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Table of Contents

1 Overview 4
1.1 Associated Documents 4

2 General Requirements 6
2.1 Human Machine Interface 6
2.1.1 Screen Layout 6
2.1.2 Graphic Displays 6
2.2 PLC Control from HMI 6
2.3 Control Interface Requirements 6
2.3.1 Parameter 7
2.3.2 Control Interface Type 7
2.3.3 Range 7
2.3.4 HMI Interface 7
2.3.5 Security 8
2.3.6 Alarms 8

3 Implementation 10
3.1 HMI Application 10
3.1.1 Graphic Displays 10
3.1.2 Trend Displays 11
3.1.3 Variable Naming Convention 11
3.2 PLC Application 11
3.2.1 Software Automatic/Manual Modes 11
3.2.2 PIDs 12
3.2.3 Variable Naming Convention 12

4 Base classes 13
4.1 Alm – Alarm 13
4.1.1 Control Interface 13
4.1.2 PLC Generated Alarms 13
4.2 Alm_TD – Alarm Time Delay 13
4.2.1 Control Interface 13
4.2.2 PLC Generated Alarms 13
4.3 ValveD – Discrete Valve 14
4.3.1 Control Interface 14
4.3.2 Alarms 14
4.3.3 Interlocks 15
4.3.4 Control Narrative 15
4.4 IC - Indicating Controller 15
4.4.1 Control Interface 15
4.4.2 PLC Generated Alarms 16
4.4.3 Interlocks 16
4.4.4 Control Narrative 16
4.5 FI_FBus – FieldBus Flow 17
4.5.1 Control Interface 17
4.5.2 PLC Generated Alarms 17
4.5.3 Control Narrative 17
4.6 IndA_FBus – FieldBus Indication with Alarm/Control Points 17
4.6.1 Control Interface 17
4.6.2 PLC Generated Alarms 18

Table of Contents

4.7 Mtr – Motor Controller 18
4.7.1 Control Interface 18
4.7.2 PLC Generated Alarms 19
4.7.3 Interlocks 19
4.7.4 Control Narrative 19
4.8 EMBV – Effluent Monitoring Building Ventilation Controller 19
4.8.1 Control Interface 19
4.8.2 PLC Generated Alarms 21
4.8.3 Interlocks 21
4.8.4 Control Narrative 21
4.9 Wdog_Cnt – Watchdog Counter 22
4.9.1 Control Interface 22
4.9.2 PLC Generated Alarms 22
4.9.3 Control Narrative 22
4.10 Pre_Val – Previous Value 22
4.10.1 Control Interface 23
4.10.2 Control Narrative 23

5 Effluent monitoring station 24
5.1 Effluent Monitoring Process 24
5.1.1 Class Instances 24
5.2 Effluent Monitoring HVAC 25
5.2.1 Class Instances 25
5.3 Miscellaneous 26
5.3.1 Class Instances 26

1 OVERVIEW

The logic specified in this document is intended to provide functional requirements for Area Z – Ponds, Effluent and Outfall. 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 documents and drawings associated with this functional requirements specification are listed below. Additional P&ID drawings may be referenced in this document.

Document / Drawing Number	Description
SD-A106	Functional Requirements Specification – Standard Function Block Classes
612620-0014-40ER-0001	Tag Naming Standard
612620-0015-40ER-0001	HMI Layout and Automation Plan
1-0103-PPID-Z001	Process and Instrumentation Diagram - Effluent P&ID
1-0103-PPID-Z601	Process and Instrumentation Diagram - HVAC P&ID
1-0103-AILD-Z001	Loop Diagram - LSH-Z0003, LSH-Z0007
1-0103-AILD-Z002	Loop Diagram - PSH-Z0050, HS-Z5050
1-0103-AILD-Z003	Loop Diagram - LSL-Z0041, HS-Z0040
1-0103-AILD-Z004	Loop Diagram - PSL-Z5030, FSL-Z0042, SA-Z006, FIT-Z0002
1-0103-AILD-Z005	Loop Diagram - ZSC-Z9801-1, ZSC-9801-1, ES-Z7030
1-0103-AILD-Z601	Loop Diagram - XV-Z6010, XV-Z6060, PDSH-Z6020
1-0103-AILD-Z602	Loop Diagram - MSH-Z605, HS-Z6040
1-0103-AILD-Z603	Loop Diagram - HCE-Z6030
1-0103-AIFS-Z001	Instrument Fieldbus Segment Drawing
1-0103-EMCL-Z001	Motor Control - P-Z004 Motor Schematic and Wiring Diagram
1-0103-EMCL-Z002	Motor Control - P-Z005 Motor Schematic and Wiring Diagram
1-0103-EMCL-Z601	Motor Control - SF-Z604 Motor Schematic and Wiring Diagram
1-0103-ACBD-Z001	Station PLC - Cabinet Layout - CP-Z800 PLC Panel

