SIGNALFIRE
WIRELESS TELEMETRY

Monitoring Water Flow with the SignalFire RANGER

Enhancing Water Management Through Wireless Innovation

Table of Contents

Introduction

Users across multiple industries measure water with either electronic or mechanical flow meters for control, monitoring, or regulatory compliance. If you are installing a meter for the first time and you're required to add telemetry, specifically, the SignalFire Wireless RANGER, then this document will be helpful. This guide will focus on the proper configuration of your flowmeter and the SignalFire RANGER. You'll find examples from Seametrics, McCrometer, and Bermad magnetic flowmeters. This process will be similar for other manufacturers. You will want to consult with your supplier or meter manufacturer to understand their process and the software/hardware tools you may need.

In general, all flowmeters have some form of an output to allow the user to know how much fluid it has measured. This could be a simple display with a flow rate and totalizer, such as the display on the right from a Seametrics AG3000 magnetic flow meter or an electronic signal that is generated by the flowmeter.

When the need arises, to integrate a meter with some form of automation, such as programmable logic controller or remote telemetry then an electronic output from your meter is required. You will need to confirm that your flowmeter has an electronic output and exactly what type of output. You will hear terms such as Pulse, Frequency, Analog current 4-20ma (milliamp), DC Voltage in ranges of 0-5, 1-5, 0-10 along with digital communication protocols such as Modbus RTU, SDI12, HART, Profibus, Sensus, just to name a few.

For this guide, we are going to focus on an electronic pulse that is generated by the flow meters' electronics and how to proper configure it to use with SignalFire Wireless Telemetry RANGER. We will also show you how to properly set up the SignalFire Cloud to read the pulse and display your flow rate and total.

You're going to learn how to configure your meters pulse output so you 'll see the term K-Factor a lot. What is a K-Factor, you ask?

Definition: A **flowmeter K-factor** is a numerical value that represents the relationship between the **measured pulses** (or other output signal) of a flowmeter and the **actual volume** or **mass of fluid** that has passed through it.

The **K-factor** is typically expressed in:

- **Pulses per gallon (ppg)**
- **Pulses per liter (ppl)**
- Or other similar units

$$\text{K-factor} = \frac{\text{Number of Pulses}}{\text{Volume of Fluid}}$$

So:

- If a flowmeter has a K-factor of **1,000 pulses/gallon**, then for every 1,000 pulses counted, **1 gallon** of fluid has passed through the meter.

For you to get accurate flow readings you MUST configure BOTH your flow meters' output properly along with the RANGER's discrete input used for flow measurement. It's critical to understand how the manufacturer allows you to configure this output.

Now, where this becomes confusing is that many modern electronic flow meters define their pulse output as a Unit Volume/Pulse, for example, gallons/pulse, acre feet/pulse. Occasionally, you'll run across a manufacturer that defines their pulse output as Pulses/Gallon. Contrast that to legacy mechanical meters such as a prop, turbine, or PD meter, they will have a K-Factor generated at the time of manufacturer and calibration. You should find this on the original calibration certificate or stamped somewhere on the body of the meter. It's imperative that you know how your manufacturer handles pulses. In this guide we'll show you three manufacturers and how they configure their pulse outputs. All these manufactures use Units Volume/Pulse, i.e. Gallons/Pulse, Acre Feet/Pulse, etc.

This guide will help you with the basics for getting the accurate measurement you need on the SignalFire RANGER. It is not necessary to read this entire guide. If you have wired your meter's output properly, move to section 2 Flow Meter & RANGER wiring. Once complete move on to the flow meter configuration and then finish with the RANGER/SignalFire Cloud Configuration.

Steps to follow:

The SignalFire Wireless Telemetry RANGER: Overview

The SignalFire RANGER is a cutting-edge wireless telemetry device designed to simplify the process of gathering and transmitting field data. It is part of the SignalFire Wireless Telemetry product offering which supports a vast array of sensors and measurement types. The RANGER itself is a low-power, battery-operated device that communicates via cellular networks or private wireless infrastructure, making it ideal for remote and hard-to-access locations.

Core Features

- Versatile Sensor Support: Compatible with a broad range of water flow meters, that have an electronic pulse or a digital protocol such as Modbus, SDI12, or HART protocol. Multiple sensors other than your flow meter can be connected to a RANGER. Examples: level transducer for your water well, motor saver from your motors driving your pumps, weather stations, soil moisture sensors, pressure transducers, temperature transducers. For this document, we'll provide examples of utilizing Modbus RTU communications.
- Wireless Connectivity: Utilizes LTE-M/NB-IoT cellular technology for reliable, wide-area data transmission.
- Battery Powered: Designed for multi-year operation on a single battery pack, reducing maintenance needs.
- Rugged Design: Built to withstand harsh environmental conditions, including extreme temperatures, moisture, and physical impact.
- Cloud Integration: Seamless data delivery to cloud-based dashboards and SCADA systems, enabling remote visualization and analytics.

Deployment Process

1. Site Assessment and Planning

Begin by identifying the specific points in the water system where flow data is needed. The RANGER communicates with cellular carriers that support LTE-M and NB-IoT networks. Assess

network coverage to ensure reliable cellular communication and determine power requirements. The best approach is to work with your sales representative to physically take a RANGER to your location and test it. While many networks provide maps showing their coverage, we have all experienced, with our cell phones, places where we are supposed to have coverage but either we don't or it's very weak. Understanding this up front allows us to either provide a different carrier or provide a solution with a remote antenna.

The RANGER can be supplied with either a battery, DC Power, or a High Capacity Solar and rechargeable battery. A RANGER with a battery can has a battery life of over 5 years depending on how often it wakes up to report data, see example below.

RANGER Battery Life Estimates for 1 pulse input

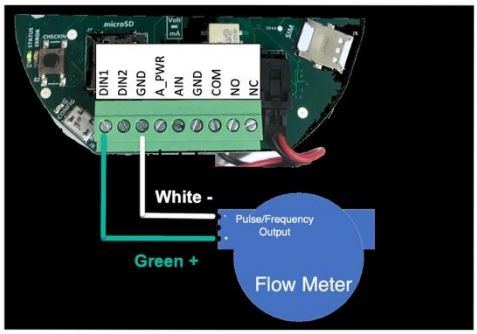
Reporting Interval	Battery Life Estimate
1 minute	1.6 years
15 minutes	6.6 years
60 minutes	7.3 years

2. Flow Meter & RANGER Wiring

The RANGER is designed to interface with multiple sensor types with inputs to support 4-20mA/1-5VDC, (2) digital inputs such as an electronic pulse from a flow meters and digital protocols; (Modbus RTU, SDI12, HART) that can be configured for volume of water passing through. Proper wiring and sensor configuration are essential to guarantee accurate data collection.

