

Flow Meter Calibration Bucket Test Procedure:

There are several ways to calibrate a FLO EZO, but for this example we will use one common way which is called a bucket test.

Download the companion spreadsheet [Flow Meter Calibration.xlsx] from our website at www.intreatsys.com/downloads to assist with the math.

[Step 1: Gather materials and Tools](#)

Obtain an appropriately large container depending on meter size. Maybe a 5 gallon bucket? Maybe a 50 gallon drum? Maybe a 275 gallon tote? The size bucket depends on the meter size. Bigger meters will require larger calibration volumes. Use good judgement here ... the exact size is not critically important, but measuring the volumes accurately will improve the overall accuracy of the meter after calibration.

For this example we will use:

1. Large bucket.
2. Smaller bucket of known volume for establishing calibration volume.
3. Waterproof marker.
4. Stopwatch (or the stopwatch feature on your watch or smartphone).
5. *WaterFeature#* water quality monitor.
6. Atlas Scientific FLO EZO circuit installed in any channel of the *WaterFeature#*.
7. DC Pulse type meter.

[Step 2: Calibrate measuring vessels](#)

For this example fill the 5-gallon bucket with exactly 4-gallons of water using the 1-gallon pail. Mark the water level with a permanent marker and dump the water out.

[Step 3: Find the current K-value\(s\) of the FLO EZO you are calibrating](#)

Connect the flow meter and ensure the *WaterFeature#* is powered ON and properly displaying the flow meter flow rate data.

Establish the current K-value of the FLO EZO. If you do not know the K-value of the FLO EZO you want to calibrate, there are two ways to find this information:

1. Connect to the *WF#* device and follow the instructions on interfacing with the EZO using Remote State and the encapsulation commands.
2. Power off the *WF8*, remove the FLO EZO, and connect directly with it using a Terminal Emulator.

The instruction manual that arrived with your *WaterFeature#* will show you how to do this. [Download the manual here](#).

Write down the K-value(s) for use later. For this example our K-value is **K[0.45 gpm,15 pulses]**. We need to know what the EZO thinks is the correct K-value before we can correct it using the bucket test.

Pre-Calibration K-Value Volume or Flow Rate	Pre-Calibration No. Pulses or Hz

[Step 4: Run the bucket test to establish baseline performance](#)

If you removed the FLO EZO in Step 3, reinstall it on the *WaterFeature#* unit now. Otherwise, return the *WaterFeature8* to Local State, or leave it in Remote State if you prefer to interface in this manner.

The bucket test involves filling the large bucket with water passing through the flow meter and recording the time it takes to fill the known volume.

- If the meter/EZO uses a single K-Value, take note of the reported flow rate during the fill period. Record this value in CELL **B15** of the companion spreadsheet.
- If the meter/EZO uses multiple K-Values, set the discharge flow rate to match the K-Value you are recalibrating, then time how long it takes to fill the bucket at that flow rate. This flow value (i.e. K-Value) needs to be input into CELL **B15** of the companion spreadsheet. It is advised to repeat the test for each K-Value programmed into the EZO.

As the bucket is filling use a stopwatch or other suitable timer to time the fill duration. Enter the Fill Volume (V_F) and Fill Time (F_T) on the companion spreadsheet in CELLS **B7** and **B9**, respectively.

The Calculated Fill Flow Rate (Q_F) is shown in CELL **B13**. In this example the Calculated Fill Flow Rate is 1.92 gallons per minute.

In this example for a single K-Value, the *WF#* showed the Display Reported Fill Flow Rate (Q_0) of 2.05 gallons per minute during the fill, and this value as well as the correct units are entered on the companion spreadsheet in CELL B15.

Note, the units in ROW 13 of the companion spreadsheet **MUST** match those of the Display Reported Fill Flow Rate (Q_0), otherwise the calculation will be incorrect. Make sure the units in ROW 15 match those displayed on the WaterFeature# (as they should match those in the EZO), and set the units in ROW 13 to be the same.

[Step 5: Calculate the new FLO EZO K-value\(s\)](#)

According to the meter (and thus the default K-value in the FLO EZO) it **should have** taken 1.95 minutes (117 seconds) to fill the bucket based on the 4 gal / 2.05 gpm *WF#* display reading. However, since it actually took more time to fill the bucket (2.08 minutes = 125 seconds) we know that the actual flow is a bit lower than the meter reading, and this means that the meter is over-reporting the actual flow. Therefore, the volumetric parameter of the K-value should *decrease* so that a lower volume is reported for the same number of pulses.

The calculation involves adjusting the K-value by the ratio of the bucket test actual flow rate to the displayed theoretical reading. This is called the **adjustment ratio**, R , and it is calculated as the ratio of actual, calculated flow to the display reported flow:

$$R = (\text{Calculated Fill Flow Rate, } Q_F) / (\text{Display Reported Fill Flow Rate, } Q_0)$$

In this example the K-value needs to be shifted by the adjustment ratio of:

$$R = 1.92 \text{ gpm} / 2.05 \text{ gpm} = 0.9366$$

Next, multiply the volume portion (or flow rate portion) of the Existing K-value (K_0) by the adjustment ratio, R , to obtain the new K-value flow rate.

$$\text{New K-value, } K_F = R \times K_0$$

$$K_F = 0.9366 \times 0.45 = \mathbf{0.4215 \text{ (volume or flow rate)}}$$

The corrected meter K-value is **K,[0.4215 gpm,15 pulses]**.

For meters/EZOs with multiple K-values, repeat steps 4 and 5 to gather more K-value data points.

[Step 6: Reprogram the FLO EZO](#)

Overwrite the existing FLO EZO K-value(s) with the corrected K-value K_F by interfacing with the FLO EZO in one of the two methods discussed in Step 2, above. Instructions for FLO EZO commands can be found in the [Data Sheet on Atlas Scientific's website](#).

Refer to our [Downloads](#) page and check our our EZO programming instructions, or download the instruction manual for directions on how to connect via Remote State and interface with the FLO EZO using encapsulation.

[Step 7: Accurately measure flow](#)

Continue using the installed flow meter and FLO EZO as desired, there are no other EZO parameters to change and no other updates are required on the *WF#* unit.

Flowmeter Calibration Tips:

Review the flow meter accuracy at least once every calendar year to confirm that the meter is properly calibrated. Recalibrate more frequently if the meter performance is changing unexpectedly.

If the meter measures flows over a wide range of flow rates, then multiple K-value data points will improve the overall accuracy of the device. However, if the hydraulic system generally operates near a typical flow rate value, a single K-value will likely be accurate enough for process control.

When interfacing with the *WaterFeature#* unit in Remote State, the FLO EZO will report both instantaneous flow rate and the totalized flow. This totalized flow information is legitimate and can be used for other process control purposes.