Document / Drawing Number	Description
1-0103-ACBD-Z002	UPS Enclosure Layout and Bill of Materials - PLC (CP-Z800) and UPS (PSP-Z800)
1-0103-ACBD-Z003	Wiring/Connection Diagram PLC Panel CP-Z800 - Power Distribution
1-0103-ACBD-Z004	Module Wiring Diagram - Rack 0 Slot 2 - Discrete Input
1-0103-ACBD-Z005	Module Wiring Diagram - Rack 0 Slot 3 - Discrete Input
1-0103-ACBD-Z006	Module Wiring Diagram - Rack 0 Slot 4 - Discrete Output
1-0103-ACBD-Z007	Module Wiring Diagram - Rack 0 Slot 5 - Analog Output
1-0103-ACBD-Z008	Junction Box Layout and Bill of Materials - JBA-Z0003, JBA-Z0007, JBA-Z00041, ADP-Z801 - JBA-Z6010, JBA-Z6060
1-0103-ABDG-Z001	Block Diagram - Control System Architecture
1-0103-EWDG-Z001	Wiring Schematics – Motion Sensor

2 GENERAL REQUIREMENTS

2.1 Human Machine Interface

2.1.1 Screen Layout

The typical screen layout for the HMI graphic terminal shall be as shown in Figure 1. Navigation buttons shall reside across the bottom, a single-line alarm banner across the top, and the remainder of the screen allocated for the graphic display area. The graphic display area will be utilized for mimic displays, configuration screens, trends, and an alarm summary.

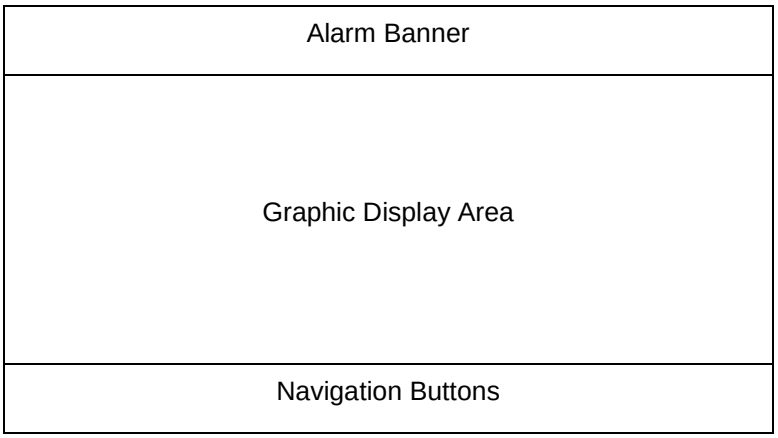


Figure 1: Screen Layout

2.1.2 Graphic Displays

A graphic (process mimic) display is a graphical representation of the process, showing pumps, instruments, and associated piping. Show sufficient detail from the P&ID's to allow operators a full understanding of the process. Metric units are to be used.

2.2 PLC Control from HMI

Configure HMI commands to utilize a SET operation rather than the Momentary On operation. The PLC shall reset the bit. This prevents discrete PLC tags from being stuck on in the event of communication failures, timing issue, or control from multiple HMI nodes.

Pushbuttons on the HMI shall be disabled and enabled appropriately to indicate to the operator which commands/actions are possible at any given time.

Setpoint values from the HMI will be maintained in memory by the PLC until they are modified by the HMI. The HMI will continually read setpoint values from the PLC to ensure that the current value is correctly displayed on the HMI.

2.3 Control Interface Requirements

The class definitions contained in this document specify the control interface for each class in tables containing Parameter, Type, Description, Range and HMI columns.

2.3.1 Parameter

The Parameter is the name given to each input or output associated with the class.

2.3.2 Control Interface Type

Type	Description
I	Input – General
IH	Input from the HMI
O	Output
SP	Setpoint (value retained, typically set from HMI)

2.3.3 Range

The Range field is utilized to indicate the extent of acceptable values for the parameter. Examples are indicated in the table below.

Type	Description
0/1	Discrete Value – True / False
0 - 1000	A number between 0 and 1000
10 - 500 ML	Analog value ranging from 10 to 500 megaliters
W1	A discrete command signal from the HMI (reset by the PLC)

2.3.4 HMI Interface

The HMI column in the Control Interface indicates the typical type and location for the corresponding HMI interface. The HMI Interface Type Codes are indicated below.

