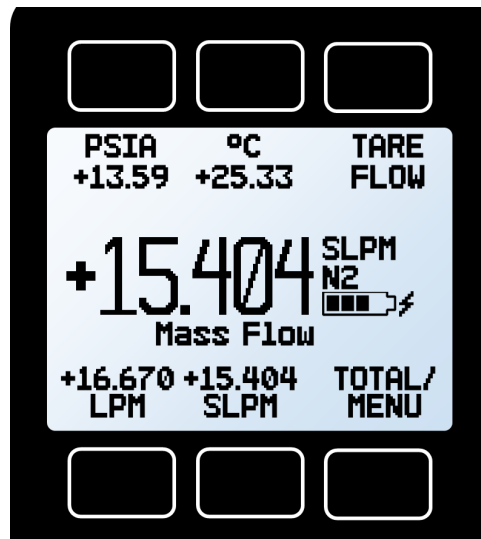


Figure 18 A meter set to measure N₂.

Category and gas listings controls

- **UP/DOWN** moves the selection arrow up or down the listing of gas categories (**Figure 19**) or gases (**Figure 20**).
- **PAGE** advances the view to the next page of categories.
- **BACK** returns to the Basic Configuration Menu (**page 40**).
- **SELECT** (in **Figure 19**) opens a list of gases in that category.
- **SET** (in **Figure 20**) immediately loads the gas measurement properties and exits to the Main Display (**page 31**).

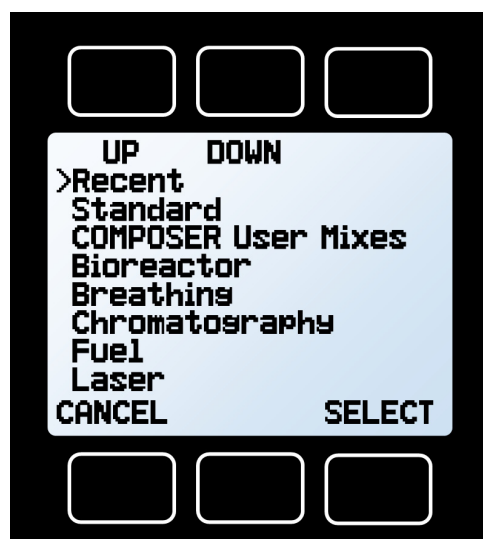


Figure 19 Category listing menu.

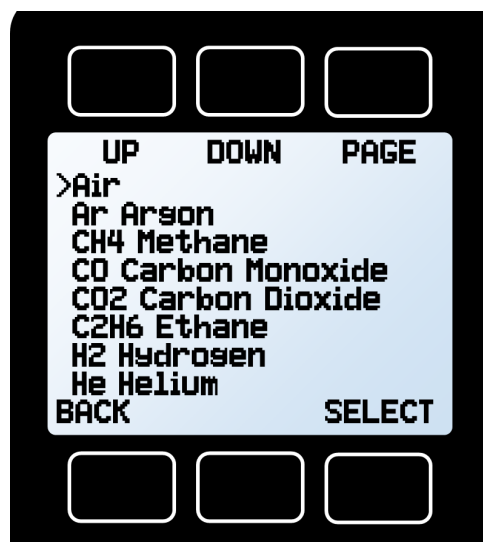


Figure 20 Gas listing menu.

Using COMPOSER to personalize mixed gas compositions

To remain accurate, your flow meter needs to know the viscosity of the gas you are flowing through it. The more closely you can define your actual gas composition, the more accurate your flow readings will be. COMPOSER is an included feature of Gas Select that lets you define new mixed gas compositions to reconfigure your flow meter on the fly.

COMPOSER uses the Wilke's semi-empirical 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 flow meter.

NOTE

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

Menu/Basic Config/Gas/COMPOSER User Mixes

- 1 To access COMPOSER, select **COMPOSER User Mixes** from the Gas Select category listing (for more information on the category listing, see [page 42](#)).
- 2 Select any existing mix to reconfigure your flow meter to measure that gas mixture.
- 3 Select **Delete Mix** to permanently remove a gas mix.
- 4 Press **SET** to confirm your selection. The setting will be applied immediately, and exit to the Main Display ([page 31](#)). Otherwise, **CANCEL** will return to the Gas Select Menu.

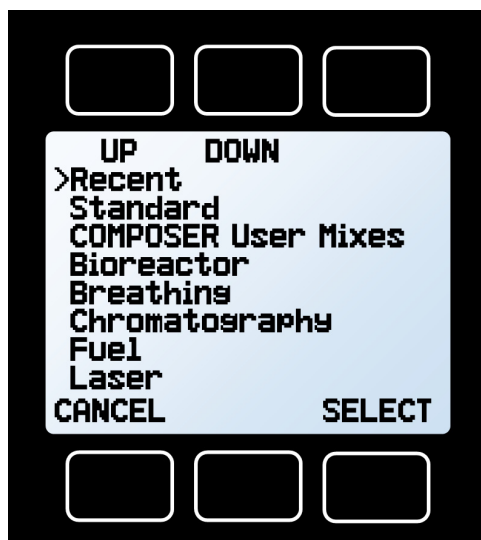


Figure 21 Category listing menu.

