
	<b>FUNCTIONAL REQUIREMENTS SPECIFICATION</b>		Document Code: 644548-48ER-0001
			Revision PA
Client: City of Winnipeg	Project: Community Row Pumping Station	Package / Area:	


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## 1.0 OVERVIEW

This document is intended to provide a description of the PLC functionality for the Community Row Pumping Station. It is written from a technical perspective, and is intended to be read along with the associated Process & Instrument Diagram (P&ID) drawings.

### 1.1 Associated Documents

The associated Process and Instrument Diagrams and Loop Diagrams are listed below.

Drawing Number	Rev	Description
1-0130L-P0001-001	00	P&ID, Wastewater Pumping
1-0130L-P0001-002	00	P&ID, Wastewater Pumping
1-0130L-P0002	00	P&ID, HVAC and Misc.

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## 2.0 GENERAL REQUIREMENTS

### 2.1 Human Machine Interface

See the HMI Layout and Animation Plan for details.

### 2.2 Tagname Convention

See the Tagname Identification Standard for details.

### 2.3 Equipment and System General Requirements

#### 2.3.1 HMI Interface Points

Not all points between the HMI and PLC are necessarily specified or listed under the HMI-PLC interface lists. In many cases the points listed as PLC I/O might also be part of the HMI-PLC interface. The requirement is based upon the HMI logging or display requirements.

#### 2.3.2 HMI Interface Type Codes

R	HMI Read
RA	HMI Read, Alarmed
RW	HMI Read/Write
W	HMI Write
W1	HMI Write, PLC will immediately reset to 0

#### 2.3.3 HMI Display Type

HMI Display Type	Description
-	Do not show on the HMI
A	Alarm Banner
DD-T	Show as text on the data display.
EF-G	Show as graphic on the faceplate, which will popup when the operator clicks on the specific piece of equipment
EF-L	Show as an indicator light on the equipment faceplate.
EF-T	Show as a text display on the faceplate
EF-TE	Show as a text entry on the faceplate
GD-A	Show as an animation on the graphic display.
GD-G	Show as a graphic on the graphic display.
GD-L	Show as an indicator light on the graphic display.
GD-T	Show as text on the graphic display.
SW-T	Show as text on a settings window.
T	Trend

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Example:

HMI Display Type

Tag	Type	Description	0 State	1 State	Display
P-L01.Rdy	DI	Starter Ready	Not Ready	Ready	GD-T
P-L01.HS_Auto	DI	Starter in Automatic Mode	Not Auto	Auto	GD-T
P-L01.Run	DI	Starter is Running	Stopped	Running	GD-T

#### 2.3.4 HMI Control Type


HMI Control Type	Description
-	Not Applicable
EF-PB	Show as a button on the equipment faceplate
EF-TE	Show as a text entry on the equipment faceplate
SW-CB	Show as a checkbox on the equipment settings window.
SW-TE	Show as a text entry on the equipment settings window.

#### 2.3.5 Security

Security Type	Description
N	None
L	Low (Accessible to operator security level)
M	Medium (Accessible to mid level maintenance technicians)
H	High (Accessible to senior personnel only)

#### 2.3.6 Alarm Priority

Pri	Description
1	High Priority
2	Medium Priority
3	Low Priority

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### 3.0 IMPLEMENTATION

#### 3.1 Graphic Displays

##### 3.1.1 Pump Graphic

Create a graphic (process mimic) display containing a representation of the process shown on P&ID 1-0130L-P0001 Sheets 1 and 2. Specific requirements include, but are not limited to:

- Animate the wet well level using vertical fill animation. Also display the level value in the center of wet well in relative and absolute units. Display the wet well level setpoint as an animated slider on the side of the wet well.
- Provide access to the following controller faceplates:
  - LX-L500 – Wet Well Level Conditioning Function
  - LC-L500 – Wet Well Level Controller
  - YC-L001 – Pump Duty Sequencer
- Provide access to the Maintenance Screen.

##### 3.1.2 Settings Window

- Create a settings window with settings as indicated in Section 4.0.

##### 3.1.3 Data Display Screen

Display the runtime hours and off time hours for each pump.


Display the current and previous hour and day station flow volumes in units of m<sup>3</sup>.

#### 3.2 Trend Displays

##### 3.2.1 Trends

Create, at minimum, the following trend displays, with the indicated pens.

