



**Agilent G6691A
ADM Flow Meter**

**Operating
Instructions**



Agilent Technologies

Notices

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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.

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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.



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Introduction

Congratulations on your purchase of the new Agilent ADM Flow Meter! The ADM Flow Meter has been designed to accurately measure the flow of gases commonly used in Gas Chromatography without knowledge of the gas type or mixture composition. A complete ADM Flow Meter consists of a Flow Meter Mainframe and a Flow Meter Cartridge. The Flow Meter Mainframe contains the display, keypad, batteries, and microprocessor; while the Flow Meter Cartridge contains all of the hardware used to make a flow measurement. Flow Meter Cartridges are individually factory calibrated and can easily be replaced with a new cartridge without returning the Flow Meter to Agilent. This eliminates the hassle and downtime associated with maintaining the calibration of an instrument that would normally need to be sent to an outside facility for calibration on a yearly basis.



Included in the packaging are the following items:

Table 1 Packing List

1	ADM Flow Meter Mainframe
1	ADM Flow Meter Cartridge
1	USB Cable
1	Screwdriver, Phillips head
3	AA Alkaline Batteries
1	Calibration Certificate
1	Declaration of Conformance
1	Quick Start Guide

Principles of Operation

The ADM Flow Meter provides continuous, real time measurements of dry gas flows, such as those used for Gas Chromatography. Unlike bubble flow meters, the ADM Flow Meter operates without liquids, bubbles, or glass parts. When activated, a solenoid actuated valve interrupts the gas flow momentarily. The gas flow moves a diaphragm in proportion to the flow rate. This movement is transformed by the Flow Meter's electronics into a digital value which is displayed on the Flow Meter's screen. The ADM Flow Meter provides two different types of flow measurements: volumetric flow (mL/min) and mass flow reported in standard cubic centimeters per minute (sccm). Mass flow values are calculated from the volumetric measurements by correcting for ambient temperature and atmospheric pressure, and reporting the flow rate referenced to 0 °C and 1 atmosphere of pressure, using digital temperature and pressure sensors installed in the mainframe of the flow meter.

The ADM Flow Meter employs a replaceable cartridge that contains all parts subject to calibration. This eliminates the need to ship the entire meter back to the factory to maintain its calibration. The cartridge calibration is valid for a period of one year from its first use. A new, calibrated cartridge can be ordered in advance, and then installed when necessary.

CAUTION

The measurement calibration can be affected if the instrument is exposed to temperatures above 50 °C for extended periods of time.

Please inspect the temperature label attached to the inside of cartridge packaging to verify that your cartridge has not been damaged in shipment. A grey circle is acceptable, a black circle indicates that the cartridge may have been exposed to an extreme temperature.

Please contact Agilent Technical Support if your cartridge is delivered with a temperature indicator that is black.

When the flow meter is powered on with a new cartridge installed, the current date is written to the cartridge's memory based on the mainframe's internal clock. Each time the flow meter is turned on, the meter will compare the current date to the initial turn on date of the cartridge. If the initial turn on date is more than a year from the current date, the flow meter will flash a notification to the user that the calibration has expired. The flow meter will still function with an expired calibration. This eliminates downtime, enabling you to keep working. See ["Replacing the Cartridge"](#) on page 24.

The ADM Flow Meter is powered by three AA alkaline batteries. Power can also be supplied via the micro USB port located on the side of the unit.

NOTE

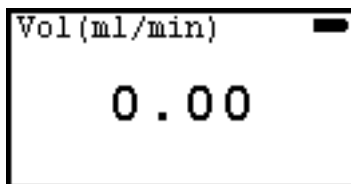
Using the USB port to supply power does not recharge the installed batteries.

NOTE

The ADM Flow Meter can also be powered by rechargeable batteries, but the battery indicator may not display correctly.

Display

The ADM Flow Meter has a bright OLED display with a battery strength indicator.