- For a meter with a pulse output, connect the flow meter's output: (Pulse +/Pulse -) to the RANGER's input terminals DIN1 (+) & GND (-). The RANGER can monitor up to (3) flow meters with the optional A2DI daughter card. Follow the same instructions for the 2nd & 3rd meter. **Document which terminal you wired the Pulse + into; DIN1 or DIN2. You will need this when configuring the RANGER on the SignalFire Cloud**

Before configuring the RANGER, you will want to configure your flow meter's pulse output first. This will determine how you will configure the RANGER K-Factor in the Flow Tile.



3. Flow Meter Configuration – Seametrics AG/iMAG, AG90/EX90 family meters

Setting the output of any AG3000, iMAG4700, AG90 or EX90 meter to communicate with a RANGER is all the same procedure.

If the display is off, the meter is probably configured as a battery powered meter and will have a BX in the model number (AG3000-0800-F1-**BX**-X-01-0000) and the meter is probably asleep.

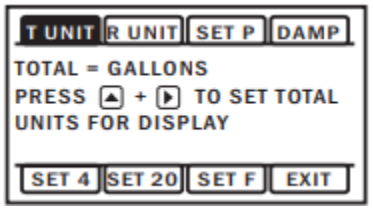
To wake the meter up, cover one of the arrows for 5 seconds and then uncover. If the meter does not wake up, follow that procedure again. To save battery life, the meter only looks for the switch input once every 5 seconds. The meter will probably wake up easier than this but may need the full 5 second inputs.

To enter the Menu System, cover the UP arrow and while continuing to cover the UP arrow, tap and release the RIGHT arrow. Continue to cover the UP arrow until after you have released the right arrow and do this all within 1 second.

This will bring you to the Passcode entry screen. The default passcode is 000000. If a different passcode has previously been set, use the RIGHT and UP arrows to enter that passcode. In either case, use the same procedure again (cover the UP arrow and tap the RIGHT arrow while continuing to hold the UP arrow) to move into the menu system.

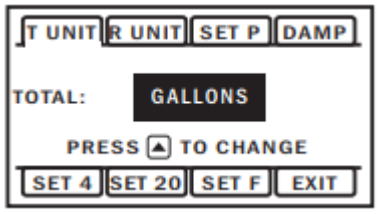
Once in the Menu System, move from tab to tab by tapping the RIGHT arrow. To change the settings within a tab, while that tab is highlighted, cover the UP arrow and tap the RIGHT arrow. This will bring you into the tab and the values within that tab can then be changed.

For example,



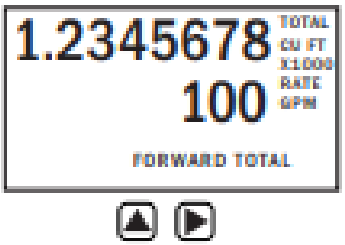
plus

plus



Would allow you to change the TOTAL unit.

To connect to a RANGER, you will need to navigate to SET P which represents the number of gallons totalized per output pulse from the meter. Enter that tab, then use the RIGHT and UP arrows to select 1.0 GALLONS. Using a SET P of 1.0 on the meter is equal to a K-factor of 1.0 on your RANGER.



Once you have adjusted or confirmed the SET P, use the hold and tap procedure (cover the UP arrow and while continuing to cover the UP arrow, tap and release the RIGHT arrow) to get back to the first menu screen. RIGHT arrow to the EXIT tab and use the hold and tap procedure again to return to the home screen.

EXIT tab plus

gets you to the hone screen

SIMULATE Pulse Output – Come back to this step AFTER you have configured the RANGER pulse input.

The Seametrics AG/iMAG and AG90/EX90 meters have a TEST mode that allows the user to simulate a fully functional, artificial flow rate for the purpose of testing other connected equipment. When the meter is in TEST mode, all features of the meter will function at the stated flow rate (in gallons per second) without the need to flow water. This can be helpful when setting up meter outputs and your RANGER telemetry device.

For TEST to function, the meter must be filled and not be in an EMPTY PIPE state.

To enter a value into the TEST feature, navigate to the TEST tab in the third menu screen. To navigate to deeper menu screens, go to the EXIT tab and slowly tap the up arrow 5 times. Once you are in the TEST tab, enter a flow rate value in the VAL screen (in gallons per second only,) then RIGHT arrow to the VAL box and UP arrow to the ON screen. This will initiate the TEST feature. The next UP arrow would bring you to the OFF screen, but you can 'hold and tap' the arrows to return you to the sub menu while the feature operates.

On the RANGER, SignalFire Cloud, or SignalFire Toolkit

Confirm the RANGER is receiving pulses. Let TEST run for 1 – 10 minutes to confirm results

After use, the TEST feature must be turned OFF. If the TEST feature is not turned OFF, the stated static flow rate (in gallons per second) will be shown any time the meter is full or in a flowing condition. Turn off the feature in the TEST tab, or by cycling power.

4. Flow Meter Configuration – Seametrics FT430, FT440, FT450, PS32 and PM04 are used with Seametrics insertion meters and some of the Technoflo prop meters.

These units calculate rate and total using a K-factor input. Click any button to bring you to the first menu screen. The first tab is SETK (K-factor.) Press the check mark ☑ to enter the SETK tab. The K-factor must be entered as pulses per GALLON. And use the check mark to exit the SETK tab. The PS32 and the PM04 units will have the K-factor preloaded and locked out.

If your device does **not** have a 4-20mA loop output, this would be an FT430, FT450, battery powered PS32 or battery powered PM04 the PULSE OUT 2 terminals on the back of the board are "pulse pass through" so the pulse output is the same as the K-factor input, and the pulse width is the same as the pulse input width.

In this case (no 4-20mA) use the PULSE OUT 2 terminals and set the RANGER input K-factor to the same value as the SETK you just entered here.

If your device is outputting a 4-20mA loop, this would be an FT440 or PS32 or PM04 with 4-20mA, you will need to use the scaled PULSE OUT 1 terminal and you will need to set the scaled pulse output in the first menu screen. In the first menu screen, navigate to SET P, press the check mark to enter, then set the number of gallons totalized per pulse sent out on PULSE OUT 1.