HMI Type Code	Description
-	Do not show on the HMI
EF-G	Show as graphic on the equipment 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-PB	Show as a pushbutton on the equipment faceplate.
EF-T	Show as a text display on the equipment faceplate.
EF-TE	Show as a text entry on the equipment faceplate.
EF2-*	Show as a 2nd tab on the equipment faceplate.
EF3-*	Show as a 3rd tab on the equipment faceplate.
GD*-A	Show as an animation on the graphic display, where * is the level of the display.
GD*-BG	Show as a bar graph on the graphic display, where * is the level of the display.
GD*-BGT	Show as a threshold / setpoint on a bar graph.

HMI Type Code	Description
GD*-CA	Show as a common animation on the graphic display, where * is the level of the display. More than one variable may affect the same animation.
GD*-F	Show as a flag on the graphic display, where * is the level of the display.
GD*-G	Show as a graphic on the graphic display, where * is the level of the display.
GD*-L	Show as an indicator light on the graphic display, where * is the level of the display.
GD*-PB	Show as a pushbutton on the graphic display, where * is the level of the display.
GD*-T	Show as text on the graphic display, where * is the level of the display.
SW-T	Show as text on a settings window.

Notes:

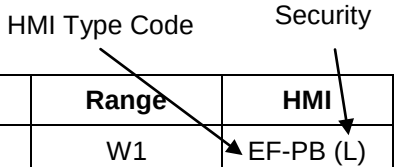
1. Where the level of display is indicated as a number, the element shall be displayed on that level of display and lower. For example, if an element is flagged with a GD3-F HMI Type Code, then that flag shall be shown on level 3 displays and level 4 displays as applicable.
2. Where the level of display is indicated as x, the element shall be displayed on all levels display that show the relevant equipment or context.

2.3.5 Security

Each input parameter with an HMI Type Code specified in the HMI field will be assigned a security level to restrict the ability of users to perform manual HMI control and modify control system parameters.

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

The following is an example of how an HMI type code and a security level is assigned in the Parameters table within a class definition:



Parameter	Type	Description	Range	HMI
CtrlAutoCmd	IH	Set to Auto Control Mode	W1	EF-PB (L)
CtrlManCmd	IH	Set to Manual Control Mode	W1	EF-PB (L)
F	I	Flow	As Req'd	GDx-BG

2.3.6 Alarms

The PLC Generated Alarms table in each class definition specifies the alarm points that will be displayed on the alarm list in the HMI. Alarms are inherently designated outputs of the Control Interface, even though they are not explicitly identified in the Control Interface table. The alarm descriptions defined in each class are generic, and are intended to be preceded by the equipment identifier and description corresponding to each instance.

Each alarm is assigned a default priority **(DPri)** which indicates the action/response required if that alarm becomes active. See the following table for a list of alarm priorities and corresponding actions. Note that the default priority shown in the class definitions may be superseded by the class instance for a particular piece of equipment, as specified in the supporting FRS documents. When this occurs, the revised alarm priority will be shown in brackets following the alarm tag name (E.g. AlmFlt(1)) in the corresponding class instance table

Pri	Description
1	Emergency / High Priority. The alarm requires immediate attention. Also, indicates a requirement for a callout when unmanned.
2	Medium (Warning) Priority. The alarm requires attention within approximately a day, but does not require a callout when unmanned.
3	Low (Advisory) Priority. The alarm does not require immediate attention.

Example

Alarm	Description	Logic	DPri	Reset
S_Fault	Speed Fault	ABS(S – CmdS) > 5% for 30 sec	2	Auto

3 IMPLEMENTATION

3.1 HMI Application

Create local process graphics on the Effluent Monitoring control panel HMI that meets the following specifications.

3.1.1 Graphic Displays

Create a process graphic (process mimic) displays containing a representation of the process shown on the process and instrumentation diagrams for the local HMI. Implement the HMI system in accordance with the City of Winnipeg HMI Layout and Animation Plan, document 612620-0015-40ER-0001.

Below are the anticipated groupings of process displays.

3.1.1.1 Facility Overview

Level - 2

This is the default display for the system.