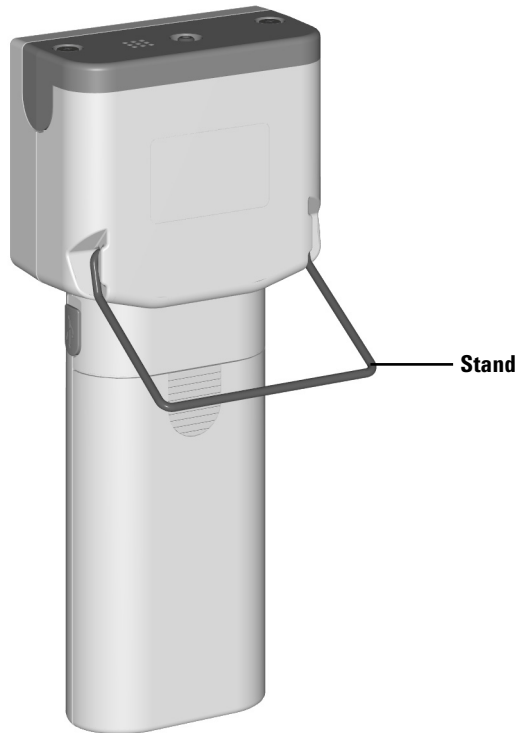
The unit automatically adjusts the resolution of the display in response to various gas flow ranges as follows:

Flow (mL/min)	Display resolution (mL/min)
0 - 9.99	0.01
10.0 - 99.9	0.1
100 - 750	1.0

When the battery strength indicator shows that the battery strength is low, replace the batteries. See ["Replacing Batteries"](#) on page 27.

Using the Flow Meter Stand

The flip down wire stand will give you a better viewing angle when the ADM Flow Meter is placed above bench level. Pull the stand down until it is in the locked position.



Power/Mode Button

The Power/Mode button is used to switch the ADM Flow Meter on and off, as well as to scroll through and select the different operational modes.

- To turn on the instrument briefly press and release the Power/Mode button.
- To turn off the instrument press and hold the Power/Mode button for three seconds.
- To scroll through the available modes, when the instrument is on, briefly press and release the Power/Mode button.

Select Button

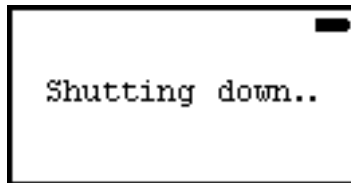
The Select button is used to access additional functionality within the operating modes. This includes storing flow measurements, setting a reference value for the Split Mode, and changing the settings.

Switching the ADM Flow Meter On and Off

With the ADM Flow Meter powered off, briefly press and release the Power/Mode button to turn the unit on. The display will flash the Agilent logo for approximately 3 seconds, and then begin operating. During startup, the microprocessor will run a self-diagnostic test to ensure the unit is functioning properly.

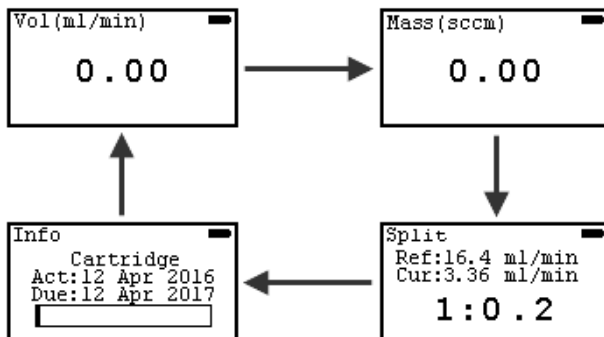


With the unit powered on, press and hold the Power/Mode button for three seconds to power down the unit.



Operating Modes

With the ADM Flow Meter switched on, briefly press the Power/Mode button to scroll through the different operational modes.



The available modes are as follows:

Volumetric flow mode

This is the default mode on power up. In this mode, the volumetric flow rate is displayed in mL/min.