The scaled pulse outputs are hard coded with a pulse width of 100ms, and the scaled pulse output can only output 6.5 Hz maximum so setting the correct scaled pulse output can take some calculations.

We will want to set the pulse output to the highest frequency we can while staying below the maximum of 6.5Hz.

To calculate a reasonable SETP, take the maximum flow rate expected (in units per second) and divide by 6.5Hz. This will equal the minimum SET P and then round up to a number that is easy to work with.

Set P and K-factor are the inverse of each other. To set the K-factor in the RANGER you will need to divide 1 by the SET P value to calculate the K-factor for the RANGER.

The instantaneous flow rate shown on the RANGER is a 2 second sample and due to the low frequency scaled pulse inputs from the 4-20mA FT440, PS32 and PM04, if the running flow rate is significantly lower than the maximum flow rate expected, the instantaneous rate on the Ranger may count an inconsistent number of pulses every time it polls the unit (for 2 seconds) so the instantaneous rate may jump around, but the average rate will be correct. So, if using the scaled pulse output and the input pulses are low, you will need to read the average rate and disregard the instantaneous rate.

Setting the 4-20mA parameters is just a matter of entering the 4mA value you want (usually SET4 = zero) and the SET20 should be a value just above the maximum flow rate expected.

5. Flow Meter Configuration – McCrometer ProComm GO/FlowCom (FC200/201)

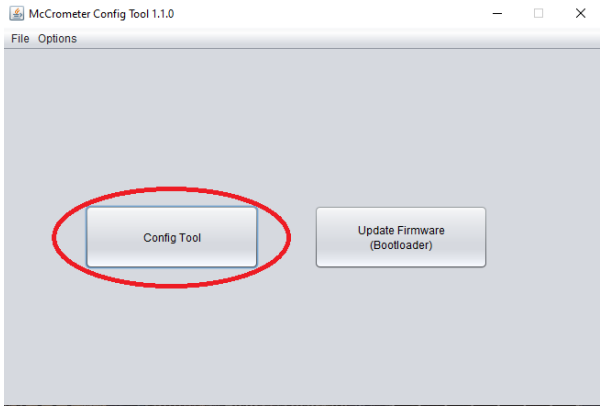
To configure the ProComm GO you will need to download the McCrometer Configuration Tool (Microsoft Windows based) from their website.

https://www.mccrometer.com/quick.search-download.search.jsa?keywords=Configuration+software along with any additional software drivers they recommend.

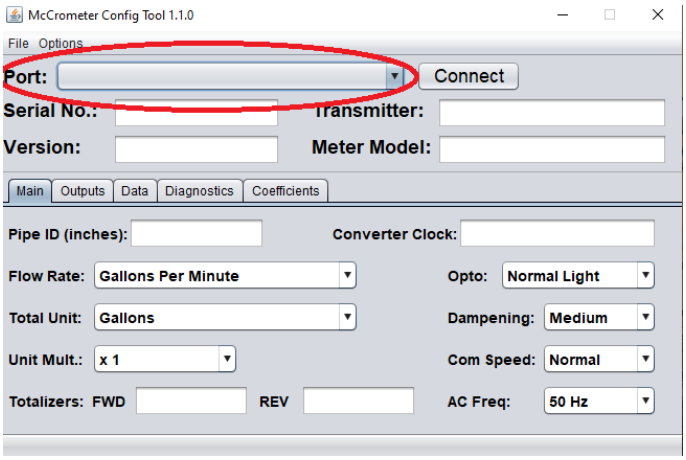
To connect your Windows laptop to the ProComm GO you will need a USB to Mini USB Type B connector.

1. Download the McCrometer config tool (version 1.1.0 or later) from the McCrometer website & connect the micro-USB to the side port on the meter.

2. Open the config tool and select the config toolbox from the two options.



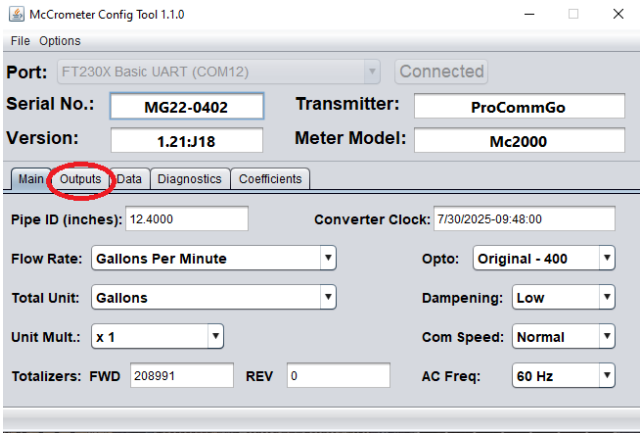
3. On the top left, you will have a dropdown that will allow you to select your USB port, the config tool will detect the ProComm Go.



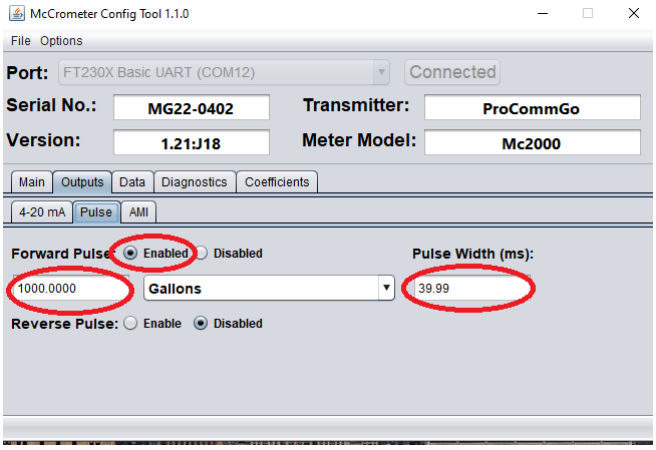
4. Once connected, you will receive a confirmation text box stating that the loading of the ProComm Go data is complete, press OK. The menu will now display the ProComm Go information.

5. Before you configure the pulse output. Select the Flow Rate units and Total Units that you want to measure in. For the Unit Mult, Select x 1.