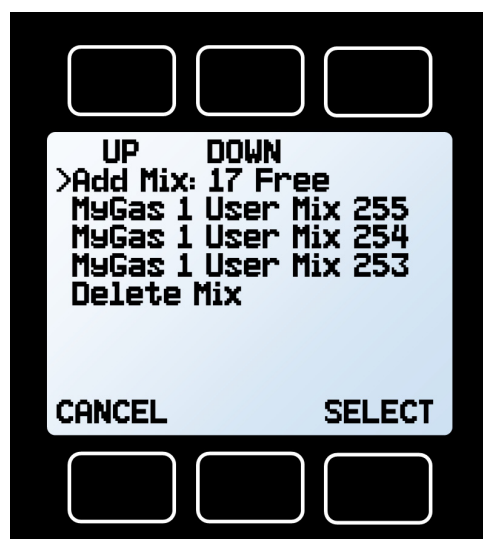


Figure 22 Existing mixes list.

Navigating and Customizing Your Flow Meter

Creating gas compositions in COMPOSER

Create your gas in 3 steps:

- 1 Name the Mix.
 - **UP/DOWN** will change the character. Any 6-character name may be used with A to Z, 0 to 9, punctuation (, -), and space.
 - **NEXT LETTER** will move to the next character, and cycle to the beginning from the end.
 - **BACK/CANCEL** exits to the COMPOSER Menu.
 - **CHANGE CASE** toggles upper- and lower-case letters.
 - **SET** accepts the name and moves to the Mix Definition Menu in Step 2.
- 2 Define the Mix.
 - **EDIT NAME** returns to Step 1.
 - **ADD GAS** enters the Gas Select listing to choose up to five component gases, then asks to set its composition percentage.
 - **GAS OPTNS** edits the non-final gas mix composition. Use **UP/DOWN** to select the gas, and **EDIT %** to change its percentage. You will need the mixture to total 100 % when selecting **SAVE**.
- 3 Save the Mix.
 - **CREATE NEW** creates a new mix.
 - **CREATE SIMILAR** duplicates the current mix.
 - **MAIN** exits to the Main Display without activating the new mix. **SELECT MIXTURE** exits and activates the mix.

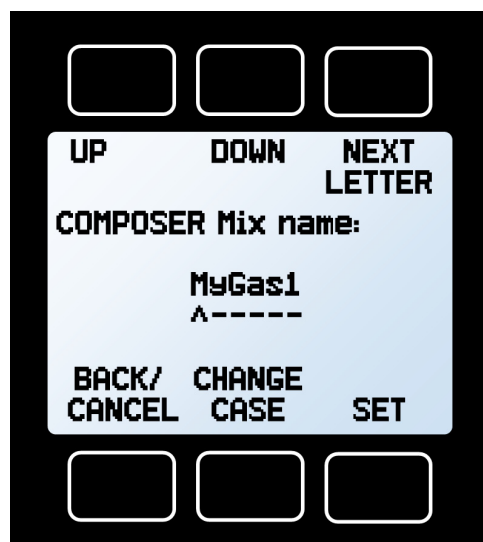


Figure 23 Naming the mix.

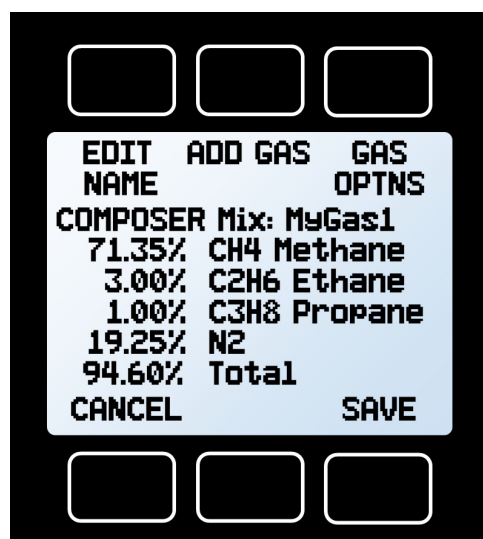


Figure 24 Mix summary menu.