Mass flow mode

In this mode, the volumetric flow rate is corrected taking into account the current atmospheric pressure and ambient temperature. The flow rate is displayed in sccm (standard cubic centimeters per minute) referenced to 1 atmosphere of pressure and 0 °C.

Split mode

In this mode, you can store a flow measurement as a reference value, and then compare subsequent flow measurement values as a ratio of the current measurement to the reference measurement. This is useful when trouble shooting a GC Inlet.

Info mode

Info mode provides details on the flow meter and the currently installed cartridge, including the calibration expiration date. In addition, Info Mode allows you to set the display brightness and control the Auto off functionality.

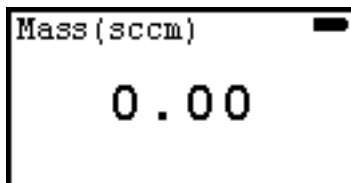
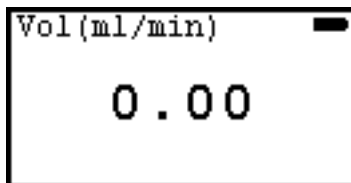
Making a Flow Measurement

CAUTION Make sure that the flow to be measured is within the range of the flow meter. Over ranging the flow meter can damage the transducer.

NOTE Always turn the flow meter on before connecting it to a flow source.

- 1 When the unit is powered on, it defaults to volumetric flow mode. (If you want to use the mass flow mode, briefly press the Power/Mode button.)
- 2 Connect the flexible tubing to the gas source to be measured.
- 3 Wait for the reading to stabilize (1 - 2 seconds) and then observe the reading.

NOTE Low flows (less than 1 mL/min) may take up to 5 seconds for the reading to stabilize

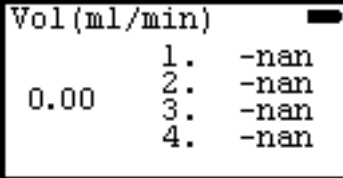


Storing Flow Measurements

When in the volumetric flow mode or mass flow mode up to four flow values can be stored on the screen for reference later.

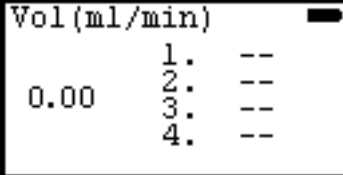
To store one or more values:

- 1 With either volumetric flow mode or mass flow mode displayed, briefly press the Select button. The measurement storage screen appears. Any previously stored values are displayed on the screen. If the cartridge is unused, the values will be listed as nan (not a number).



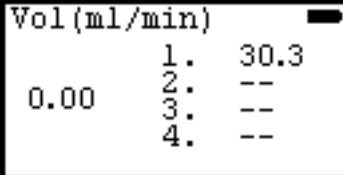
```
Vol (ml/min)
0.00      1.  -nan
          2.  -nan
          3.  -nan
          4.  -nan
```

- 2 Press and hold the Select button to clear the previously stored values.



```
Vol (ml/min)
0.00      1.  --
          2.  --
          3.  --
          4.  --
```

- 3 Press the Select button to store a value to the first available slot.



```
Vol (ml/min)
0.00      1.  30.3
          2.  --
          3.  --
          4.  --
```

- 4 Repeat step 2 to store additional values to the subsequent slots. Up to four values can be stored.

Vol (ml/min)		
	1.	53.4
0.00	2.	92.7
	3.	92.7
	4.	67.5

To clear the stored values:

- Hold down the Select button. All of the stored values are cleared from memory.

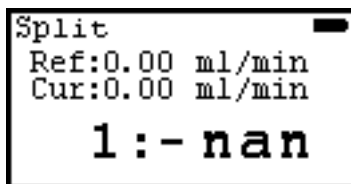
Vol (ml/min)		
	1.	--
0.00	2.	--
	3.	--
	4.	--

Reading and Setting a Split Ratio

In split mode, you can store a flow measurement as a reference value, and then compare subsequent flow measurement values as a ratio of the current measurement to the reference measurement. This is useful when verifying or troubleshooting the operation of a Gas Chromatograph Inlet.