- Pump Trend:
  - Pens:
    - LI\_L500, Wet Well Level
    - YC\_L010\_S, Pump 1 Speed Feedback
    - YC\_L020\_S, Pump 2 Speed Feedback
    - YC\_L030\_S, Pump 3 Speed Feedback
  - Sample Rate: 5 seconds
  - Vertical Scale: 221 – 231 m on left / 0 – 100% on right
  - Horizontal Scale: 30 minutes

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- Pump 1 Speed vs. Discharge Flow Trend
  - Pens:
    - YC\_L010\_S, Pump 1 Speed Feedback
    - FI\_L011, Pump 1 Flow Rate
  - Sample Rate: 5 seconds
  - Vertical Scale: 0 – 250
  - Horizontal Scale: 30 minutes
- Pump 2 Speed vs. Discharge Flow Trend (similar to Pump 1)
- Pump 3 Speed vs. Discharge Flow Trend (similar to Pump 1)
- Pump Discharge Flow Trend - Day
  - Pens:
    - FI\_L002, Total Station Flow Rate
  - Sample Rate: 1 minute
  - Vertical Scale: 0 – 300
  - Horizontal Scale: 10 hours

### 3.2.2 Logging Settings


The following is applicable to Vijeo Touchscreen HMIs.

Create a new log file each day, and keep log files for 14 days.

### 3.3 Networked Signals

There are some signals between the McPhillips control centre and the station that will be via the communication network. Set up and implement these signals as required. These signals included, but are not limited to:

- All statuses and alarms within the PLC.
- Minor alarm signal and major alarm signal from Perimeter Road pumping station.

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## 4.0 EQUIPMENT AND SYSTEM REQUIREMENTS

### 4.1 Wet Well Level Conditioning Function – LX-L500

Wet Well Level Conditioning Function LX-L500 conditions the level measurement to be used by control of the wet well.

#### 4.1.1 HMI-PLC Interface

##### .1 Analog Values:

Tagname	Description	Values	Type	Display
LI_L500	Wet Well Level	0 – 327.67 m	R	EF-T
LI_L500_Perc	Wet Well Level in Percent	0 – 100%	R	EF-T


##### .2 Analog Set Points:

Tagname	Description	Values	Type	Control
LX_L500_Mode	Control Mode: 0 = Average, 1 = L500-LT-A, 2 = L500-LT-B	0 - 2	RW	EF-T EF-PB (M)
LX_L500_LAHH_SP	Level High-High Alarm Setpoint	0 – 327.67 m	RW	SW-TE (M)
LX_L500_LAH_SP	Level High Alarm Setpoint	0 – 327.67 m	RW	SW-TE (M)
LX_L500_LAL_SP	Level Low Alarm Setpoint	0 – 327.67 m	RW	SW-TE (M)
LX_L500_LALL_SP	Level Low-Low Alarm Setpoint	0 – 327.67 m	RW	SW-TE (M)

##### .3 Alarms

Tagname	Description	Logic	Mask	Pri	Reset
LX_L500_Disabled	Wet Well Level Control by PLC is disabled	LX_L500_Disable == 1 AND NOT HS-L600	N/A	1	Auto
LX_L500_Calibration	Wet Well Level Calibration Warning	LX_L500_Mode == 0 AND ABS(LI_L500_A – LI_L500_B) > 0.2m for > 15 sec	N/A	3	Auto
LX_L500_ABError	Wet Well Level Transmitter Mismatch	LX_L500_Mode == 0 AND ABS(LI_L500_A – LI_L500_B) > 0.4m for > 15 sec	N/A	2	Auto



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LX_L500_A_LAF	Wet Well Level Transmitter (DP- Cell) LIT-L500-A Failure	LIT-L500-A < 4mA or > 20mA	N/A	2	Auto
LX_L500_B_LAF	Wet Well Level Transmitter (DP Cell) LIT-L500-B Failure	LIT-L500-B < 4mA or > 20mA	N/A	2	Auto
LX_L500_LAH	Wet Well Level High	LI_L500 >= L500_LAH_SP for > 5 sec	N/A	2	Auto
LX_L500_LAHH	Wet Well Level High-High – Weir Overflow	LI_L500 >= L500_LAHH_SP for > 5 sec	N/A	1	Auto
LX_L500_LAL	Wet Well Level Low	L500_LI <= LX_L500_LAL_SP for > 1 sec Reset when L500_LI > LX_L500_LAL_SP for 10 sec	N/A	2	Auto
LX_L500_LALL	Wet Well Level Low-Low (For pump interlocks)	L500_LI <= LX_L500_LALL_SP for > 1 sec Reset when L500_LI > LX_L500_LALL_SP for 10 sec	N/A	2	Auto

