Aquatrac Instruments
Application Note

1. OBJECTIVE

Details converting 4-20ma on Rate to Volume for the ON/OFF control of chemical feed pumps.

2. TYPICAL APPLICATIONS

1. Convert a make-up water meter from GPM to Gallons and use the volume to set the ON time of inhibitor pump. For every 250 Gallons of make-up, turn the pump ON for 23 seconds.
2. Convert a steam demand meter or meters from lbs/hour to lbs of steam. Use the steam volume to control fractional horsepower amine and boiler treatment pumps. Every 10,000 pounds of steam turn ON the pumps for 46 seconds.
3. Convert a production line speed in Feet/per/second at 4-20mA to ON/OFF control of a process chemical.

3. REQUIRED SOFTWARE

Controller software Version 3.52 or later & controller with **R2** or **RM** option.
Trackster Version 2.1 or later with Terminal screen option.
As of 05/01 **Trackster** does not support the '**R**' sensor compensation option.

Supporting References:
1. Loop powered, 4-20mA current loop isolators: www.omega.com   OMEGA part CCT-100, approximately $130.00 ea.

Contact Aquatrac: www.aquatrac.com on questions or operating concerns.

4. INSTALLATION

4.1 Hardware Installation – Connecting the 4-20mA cable,
1. Connect the 4-20mA signal to a sensor controller input. Any unused input **G** to **N** on a '**Flex**' or **G** to **J** on an '**AS**' series controller may be used.
2. **CAUTION:** 4-20mA signals that are used by other equipment usually require loop isolators to prevent ground loops. Aquatrac's controllers ground one side of the current loop. A ground loop occurs if the other equipment monitoring the loop also grounds the current loop. If in doubt, install a loop isolator: see Supporting references in Section 3.
3. Connect to the controller and verify that the analog input that you intend to use is not being used for Feed Verification ppm or inventory tracking.
4. The following example uses analog input '**J**' & water input '**Q**'.
   > Prior to terminating the current loop, verify that the **LJ** jumper is installed ½" inboard from the **J** controller terminals.
   > The factory default has the **LJ** jumper installed & it will be installed unless you are converting input '**J**' from a prior use.
   > Connect the 4-20mA current loop to **J+** and the negative of the loop to **J-.**
   > > The **LJ** jumper terminates the current loop with 50 ohms.

Any unused analog input and water meter input can be used for Rate-to-Volume conversion.

4.2 Software Set-Up – '**J**' **& '**Q**' Example

1. Connect to the controller using **Trackster** at the Configure password level and using Diagnostic View II
2. Right click on sensor '**J**' and *enable* sensor '**J'**
3. Right click on meter '**Q**' and enable meter '**Q**' and set its descriptor: Make-up, Steam Production, Line Speed… and units: Gal, Lbs, Ft…. descriptor & Units have no effect on function.
4. Set the gallons/count for water meter '**Q**' for 1 for GPM & LBH.
5. Right click on the inhibitor pump, select *Configure Control* and key **Control-Alt-Shift** & you'll be in the **Trackster** terminal screen
6. Key *Enter* to get to the command prompt '**>**'
7. Key **PAJ,,1** & *Enter*
8. Close the terminal window select sensor '**J**' and calibrate for 4mA and 20mA levels. Use the theoretical 4-20mA calibration, it's accurate enough to verify you have a functioning current loop.
9. Verify the current loop displays correctly on sensor '**J**'. Set the sensor '**J**' descriptor and units: GPM, LBH, FPM…. descriptor & Units have no effect on function.
10. Right click on the inhibitor pump, select *Configure Control* and key **Control-Alt-Shift** & you'll be in the **Trackster** terminal screen
11. Key *Enter* to get to the command prompt '**>**'
12. Key **PAJ,,,,,RMQ** & *Enter* for Gallons/Minute or **PAJ,,,,,RHQ** & *Enter* for LBs/Hour & close the terminal window,
13. Verify that water meter '**Q**' updates every 14 seconds: **Flex** series controllers or 8 seconds for '**AS** series controllers. For example: a **Flex** series controller with 100 GPM on '**J**' would add 200 Gallons to meter '**Q**' every two minutes.
14. Water meter input '**Q**' may be used for control of any pump with Control Equation ='Q' either by itself or summed with other meters.

4.3 Technical – Operational Notes

1. Rate-to-volume conversion occurs when the **Rrm** command is placed in the sensor **compensation** field using the **PA** command, where **R**=Rate-to-volume, **r**= **M** or **H** for GPM or LBH respectively & **m** = water meter input O to T: **Flex** or O-Q:**AS**. **M** assumes a rate/minute & **H** a rate/hour.
   Keying **PAJ** & *Enter* will display **R 60 Q** if rate per minute or **R 3600 Q** if rate per hour.
2. Any unused, enabled input '**G**' to '**N**' and meter '**O**' to '**T**' can be used. If you attempt to use a non-enabled water meter, you'll get the Cannot Compensate on a Disabled Parameter!, error message.
3. The water meter input, '**Q**' in our example, cannot be used for an actual water meter; errors in the gallons/day total will occur.
4. Negative rate-to-volume conversions add zero. If you calibrate the 4-20mA loop so that 4mA is, for example, –1 GPM then you ensure that the water meter does not accumulate at 4mA.
5. Set the inhibitor pump feed limit timers to prevent overfeeding due to miscalculation or miscalibration of the 4-20mA loop. Ensure that the minutes/per/actuation timer is set high enough to prevent nuisance feed outages.
6. **Trackster***:* Rate-to-Volume inputs will display '*No Compensation'* on the 4-20mA sensor **Set Compensation** option until **Trackster** is updated.
7. **Feed Verification:** Rate-to-Volume conversion may be used as the make-up water meter for control of an Inhibitor Pump if the Gain or Gallons/Contact is on the controlling water meter = 1. **WARNING:** Feed on mL, O:Q type control equations will not totalize correctly unless Gain =1 on Water Meter 'O'.