To read and set a split ratio:

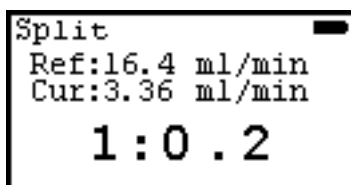
- 1 With the unit switched on, repeatedly press the Power/Mode button until Split mode is displayed.



NOTE

Accurate column flow rates can only be determined when detector gases have been turned off.

- 2 Turn off the detector gases.
- 3 Connect the flexible tubing to the GC column gas flow.
- 4 Wait for the reading to stabilize (1 - 2 seconds).
- 5 Briefly press the Select button. The current reading is stored as the reference value. The ratio value is displayed as 1:1.
- 6 Disconnect the flexible tubing from the GC column flow and then connect it to the split vent, or the gas flow that you want to compare. The display shows the ratio directly.
- 7 Adjust for the desired ratio by adjusting the flow of the split vent, or the other reference flow, until the required ratio is displayed.



To clear the stored reference value, press the Select button.

About Flow Measurements

When compared with readings from the ADM Flow Meter, measurements taken with bubble-type flow meters may show a difference. This does not indicate a problem with your ADM Flow Meter. As a consequence of the ideal gas law, measurements made with both soap bubble meters and the ADM Flow Meter are temperature sensitive. However, bubble-type flow meters add water vapor to the gas being measured, which introduces error into the flow rate measurement.

Even when accurately calibrated, soap bubble meters typically read slightly higher than the ADM Flow Meter. The higher readings arise from relatively high concentrations of water vapor present in the soap bubble apparatus. At room temperature, water vapor can raise readings by nearly 4%. This unfortunate property is amplified by the effect of temperature. As the measured gas or the flow meter itself is warmed, the amount of water vapor increases, and the readings can be much higher than the true flow rate.

Info Mode

Info mode provides details on the flow meter and the installed cartridge. In addition, Info Mode allows you to set the display brightness and control the Auto off functionality.

To access Info mode:

- With the unit switched on, repeatedly press the Power/Mode button until Info mode is displayed.

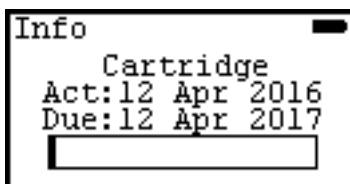
Once in Info mode, pressing the Select button scrolls through the available Info mode screens.

Cartridge and flow meter information

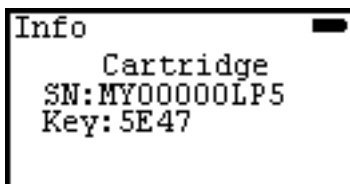
To view cartridge and flow meter details:

- With Info mode displayed, press the Select button to cycle through the available screens.

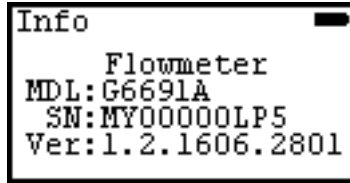
The first screen displays information about the currently installed cartridge. This includes the date that the cartridge was first used, and the date that the cartridge is due to be replaced. In addition, a graphic representation of the remaining life of the installed cartridge is displayed. (See "[Replacing the Cartridge](#)" on page 24 for details on replacing a cartridge.)



The second screen displays the cartridge serial number (SN) and Key number. The Key number is used to access the online copy of the cartridge's calibration certificate. (See "[Upgrading the Firmware/Retrieving Certificate of Calibration](#)" on page 30 for details on retrieving a digital copy of the Certificate of Calibration for your cartridge.)



The third screen displays the flow meter model number (MDL), serial number (SN) and firmware version number (Ver). (See ["Upgrading the Firmware/Retrieving Certificate of Calibration"](#) on page 30 for details on upgrading the flow meter firmware.)



Display brightness

Display brightness can be set to high or low.

