

Example Controls Functional Definition for a Waste Water Treatment System

1. pH Basin Level Control

The pH basin level is maintained by basin pumps 02-P-009A and 02-P-009B based on readings from LE (02-505). The level in this tank starts and stops the two pumps when in AUTO mode. The pumps will be set up on lead/lag in the AUTO mode. Each pump has a local H-O-A, HS (02-009A) for 02-P-009A and HS (02-009B) for 02-P-009B.

Run status is indicated for each pump at the PC.

Level control for the tank has been set up as follows:

<u>Tank Level (0-100%)</u>	<u>Condition</u>
≥74%	Swap Lead/Lag order
70%	Increase Lead Pump speed to 700 GPM
65%	Increase Lead Pump speed to 450 GPM
60%	Increase Lead Pump speed to 250 GPM
≥50%	Start Lead Pump @ 150 GPM
45%	Stop Pumps

2. Lime Slurry/pH Adjustment System

Lime Recirculation Pump, 02-P-225, circulates a 30% lime slurry from one of the two existing horizontal bulk supply tanks, 02-T-201, or 02-T-301. Local H-O-A (02-802) selects operation of the pumps in HAND, OFF, or AUTO operation. In AUTO position, the pump *can* be started by the operator from the SCADA/PC, and recirculate lime to and from either 02-T-201, or 02-T-301. The pump is normally on and recirculating lime continuously in AUTO mode. Running status will be indicated at the PC. *There are no process interlocks.*

Lime will be added to the pH Polishing tank, 02-T-230, through a ½” air operated pinch valve, AV (02-901) from the lime circulation piping loop. The valve is air-to-close and lime is added by removing air from the valve by closing solenoid valve(SV-02-901)This valve will open or close based on a pH reading from pH element AE (02-901) located in the pH Polishing Tank, 02-T-230. Continuous pH readings will be indicated at the SCADA/PC. The PLC will direct the following control functions.

- At pH 6.05 or lower, solenoid valve SV (02-901) will deenergize and AV (02-901) will open allowing lime solution to be delivered into 02-T-230. Lime addition is not continuously added during this period. Rather, the valve pulses open and recloses at intervals specified in the “pH Polishing Tank Setpoint” pop-up screen.

- At pH 6.10 or higher, solenoid valve SV (02-901) will energize and AV (02-901) will close.
- Hi and Low pH alarm levels are defined by the operator as well in the same screen and will be indicated at the SCADA/PC. No “Plant-Wide” alarms will be given for either condition.

3. Polymer Feed Systems (Package Units)

The Two Polymer Systems are 02-Z-251 and 02-Z-252. Each polymer unit will feed polymer to one of the separators: 02-S-281, 02-S-282.

The polymer feed pump of each unit will accept a 4-20 mA signal from the main PLC to vary polymer dosage according to influent flow when the unit is in the AUTO mode. Run status, AUTO position, and PUMP SPEED status of each polymer unit will be indicated at the PC. Continuous flow readings are indicated at the PC. Flow is measured from FE (02-701). A Zero gpm will equal 4mA and 700 gpm will equal 20 mA. Flows greater than 700 GPM will result in a 20 mA output as well.

The function of FIC-02-701 is to provide the Polymer setpoint to the Polymer Units. With both polymer units in AUTO position, the flow signal will be split between the two feed units. For example, at 700 gpm, with both polymer units in AUTO, the PLC will send a signal to each unit for 350 gpm or 12 mA to each. If one polymer unit is in the OFF or HAND position and one is in the AUTO position, the PLC will send the full signal to the operating polymer unit. For example at 700 gpm, a signal of 20 mA would be sent to the operating polymer unit.

There are no flow switches from the polymer units that are brought back into the SCADA/PLC. There is a flow switch on the water supply lines for each unit that is used for local control of the polymer feed pumps

4. Polymer Weigh Scales

A weigh scale, 02-Z-241, 02-Z-242, is provided for each polymer tote. These scales will indicate tote weight locally and provide a 4-20 mA output for weight indication at the PC. An alarm will be given at the PC when the totes reach a low weight condition. The weigh scales are ranged from 0-3000 lbs with a low weight alarm generated at 100 lbs.