#### 4.1.2 Control Narrative

While LX\_L500\_Mode is set to 0, move the average of LI\_L500\_A and LI\_L500\_B into LI\_L500. When LX\_L500\_Mode is set to 1, move LI\_L500\_A into LI\_L500. When LI\_L500\_Mode is set to 2, move LI\_L500\_B into LI\_L500.


Upon LX\_L500\_A\_LAF and NOT LX\_L500\_B\_LAF set LX\_L500\_Mode = 2 (LI\_L500\_B).

Upon LX\_L500\_B\_LAF and NOT LX\_L500\_A\_LAF set LX\_L500\_Mode = 1 (LI\_L500\_A).

Do not automatically transition back to LX\_L500\_Mode to 0 (Average) without operator intervention.

#### 4.2 Wet Well Level Controller – LC-L500

Wet well level speed controller LC-L500 utilizes PID control loops to control the number of pumps to run and the pumps' speed.

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#### 4.2.1 HMI-PLC Interface

##### .1 Discrete Control Bits:

Tagname	Description	Type	Control
LX_L500_Disable	Disable Controller	W1	EF-PB (H)
LX_L500_Enable	Enable Controller	W1	EF-PB (H)
LX_L500_PRPSMinorAlm	Perimeter Road Pumping Station Minor Alarm	-	See Note 1.
LX_L500_PRPSMajorAlm	Perimeter Road Pumping Station Minor Alarm	-	See Note 1.


Note 1: These signals come from the McPhillips control centre via communications.

##### .2 Analog Values:

Tagname	Description	Values	Type	Display
LC_L500_CV	Speed Output Signal	0 – 100%	R	EF-T
LC_L500_NumPumps	Number of Pumps Called to Run	0,1,2,3	R	EF-T

##### .3 Analog Settings and Set Points:

Tagname	Description	Values	Type	Control
LC_L500_EmergModeStartLevelOfset	Level above LC_L500_SP to start Emergency Mode pumping	0 – 20 m	RW	EF-TE (M)
LC_L500_3PumpsStartLevelOffset	Level above LC_L500_SP to start third pump	0 – 20 m	RW	EF-TE (M)
LC_L500_EmergModeStopLevelOffset	Level above LC_L500_SP to stop Emergency Mode pumping	0 – 20 m	RW	EF-TE (M)
LC_L500_2PumpsStartLevelOffset	Level above LC_L500_SP to start second pump	0 – 20 m	RW	EF-TE (M)
LC_L500_1PumpStartLevelOffset	Level above LC_L500_SP to start first pump	0 – 20 m	RW	EF-TE (M)
LC_L500_SP	Level control set point	0 – 327.67 m	RW	EF-TE (M)
LC_L500_3PumpsStopLevelOffset	Level below LC_L500_SP to stop third pump	0 – 20 m	RW	EF-TE (M)
LC_L500_2PumpsStopLevelOffset	Level below LC_L500_SP to stop second pump	0 – 20 m	RW	EF-TE (M)
LC_L500_1PumpStopLevelOffset	Level below LC_L500_SP to stop first pump	0 – 20 m	RW	EF-TE (M)

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LC_L500_1to2PumpsInitSpeed	Initial output speed setting on transition from one to two pumps	0 – 100%	RW	EF-TE (M)
LC_L500_2to3PumpsInitSpeed	Initial output speed setting on transition from two to three pumps	0 – 100%	RW	EF-TE (M)
LC_L500_3to2PumpsInitSpeed	Initial output speed setting on transition from three to two pumps	0 – 100%	RW	EF-TE (M)
LC_L500_2to1PumpInitSpeed	Initial output speed setting on transition from two to one pump	0 – 100%	RW	EF-TE (M)
LC_L500_MaxSpeed	Maximum speed for pumps during normal operation	0 – 100%	RW	EF-TE (M)
LC_L500_RemovePumpSpeed	Speed at which a pump will be removed from duty	0 – 100%	RW	EF-TE (M)
LC_L500_MinSpeed	Minimum speed for pumps	0 – 100%	RW	EF-TE (M)
LC_L500_AddPumpDelay	Time delay before adding another pump	0 -10 min	RW	EF-TE (M)
LC_L500_RemovePumpDelay	Time delay before removing a pump	0 -10 min	RW	EF-TE (M)

Create a faceplate for all the analog set point values.

