



SABLE SYSTEMS INTERNATIONAL

THE MFC-4 GAS MIXING MASS FLOW CONTROLLER

FOUR CHANNELS + SUPPORT FOR GAS MIXING & REMOTE COMPUTER CONTROL

The **MFC-4** has all of the capabilities of our two channel TR-FC1 mass flow controller/ meter electronics unit and some important additional features:

- ❖ **Support for four mass flow control valves or mass flow meters.** More capacity for larger systems or tertiary and quaternary gas mixing.
- ❖ **Read flow in percentage units or in volumetric flow units.** No more "375 ml is what percent of 2 liters?" when you are setting up an experiment.
- ❖ **Perform gas mixing by setting the total flow rate and desired proportions for each gas.** The MFC-4 will calculate the correct individual flows for you without arithmetic or order of magnitude errors.
- ❖ **Change flow rates or gas mixtures automatically during an experiment under computer control.** Graded hypoxia, thermal challenge with helium/ oxygen or exposure to test gases are no problem with the MFC-4's serial control capabilities.

The **TMFC4** can control **four** separate mass flow control valves or mass flow meters simultaneously. Like, the two-channel TR-FC1, the input power requirement is an unregulated 11-15 VDC at up to 2A with all of the required internal voltages generated by on-board electronics. The **MFC-4** does have a somewhat higher current requirement when four mass flow valves are being used - when only one or two valves are connected, its requirements are similar to those of the TR-FC1 two channel unit. Like the TR-FC1, the **MFC-4** is fully protected against reverse polarity connection.

USER FRIENDLY: Flow rates are set with digital rotary encoders that have minimal drift and are nearly impossible to accidentally readjust. Simply press the mode button to select an input channel, turn the knob to set the desired flow rate and press the mode button again to confirm the new setting.

A four line by 20 character digital display shows read both the set *and the actual* mass flow rates of all attached mass flow controllers, simultaneously - no need to switch between "set" and "read". Mass flow can be set and read in percentage units (the default, and the only mode available for the TR-FC1) or in actual volumetric flow units. Do you want to do an experiment with helium just this one time without going to the expense of an additional mass flow device? With the **MFC-4**, it is no problem to use a flow valve or meter calibrated for one gas with another gas by simply entering the correction factors when prompted to do so during set-up

Flow data are available in buffered voltage form from four BNC connectors for analog data acquisition systems, and in digital form from a digital (RS-232) interface allowing for easy use of mass flow meters as well as mass flow control valves.

Plus, the **MFC-4** has a **built-in, stand-alone gas mixing mode**, allowing any mixture of up to four different gases to be dialed in incredibly simply and quickly. Enter the total flow rate and then enter the percentage composition for each gas. The MFC-4 calculates all of the necessary setpoints internally without errors. And the MFC-4 can accept instructions from a computer over a serial link. Our serial protocols are standard, straightforward and available to anyone who wishes to make use of these capabilities in their application.

VALUE ADDED: Like all of our instruments the MFC-4 is guaranteed for three years and comes with free, lifetime technical support.





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The MFC-2 Two Channel Mass Flow Controller Meter Electronics Unit

CONTROL: Accurate flow control is vital in applications such as respirometry or gas mixing. Conventional flow meters and control valves are temperature- and pressure-dependent, making them unreliable for critical work. If you need research-quality results, mass flow meters and mass flow controllers are essential.



THE RELIABLE CHOICE: Unlike budget alternatives such as rotameters, mass flow controller valves are not affected by local temperature and pressure, and deliver a closely-regulated output continuously corrected to STP. This output can be set externally. This makes them ideal for research and other critical applications. However, mass flow controller valves need a suitable electronics unit that supplies the electronic infrastructure required for accurate operation. The Sable Systems mass flow controller electronics units are designed to supply the carefully-regulated ± 15 Volts supply that gas-phase mass flow controller valves require, together with precise user-variable voltage reference sources. These variable voltage sources determine the rate of mass air flow through industry-standard external mass flow controller valve(s) supplied by the user or by Sable Systems. All of the required voltages, in keeping with the Field-Aware design philosophy of Sable Systems, are internally generated from an unregulated voltage input of 11 - 15 VDC (a suitable power supply is supplied with the unit).

The MFC-2 can control two separate mass flow control valves simultaneously. Flow rates are set with a quick, intuitive menu system using long-life controls and non-volatile memory with a rated retention of 200 years. A two-line alphanumeric display accurate to 0.1% is provided so that the user can easily and simultaneously read both the set *and the actual* mass flow rates of attached mass flow controllers. This simple capability, essential to obtaining reliable data and for de-bugging plumbing problems, is lacking from most competitive units. You can also read mass flow rates from mass flow meters if control is not required, or is implemented elsewhere in the system. Actual mass flow rates of attached mass flow controller valves are also available in buffered voltage form from two BNC connectors, and from the serial output. These features allow for recording of mass flow rates along with other respirometric or process management variables. Moreover, the MFC-2 can be remotely controlled over its serial data link (software available on request).

For four channel mass flow control plus built-in gas mixing ability, consider our **MFC-4**.

Brief Specifications:

Power: Input: Nominal 12VDC (11-15 VDC) at up to 850mA with two mass flow valves connected. Fully protected against reverse polarity connection. A universal power source is supplied. **Output:** Internally generated, isolated supplies of $+15.0 \pm 0.25$ V and -15.0 ± 0.25 V at up to 350 mA each per mass flow controller/meter. Regulation over the full load range is better than 0.1%. Fully isolated from the input voltage, eliminating grounding conflicts.

Controller/ meter Connectors: Two standard 15-Pin D-sub female connectors. One 6-foot cable with a 15-pin D-sub to 20 pin card edge connector (industry-standard mass flow control valve pin out) is supplied with the unit. Cables for mass flow meters or for other connector types supplied upon request. Ask us if you have questions.

Flow read output: Output is 0.000V (no flow) to 5.000V (100% of full scale flow) with linear scaling. Accurate to 0.1 mV over the 0-5V range, with gain accuracy better than 0.01% and linearity error less than 0.01%. Serial output at settable rates or operable in polling mode for remote control (full specifications and protocol available on request).

Flow scaling output: Control voltage 0-5V for 0-100% of full scale. Reference voltage stable to better than 0.01% over a 0-50°C temperature range. Output is short circuit proof.

Case: heavy-gauge aluminum, fully shielded. 6-x 7-x 4+ Weight less than 5 lbs (3 kg)

VALUE ADDED: Like all of our instruments the MFC-2 is guaranteed for three years and comes with free, lifetime technical support.