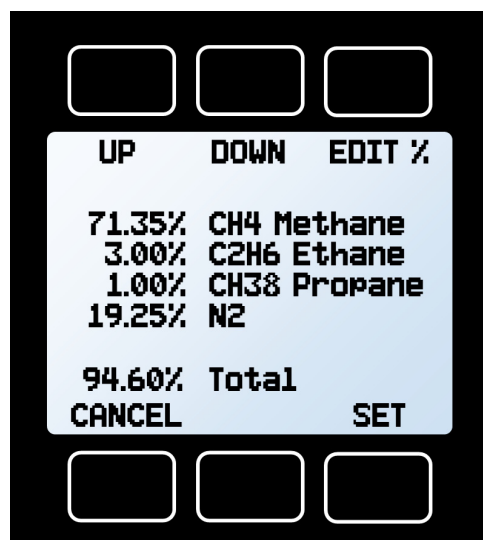


Figure 25 Gas options menu.

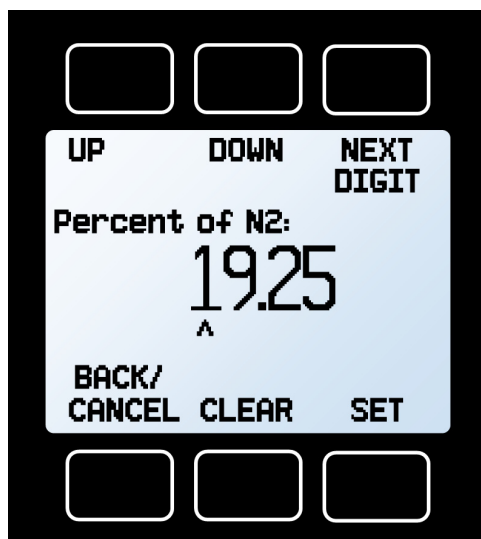


Figure 26 Editing gas percentage.

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. This reference is called an STP (standard temperature and pressure) or, typically in Europe, an NTP (normal temperature and pressure).

Menu/Basic Config/STP/NTP

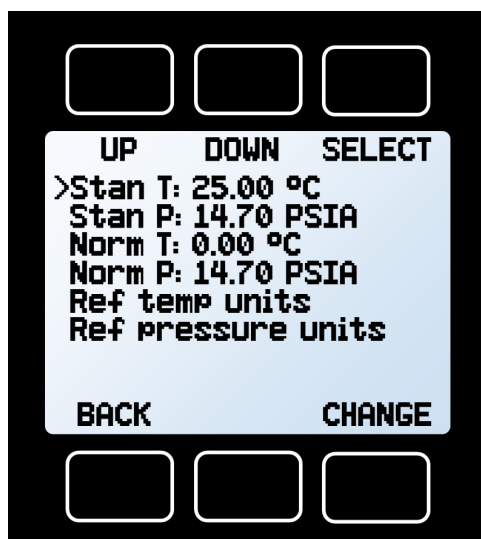


Figure 27 STP/NTP menu.

- **Stan T:** Standard Temperature
- **Stan P:** Standard Pressure
- **Norm T:** Normal Temperature
- **Norm P:** Normal Pressure
- **Ref temp units:** changes the temperature units used for STP and NTP calculations.
- **Ref pressure units:** changes the pressure units used for STP and NTP calculations

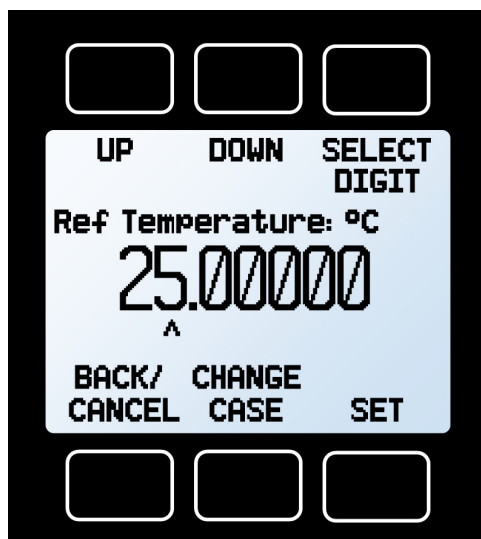


Figure 28 Selecting a standard.

Using the **STP/NTP** menu, you can independently change the temperature or pressure references for STP and NTP. Your flow meter ships with a default STP of 25 °C and 1 atm (which affects flow units beginning with “S”), and an NTP of 0 °C and 1 atm (which affects flow units beginning with “N”).

To make changes, follow these steps:

- 1 Select the desired pressure or temperature reference engineering unit by selecting **Ref temp units** or **Ref pressure units** and pressing **CHANGE**. Both normal and standard references use the same engineering units.
- 2 Select the value you wish to modify, and press **CHANGE**.
- 3 At the confirmation screen, press **SET** to confirm your change.

CAUTION

Changes to STP/NTP references will alter your mass flow readings.

Advanced Setup

The Advanced Setup Menu lets you configure the display, zero band, averaging (for flow and pressure), and serial communications.