To change the display brightness setting:

- 1 With Info mode displayed, press the Select button to cycle through the available screens until the Brightness screen is displayed.
- 2 Briefly press the Power/Mode button to change the selected value. The screen brightness changes based on the selected value.



- 3 Press the Select button to cycle through the available screens until you are returned to the Info mode screen with the cartridge statistics displayed.

Auto off

When the unit is turned on, the unit defaults to Auto off. This means that every time the unit is activated, a "power-off" cycle begins, lasting 10 minutes.

To disable this feature:

- 1 With Info mode displayed, press the Select button to cycle through the available screens until the Auto off function is displayed.
- 2 Briefly press the Power/Mode button to toggle the Auto off function On and Off.
- 3 With the desired setting highlighted, briefly press the Select button.

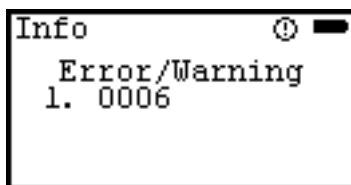
The flow meter will now operate continuously until it is manually turned off.



- 4 Press the Select button to cycle through the available screens until you are returned to the Info mode screen with the cartridge statistics displayed.

Errors/Warnings

With Info mode displayed, press the Select button to cycle through the available screens until the Error/Warning screen is displayed.



Error number definitions are as follows:

Error number	Type	Description	Troubleshooting
0001	Error	No calibration information.	Contact Agilent Technical Support.
0002	Error	Flow meter is not verified.	Contact Agilent Technical Support.
0003	Error	Pressure/temperature sensor failure.	Contact Agilent Technical Support.
0004	Error	No cartridge detected.	Install a valid cartridge.
0005	Warning	No ADM information.	Contact Agilent Technical Support.
0006	Warning	Auto-recovery mode.	Shut down and restart the ADM Flow Meter.

Error number	Type	Description	Troubleshooting
0007	Warning	Measurement exceeds instrument range.	Measure gas flows within the acceptable flow range.
0008	Warning	Cartridge calibration expired.	Install a new cartridge.
0009	Warning	RTC (real time clock) backup battery low.	Contact Agilent Technical Support.
0010	Warning	Out of operating temperature range condition (0 - 45 °C)	Operate the flow meter within the acceptable temperature range.
0011	Warning	Out of operating atmospheric pressure range.	Operate the flow meter within the acceptable atmospheric pressure range.

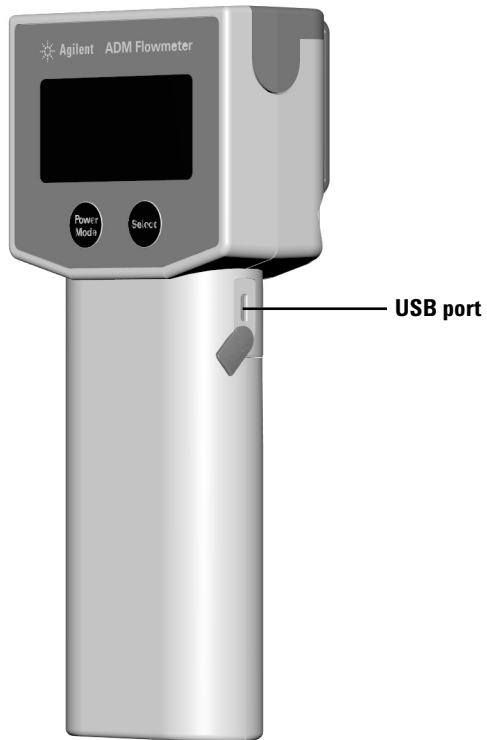
For information on contacting Agilent Technical Support, see ["Technical Support"](#) on page 30.

USB Interface

Power can be supplied via the micro USB port located on the side of the unit.

NOTE

Using the USB port to supply power does not recharge the installed batteries.