Specific requirements include, but are not limited to:

Display bar graphs for the following:

- FQI-Z0002 Total Effluent Flow (Show both current day as well as previous day)
- FI-Z0002 Effluent Flow Rate
- TIC-Z6101 Main Floor Air Temperature
- TIC-Z6030 Supply Air Temperature

Equipment graphics (without process flow linking)

- Sample Pump P-Z004 Status
- Vacuum Pump P-Z005 Status
- Supply Fan SF-Z604 Status

3.1.1.2 HVAC Display

Level – 3

Provide a comprehensive display to show the HVAC system shown on PPID-Z601 as well as security devices indicated on PPID-Z001.

Provide equipment faceplate links, as well as links to controllers.

3.1.1.3 Effluent Monitoring Process Display

Level - 3

Provide a comprehensive display to show the effluent monitoring process indicated on PPID-Z001 (other than security devices).

Provide equipment faceplate links, as well as links to controllers.

3.1.1.4 Control System Status

Level - 3

Create a graphic display showing a hierarchical layout of the control system components including but not limited to the following:

- Main controller rack(s).
- Remote I/O rack(s), as applicable.
- Networking components,
- Power supplies.
- Communication to the DCS.

Display comprehensive heath/alarm information adjacent to each control system component.

3.1.1.5 Process Detail Displays

Level - 4

Provide detail displays as required to detail any portion of the Level 3 displays which cannot be adequately addressed by the Level 3 displays.

Provide equipment faceplate links, as well as links to controllers.

3.1.2 Trend Displays

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

Create appropriate links from the various graphic screens to the trend displays.

Note that for all discrete trend points where the value is 0 or 1, they shall be scaled such that the discrete value is clearly displayed on the trend (For example, a scale of -0.2 to 1.2).

Trend Screen 1

- FI-Z0002 Effluent Flow Rate
- YC-Z0060 (Discrete)

Trend Screen 2

- TI-Z6101 Main Floor Air Temperature
- TIC-Z6030 HVAC Supply Air Temperature
- MSH-Z0006 Humidity High Level Switch (Discrete)

3.1.3 Variable Naming Convention

Variables are to be named as per the City of Winnipeg Tagname Identification Standard, document 612620-0014-40ER-0001.

3.2 PLC Application

3.2.1 Software Automatic/Manual Modes

In addition to the physical Hand-Off-Remote switch, each piece of equipment that is controlled by the PLC shall also have a software Automatic and Manual mode. The software Manual mode allows operators to manually control equipment from the HMI.

3.2.2 PIDs

The PLC logic shall be written such that bump-less transfer occurs when switching from Automatic to Manual, and vice versa. When a change from software Automatic mode to software Manual mode occurs, move the output of the PID into the Manual speed setpoint. This prevents the speed from changing when entering software Manual mode.

PIDs that are controlling variable frequency drives are to have their Lower Limit configured to be the same as the drive's minimum speed setting to prevent integral windup.

3.2.3 Variable Naming Convention

Variables are to be named as per the City of Winnipeg Tagname Identification Standard, document 612620-0014-40ER-0001.

4 BASE CLASSES

4.1 Alm – Alarm

The Alm class implements a discrete alarm without time delay.

4.1.1 Control Interface

Parameter	Type	Description	Range	HMI
Enbl	I	Enable Alarm (Default = 1)	0/1	
Inp	I	Alarm Signal Input	0/1	
Rst	I	Alarm Reset (Default = 1)	0/1	

4.1.2 PLC Generated Alarms

Alarm	Description	Logic	DPri	Reset
Alarm	As Req'd	If Inp and Enbl	2	As per Rst

Note: The alarm set logic takes a higher precedence than the reset logic. That is, the alarm will not reset unless the alarm condition is no longer true.

4.2 Alm_TD – Alarm Time Delay

The Alm_TD class implements a time delay alarm.

4.2.1 Control Interface

Parameter	Type	Description	Range	HMI
Dly	I	Time Delay	0 – X ms	
Enbl	I	Enable Alarm	0/1	
Inp	I	Alarm Signal Input	0/1	
Rst	I	Alarm Reset	0/1	

4.2.2 PLC Generated Alarms

Alarm	Description	Logic	DPri	Reset
Alarm	As Req'd	If Inp and Enbl for Dly msec	2	As per Rst

Note: The alarm set logic takes a higher precedence than the reset logic. That is, the alarm will not reset unless the alarm condition is no longer true.

4.3 ValveD – Discrete Valve

The ValveD class is utilized to control a discrete valve.