6. Next, click on the outputs tab towards the middle of the screen, once in that sub-menu select the pulse tab.



7. Check the Enabled bubble and **SET PULSE RATE to 10**. Pulse width should not need to be changed



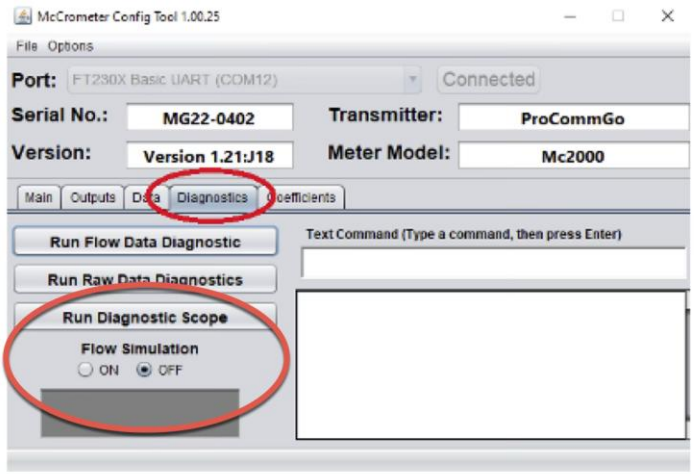
8. The ProComm Go is now ready to connect to Telemetry.

9. <u>The FlowCom (FC200/201) is set up the same way, using the same config tool.</u>

SIMULATE Pulse Output – Come back to this step AFTER you have configured the RANGER pulse input.

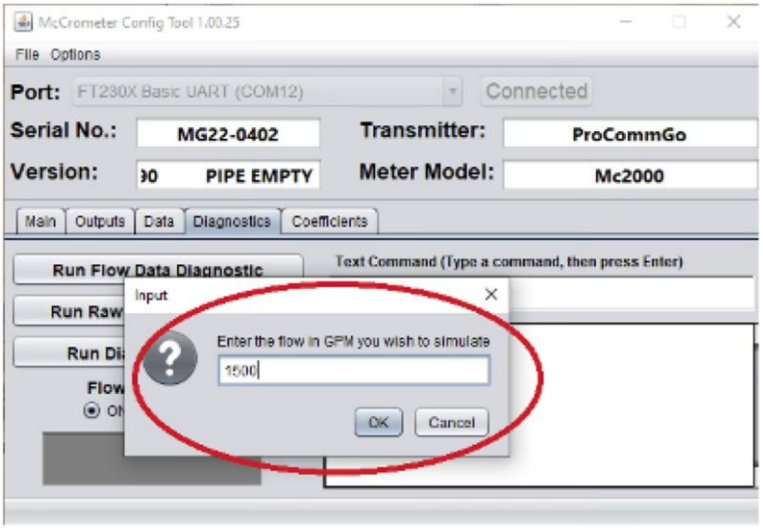
Click on the diagnostics tab towards the middle of the screen, once in that sub-menu click on the "ON" bubble under Flow Simulation.

1



You will be prompted to enter the flow you wish to simulate (Note: flow will be displayed in gallons per minute). A blue box will confirm your flow simulation is running. Verify the same rate is displayed on your meters' display.

2

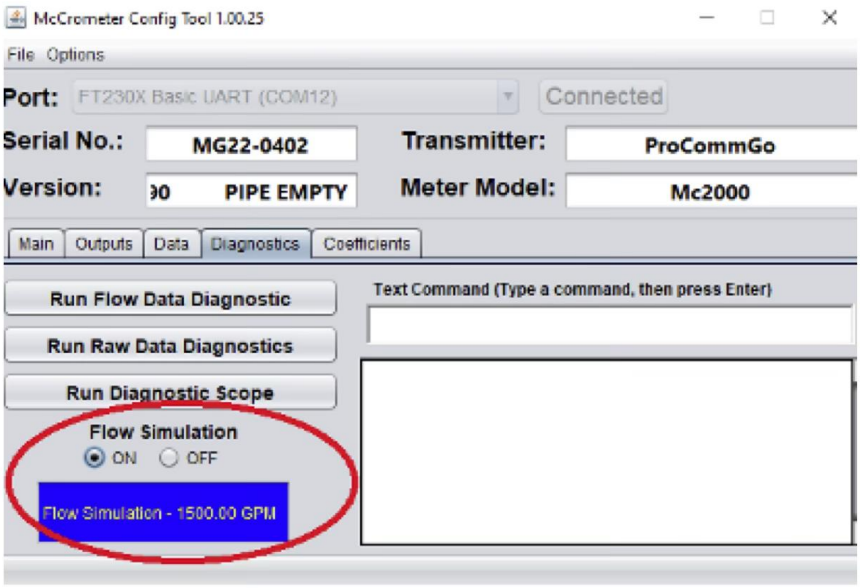


On the RANGER, SignalFire Cloud, or SignalFire Toolkit

FORCE REPORT

Confirm the RANGER is receiving pulses. Let Flow Simulation run for 1 – 10 minutes to confirm results

3



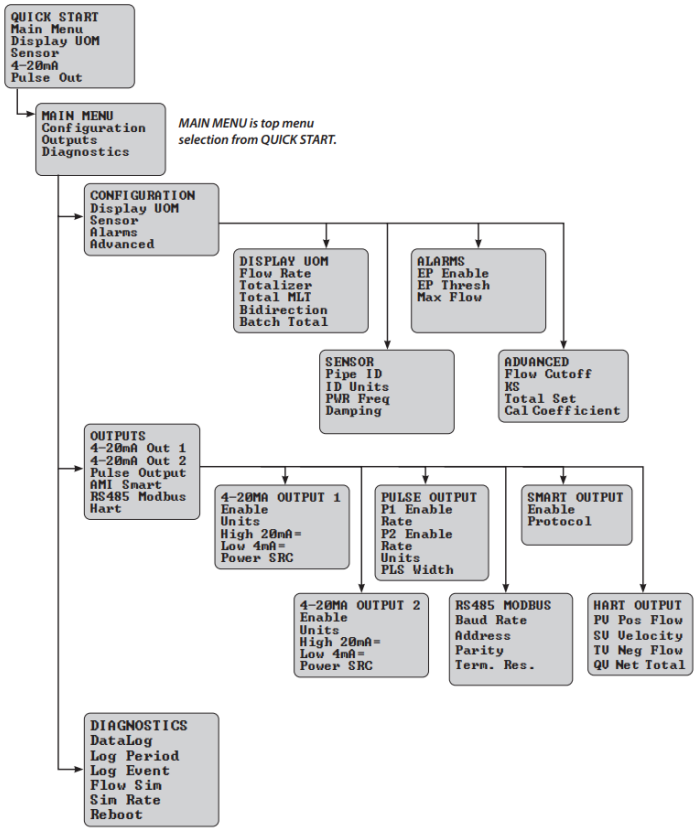
To turn off flow simulation simply click the "OFF" bubble.