#### 4.2.2 Alarms


None

#### 4.2.3 Control Narrative

The pump speed control shall be PID controlled based upon the level in the wet well. The PID tuning parameters will only be adjustable via modifications in the PLC program. Three PID control loops will be utilized, with separate tuning parameters. The first PID control loop will be utilized with one pump active. The second PID control loop will be utilized with two pumps active. The third PID control loop will be utilized with three pumps active. The output of the PID controllers will be used to control all operating pumps at the same speed. The maximum speed for pumps during normal operation is limited in order to minimize the noise and vibrations associated with operating the pumps at their maximum speed. However, during emergency conditions, if the wet well gets too high, the pumps will all operate at 100% speed.

The station has a backup panel meter (LIC-L500) for level control in case the PLC fails. The LX\_L500\_Disable signal will be used to set the enable output for LIC-L500 to zero and remove all speed and pump start commands from the PLC, in order to be able to test the panel meter level control.

The first duty pump will start upon the following condition:

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- The wet well level has reached LC\_L500\_1PumpStartLevel.

The second duty pump will be called to start upon the following conditions:

- The pump speed is  $\geq$  (LC\_L500\_MaxSpeed – 1%) for LC\_L500\_AddPumpDelay minutes, AND
- The wet well level is  $\geq$  (LC\_L500\_SP + LC\_L500\_2PumpsStartLevelOffset)

The third duty pump will be called to start upon the following conditions:

- The pump speed is  $\geq$  (LC\_L500\_MaxSpeed – 1%) for LC\_L500\_AddPumpDelay minutes, AND
- The wet well level is  $\geq$  (LC\_L500\_SP + LC\_L500\_3PumpsStartLevelOffset)

If the three pumps are operating and the level reaches (LC\_L500\_SP + LC\_L500\_EmergModeStartLevelOffset), then command all three pumps to operate at 100% speed until the level reaches (LC\_L500\_SP + LC\_L500\_EmergModeStopLevelOffset).

The third duty pump will be called to stop upon the following conditions:

- The pump speed is  $\leq$  LC\_L500\_RemovePumpSpeed for LC\_L500\_RemovePumpDelay minutes, AND
- The wet well level is  $\leq$  (LC\_L500\_SP - LC\_L500\_3PumpsStopLevelOffset)

The second duty pump will be called to stop upon the following conditions:

- The pump speed is  $\leq$  LC\_L500\_RemovePumpSpeed for LC\_L500\_RemovePumpDelay minutes, AND
- The wet well level is  $\leq$  (LC\_L500\_SP - LC\_L500\_2PumpsStopLevelOffset)

The first duty pump will be called to stop upon the following conditions:

- The wet well level is  $\leq$  (LC\_L500\_SP - LC\_L500\_1PumpStopLevelOffset)

Upon changing the number of pumps, the PID controller for that number of pumps will be activated with the initial output set to certain value. These initial values will be determined during commissioning to match the flow rates between the different number of pumps.

The PID controllers' maximum slew rate shall be set less than the maximum ramp rate setting for the pump VFDs.

Limit the controller minimum output to the same value as the pump minimum speed setting in the pump VFDs.

When the generator is running, only allow one pump to operate at a time.

When LX\_L500\_PRPSMinorAlm is activated, only allow one pump to operate at a time.

When LX\_L500\_PRPSMajorAlm is activated, do not allow any pumps to operate.

### 4.3 Pump Duty Sequencer – YC-L001

The Pump Duty Sequencer is utilized to decide which specific pump or pumps will be called to run.