4.3.1 Control Interface

Parameter	Type	Description	Range	HMI
CtrlAutoCmd	I	Set to Auto Control Mode	W1	EF-PB (L)
CtrlManCmd	I	Set to Manual Control Mode	W1	EF-PB (L)
CtrlRem	I	Remote Control (Controlled by PLC)	0/1	GDx-F EF-L
FbkDly	I	Feedback Delay (Default = 2 sec)	0 – 1000 sec	-
Intl	I	Interlock (Man/Auto)	0/1	EF-L
IntlA	I	Interlock When In Auto	0/1	EF-L
OpnReq	I	Open Request - AutoMode	0/1	
ManCls	IH	Manual Close Command	W1	EF-PB (L)
ManOpn	IH	Manual Open Command	W1	EF-PB (L)
ZSC	I	Position Closed	0/1	GD3-A EF-T
ZSO	I	Position Open	0/1	GD3-A EF-T
CtrlMan	O	Control Mode Manual	0/1	GD3-F EF-T
CmdOpn	O	Position Cmd	0 – 100%	EF-T

4.3.2 Alarms

Alarm	Description	Logic	DPri	Reset
ClsFail	Close Fail	NOT CmdOpen AND (ZSO OR NOT ZSC) for FbkDly sec	2	Auto
FbkFail	Limit Switch Feedback Fail	(ZSC AND ZSO) OR NOT (ZSC OR ZSO) for FbkDly sec	2	Auto
OpnFail	Open Fail	CmdOpen AND (ZSC OR NOT ZSO) for FbkDly sec	2	Auto

4.3.3 Interlocks

Initiating Event	Action	Control Mode		Set Intlocked Output	Description
		Auto	Manual		
Intl	Close	Y	Y	Y	Close valve regardless if in Auto or Manual Mode.
IntlA	Close	Y	N	Y	Close valve if in Auto Mode.

4.3.4 Control Narrative

If in Auto mode, open the valve (CmdOpn) when the OpnReq signal is on.

4.4 IC - Indicating Controller

The IC indicating controller is a base class for use within specific controller classes.

4.4.1 Control Interface

Parameter	Type	Description	Range	HMI
CtrlAutoCmd	IH	Set to Auto Control Mode	W1	EF-PB (L)
CtrlManCmd	IH	Set to Manual Control Mode	W1	EF-PB (L)
Input	I	Input (Process Variable)	As Req'd	GDx-BG GDx-T
SP	SP	Setpoint	As Req'd	EF-T
SP_Min	SP	Minimum Input Capability	As Req'd	EF2-TE (M)
SP_Max	SP	Maximum Input Capability	As Req'd	EF2-TE (M)
SP_AlmHiHi	SP	High High Alarm Setpoint	0/1	EF2-TE (M)
SP_AlmHi	SP	High Alarm Setpoint	0/1	EF2-TE (M)
SP_AlmLo	SP	Low Alarm Setpoint	0/1	EF2-TE (M)
SP_AlmLoLo	SP	Low Low Alarm Setpoint	0/1	EF2-TE (M)
ManOut	I	Manual Output	0-100%	EF-TE (L)
IntlkOut	I	Interlocked Ouput (Default = 0%)	0-100%	EF-TE (H)
Intlk	I	Interlock (In Manual and Auto)	0/1	EF-L
IntlkAuto	I	Interlock When in Auto	0/1	EF-L
AlmHiHi	O	High High Alarm	0/1	
AlmHi	O	High Alarm	0/1	
AlmLo	O	Low Alarm	0/1	

Parameter	Type	Description	Range	HMI
AlmLoLo	O	Low Low Alarm	0/1	
Interlocked	O	Interlocked	0/1	GDx-F
CtrlMan	O	Control Mode Manual	0/1	GDx-F EF-T
CV	O	Controlled Variable Output	0-100%	

4.4.2 PLC Generated Alarms

Alarm	Description	Logic	DPri	Reset
InputFail	Transmitter Failure	Input is bad quality (Out of range or bad quality from instrument via fieldbus)	2	Auto
AlmHiHi	Input High High Alarm	Input >= SP_AlmHiHi	2	Auto
AlmHi	Input High Alarm	Input >= SP_AlmHi	3	Auto
AlmLo	Input Low Alarm	Input <= SP_AlmLo	3	Auto
AlmLoLo	Input Low Low Alarm	Input <= SP_AlmLoLo	2	Auto

4.4.3 Interlocks

Initiating Event	Action	Control Mode		Set Intlocked Output	Description
		Auto	Manual		
Intlk		Y	Y	Y	Set CtrlMan = 1 and Set ManOut = IntlkOut in Auto and Manual modes
IntlkAuto		Y	N	Y	Set CtrlMan = 1 and Set ManOut = IntlkOut in Auto mode only

4.4.4 Control Narrative

Utilize PID control to control the Control Variable (CV) based upon the Setpoint (SP). Set the control action direction (direct / reverse acting) as required. Provide bumpless control when in Manual Mode. In Automatic Mode have the Manual Output (ManOut) track the Control Variable (CV). Limit the Setpoint (SP) to within [SP_Min, SP_Max].