Menu/Advanced Setup

- **SENSOR SETUP** enters the Sensor Setup menu ([page 53](#)).
- **COMM SETUP** enters the Communications Menu ([page 56](#)).
- **DISP SETUP** enters the Display Setup Menu ([page 52](#)).
- **BACK** returns to the top-level menu ([page 30](#)).
- **MAIN** exits to the Main Display ([page 31](#)).

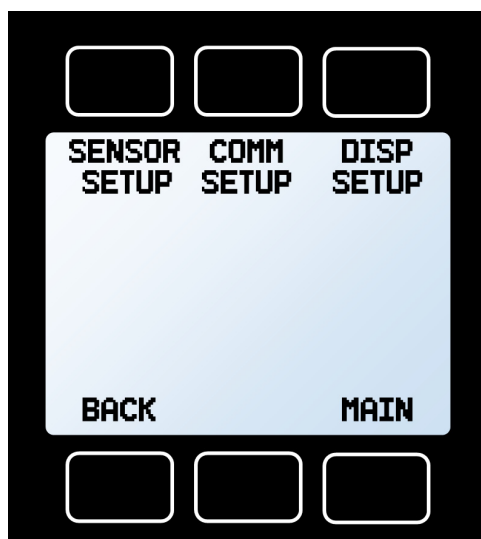


Figure 29 Advanced setup menu.

Display Setup

The options in the Display Setup Menu adjust the contrast of the display and enable screen rotation.

- **LCD CONTRAST** sets the contrast level of the display. Press reset to revert to the default contrast level.
- **POWER UP -DARK-** or **-LIT-** toggles whether the back light of the unit will be on or off when the device powers on.
- **ROTATE DISP** displays a sub-menu to select a screen orientation. Available orientations vary by model.
- **BACK** returns to the top-level menu ([page 30](#)).
- **MAIN** exits to the Main Display ([page 31](#)).

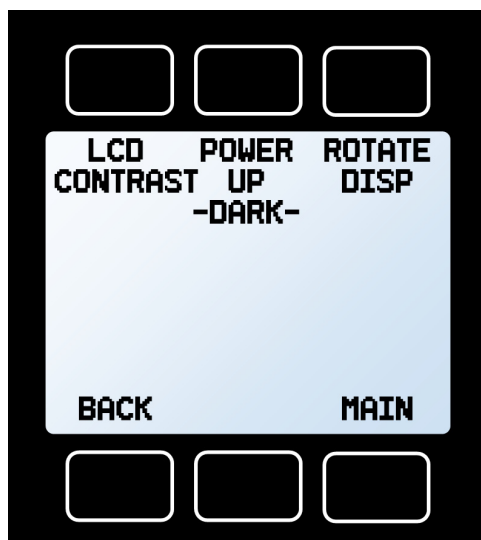


Figure 30 Display setup menu.

Sensor Setup

The Sensor Setup Menu contains advanced settings that govern how the flow and pressure sensors report their data.

Menu/Advanced Setup/Sensor Setup

- **DISPLAY AS ZERO** defines the zero band threshold under which flow values are displayed as 0, and the current setting. The maximum zero band is 6.38 %. This function also applies to gauge pressure readings when using the optional barometer. For example, a 20-slp_m meter with a zero band value of 0.25 % would display as 0 slp_m for all readings below 0.05 slp_m.
- **NUM OF DIGITS** sets the number of significant digits to display flow readings on-screen and in the serial data frame. Older devices typically had one less significant digit, and newer devices can be set to match.
- **BACK** returns to the top-level menu ([page 30](#)).
- **AVERAGING** adjusts the time constants of the geometric running averages for flow and pressure. These are changed independently via **PRESS AVG** and **FLOW AVG** in the Averaging Menu, which also displays the current settings. Values roughly correspond to the time constant (in milliseconds) of the averaged values. Higher numbers generate a greater smoothing effect on rapidly fluctuating readings (maximum 255 ms).
- **MAIN** exits to the Main Display ([page 31](#)).

NOTE

Deadband settings do not affect the values reported in the serial data.

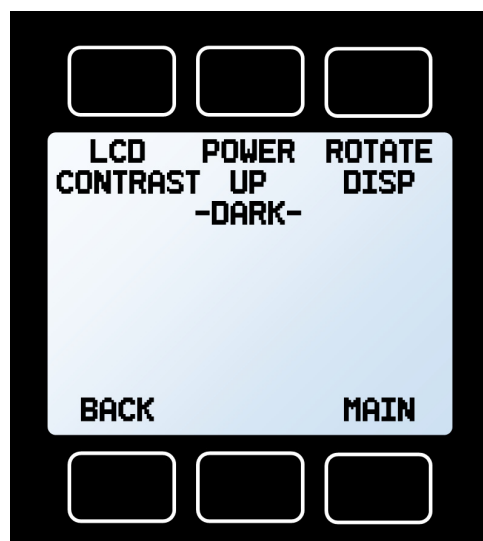


Figure 31 Sensor setup menu.