6. ProComm Max

1. Navigating the Menu:

Key	Function
UP Key	Moves the cursor up to the previous subject on the menu Increases the numeric figure of the parameter highlighted by the cursor
DOWN Key	Moves the cursor down to the next subject on the menu Decreases the numeric figure of the parameter highlighted by the cursor
LEFT Key	Moves the cursor to the left on the input field Moves the cursor to the previous subject on the menu
RIGHT Key	Moves the cursor to the right on the input field Moves the cursor to the following subject of the menu
ENTER Key	Opens the Quick Start menu for the instrument configuration Enters the selected function Confirms the selected function
ESC Key	Leaves the current menu Cancels the selected function under progress

2. Menu Structure:



3. Navigate to the Main Menu
4. Select Outputs
5. Select **Pulse Output** from the list and configure the parameters for the pulse. Set the pulse rate to 10
6. The ProComm (previous version) is set up similarly.

Other McCrometer Transmitters:

McCrometer & Water Specialties mechanical propeller meters can also be equipped with other transmitters besides the FlowCom.

a. MC transmitters include EA631, SA100
b. WS transmitters include TR04, TR12

These transmitters have a pulse rate that is preset from the factory.

Locate the label on the transmitters to determine what that pulse rate is.

7. Flow Meter Configuration – Bermad MC 406 Converter with pulse output

Meter Pulse Output Wiring

Open MC 406 converter using a 4 mm Allen Wrench.

Lift hardware to clear bottom of converter.

Hold base of converter from turning, while turning top of converter counterclockwise 45 degrees.

Lift to open converter.

Pulse output wires shall be landed on both POS terminals.

Terminal block is removeable.

TIP: thread wires through glands prior to wiring to terminal block POS.

MAIN SCREEN VIEW

Totalizer=318132 GAL

Instant Flow=0.00 Gal/Min

T= Displaying Total Forward

ALTERNATE SCREEN VIEWS

-T= Reverse Flow Total

P= Partial Total Forward Flow

-P= Partial Reverse Total Flow

BUTTON #3- Cycles through Alternate Screen Views.

BUTTON #4- Cycles through Main Screen Views.

Entering Function Menu

STEP 1- Press any button to wake up Red LED

STEP 2- Press #1 button to enter access screen

STEP 3- Press #2 button to 6 times to move cursor and enter Function Menu.

NOTE: Password protected units must contact local GSA

Function Selection Menu

Entering Pulse Output Settings

Use button #4 to navigate to **(Pulse Volume Setting)**

F SEL 07

Press #2 button to access F SEL 07

Use button #3 or 4 to adjust this value. At 10, this meter will send 1 pulse for every 10 units that pass through the sensor.

Preferred Signal Fire RANGER Settings

2”-3” Diameter meters- 1 or 10

4”-12” Diameter Meters- 10

After selections have been changed press button #2 to

Use button #4 to navigate to (**Pulse Technical Unit Settings**)

F SEL 08

1= ML; 2=L; 3=M3; **4= Gallons**

After selections have been changed press button #2 to save any changes.

Use button #4 to navigate to (**<u>Pulse Length Settings</u>**)

F SEL 09

Setting options are between **5-500** milliseconds.

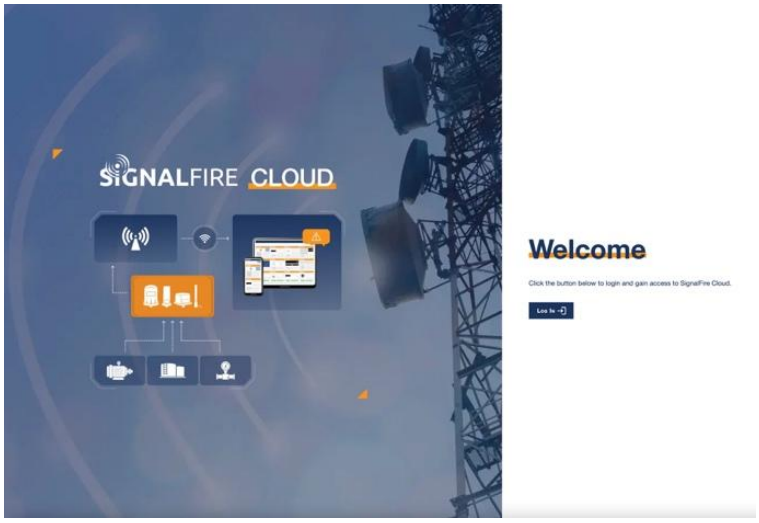
<u>Signal Fire RANGER preferred settings 10 ms</u>

<u>After selections have been changed, press button #2 to save any changes.</u>

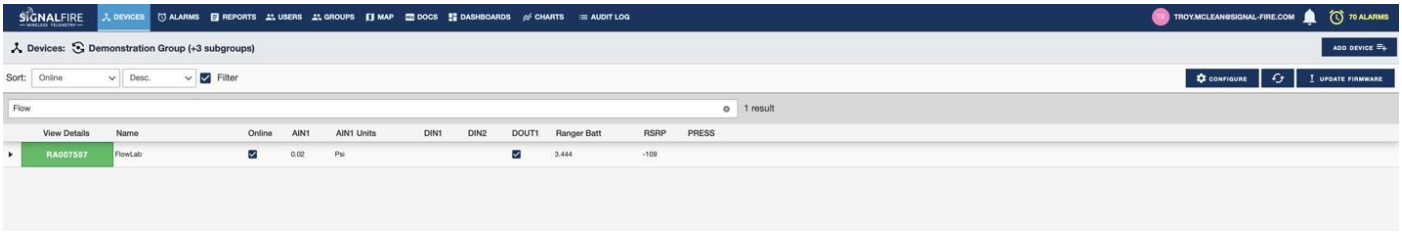
Press the #1 button to return to the main screen.