4.5 FI_FBus – FieldBus Flow

4.5.1 Control Interface

Parameter	Type	Description	Range	HMI
Flow	I	Input Flow Rate (Process Variable)	As Req'd	GDx-T EF-T
Volume	I	Total Flow Volume	As Req'd	GDx-T EF-T
Rst	I	Reset Totalizer	0/1	EF-PB (M)

4.5.2 PLC Generated Alarms

Alarm	Description	Logic	DPri	Reset
InputFail	Transmitter Failure	Input is bad quality (Out of range or bad quality from instrument via fieldbus)	2	Auto
Overflow	Totalizer Overflow	Total exceeds maximum register value	2	Auto

4.5.3 Control Narrative

Upon Rst, reset the totalized value in the fieldbus transmitter.

4.6 IndA_FBus – FieldBus Indication with Alarm/Control Points

4.6.1 Control Interface

Parameter	Type	Description	Range	HMI
Inp	I	Input (Process Variable)	As Req'd	GDx-T EF-T
SP_AlmHiHi	SP	High High Alarm Setpoint	0/1	EF2-TE (M)
SP_AlmHi	SP	High Alarm Setpoint	0/1	EF2-TE (M)
SP_AlmLo	SP	Low Alarm Setpoint	0/1	EF2-TE (M)
SP_AlmLoLo	SP	Low Low Alarm Setpoint	0/1	EF2-TE (M)
AlmHiHi	O	High High Alarm	0/1	
AlmHi	O	High Alarm	0/1	
AlmLo	O	Low Alarm	0/1	
AlmLoLo	O	Low Low Alarm	0/1	

4.6.2 PLC Generated Alarms

Alarm	Description	Logic	DPri	Reset
InputFail	Transmitter Failure	Input is bad quality (Out of range or bad quality from instrument via fieldbus)	2	Auto
AlmHiHi	Input High High Alarm	Input >= SP_AlmHiHi	2	Auto
AlmHi	Input High Alarm	Input >= SP_AlmHi	3	Auto
AlmLo	Input Low Alarm	Input <= SP_AlmLo	3	Auto
AlmLoLo	Input Low Low Alarm	Input <= SP_AlmLoLo	2	Auto

4.7 Mtr – Motor Controller

The MTR controller controls the operation of a motor controlled starter.

4.7.1 Control Interface

Parameter	Type	Description	Range	HMI
CtrlAutoCmd	IH	Set to Auto Control Mode	W1	EF-PB (L)
CtrlManCmd	IH	Set to Manual Control Mode	W1	EF-PB (L)
ManStart	IH	Manual Start Command	W1	EF-PB (L)
ManStop	IH	Manual Stop Command	W1	EF-PB (L)
KQ_Rst	IH	Runtime Totalizer Reset	W1	EF-PB (L)
Rst	IH	Reset	W1	EF-PB (L)
Rdy	I	Ready Status	0/1	GDx-F EF-T
AutoRunReq	I	Auto Run Request	0/1	-
Run	I	Motor Running	0/1	GDx-A EF-L
RunInp	I	Auto Run Input	0/1	
Flt	I	Motor Fault Status (Overload)	0/1	EF-L
CtrlRem	I	Remote Control (Controlled by PLC)	0/1	GDx-F EF-T
Intlk	I	Interlock (Man/Auto)	0/1	EF-L
IntlkAuto	I	Interlock When In Auto	0/1	EF-L
Interlocked	O	Interlocked	0/1	GDx-F

Parameter	Type	Description	Range	HMI
KQ	O	Runtime	0 – 2^32-1 min	EF-T
CtrlMan	O	Control Mode Manual	0/1	GDx-F EF-T
CmdRun	O	Run Command	0/1	

4.7.2 PLC Generated Alarms

Alarm	Description	Logic	DPri	Reset
RunFault	Run Fault	CtrlRem AND ((Run AND NOT CmdRun for 0.5 sec) OR (CmdRun AND NOT Run for 0.5 sec))	2	Manual
Starter_Fault	Starter Fault	Flt	2	Auto

4.7.3 Interlocks

Initiating Event	Action	Control Mode		Set Intlocked Output	Description
		Auto	Manual		
NOT CtrlRem	Stop	Y	Y	N	Turn off the Run Cmd output if in Remote Mode.
Flt	Stop	Y	Y	N	Stop on a Starter Fault
Intlk	Stop	Y	Y	Y	Stop motor regardless if in Auto or Manual Mode.
IntlkAuto	Stop	Y	N	Y	Stop motor if in Auto Mode.