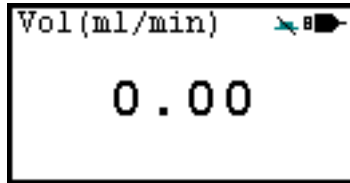
The ADM Flow Meter can communicate with a connected PC via the USB port. Data from your flow meter can be collected by connecting the USB port to your computer with the included USB cable. The ADM Flow Meter USB driver will be needed for the instrument to communicate with your PC. For details, please visit <http://www.agilent.com/chem/ADMflowmeter> to download the driver and view the Connecting your Flow Meter to your PC instrument sheet.

NOTE

When using the data acquisition capability of the ADM Flow Meter, you should disable the auto-off feature. See "Auto off" on page 18.

When the ADM Flow Meter is being powered via the USB port, the battery icon on the screen is replaced by a USB connector icon.

When the ADM Flow Meter is connected to PC software, the buttons on the flow meter are disabled. This is indicated by an icon to the left of USB icon on the screen.

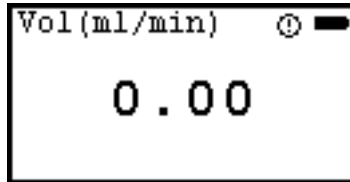


Warning and Error Indications

Various warning and error indications are displayed on the screen as appropriate. Each is described below.

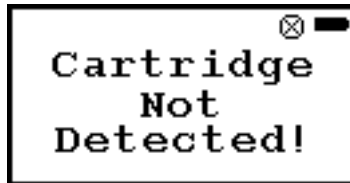
Warning indication

A warning icon appears on the screen when the flow meter is being operated outside of acceptable conditions, when the calibration is expired, when the RTC battery is low, and so on. See [“Errors/Warnings” on page 19](#).



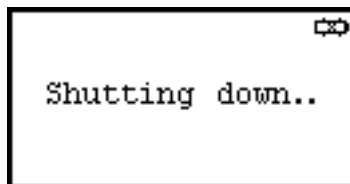
Error indication

When a hardware fault occurs, an error icon is displayed on the screen. This example shows when a cartridge is not detected in the flow meter. See [“Errors/Warnings” on page 19](#).



Low battery indicator

When the batteries need to be replaced, a low battery indication is displayed on the screen. When power is too low for operation, the flow meter will automatically shut down.



Replacing the Cartridge

To order a replacement cartridge, order P/N G6692A. The replacement cartridge includes replacement tubing.

