Technical Bulletin
Seametrics 4-20mA circuits

Most Seametrics instruments with 4-20mA outputs ship from the factory as passive 4-20mA units, however, the FT520 ships with active 4-20mA and can be switched to be passive 4-20mA. Passive 4-20mA devices do not output a voltage but will modulate the current of the voltage supplied from a 4-20mA reader (control device.) For any passive device, a voltage needs to be supplied for the 4-20mA output. This voltage will commonly be supplied by the PLC, motor controller, system control panel, or from an external power supply wired into the 4-20mA loop.

An active 4-20mA output device will supply the voltage for the loop so if you measure the current or the voltage at the 4-20mA output of an active 4-20mA loop, you would be able to see a voltage and a current reading with no external connections.

A passive 4-20mA output has external voltage supplied and the passive controller scales the current output in proportion to the SET 4 mA and SET 20 mA values programmed into the device (this will be the minimum and maximum flow rates expected on the system.)

The Seametrics FT520 leaves the factory configured with an active 4-20mA loop but can be field configured to have a passive 4-20mA loop.

Some 4-20mA devices are "loop powered" meaning that the entire device and the 4-20mA output are powered off the voltage of the 4-20mA loop coming from the PLC or other controller and that power is then modulated by the loop powered device. This would be a 2-wire 4-20mA device and does not need a separate external power source.

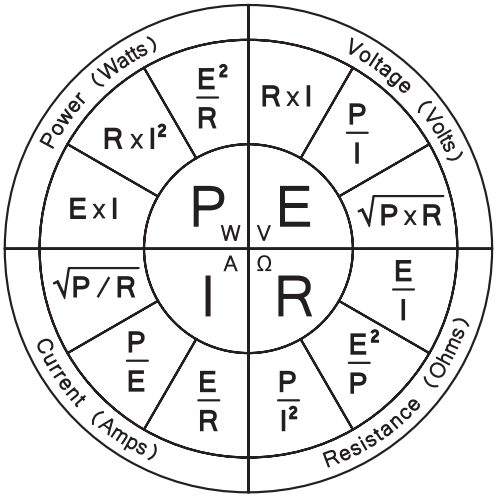
4-wire 4-20mA devices need an external power source to control their internal processor as well as power for the 4-20mA output.

Total resistive load on the system

The maximum current output of a 4-20mA loop will be no more than about 20mA. The most common voltages will likely either be 12 or 24 volts. Since the 4-20mA output device itself may need around 2.5 mA to operate, we need to be aware of the overall resistive load in cases where other devices (displays, other telemetry etc.) may also be in the 4-20mA loop. Exceeding the available resistive load on the loop will cause the 4-20mA loop to cap out at a value less than 20mA and the loop will not reflect the true value of higher flow rates approaching the SET20mA flow rate.

The overall resistive load can be calculated as V/I = R
or
24 volts/.020 Amps = 1200 ohms
or
12 volts/.020 Amps = 600 ohms

The advantage of using 24 volts on the loop is that it allows for a greater resistive load.



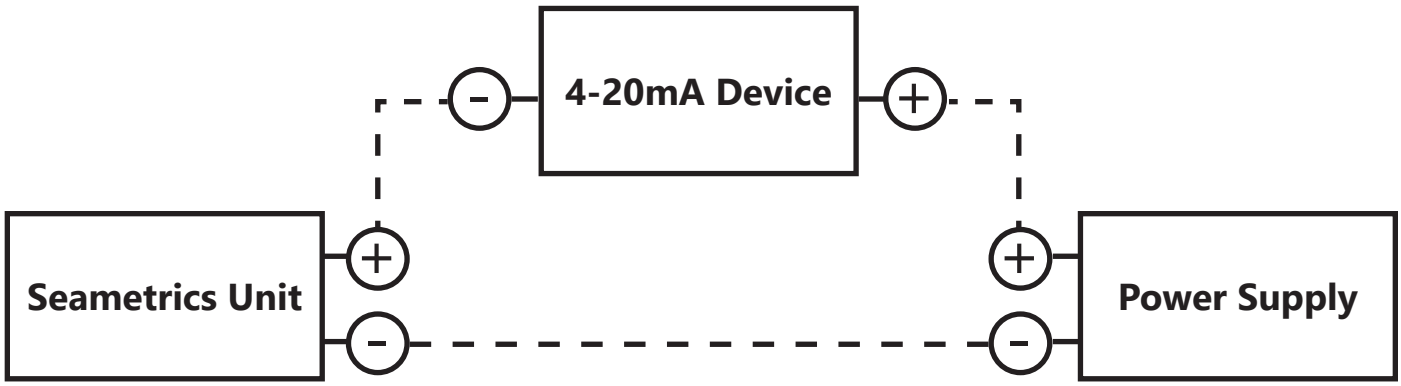
Alarms

Some 4-20mA devices will send an alarm signal when the device detects an error condition. This will result in a reading on the 4-20mA loop that falls outside the range of valid readings. AG3000/iMAG4700 and AG/EX90 meters have alarm values of 22.8 mA (high, and default) and 3.2mA (low.) The alarm level is field selectable. Many 4-20mA reading devices will correctly identify these readings as alarms, but not all, and if your device does not identify the high or low value outside the expected range as an alarm, it will read the alarm value as maximum flow or minimum flow. Since EMPTY PIPE is considered an error state and would trip the alarm, it may be helpful to change the alarm from high to low in your meter if this could cause an issue.

Please see LT-14491 '***iMag4700/AG3000: Changing the 4-20mA alarm***'
(https://www.seametrics.com/wp-content/uploads/LT-14491r1.0-20170608-iMAG4700-AG3000-4-20AlarmChange.pdf)

Zero milliamps on the loop would tell you the loop is broken, and although that is also an error state, it is a different sort of failure.

When wiring components into your 4-20mA loop, all devices will be wired + to -, but your power supply will be wired + to the + side of the loop and - to the – side. This can give the appearance that a 4-20mA loop will always have a + to + or – to – in the loop. When wiring, it may be helpful to start at the positive side of the power supply and think of each connection point as "this is more positive than anything down the circuit from here." Or vice versa and start on the negative side.



If you ever need a scaled voltage output instead of the more common scaled 4-20mA output, the milliamp signal can be changed to voltage using a resistor across the legs of the loop circuit as shown in the instruction manual.

For more information regarding 4-20mA current loops, please see:
*'***Understanding and Troubleshooting 4-20mA Current Loops***' on our website (https://www.seametrics.com/downloads)*