#### 4.3.1 HMI-PLC Interface

##### .1 Discrete Status Bits:

Tagname	Description	Type	Display
YC_L001_P_L01_CmdRun	Pump P-L01 Run Command	R	EF-L
YC_L001_P_L02_CmdRun	Pump P-L02 Run Command	R	EF-L

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YC_L001_P_L03_CmdRun	Pump P-L03 Run Command	R	EF-L
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**.2 Discrete Control Bits:**

Tagname	Description	Type	Control
YC_L001_AlternateMode	Alternate Mode	W1	EF-PB (M)
YC_L001_NormalMode	Normal Mode	W1	EF-PB (M)

**.3 Analog Settings and Set Points:**

Tagname	Description	Values	Type	Control
YC_L001_P_L01_Duty	Pump P-L01 Duty Number	0, 1, 2, 3	RW	EF-TE (L)
YC_L001_P_L02_Duty	Pump P-L02 Duty Number	0, 1, 2, 3	RW	EF-TE (L)
YC_L001_P_L03_Duty	Pump P-L03 Duty Number	0, 1, 2, 3	RW	EF-TE (L)

Perform range checking on the above setpoints. If the value entered is < 0, make it a value of 0. If it is > 3, make it a value of 3.

**4.3.2 Alarms**

Tagname	Description	Logic	Mask	Pri	Reset
YC_L001_Alm	Pump Duty Setup Error	When not in alternating mode, alarm if there is more than one pump with a value of zero or if there are two pumps with the same number other than zero.	N/A	2	Auto

**4.3.3 Control Narrative**

Compare LC\_L500\_NumPumps with the number of pumps currently running. Start or stop pumps to match the number of pumps called to run.

If YC\_L001\_NormalMode is set:


If an additional pump is called to start, start the pump with the lowest duty greater than zero.

If a pump is called to stop, stop the pump with the highest duty that is currently running.

If YC\_L001\_AlternateMode is set:

If an additional pump is called to start, start the pump that has been off the longest.

If a pump is called to stop, stop the pump that has been running the longest.

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#### 4.4 Wastewater Lift Pump P-L01 Control – YC-L010

P-L01 is a wastewater lift pump with VFD speed control. Implement all I/O as listed in the IO list and on the P&IDs.

##### 4.4.1 HMI-PLC Interface

###### .1 Discrete Status Bits:


Tagname	Description	Type	Display
YC_L010_Alarm	Pump P-L01 Alarm Present	R	GD-A
YC_L010_CtrlMan	Pump P-L01 Manual Control Mode	R	GD-T, EF-T
YC_L010_Running	Pump P-L01 Running Status	R	GD-G
YC_L010_VFD_Flt	Pump P-L01 VFD Fault	R	EF-L
YC_L010_HS_Local	Pump P-L01 LOA Hand Switch in Local	R	EF-L
YC_L010_HS_Auto	Pump P-L01 LOA Hand Switch in Auto	R	EF-L
YC_L010_Rdy	Pump P-L01 Ready	R	GD-T

###### .2 Discrete Control Bits:

Tagname	Description	Type	Control
YC_L010_CtrlMan	Set to Manual Control Mode	W1	EF-PB (L)
YC_L010_CtrlAuto	Set to Auto Control Mode	W1	EF-PB (L)
YC_L010_Reset	Reset	W1	EF-PB (L)
YC_L010_ManualStart	Manual Start command	W1	EF-PB (L)
YC_L010_ManualStop	Manual Stop command	W1	EF-PB (L)

###### .3 Analog Values:

Tagname	Description	Range	Type	Display
YC_L010_S	Pump P-L01 Speed Feedback	0 – 100%	R	EF-T, GD-T, T
YC_L010_CmdS	Pump P-L01 Speed Command	0 – 100%	R	EF-T
YC_L010_I	Pump P-L01 Motor Current	0 – (1.6*Motor FLA) A	R	EF-T
YC_L010_I_Perc	Pump P-L01 Motor Current % of FLA	0 – 160% FLA	R	EF-T
YC_L010_K_1	Pump P-L01 Run Time	0 – (2 <sup>31</sup> - 1) min	R	DD-T
YC_L010_K_2	Pump P-L01 Off Time	0 – (2 <sup>31</sup> - 1) min	R	DD-T

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#### .4 Analog Settings and Set Points:

Tagname	Description	Range	Type	Control
YC_L010_ManualSpeed	Manual Speed Control Output	0 – 100%	RW	SW-TE (L)
YC_L010_MinSpeed	Minimum Speed Control Output	0 – 100%	RW	SW-TE (H)
YC_L010_MaxSpeedNorm	Maximum Speed for Normal Operation	0 – 100%	RW	SW-TE (H)
YC_L010_MaxRampRate	Maximum Ramp Rate for VFD starting	1 – 20% / sec	RW	SW-TE (H)
YC_L010_MotorFLA	Pump Motor FLA	0 – 3276.7 A	RW	SW-TE (M)

#### 4.4.2 Alarms

Tagname	Description	Logic	Mask	Pri	Reset
YC_L010_RunFlt	P-L01 Run Fault	NOT EAL-L721 AND YC-L010.AutoMode AND ((P-L01.CmdRun AND NOT YC_L010_Running) for 2 seconds OR (NOT P-L01.CmdRun AND YC_L010_Running) for 8 sec)	N/A	1	HMI OR EAL-L721
YC_L010_VFD_Flt	P-L01 VFD Fault	YC_L010_VFD_Flt	N/A	1	HMI
PAL_L012	P-L01 Seal Water Pressure Low	YC_L010_Running AND PSL-L012 for > 4 sec	N/A	1	Auto

#### 4.4.3 Interlocks


Initiating Event	Action	Description
NOT YC_L010_Rdy	Stop	Pump Not Ready
YC_L010_VFD_Flt	Stop	VFD Fault
LALL_L500	Stop	Wet Well Low Level Interlock
LAL_S950	Stop	Downstream Interceptor High Level Interlock

#### 4.4.4 Control Narrative

Limit the minimum speed of the pump to YC\_L010\_MinSpeed in all operating states.

Operating states are as follows:

1. Pump not in Auto (NOT YC\_L010\_HS\_Auto)

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The PLC does not have control of the pump, so turn off the run and speed outputs. All HMI control is disabled. The HMI continues to monitor the status and display alarms.

2. Pump in Auto (YC\_L010\_HS\_Auto) AND Manual Control Mode

The operator manually controls the starting/stopping of the pump and pump speed through the HMI. Ensure transition between Auto control and Manual control is bumpless.

3. Pump in Auto (YC\_L010\_HS\_Auto) AND Auto Control Mode

Utilize the signals from Wet Well Level controller LC-L500 and Pump Duty Sequencer TC-L001 to start and stop the pump and set the pump speed.

Limit the ramp rate for VFD start up to YC\_L010\_MaxRampRate. This should be the same value as the setting in the VFD.

#### 4.5 Wastewater Lift Pump P-L02 Control – YC-L020

Pump P-L02 is identical to P-L01. Use P-L01 as the basis for P-L02.

#### 4.6 Wastewater Lift Pump P-L03 Control – YC-L030

Pump P-L03 is identical to P-L01. Use P-L01 as the basis for P-L03.

#### 4.7 Flow Meter – FIT-L011

FIT-L011 is a flow meter for pump P-L01. Implement all I/O as listed in the IO list and on the P&IDs.

##### 4.7.1 HMI-PLC Interface


###### .1 Discrete Control Bits:

Tagname	Description	Type	Control
FQI_L011_Reset	Reset Totalizer	W1	EF-PB (L)

###### .2 Analog Values:

Tagname	Description	Range	Type	Display
FI_L011	Flow for pump P-L01	0 – 32767 l/s	R	EF-T
FQI_L011	Flow total for pump P-L01	0 – (2 <sup>31</sup> - 1) m <sup>3</sup>	R	EF-T
FQI_L011_HourC	Flow total for pump P-L01– Current Hour	0 – 32767 m <sup>3</sup>	R	EF-T
FQI_L011_HourP	Flow total for pump P-L01– Previous Hour	0 – 32767 m <sup>3</sup>	R	EF-T
FQI_L011_DayC	Flow total for pump P-L01– Current Day	0 – (2 <sup>31</sup> - 1) m <sup>3</sup>	R	EF-T
FQI_L011_DayP	Flow total for pump P-L01– Previous Day	0 – (2 <sup>31</sup> - 1) m <sup>3</sup>	R	EF-T



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### .3 Analog Set Points:

Tagname	Description	Range	Type	Control
FIT_L011_FAL_SP	Flow Alarm Low Setpoint	0 – 32767 l/s	RW	SW-TE (M)

