TELEMETRY CONTROL UNIT (TCU) VFD RIO INSTRUCTIONS

The RTU contains a Telemetry Control Unit (TCU), Radio, Rail Input/Output (RIO) module, relays, loop isolators and other appurtenances to monitor and control the three pumps both locally and remotely via the Owners existing SCADA system. The pumps can be manually controlled locally and automatically when selected using the Hand-Off-Auto selector switches on the TCU or remotely via the remote Operator interface. The Master Pump Station operates as a triplex pump station. Using this “Automatic” scenario, 3 Variable Frequency Drive (VFD) pumps are controlled to handle the influent flows. The standard TCU program has been customized to operate the RIO and VFDs. Figure 1 shows the customized menus and their interaction.

When placed in the “Hand” position, the pumps are started and the speed manually controlled using the menu driven buttons on the key pad of the TCU.

In the “Auto” control mode, the pumps are controlled using a “Lead-Lag 1-Lag 2” configuration. The “Lead” VFD pump operates first, followed by the “Lag 1” and Lag 2 VFD pumps. Pump operation is controlled by the wet well level transducer. When the wet well level exceeds a preset, adjustable “Start” set point, the “Lead” VFD pump is called and starts at a minimum speed (user set point). The speed of the pump then is controlled by the pump station controller so as to maintain either a “constant operating level” (user set point) or the controller operates the station as a “variable level” station wherein the VFD pump operates at minimum speed (user set point) when the wet well is at a low level up to maximum speed when the wet well level is at high level. Stopping the “Lead VFD pump is controlled by the pump station controller using either wet well.
Wet Well Level Controllers

The VFD TCU is capable of two modes of level control, fixed level and variable level control.

**Wet Well Fixed Level Controller**

The aim of the fixed level controller is to match the effluent flow of the lift station with the influent flow. To achieve this, the VFD TCU will vary the pump(s) speed between the MIN and MAX SPD set points to maintain a level in the well defined by the operator adjustable Level set point using a PID algorithm. The PID algorithm may be tuned by adjusting the P, I, and D set points. The lead pump is called to run and stop using the LEAD ON / OFF set points.

**Wet Well Variable Level Controller**

Variable level control allows the well level to travel up and down the well to eliminate a scum line / grease-cake build ups. The lead pump is called to run and stop using the LEAD ON / OFF set points.

When a single pump is running the speed control of the pump is scaled MIN SPD when the well level is equal to the LEAD OFF set point and MAX SPD at the LAG ON set point.

When more than one pump is called to run the speed control of the pumps are scaled MIN SPD when the well level is equal to the LEAD OFF set point and MAX SPEED at the LAG 2 ON set point.

**VFD Speed Control**

When in automatic the VFD speed control output will be limited by the operator defined MIN and MAX SPD set points. The MIN and MAX SPD set points are applicable during both automatic and manual operation.

When a VFD is initially called to run it will gradually increase speed from 0% to the desired control output in increments defined by the RAMP SPD set point in units of %. Once the control output has been met the ramp speed function is disabled. Ramp speed is applicable during automatic operation only.

**Lag Pumps Call Controller**

The VFD TCU is capable of two modes of lag pump controls, Level and Speed.

**Level Call**

When LEVEL mode is selected the Lag pump[s] will be called to run using [the / their respective] LAG ON and LAG OFF set points.

**Speed Call**

When SPEED mode is selected the VFD TCU will call an addition pump to run should the current pump(s) run at max speed in excess of 30 seconds. In the event that the Lag [or Lag2] pump[s] run at minimum speed in excess of 30 seconds a pump will be called to stop

**Alternation Modifiers**

The standard alternation schema may be modified in two ways. When the LAG2 STDBY option is enabled the Lag 2 position pump will be handled as a stand by pump and will only be called in the event the Lead or Lag pumps fault. When the PMP 3 LAG option is enabled pump 3 will always be called to run in the Lag position.

When fixed Alternation is desired set the ALTERNATE option to None and select the lead pump using the LEAD option (1, 2, or 3). During this mode the pump assigned to the lead position will always be called to run as Lead. Lag and Lag2 will follow in order. For example, with the LEAD option set to 2 Lead will call Pump 2, Lag will call Pump 3, and Lag2 will call Pump 1.
Manual VFD Control

When a pump is placed into the HAND position, the pump will be called to run at a fixed speed determined by the operator defined OVRD SPD set point. Once called to run the pump speed may be adjusted up by using the 1 key (+1%) and 2 key (+5%) and down using the 7 key (-1%) and 8 key (-5%). Any change made to the manual pump speed will be stored in the OVRD SPD set point.

VFD TCU Set points

All set points residing in the TCU will have default factory set points when shipped. The set points can then be modified by an operator using a custom screen as needed. The new set points will be retained in the TCU in the event of a power cycle.