RANGER Configuration – Using the SignalFire Cloud

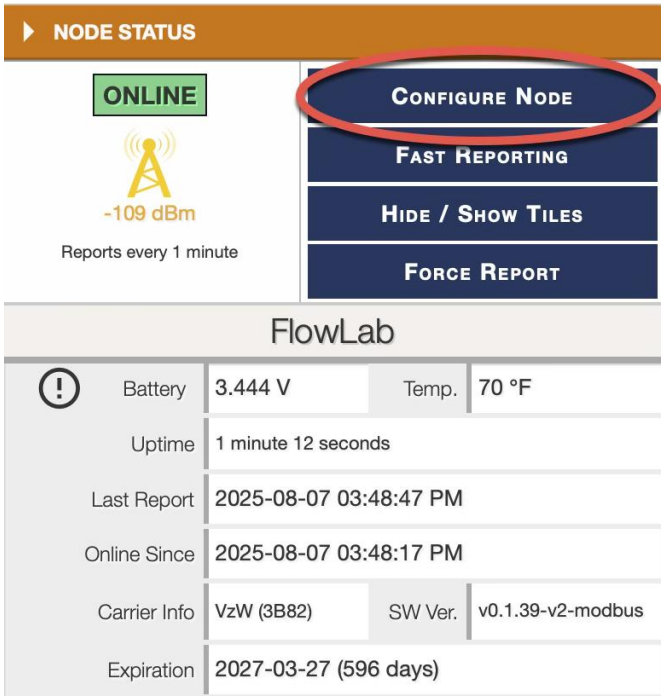
It's assumed that you have a SignalFire Cloud Account and that you have CLAIMED your RANGER to your account. Contact your local representative or SignalFire Support if this is not the case at support@signal-fire.com or 978-212-2868



Login to your cloud account and choose the RANGER you are working with. NOTE: Your RANGER will need to be connected and ONLINE to perform this setup. GREEN indicates that your RANGER is ONLINE and connected to the cloud, RED indicates that the RANGER is offline. Click on it and this will launch the RANGER Home Screen that you have setup. Follow the steps below to configure the RANGER for your meter.

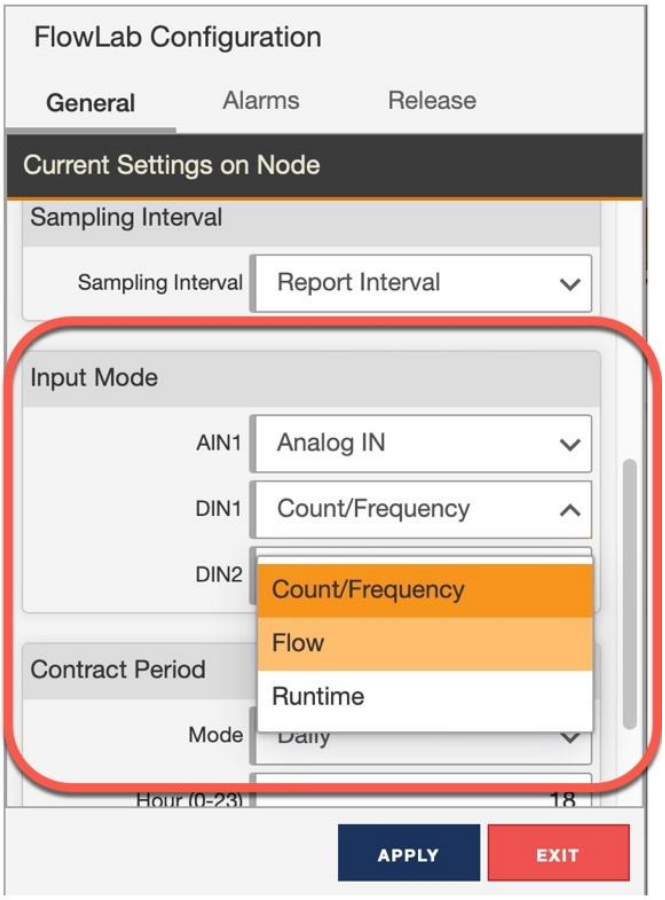


1. Locate the NODE Status Tile and click on Configure Node.

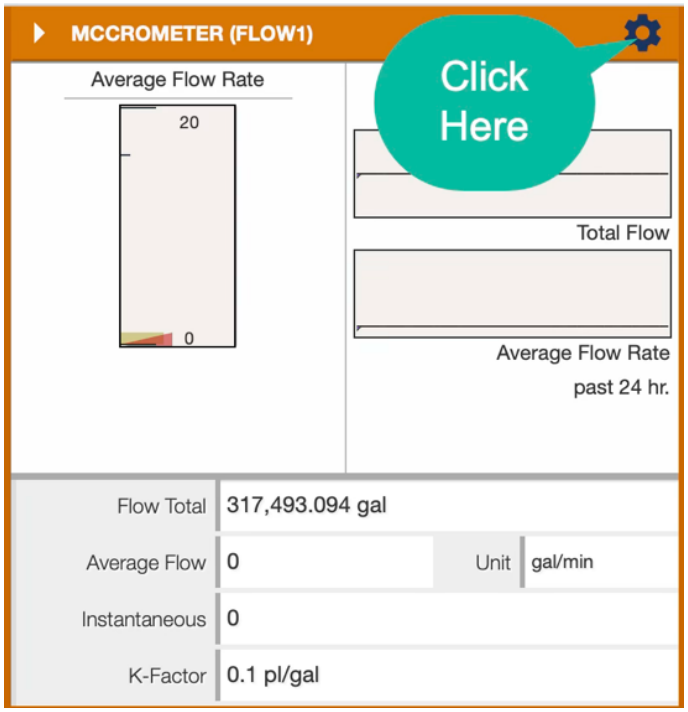


2. Scroll down the tile until you see Input Mode. Choose DIN 1 or DIN2 pull down menu, depending on which wiring terminal you used for the Pulse +. Click on the drop-down menu and choose "Flow"

Click on APPLY to save your changes.