Serial Communication

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Connecting your flow meter to a computer allows you to log the data that it generates. The flow meter communicates digitally through its communications connector using a real or virtual COM port on your computer. This section of the manual shows you how to operate the flow meter using ASCII commands.

Configuring Serial Communications

You can operate the flow meter remotely via its top connector for easy streaming and logging of all data. Before connecting the flow meter to a computer, ensure that it is ready to communicate with your PC by checking the options in the COMM SETUP menu.

Menu/Advanced Setup/Comm Setup

Unit ID

The unit ID is the identifier that a computer uses to distinguish your flow meter from other similar mass flow 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 COM port. This is called polling mode ([page 60](#)). Unit ID changes take effect when you select **SET**.

If you select **@** as the Unit ID, the flow meter enters streaming mode when you exit the menu (see [page 63](#)).

Baud rate

Baud rate is the speed at which digital devices transfer information. The flow meter has a default baud rate of 19,200 baud (bits per second). If your computer or software uses a different baud rate, you must change the flow meter baud rate in the **BAUD** menu to match them both.

Alternatively, for computers with Microsoft Windows operating systems, you can change your a computer's baud rate in Device Manager. Baud rate changes take effect immediately for the device once you press **SET**, but you may need to restart your software.

Establishing Communication

After connecting your flow meter using a communications cable, you will need to establish serial communications through a real or virtual COM port on your computer or programmable logic computer (PLC).

- If you have connected your device to a serial port, note its COM port number. This can be found in Windows Device Manager.
- If you have used a USB cable to connect your device to your computer, the computer in most cases will recognize your device as a virtual COM port. If it does not, download the appropriate USB device driver and note the COM port number as found in Windows Device Manager. Drivers may be found at <https://www.ftdichip.com/Drivers/D2XX.htm>.
- The meter will be configured with the following settings:
 - **Baud:** 19,200 (default; others can be used if the computer, its software and the meter are set for the same rate)
 - **Data bits:** 8
 - **Parity:** none
 - **Stop bits:** 1
 - **Flow control:** none

Communication programs

Although the meter will communicate with any compatible terminal program over RS-232, PuTTY is commonly used.

Configuring PuTTY

- Download PuTTY from putty.org and run the installer.
- Open PuTTY; it will start on the Configuration screen.
- Click on the **Terminal** category. The changes we make here will cause PuTTY to act like a normal serial terminal, such that pressing enter will move the cursor to the next line and both what you type and what gets returned stay on the screen:
 - Check the box **Implicit LF in every CR**.
 - Select the **Force on** radio button in the **Local echo** section.
- Click **Connection**, and then the Serial subcategory.
 - Set the Speed (baud) to 19,200.
 - Set the Data bits to 8.
 - Set the Stop bits to 1
 - Ensure **None** is selected for both **Parity** and **Flow control**.
- Click on the **Session** category.
 - Select the **Serial** radio button under **Connection type**.
 - Check that the COM port and baud rate (Speed) are correct.
- Save your settings so they can be recalled again later.

NOTE

In what follows, ␣ indicates an ASCII carriage return (decimal 13, hexadecimal D). Serial commands are not case-sensitive. [unit ID] indicates to type the unit ID, which defaults to A.

Polling Mode Versus Streaming Mode

In the Streaming Mode, the HyperTerminal screen is updated approximately 10 to 60 times per second, depending on the amount of data on each line.

It is sometimes desirable to limit responses to when they are requested, which is called Polling Mode. This is necessary when using more than one unit on a single RS-232 line. Each unit can be given its own unique letter identifier or unit ID, from A through Z.

Unless otherwise specified, each unit is shipped in polling mode with a default Unit ID of capital A.

Polling Mode

Polling the flow meter returns a single line of data each time you request it. To poll your flow meter, type A↵. This does an instantaneous poll of unit A and returns the values once. You may type A↵ as many times as you like.

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)

You can also do this via the menu: **MENU/ADV SETUP/COMM SETUP/UNIT ID** (page 56). Valid unit IDs are letters A to Z, and up to 26 devices may be connected at any one time, as long as each unit ID is unique.

Taring

Before collecting flow data, be sure to tare your flow meter. This can occur serially through two separate commands. Taring flow sets the zero flow reading and must be done when no flow is passing through the flow meter:

Tare flow: [unit ID]v↵

Example: av↵ (sets flow reading to zero)

For devices equipped with a barometer, the second tare aligns the internal absolute pressure sensor with the current barometer reading and must be done with the flow meter open to atmosphere:

Tare absolute pressure: [unit ID]pc↵

Example: apc↵

(aligns internal pressure to barometer)

Collecting Flow Data

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

A +13.5424 +24.5782 +16.6670 +15.4443 N₂

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 flow meter display (see [page 22](#)). You can query the engineering units of the instant data frame by typing:

Query live data info: [unit ID]??d*↵

Example: a??d*↵

(returns the data frame descriptions)

Additional columns, including status codes ([page 22](#)), may be present to the right of the gas label column.

