1. OBJECTIVE

Provides up to two independent feed verification functions per controller.

Meters chemical feed in ml, calculates and logs ppm, calculates and logs inventory, displays and logs ml/hour, supports ml per gallon feed controls and alarms on fail–to-feed.

Alarms locally and pages on low or high, ppm, ml fed and inventory level.

2. TYPICAL APPLICATION

1. A Feed Verification Meter is installed on the inhibitor chemical feed pump discharge. The Controller is set to feed 10ml every 100 gallons of make-up and display ppm based on the make-up volume and the ratio of the tower to make-up conductivity. The Controller dials out an alarm on low ppm, low tank level and fail to feed inhibitor.

3. REQUIRED COMPONENTS

Controller software Version 4.0 or later, controller with **R2** or **RM** option.
Controller must be controlling inhibitor feed based on make-up water meter volume and use one of three methods of measuring cycles of concentration:
1. Bleed valve control uses the ratio of tower-to-makeup conductivities
2. Bleed volume is measured by a water meter connected to the controller.
3. Make-up water conductivity is constant allowing a fixed number to be used for cycles of concentration.

Trackster Version 2.1 or later with Terminal screen option.
As of 05/01 **Trackster** does not support the '**FV**' special control within *View Configuration*.

Aquatrac accessory **SFX-FV Kit** consisting of the Feed Verification Meter, upgrade software chip and controller upgrade code.

Supporting References:
1. Installing & wiring the Feed Verification Meter, AN010-08

Contact Aquatrac: www.aquatrac.com on questions or operational issues.

4. INSTALLATION

3.1 Hardware Installation
Refer to Feed Verification Meter, AN010-08 for meter installation, wiring and verification.

3.2 Typical Software Set-Up   Q-WaterMeter, I - Inventory & J - ppm Example

The following example assumes:
1. That controller inputs **Q**, **I** and **J** are enabled are not being used by the controller for water meters or sensors.
2. The Feed Verification Meter is connected to water meter Input '**Q**'.
3. Parameter '**I**' will display the current drum or tank level.
4. Parameter '**J**' will display the current ppm.
5. **Relay No.1** is being used to feed inhibitor and it's controlled water make-up meter '**O**'.
6. We're operating the tower at **3.5** cycles

Configuration Sequence
1. Connect to the controller using **Trackster** at the Configure password level.
2. Right click on the bleed valve, select **Configure Control** and key **Control-Alt-Shift** & you'll be in the **Trackster** terminal screen
3. Key *Enter* to get to the command prompt '**>**'
4. Key **SW1,,,,FV** & *Enter*
5. Key **FV1,Q,I,J,C3.5** & E*nter* & close the terminal window,

You have configured the controller to use the Feed Verification Meter connected to input '**Q**' to monitor the inhibitor feed pump which controlled by water meter '**O**' and powered by Relay No.**1**.
As the Feed Verification Meter reads feed volume, it will adjust the Tank Level and display the current level on parameter **'I'**
As watermeter '**O**' measures tower make-up and the Feed Verification meter '**Q**' measures chemical feed, ppm will be calculated and displayed and logged in parameter '**J**'

3.3 Technical – Operational Notes

1. A maximum of two **F**eed **V**erification controls are supported per 'Flex' or 'AS' controller. Two fully configured **FV** controls would use two water meter inputs for meters, two water meter inputs for tower make-up volumes and four analog, sensor inputs for Inventory and ppm.

2. The **DI** command displays the **F**eed **V**erify option if the option has been installed.

3. **Feed Verification Meter:** Must be connected for FV function and set to Gain =1, Scale=0. The controller applies the controller Gain correction to the Meter counts allowing for fine tuning the 1ml/pulse Meter output and for use of alternative meters or LMI's DigiPulse. Alarms can be set on the FV Meter inputs the same way as other water meters. mL/pulse may be set to 1.15 or 3.26 and the controller software will calculate, volume pumped, ppm & tank levels correctly.

4. **Feed Verification:** Every 10 seconds of chemical pump run time the FV function expects to measure at least 1mL of feed. If 1mL is not measured both the alarm on the FV Meter input and a System Alarm are set. The user can set an alarm relay an/or dial out response on either alarm.

5. **Inhibitor Control: FV** requires chemical feed based on a make-up water meter. This meter is used to calculate the volume in ppm calculations. Rate-to-Volume may be used to assign a 4-20mA input to the make-up water meter.

6. **Cycles of Concentration:** In addition to make-up volume, **FV** needs to know the cycles of concentration for ppm calculations. There are three ways set Cycles of Concentration:
    1. **Fixed:** User defines a fixed number of cycles. This works well make-up conductivity constant and a bleed meter or a make-up conductivity do not exist. Zero and negative fixed cycles are rejected & set Cycles = 1.
    2. **Bleed Volume**: Requires a water meter on the tower bleed. Calculates cycles as the ratio of make-up to bleed volumes. Any water meter may be used. There is no software check on the validity of the designated bleed water meter. If you use an incorrect meter, the calculated ppm will understandably incorrect. If the bleed volume is zero, ppm is not calculated. The ppm calculation is updated only when the make-up volume or Feed verification meter updates.
    3. **Conductivity Cycles**: Controllers using the ratio of Tower-to-Makeup conductivity to control the bleed can use the same ratio for cycles. The control equation of a cycles controlled bleed relay is the ratio of conductivities, typically 'E/F'. There is no software check of the relay designated for cycles control. You may use any relay with a non-zero control equation. Every time the Cycles method is changed, ppm is re-calculated from mid-night.