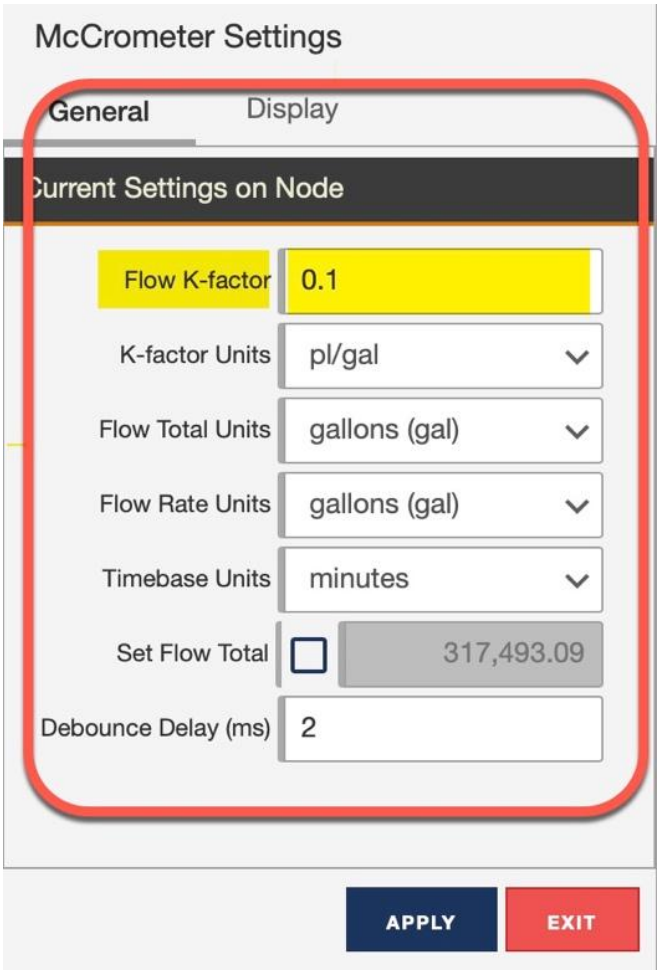


3. You will now find a FLOW Tile on your home screen. Next, you'll need to click on the GEAR to configure the tile



4. Click on General and you'll see all your configuration parameters to define your Flow K-Factor, Flow Total, Flow Rate units and time base. Here you can also set your flow total to match your meter when configuring on a meter that has been in service.

Ignore the Debounce Delay.



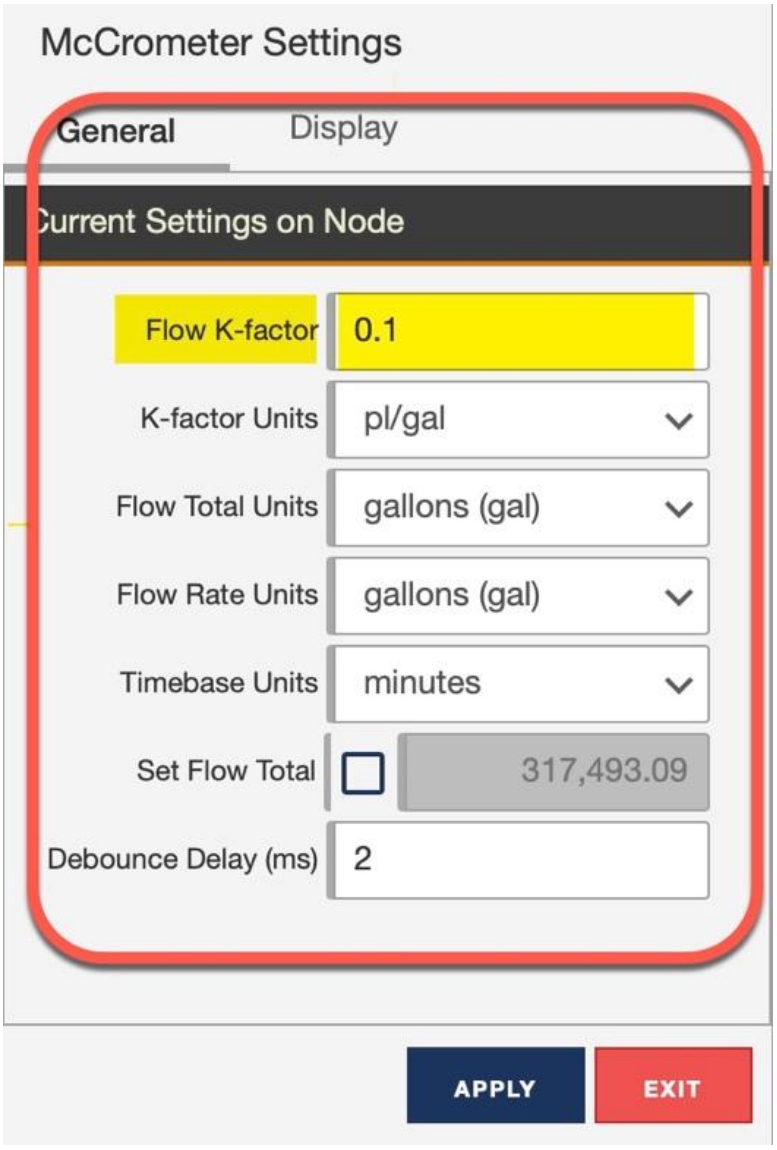
K-Factor is defined as Pulses/Flow Unit. Play with the pull-down menus to learn the various settings you can choose for K-Factor. For our example, we chose pl/gal (pulse/gallon). Your K-Factor Units MUST match that of the UNITS you chose for the flow meter pulse output.

$$\text{K-factor} = \frac{\text{Number of Pulses}}{\text{Volume of Fluid}}$$

So, if you configured your meter's pulse output to acre-feet, then you will need to choose the pl/ac-ft as your K-Factor Units on the RANGER.

You'll want to choose the SAME flow total unit and SAME flow rate units that you set on your flowmeter. You are allowed to have different units for the Flow Total and Flow Rate, just make sure you're comparing the same units on both the RANGER and your flowmeter.

For the Time base, you MUST use the SAME units that you configured your flowmeter flow. If you choose Gallons per Minute on your flowmeter, then choose MINUTES for your time. If you choose Gallons per Hour, then choose HOUR as your time base, etc.

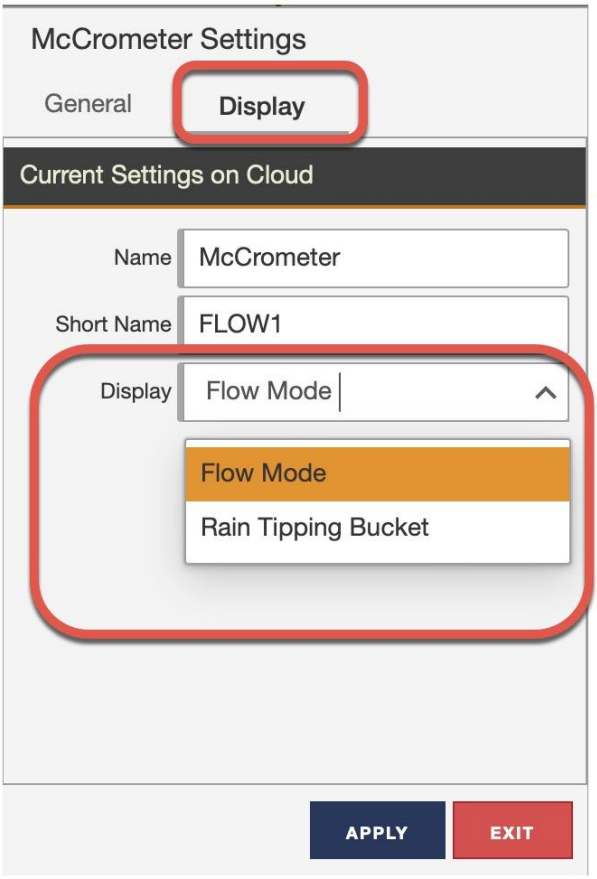


To set your K-Factor you must recall what you set your meters pulse output for. Example, 10 pulse/gallon becomes a K-Factor of 0.1 (1/10 = 0.1) See chart for other values.