Streaming Mode

In the default polling mode, the screen should be blank except for a cursor.

Begin streaming: [unit ID]=@↵

Example: a=@↵

Once you have established communication, and have a stream of information:

Stop the stream: A@=A↵

(or using the RS-232 communication select menu,
select A as identifier and exit the screen)

Resume streaming: A@=@↵

The flow of information will not stop while typing, and you will not be able to read what you have typed. Also, the unit does not accept a backspace or delete in the line, so it must be typed correctly. If in doubt, hit enter and start again. Any command that is not understood will be ignored.

The device can also be set to streaming mode from the device front panel by setting its **Unit ID** as @ from the **Comm Setup Menu** (see [page 56](#)).

Streaming mode - advanced

The streaming data rate is controlled by register 91. The recommended default rate is 50 ms, but it can be changed to a value from 1 to 65,535 ms, or slightly over once per minute.

Below approximately 40 ms, data provision will depend on how many parameters are selected. Fewer parameters will stream more quickly.

Reading register 91: [unit ID]r91↵

Modifying register 91: [unit ID]w91=n↵

(where n is a positive integer from 1 to 65535)

Using Gas Select and COMPOSER

To reconfigure your flow meter to flow a different gas, look up its Gas Number (**Table 4** on page 72). Then type:

Choose a gas: [unit ID]g[Gas Number]↵

Example 1: ag8↵ (reconfigures to flow nitrogen)

Example 2: ag206↵ (reconfigures to flow P-10)

COMPOSER user mixes are selected in the same way. All COMPOSER gas mixes are numbered between 236 and 255, starting at 255.

Choose a user mix: [unit ID]g[Gas Number]↵

Example: ag255↵ (reconfigures for user mix 255)

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

[unit ID] gm [Mix Name] [Mix Number] [Gas1%] [Gas1 Number]
[Gas2%] [Gas2 Number]...↵

- [Mix Name] Use a maximum of six 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. 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 (**Table 4** on page 72). You must have 2 to 5 gases in your COMPOSER mix.

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

Example 1: Create a mix of 71.35% helium, 19.25% nitrogen and 9.4% carbon dioxide as Gas 252, called "MyGas1".

a gm MyGas1 252 71.35 7 19.25 8 9.4 4↵

Response: A 252 71.35% He 19.25% N₂ 9.40% CO₂

Example 2: Create a mix of 93% methane, 3% ethane, 1% propane, 2% N₂ and 1% CO₂, using the next available gas number, called "MyGas2".

a gm MyGas2 0 0 93 2 3 5 1 12 2 8 1↵

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

NOTE

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

Quick Command Guide

NOTE

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

Change unit ID: a@[desired unit ID]↵

Tare flow: av↵

- Poll the live data frame: a↵
- Begin streaming data: a@=@↵
- Stop streaming data: @@=[desired unit ID]↵
- Set streaming interval: aw91=[number of milliseconds]↵
- Query gas list info: a??g*↵
- Choose a different gas: ag[Gas Number]↵

Create a

COMPOSER mix: agm [Mix Name] [Mix Number] [Gas1%]
[Gas1 Number] [Gas2%] [Gas2 Number]...↵

Delete a

COMPOSER mix: agd [Mix Number]↵

- Query live data info: a??d*↵
- Manufacturer info: a??m*↵
- Firmware version: a??m9↵
- Lock the front display: al↵
- Unlock front display: au↵

If you have need of more advanced serial communication commands, please contact support at <https://www.agilent.com/en-us/contact-us/page>.

Troubleshooting and Maintenance

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Troubleshooting

If you run into any trouble with your meter's installation or operation, please contact support at <https://www.agilent.com/en-us/contact-us/page>.

General use

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

Action: Portable flow meters run on a rechargeable battery, but you can also connect to a wall outlet or computer using a 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 flow meter will not power on after being plugged in for at least five minutes, please contact support at <https://www.agilent.com/en-us/contact-us/page>.

Issue: The buttons do not work, and the screen shows **LCK**.

Action: The flow meter buttons were locked out via a serial command. Press and hold all four outer buttons to unlock the interface, or use the serial command [Unit ID]U. See [Quick Command Guide](#) on page 65 for more serial commands.

Issue: I can not read the display easily.

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

Issue: How often do I need to calibrate my meter?

Action: Annual recalibrations are recommended. Check your flow meter's last calibration date by selecting **MENU/ABOUT/DEVICE INFO**. If it is time to recalibrate, request a recalibration ([page 38](#)).

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

Action: 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 support about the drop at your next annual recalibration so we can check it out for you.