4.7.4 Control Narrative

In CtrlMan == 0 AND CtrlRem == 1 AND RunInp == 1 set CmdRun = 1.

Increment the runtime totalizer (KQ) whenever the pump is running, regardless of Auto/Manual/Local mode.

Set the Rdy output to true when the pump is ready for automatic control.

4.8 EMBV – Effluent Monitoring Building Ventilation Controller

The EMBV (Effluent Monitoring Building Ventilation) Controller controls the operation of the ventilation fan along with two dampers (inlet and outlet).

4.8.1 Control Interface

Parameter	Type	Description	Range	HMI

Parameter	Type	Description	Range	HMI
CtrlAutoCmd	IH	Set to Auto Control Mode	W1	EF-PB (L)
CtrlManCmd	IH	Set to Manual Control Mode	W1	EF-PB (L)
ManStart	IH	Manual Start Command	W1	EF-PB (L)
ManStop	IH	Manual Stop Command	W1	EF-PB (L)
KQ_Rst	IH	Runtime Totalizer Reset	W1	EF-PB (L)
Rst	IH	Reset	W1	EF-PB (L)
Rdy	I	Ready Status	0/1	GDx-F EF-T
AutoRunReq	I	Auto Run Request	0/1	-
Run	I	Motor Running	0/1	GDx-A EF-L
RunInp	I	Auto Run Input	0/1	
Flt	I	Motor Fault Status (Overload)	0/1	EF-L
CtrlRem	I	Remote Control (Controlled by PLC)	0/1	GDx-F EF-T
Intlk	I	Interlock (Man/Auto)	0/1	EF-L
IntlkAuto	I	Interlock When In Auto	0/1	EF-L
Vlv1_ZSC	I	Valve 1 Position Closed	0/1	GD3-A EF-T
Vlv1_ZSO	I	Valve 1 Position Open	0/1	GD3-A EF-T
Vlv2_ZSC	I	Valve 2 Position Closed	0/1	GD3-A EF-T
Vlv2_ZSO	I	Valve 2 Position Open	0/1	GD3-A EF-T
FbkDly	I	Valve Feedback Delay (Default = 30 sec)	0 – 1000 sec	-
Interlocked	O	Interlocked	0/1	GDx-F
KQ	O	Runtime	0 – 2^32-1 min	EF-T
CtrlMan	O	Control Mode Manual	0/1	GDx-F EF-T
CmdRun	O	Run Command	0/1	

4.8.2 PLC Generated Alarms

Alarm	Description	Logic	DPri	Reset
RunFault	Run Fault	Vlv1_ZSO AND CtrlRem AND ((Run AND NOT CmdRun for 0.5 sec) OR (CmdRun AND NOT Run for 0.5 sec)) Note: The motor contactor is not initiated until the inlet valve (Vlv1) has been proven open.	3	Manual
Starter_Fault	Starter Fault	Flt	3	Auto
Vlv1_ClsFail	Valve 1 Close Fail	NOT CmdRun AND (Vlv1_ZSO OR NOT Vlv1_ZSC) for FbkDly sec	3	Auto
Vlv1_FbkFail	Valve 1 Limit Switch Feedback Fail	(Vlv1_ZSC AND Vlv1_ZSO) OR NOT (Vlv1_ZSC OR Vlv1_ZSO) for FbkDly sec	3	Auto
Vlv1_OpnFail	Valve 1 Open Fail	CmdRun AND (Vlv1_ZSC OR NOT Vlv1_ZSO) for FbkDly sec	3	Auto
Vlv2_ClsFail	Valve 2 Close Fail	NOT CmdRun AND (Vlv2_ZSO OR NOT Vlv2_ZSC) for FbkDly sec	3	Auto
Vlv2_FbkFail	Valve 2 Limit Switch Feedback Fail	(Vlv2_ZSC AND Vlv2_ZSO) OR NOT (Vlv2_ZSC OR Vlv2_ZSO) for FbkDly sec	3	Auto
Vlv2_OpnFail	Valve 2 Open Fail	CmdRun AND (Vlv2_ZSC OR NOT Vlv2_ZSO) for FbkDly sec	3	Auto

4.8.3 Interlocks

Initiating Event	Action	Control Mode		Set Intlocked Output	Description
		Auto	Manual		
NOT CtrlRem	Stop	Y	Y	N	Turn off the Run Cmd output if NOT in Remote Mode.
Flt	Stop	Y	Y	N	Stop on a Starter Fault
Intlk	Stop	Y	Y	Y	Stop motor regardless if in Auto or Manual Mode.
IntlkAuto	Stop	Y	N	Y	Stop motor if in Auto Mode.