#### 4.7.2 Alarms

Tagname	Description	Logic	Mask	Pri	Reset
FAL_L011	P-L01 Low Flow Alarm	YC_L010_Running AND FI_L011 < FIT_L011_FAL_SP AND NOT FIT_L011_Fit for > 60 sec	N/A	1	Auto
FIT_L011_Fit	Flow Meter Transmitter Failure	FIT-L011 < 4mA or > 20mA	N/A	2	Auto

#### 4.7.3 Control Narrative

Compute three flow totals from the pulse input:

- 1) Total Flow
- 2) Current hour flow total
- 3) Current day flow total

Copy the Current Hour and Current Day values to the Previous Hour and Previous Day values at the end of each hour and day respectively.

Reset the Total Flow upon the operator pressing the Reset Totalizer button on the equipment faceplate. Do not reset the Hourly and Daily total values.

#### 4.8 Flow Meter – FIT-L021

FIT-L021 is a flow meter for pump P-L02. Use FIT-L011 as the basis for FIT-L021.

#### 4.9 Flow Meter – FIT-L031

FIT-L031 is a flow meter for pump P-L03. Use FIT-L011 as the basis for FIT-L031.


#### 4.10 Miscellaneous

Implement all I/O as listed in the IO list and on the P&IDs.

##### 4.10.1 HMI-PLC Interface


### .1 Analog Values:

Tagname	Description	Range	Type	Display
FI_L002	Total Flow for Station	0 – 32767 l/s	R	GD-T

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#### 4.10.2 Alarms

Tagname	Description	Logic	Mask	Pri	Reset
LAH_L500	Wet Well High Level	LSH-L500 for > 5 sec	N/A	1	Auto
LAH_L101	Downstream Interceptor High Level	LSH-L101 for > 5 sec	N/A	1	Auto, with delay of 1 minute
LAH_L523	Station Flood	NOT LSH-L523 for > 3 sec	N/A	1	Auto
EAL_L721	600 VAC Power Failure	NOT ESL-L721 for > 0.5 sec	N/A	1	Auto
EAL_L528	120 VAC Power Failure	NOT ESL-L528 for > 0.5 sec	N/A	1	Auto
XA_L712	TVSS Failure	NOT XS-L712 for > 0.5 sec	N/A	3	Auto
XA_L543	UPS Alarm	NOT YS-L543 for > 0.5 sec	N/A	1	Auto
YA_L720-1	Generator Alarm	NOT YS-L720-1 for > 0.5 sec	N/A	1	Auto
YA_L720-2	Transfer Switch Alarm	NOT YS-L720-2 for > 0.5 sec	N/A	1	Auto
YA_L620	Main Supply Fan Not Running	(NOT SF-L62.Run) AND (NOT HS-L600) for > 5 sec	N/A	1	Auto
IA_L660	Cooling Fan Overload	NOT SF-L68.Ovrd for > 0.5 sec	N/A	3	Auto
PDAH_L611	Main Supply Fan Filter Dirty	NOT PDSH-L611 for > 10 sec	N/A	3	Auto
PDAH_L671	Cooling Fan Filter Dirty	NOT PDSH-L671 for > 10 sec	N/A	3	Auto
TAL_L601	Main Floor Low Temperature Alarm	TT-L601 < 5 °C for > 10 sec	N/A	1	Auto
TAH_L601	Main Floor High Temperature Alarm	TT-L601 > 35 °C for > 10 sec	N/A	1	Auto
TAL_L602	Pump Room Low Temperature Alarm	NOT TSL-L602 for > 10 sec	N/A	1	Auto
AAH_L550	Gas Alarm	AIT-L550.Alm	N/A	1	Auto
AAF_L550	Gas Detector Fault	AIT-L550.FlT	N/A	1	Auto

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#### 4.10.3 Control Narrative

A heartbeat signal is to be implemented in the PLC so that the station's RTU can determine if the PLC is in Run mode (i.e. the PLC has not faulted).

Create a one second timer that increments a register, named "PLC\_Heartbeat", every one second. Increment the register to a set value (preferable 32767), reset to 0, and continue incrementing. This register will be monitored by the RTU.

Refer to the SCADA HMI Interface map for the PLC\_Heartbeat tag's Modbus register assignment.