Issue: How can I see temperature, pressure or flow in different units?

Action: From the main menu, select **BASIC CONFIG/DEVICE UNITS**. From this menu, you can adjust temperature, pressure or flow units. For more information, see [page 40](#).

Flow readings

Issue: The live flow readings will not settle down.

Action: The flow meter is very fast, so it can detect subtle variations in flow that may go unnoticed by your other flow devices. This sensitivity can help detect problems with pumps or flow controllers. You can lessen this sensitivity by increasing the flow averaging press **MENU/ADV SETUP/SENSOR SETUP/FLOW AVG**. See [page 53](#).

Issue: My flow readings are negative.

Action: If your flow meter is not connected to anything, it may be reading a small flow 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 flow meter has no flow passing through it, and select **TARE FLOW** from the Main Display to give it a fresh tare.

Issue: My flow readings jump to 0 when flow rates are low.

Action: Your flow instrument is equipped with a programmable zero band that is preset at the factory. Reduce your deadband threshold by selecting **MENU/ADV SETUP/SENSOR SETUP/ ZERO BAND**. Note: The zero band threshold has no effect upon the serial data.

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

Action: Yes to both! The flow meter 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 meter on top of a vibrating device? Will it be accurate?

Action: Yes, and yes! The flow meter is internally compensated for any changes in orientation, including rapid vibrations. Sensor noise will increase if the flow meter is vibrating.

Issue: My meter does not agree with another meter I have in line.

Action: Check the STP or NTP settings (**MENU/BASIC CONFIG/STP/NTP**) to ensure that your standardized temperature and pressure references match those of your other flow calibrator. Also check that your device's Gas Select is set to the right gas or mixture.

Issue: My flow readings will not change when flow changes.

Action: If your flow readings will not change regardless of actual flow, your flow sensor may be damaged. Please contact support at <https://www.agilent.com/en-us/contact-us/page>.

Issue: My volumetric flow readings don't match another flow calibrator I use.

Action: If you are flowing dry gas, the 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: Can I use the meter with other gases?

Action: Yes! Your flow meter is designed specifically to work with many different gases. Gas Select (**MENU/BASIC CONFIG/GAS**) includes up to 130 preloaded gases and gas mixes, or you can define your own using COMPOSER. If your desired gas is not listed (**Creating gas compositions in COMPOSER** on page 46), please contact support at <https://www.agilent.com/en-us/contact-us/page> to ensure compatibility.

Serial communications

Issue: I can't communicate to the meter when it is connected to my computer.

Action:

- 1 Make sure the baud rate and other serial settings of your software and COM Port require is the one your meter is using (**MENU/ADV SETUP/COMM SETUP/BAUD**).
- 2 Check the flow meter unit ID (**MENU/ADV SETUP/COMM SETUP/UNIT ID**) to make sure you are addressing it properly with your serial commands.
- 3 Make sure the COM number matches the one your software is using to connect to the flow meter (**page 57**).

Still experiencing issues?

Issue: None of the above helped.

Action: Please contact support at <https://www.agilent.com/en-us/contact-us/page>.

Maintenance

Cleaning

Your flow meter requires no periodic 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.

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 at <https://www.agilent.com/en-us/contact-us/page> for cleaning.

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 flow meter and is visible by selecting **MENU/ABOUT/DEVICE INFO**.

When it is time for your flow meter's annual recalibration, please contact support at <https://www.agilent.com/en-us/contact-us/page>. You will need your device's serial number and your contact information.

Gas List

Table 4 Gas list.

Number	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*
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
140	C-15	15% CO ₂ , 85% Ar
141	C-20	20% CO ₂ , 80% Ar
142	C-50	50% CO ₂ , 50% Ar
143	He-50	50% He, 50% Ar

Table 4 Gas list. (continued)