5. Parallel Plate Separators (Package Units)

Two (2) parallel plate separators (PPS) will be provided for settling solids from the wastewater. The package units includes the separator tank and a flash/flocculation tank for mixing chemicals. An agitator is provided in each tank on each unit.

Flash Mix Agitator No. 1, 02-M-261, is provided with Separator, 02-S-281. This mixer will be operated locally with the hand switch position indicated at the SCADA/PC to indicate a RUNNING condition. The flocculation agitator, 02-M-271 with this separator will also be operated locally, with run status at the PC. The flocculation agitator will have a local VFD for speed adjustment.

Flash Mix Agitator No. 2, 02-M-2612 is provided with Separator, 02-S-282. This mixer will be operated locally with the hand switch position indicated at the SCADA/PC to indicate a RUNNING condition. The flocculation agitator, 02-M-272 with this separator will also be operated locally, with run status at the PC. The flocculation agitator will have a local VFD for speed adjustment.

6. PPS Sludge Management

Sludge will be pumped from the bottom of Separator 02-S-281 by air pump 02-P-281 and/or 02-P-283. Likewise, sludge will be pumped from the bottom of Separator 02-S-282 by air pump 02-P-282 and/or 02-P-284. Separator sludge level inspections will be performed by an operator each shift by visually examining the three sludge hopper sample ports on each separator. Through these regular examinations, the operator can initiate a manual pump and flush cycle for either of the separators if it is deemed necessary or he can let the PLC handle the sludge removal process. Manual control of the sludge removal and/or flushing cycle of each separator has been provided at the SCADA/PC in the event that the operator would like to initiate either sequence before the totalization limit has been reached. These manual operations will operate continuously until the operator stops them at the SCADA/PC.

In automatic mode, the PLC would activate the pumps and valves for definable, pre-set time intervals, based on flow through the system as measured by FIC-02-701. For example, the PLC will keep a running total of influent flow processed. After the totalization limit has been reached, the PLC will reset this value to zero, begin totalizing once again and commence the cleaning cycle for Separator 02-S-281.

The cleaning sequence for Separator 02-S-281 is as follows: Solenoid valve 02-SV-904 is energized allowing air-flow to pneumatic pumps 02_P_281 and/or 02_P_283 while simultaneously opening the automated plug valve 02_FV_703 at the base of the separator. After a definable, preset interval, the plug valve is closed ending the dump portion of the cleaning sequence. The sludge lines will be flushed after each pump interval in the auto mode. Service (process) water will be introduced and pumped through the sludge line following each sludge pumping operation. After this definable, preset interval times out, the plug valve once again closes and the cleaning sequence is complete.

For example, once the sludge timer has timed out and FV (02-703) has closed, FC (02-702) opens and allows water flow for a set period of time (2-5 minutes). The sludge will continue to pump during this flushing process. Once the flush procedure has timed out, FV (02-702) will close and SV (02-904) will de-energize to stop pump flow. This shall complete the sludge pumping and flushing operation. FV (02-702) position status is indicated at the PC via limit switches. FV (02-704) is functionally equivalent for separator 02-S-282.

FV(02-702) and FV(02_703) limit switches provide open/close status at the PC. FV(02_704)) and FV(02_705) are functionally equivalent on Separator 02-S282. *NOTE: Both, separators will not dump at the same time in Automatic mode. Separator 02-S-281 would begin its dump cycle first and upon completion 02-S-282 would begin.*

The pressure regulator on the air line determines the flow rate of the sludge pump. This is a manual adjustment determined during startup and periodically adjusted during routine operations. Normally, this regulator is not adjusted and the overall sludge flow is determined by the activation time as selected by the operator at the SCADA/PC. Solenoid Valve, SV (02-904) is for pump 02-P-281 and 02-P-283 on Separator 02-S-281, and solenoid Valve, SV (02-905) is for pump 02-P-282 and 02-P-284 on Separator 02-S-282.

Each sludge discharge line contains a magnetic type flow meter for sludge flow measurement. FE (02-706) indicates sludge flow locally and at the PC for sludge flow from 02-S-281 and FE (02-707) indicates sludge flow locally and at the PC for sludge flow from 02-S-282.