

Field Calibration of Alicat Flow Meters

Experience has shown that most users of Alicat Scientific flow meters treat these instruments with care. This means that recalibration is normally a simple matter of checking the flow against a standard and adjusting the flow gain so that it matches an accurate standard.

Before attempting to recalibrate the device, it is necessary to check that the reading of the absolute pressure and temperature sensors are within specifications. If the temperature or pressure requires adjustment, adjust them prior to adjustment of the flow gain.

Step 1: Establishing Serial Communications

There are a number of options for how to establish RS-232 / RS-485 communications with the Alicat device. See the '**RS-232 / RS-485 Interface**' section for details. If the user wishes to interface via HyperTerminal, the instructions for setting up communications are included in the device manual. Communications can also easily be established via Alicat's Serial Terminal, or Flow Vision SC.

Type `*@=A<Carriage Return>` to poll the flow meter. The computer should respond with a single line of information.

After the address has been set to A, type "A" followed by hitting the <Carriage Return> key to see a line of current data.

Step 2: Temperature

To check the temperature, the meter should be left in the same environment as the temperature standard for long enough to ensure the meter and the standard are both equilibrated. The temperature sensors are quite sensitive and can easily change temperature if the flow bodies are handled or held. Make sure it has not been handled prior to comparing the displayed temperature to the standard.

The temperature reading on the meter display should be equal to the standard within +/- 2.0°C. If it is grossly out of specification, the device may have been damaged and should be returned to the factory for evaluation.

Once the device is in the conditions listed above, continue through the communications application.

*Refer to the '**Register 41 – Temperature Offset**' (page 19) section for more detailed information.

1. Type `A$$R41<Carriage Return>`. The computer responds with `A 41=XXXXXX` where the X's denote the numerical value in register 41. **Write this value down so that register 41 can be returned to the factory settings if necessary.**
2. The value in register 41 will need to be changed in order to make the reading match the temperature standard within 0.5°C.

Note: Changes are 128 counts per °C. Increasing the value in register 41 will lower the temperature. Decreasing the value will raise it.

3. Type A\$\$W41=XXXXX where the X's denote the new value to be attempted.
4. Type A<Carriage Return> to poll the device and compare the temperature reading with the temperature standard. (The temperature is the second piece of data in the line.)

Step 3: Absolute Pressure

To check the absolute pressure, the meter should be checked against an accurate barometric standard. Make sure the environment in which the meter being checked resides is still and not affected by stray air currents, as from forced air heaters or air conditioners.

The absolute pressure reading on the meter display should be equal to the standard within +/-0.5 PSIA. If it is grossly out of specification, the device may have been damaged and should be returned to the factory for evaluation.

Once the device is in the conditions listed above, continue through the communications application.

*Refer to the 'Register 33 – Pressure Offset' (page 19) section for more detailed information.

1. Type A\$\$R33<Carriage Return>. The computer responds with A 33=XXXXX where the X's denote the numerical value in register 33. **Write this value down so that register 33 can be returned to the factory settings if necessary.**
2. The value in register 33 will need to be changed in order to make the reading match the barometric standard.

Note: Increasing the value in 33 will reduce the pressure reading. The scale is fairly sensitive, so a large change should not be necessary.
3. Type A\$\$W33=XXXXX<Carriage Return>, where the X's denote the new value. The computer should respond with A 33=XXXXX with the new value.
4. Type A<Carriage Return> to poll the device and compare the absolute pressure reading with the barometric standard. (The pressure is the first piece of data in the line.)

Step 4: Flow

To check the flow, the meter should be checked against an accurate mass flow standard. Prior to checking against the standard, several things should be noted:

Be sure that the meter is set for the gas flowing through the standard.

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Be sure that the standard is correcting to standard conditions of 25°C and 14.695 PSIA

Be sure that the meter is powered by an appropriate AC/DC adapter.

Be sure there are NO leaks between the meter and the standard.

Be sure to perform a valid tare on the meter prior to the flow check. See the manual for instructions on accurately taring the meter.

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Once the device in the conditions listed above, continue through the communications application

*Refer to the '**Register 26 – Volumetric Flow Gain** (page 18) section for more detailed information

Check the flow reading at 25% of full scale, 50% of full scale, and 100% of full scale. All should match the flow standard within 1% of the full scale of the device (full scale / 100). If the meter is within +/-1.0% of the full scale range of the device, the flow gain should be adjusted as described below.

If the gain cannot be adjusted such that all of the above points fall within 1% against the standard, the meter may be fouled or the differential pressure sensor may be damaged and the meter may need to be returned to the factory for cleaning/evaluation. The most common cause of non-linearity is nonlaminar flow which is often caused by debris or corrosion.

To adjust the flow gain:

1. Type A\$\$R2 <Carriage Return>. The device should respond with A 26=XXXXXX, where the X's denote the numerical value in register 26. Perform a linear interpolation to determine what value is required to match the desired gain. This can also be approached by the trial and error method if necessary.
2. Set the flow to full scale by the flow standard and adjust register 26 as follows until the flow reading matches the flow standard.
3. Enter the new value to register 26. For example, to try a gain of 2, type A\$\$W26=XXXXXX<Carriage Return> where the X's denote the numerical value.
4. The computer will respond to the new value by confirming that A 26=32768. To see the effect of the change, type A<Carriage Return> to poll the device. Do this several times and take an average if necessary. **It is good practice to tare the meter at zero flow between gain adjustments.**
5. Once register 26 is set to a value that brings the device within +/-1.0% of full scale check readings at half and quarter scale to make sure they still match the standard. These devices are generally quite linear, and the readings should fall in within 1% of the full scale of the device.