Number	Short Name	Long Name
144	He-90	90% He, 10% Ar
145	Bio5M	5% CH ₄ , 95% CO ₂
146	Bio10M	10% CH ₄ , 90% CO ₂
147	Bio15M	15% CH ₄ , 85% CO ₂
148	Bio20M	20% CH ₄ , 80% CO ₂
149	Bio25M	25% CH ₄ , 75% CO ₂
150	Bio30M	30% CH ₄ , 70% CO ₂
151	Bio35M	35% CH ₄ , 65% CO ₂
152	Bio40M	40% CH ₄ , 60% CO ₂
153	Bio45M	45% CH ₄ , 55% CO ₂
154	Bio50M	50% CH ₄ , 50% CO ₂
155	Bio55M	55% CH ₄ , 45% CO ₂
156	Bio60M	60% CH ₄ , 40% CO ₂
157	Bio65M	65% CH ₄ , 35% CO ₂
158	Bio70M	70% CH ₄ , 30% CO ₂
159	Bio75M	75% CH ₄ , 25% CO ₂
160	Bio80M	80% CH ₄ , 20% CO ₂
161	Bio85M	85% CH ₄ , 15% CO ₂
162	Bio90M	90% CH ₄ , 10% CO ₂
163	Bio95M	95% CH ₄ , 5% CO ₂
164	EAN-32	32% O ₂ , 68% N ₂
165	EAN	36% O ₂ , 64% N ₂
166	EAN-40	40% O ₂ , 60% N ₂
167	HeOx20	20% O ₂ , 80% He
168	HeOx21	21% O ₂ , 79% He
169	HeOx30	30% O ₂ , 70% He
170	HeOx40	40% O ₂ , 60% He
171	HeOx50	50% O ₂ , 50% He
172	HeOx60	60% O ₂ , 40% He
173	HeOx80	80% O ₂ , 20% He
174	HeOx99	99% O ₂ , 1% He
175	EA-40	Enriched Air-40% O ₂
176	EA-60	Enriched Air-60% O ₂
177	EA-80	Enriched Air-80% O ₂
178	Metab	Metabolic Exhalant (16% O ₂ , 78.04% N ₂ , 5% CO ₂ , 0.96% Ar)
179	LG-4.5	4.5% CO ₂ , 13.5% N ₂ , 82% He
180	LG-6	6% CO ₂ , 14% N ₂ , 80% He

Table 4 Gas list. (continued)

Number	Short Name	Long Name
181	LG-7	7% CO ₂ , 14% N ₂ , 79% He
182	LG-9	9% CO ₂ , 15% N ₂ , 76% He
183	HeNe-9	9% Ne, 91% He
184	LG-9.4	9.4% CO ₂ , 19.25% N ₂ , 71.35% He
185	SynG-1	40% H ₂ , 29% CO, 20% CO ₂ , 11% CH ₄
186	SynG-2	64% H ₂ , 28% CO, 1% CO ₂ , 7% CH ₄
187	SynG-3	70% H ₂ , 4% CO, 25% CO ₂ , 1% CH ₄
188	SynG-4	83% H ₂ , 14% CO, 3% CH ₄
189	NatG-1	93% CH ₄ , 3% C ₂ H ₆ , 1% C ₃ H ₈ , 2% N ₂ , 1% CO ₂
190	NatG-2	95% CH ₄ , 3% C ₂ H ₆ , 1% N ₂ , 1% CO ₂
191	NatG-3	95.2% CH ₄ , 2.5% C ₂ H ₆ , 0.2% C ₃ H ₈ , 0.1% C ₄ H ₁₀ , 1.3% N ₂ , 0.7% CO ₂
192	CoalG	50% H ₂ , 35% CH ₄ , 10% CO, 5% C ₂ H ₄
193	Endo	75% H ₂ , 25% N ₂
194	HHO	66.67% H ₂ , 33.33% O ₂
195	HD-5	LPG: 96.1% C ₃ H ₈ , 1.5% C ₂ H ₆ , 0.4% C ₃ H ₆ , 1.9% n-C ₄ H ₁₀
196	HD-10	LPG: 85% C ₃ H ₈ , 10% C ₃ H ₆ , 5% n-C ₄ H ₁₀
197	OCG-89	89% O ₂ , 7% N ₂ , 4% Ar
198	OCG-93	93% O ₂ , 3% N ₂ , 4% Ar
199	OCG-95	95% O ₂ , 1% N ₂ , 4% Ar
200	FG-1	2.5% O ₂ , 10.8% CO ₂ , 85.7% N ₂ , 1% Ar
201	FG-2	2.9% O ₂ , 14% CO ₂ , 82.1% N ₂ , 1% Ar
202	FG-3	3.7% O ₂ , 15% CO ₂ , 80.3% N ₂ , 1% Ar
203	FG-4	7% O ₂ , 12% CO ₂ , 80% N ₂ , 1% Ar
204	FG-5	10% O ₂ , 9.5% CO ₂ , 79.5% N ₂ , 1% Ar
205	FG-6	13% O ₂ , 7% CO ₂ , 79% N ₂ , 1% Ar
206	P-10	10% CH ₄ 90% Ar
210	D-2	Deuterium

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

Engineering Units

Table 5 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

Table 6 Temperature units.

Label	Notes
°C	degrees Celsius
°F	degrees Fahrenheit
K	Kelvin
°R	degrees Rankine

Table 7 Time units.

Label	Notes
h:m:s	hours:minutes:seconds
ms	milliseconds
s	seconds
m	minutes
hour	hours
day	days

Table 8 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
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		1,000 cubic feet per minute
count	count	count	setpoint count, 0 to 64,000
%	%	%	percent of full scale

Table 9 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

Table 9 Pressure units. (continued)

Absolute or Barometric	Gauge	Notes
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 to 64,000
%	%	percent of full scale

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