7. **ppm Calculation & Calibration:**
    1. ppm calculation starts at midnight based on the water and chemical used that day. The average ppm for each hour is stored in the controller log in the optional parameter, A to N, used for ppm.
    2. ppm is recalculated every 10ml of chemical metered and every 100 Gallons of make-up and whenever the Cycles method is changed.
    3. ppm can be calibrated like any other parameter . Both Offset and Gain can be used to correct for wind losses etc….
    4. Setting the ppm parameter in the **FV** command, sets the parameter compensation to *Derived*.

8. **Inventory Calculation**: Inventory is updated every 10ml of chemical metered. Parameter offset is used to adjust inventory when tanks are re-filled. Key c Selecting the *Calibrate Sensors* & *Key Current Value?* options with the TV remote keypad allows the user to enter the current tank level. This level is decremented by the Feed Verification Meter every 10mL , approximately 0.003 Gallons. Alarms can be set on inventory level similar to any other parameter. Setting the Inventory parameter in the **FV** command, sets the parameter compensation to *Inventory*.

9. **Feed ml / gallon**:
    Inhibitor controls with the **FV** special control may be set to feed so many mL for every so many Gallons of make-up.
    Set the control equation to be **O:Q** where **O** = Make-up water meter O to T & **Q** – FV Meter O to T. Setpoints may be entered using the TV remote where Volume= Make-up Volume and Time = mL. Time Owed is now mL and not minutes.
    The 'ST' Command will correctly display Setpoints in mL and feed owed in mL.
      Support for **O:P** feed mode within Views requires a `Trackster` update.

10. **Site Units:** Use the '**SU**' Site Units command to switch from the factory default U.S. Gallons to Metric. '**SU**' effects only ppm and inventory calculations. This command is not blocked on controllers without the **FV** function.

11. **Activating-Removing FV Special Control;** The **FV** control ppm calculations do not become active until you select a Cycles mode. The **FV** control may be removed by setting the relay special control to '!' in Terminal mode or None in **Trackster**.

12. **Error Trapping**:
    1. A Parameter used for ppm or Inventory cannot be assigned to more than one **FV** control.
    2. Switching an inhibitor pump, with **FV** special control, from water meter control removes the **FV** function on that inhibitor pump and removes the ppm & Inventory parameters.
    3. Removing an **FV** special control, removes Inventory and Derived compensation from the parameters used for Tank Level and ppm logging.
    4. Switching the water meter controlling the inhibitor pump, forces ppm recalculation using the new make-up meter volume.

3.4 Command Syntax

The SW command is used to set **F**eed **V**erification control.
SW[1..8],,,,FV & *Enter* sets the Special Control on Relay 1 to 8 in **Flex** or 1 to 5 in 'AS' series controllers.

FV & *Enter* displays the **FV** command syntax.

FV[1..8] & *Enter* displays the current **FV** configuration. This command is blocked if the **FV** option is not installed.

DI & *Enter* displays the installed controller options including the **FV** option

Once you have set the special control on the inhibitor pump feed relay you use the **VC** command:

FV[1..8], [Feed Verify Meter O..T], [Inventory A..N], [ppm A..N],
   C[Fixed # of Cycles] or [Bleed Meter O..T] or [Bleed Control Relay 1..8] & *Enter*

Where
[Feed Verify Meter O..T]	Water meter input where Feed Verification Meter connects.
[Inventory A..N]	OPTIONAL: Parameter which logs & displays tank level
[ppm A..N]	OPTIONAL: Parameter which logs & displays ppm

Select one of:
C[Fixed # of Cycles]	Fixed number of cycles, displayed to 2 decimals
[Bleed Meter O..T]	Tower or process bleed meter
[Bleed Control Relay 1..8]	Bleed solenoid relay controlled on the ratio of tower to make-up conductivity.

HyperTerminal Display support on ml Feed in **bold** Command: **ST1,2,Q,J** & **Enter**	**Notes**

STATUS   Aquatrac Instruments   Date: 1/3/80
                SMARTFlex Controller   Time: 4:13:44
 	
 Inhibitor Pump 1   Pump Volume@100   Interlock Status
 #1State ON   **Pump mL @10**   Operating
 Time This Actuation   Control Equation: **O:Q** = 1900
     0.2 Minutes   Switch Interlock
 Operating Time Today   2U
     3.9 Minutes   Special Control
  Feed Volume Owed   **Feed Verify on Q**
     44.0 mL
 	
 Bleed Valve 1   Turn ON @2000.00   Interlock Status
 #2State OFF   Turn OFF@1975.00   Operating
 Time This Actuation   Control Equation: I   = 99.962
     0.0 Minutes   Switch Interlock
 Operating Time Today   U
     0.0 Minutes   Special Control
 Operating Time Owed
     0.0 Minutes
 	
 FV Meter   **124**   PPM Calc   **169.644**
	Feed in mL
	 New ':' control
	  equation
	
	 New control
	 Owed mL.
	
	 No change
	 In other relays
	 or controls
	
	 FV Meter on
	 'Q'
	 In mL & ppm
	 on 'J'