Click on APPLY to save your changes.

Flow Meter Pulse/Flow Unit	RANGER K-Factor
1	1
10	0.1
100	0.01
1000	0.001

5. Tile Display Settings. Click on Display. Here you can set the Name. This is a text field that will appear on top of the name. You can name this whatever you choose.



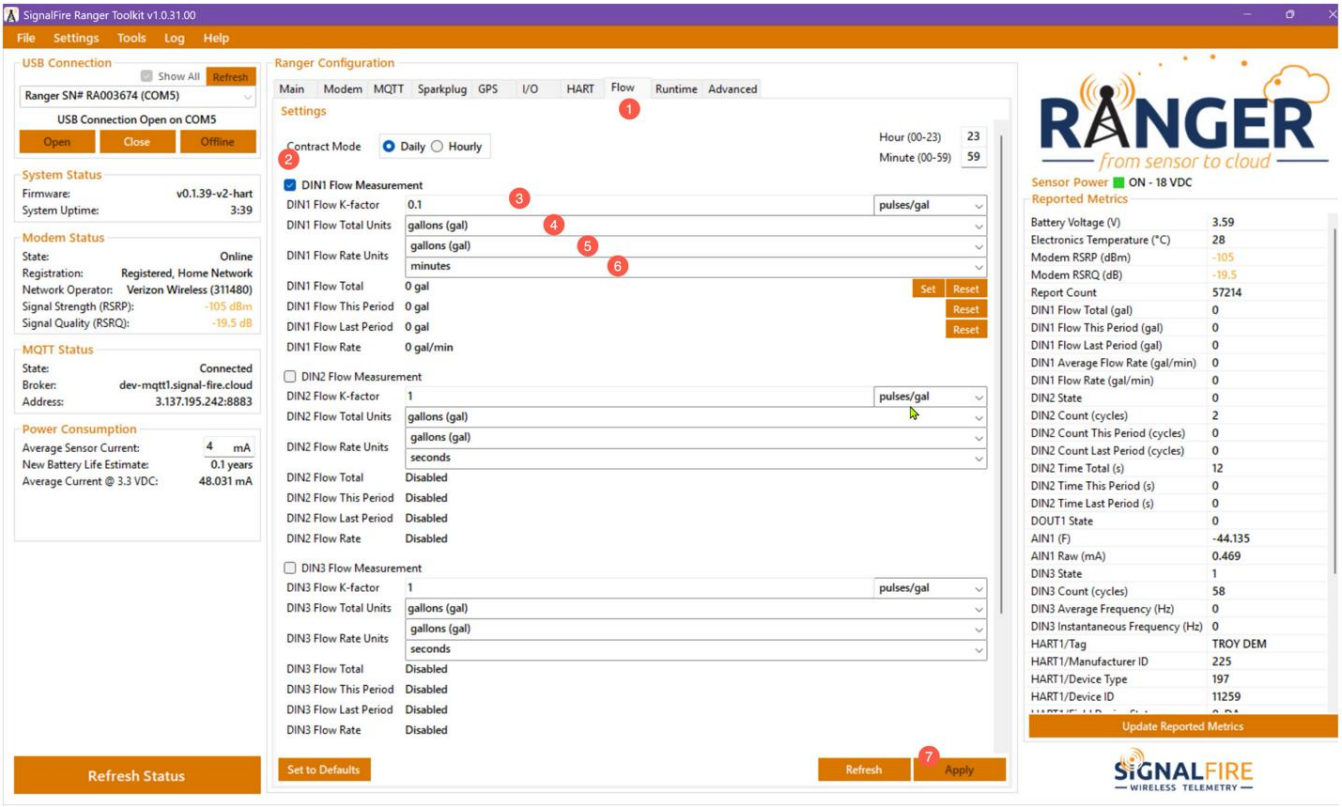
Click on APPLY to save your changes.

NOTE: If you ever connect a Rain Tipping Bucket to the RANGER, you will follow the same process as setting up a flowmeter and then select Rain Tipping Bucket as the Display.

Congratulations! You have now completed the integration of your flowmeter to the RANGER. You're ready to start remotely monitoring your flow.

Now, you'll probably want to start getting reports emailed to you automatically. Check out this link to our online manual https://www.signal-fire.com/cloud-manual/ and go the chapter on **Setting Up Reports** to learn how to do that.

6. Using RANGER Toolkit. For users that are not using our cloud, you will need to configure the RANGER using our RANGER Toolkit. You can download a FREE copy using this link https://www.signal-fire.com/signalfire-toolkit-software/



The process for calculating the K-Factor and the results are the same as doing this with the SignalFire Cloud. It's recommended to be connected to the RANGER when configuring these parameters.

Follow the number steps:

1. Click on the Flow tab
2. Check the box for whichever DIN input you are using
3. Enter the K-Factor
4. Select Flow Total Units
5. Select Flow Rate Units
6. Select Time base
7. Click Apply and wait a couple seconds for the changes to take place.

8. If you are using a flowmeter that allows you to simulate a flow rate and pulse output, do this now to confirm the pulse integration is correct. You will need to click UPDATE Metrics to see the results.

Conclusion

The SignalFire Wireless Telemetry RANGER represents a leap forward in water flow monitoring technology. Its wireless, battery-powered design enables organizations to deploy sensors virtually anywhere—without the expense and complexity of traditional wired systems. By delivering accurate, real-time data directly to decision-makers, the RANGER empowers industries to manage water resources more efficiently, respond swiftly to anomalies, and plan for a sustainable future. Embracing wireless telemetry is not just an upgrade in technology; it is a strategic investment in resilience, efficiency, and environmental stewardship.

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