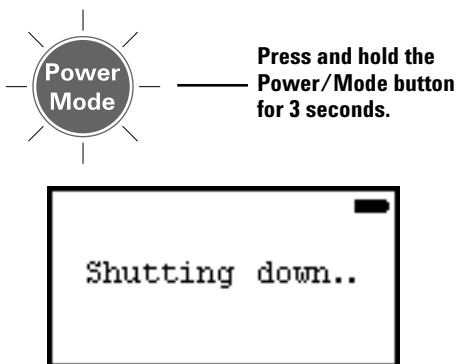


Figure 1 Power off

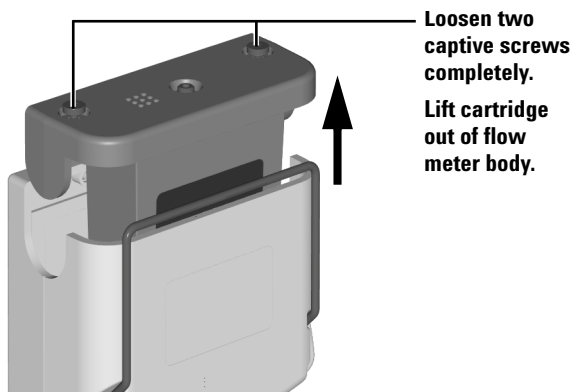


Figure 2 Remove old cartridge

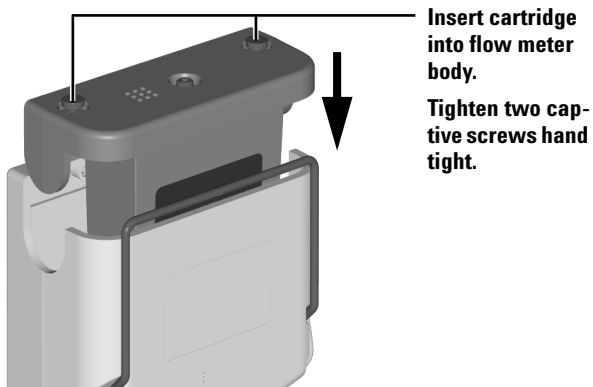


Figure 3 Install replacement cartridge

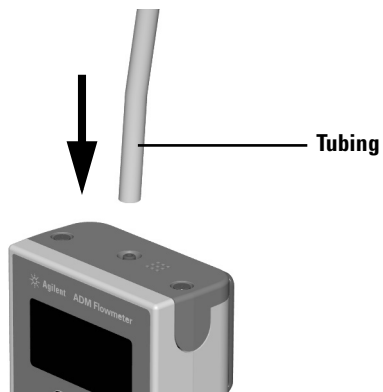


Figure 4 Install new flexible tubing

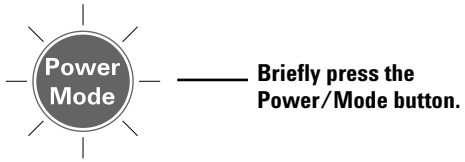


Figure 5 Power on

Replacing Batteries

To replace the batteries, do the following:

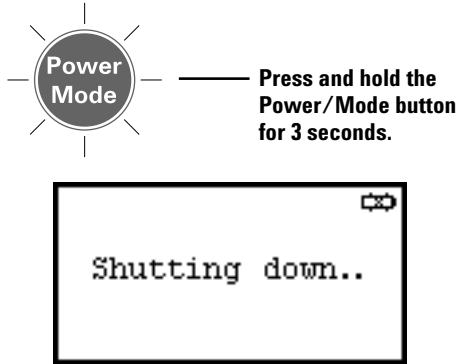


Figure 6 Power off

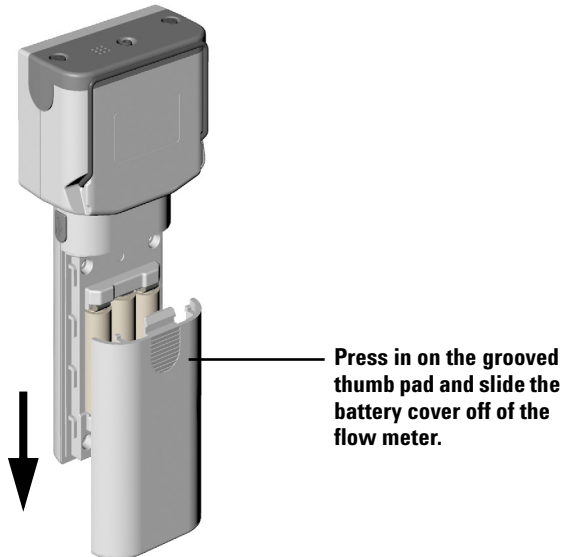


Figure 7 Remove battery cover

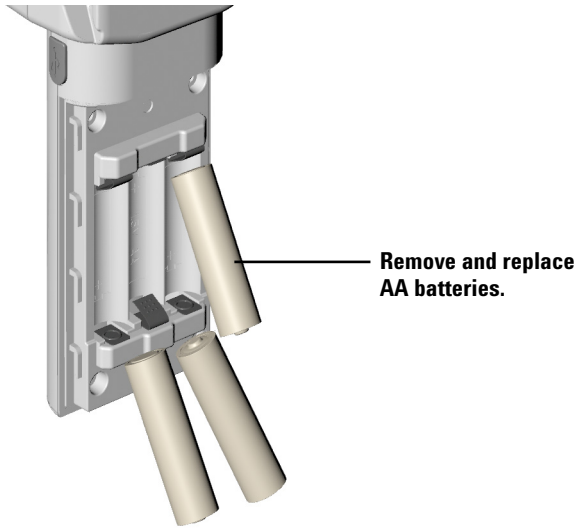


Figure 8 Replace batteries

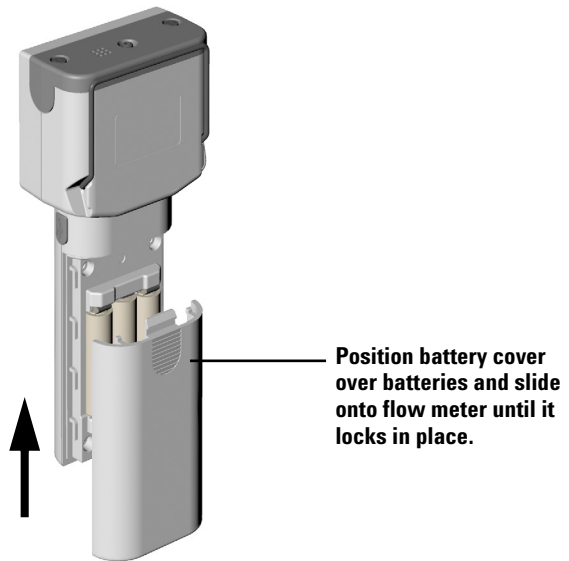


Figure 9 Install battery cover

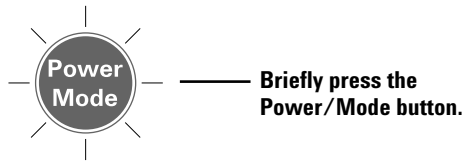


Figure 10 Power on

Upgrading the Firmware/Retrieving Certificate of Calibration

When a newer version of the flow meter firmware is available, you can upgrade to the latest version using your PC via the USB connection of the ADM Flow Meter. Please visit <http://www.agilent.com/chem/ADMflowmeter> for instructions.

It is also possible to retrieve a digital copy of your cartridge's Certificate of Calibration in PDF form through the Flow Meter's website. Please visit <http://www.agilent.com/chem/ADMflowmeter> for instructions.

A Note About Back Pressure

The ADM cartridge is calibrated with the standard flexible tubing supplied with the meter at the time of purchase. Replacement tubes should be of equal ID and length. Be aware that using tubing that increases or decreases the total volume of gas in the tubing will affect accuracy. Tubing of greater volume will result in slightly lower flow readings. This is because the transducer creates an ever-so-small back pressure that compresses the gas slightly.

Technical Support

Agilent's Technical Support Specialists are chemists with years of laboratory experience. They can provide you with in-depth knowledge and experience. Contact Agilent technical support; call 1-800-227-9770 in the US and Canada or call your local Agilent sales office or to contact Technical Support on the Internet, go to (www.agilent.com/chem).

Product Specifications

Table 2 ADM Flow Meter specifications

Flow range	0 to 750 mL/min, auto-ranging
Accuracy*:	
0 - 500 mL/min:	± 2% of reading, or ± 0.2 mL/min, whichever is greater.
501 - 750 mL/min:	± 3% of reading.
Tubing temperature range:	-62 °C to 110 °C
Operating temperature range	0 °C to 45 °C
Storage Temperature range†:	-15 °C to 50 °C
Power:	(3) AA batteries (alkaline), or USB power
Display:	128 x 64 Pixels Monochrome with 16 Gray Scales

* When verified at ambient temperature of 20 °C to 24 °C.

† Damage to the instrument may occur if it is exposed to temperatures greater than 50 °C, leading to inaccurate results.

Other features

- Automatic power off
- Split ratio mode with continuous split flow rate reading
- NIST Traceable Calibration
- Compatible with dry gases
- Volumetric and mass flow measurements
- USB communication
- Replaceable flow meter cartridge - individually computer calibrated

Safety and Regulatory Certification

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

Designed and manufactured under a quality system registered to ISO 9001.



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