4.8.4 Control Narrative

In CtrlMan == 0 AND CtrlRem == 1 AND RunInp == 1 set CmdRun = 1.

Increment the runtime totalizer (KQ) whenever the fan is running, regardless of Auto/Manual/Local mode.

Set the Rdy output to true when the fan is ready for automatic control.

4.9 Wdog_Cnt – Watchdog Counter

The Watchdog Counter is simply an incrementing register used by another controller to verify communications.

4.9.1 Control Interface

Parameter	Type	Description	Range	HMI
Enb	I	Enable	0/1	
Cnt	I	Counter Preset	0-65535	
Out	O	Output Count	0-65535	

4.9.2 PLC Generated Alarms

No alarms are generated within local PLC. All alarms are generated within a remote PLC or DCS with the accompanying Wdog_Mon (Watchdog Monitor) block.

4.9.3 Control Narrative

If Enb == 1 then Out = Out + 1 every second.

If Out == Cnt then Out = 0.

4.10 Pre_Val – Previous Value

The Previous Value block stores the input value within its output upon activation.

4.10.1 Control Interface

Parameter	Type	Description	Range	HMI
Enb	IH	Enable	0/1	EF-T
Inp	I	Input Value	As Req	EF-T
Out	O	Output Value	As Req	GD2-T EF-T
Rst_Out	O	Reset Output	0/1	

4.10.2 Control Narrative

If Enb == 1 then Out = Inp AND Rst_Out = 1. Note the Out should be written with a one-shot bit as well as the Rst_Out should only be a one-shot bit.

5 EFFLUENT MONITORING STATION

5.1 Effluent Monitoring Process

P&ID Drawing: 1-0103-PPID-Z001
PLC: CP-Z800

5.1.1 Class Instances

Equipment	Instance	Class	Control Input Links	I/O Links & Fieldbus Links
LSH-Z0007	LAH-Z0007	Alm_TD	Dly = 5 sec	I/O: Inp = LSH-Z0007
LSH-Z0003	LAH-Z0003	Alm_TD	Dly = 5 sec	I/O: Inp = LSH-Z0003
LSL-Z0041	LAL-Z0041	Alm_TD	Dly = 5 sec Note: Switch has an inherent deadband to eliminate cycling of alarm.	I/O: Inp = LSL-Z0041
FSL-Z0042	FAL-Z0042	Alm_TD	Inp = FSL-Z0042 AND P-Z004.Run Dly = 2 sec Rst = Automatically Reset after 5 sec unless FAL-Z0042 has been activate 3 successive times within a 30 minute period then a manual HMI reset is required and a Priority 1 alarm is generated.	I/O: FSL-Z0042
PSL-Z5030	PAL-Z5030	Alm_TD	Dly = 5 sec Pri = 1	I/O: Inp = PSL-Z5030
PSH-Z0050	PLH-Z0050	Alm_TD	Dly = 5 sec	I/O: Inp = PSH-Z0050
	PAH-Z0050	Alm_TD	Dly = 300 sec Pri = 2	I/O: Inp = PSH-Z0050
FIT-Z0002	FI-Z0002	FI_FBus	Rst = FQI-Z0002-1.Rst_Out	FB: Flow = FIT-Z0002 Volume = FQI-Z0002
	FQI-Z0002-1	Pre_Val	When a user settable time from HMI (default of 08:00) equals the current time of day SET Enb = 1.	I/O: Inp = FQI-Z0002
XV-Z0060	XK- Z0060	ValveD	OpnReq = FQI-Z0060.Out for a Timed Pulse of 1 sec. Intl = NOT(FAL-Z0042) for 30 sec. AND NOT(PAL-Z5030)	I/O: SA-Z006.Ext
	FQI-Z0060	Pre_Val	When FQI-Z0060 <= FQI-Z0002 then SET Enb = 1 AND SET Inp = Out + Sampling Setpoint User Settable Setpoint initially set to	

Equipment	Instance	Class	Control Input Links	I/O Links & Fieldbus Links
			200 m^3 with a settable range of 0-10,000 m^3. When the totalizer FQI-Z0002 is reset then FQI-Z0060 shall recalculate remaining volume required before a sample and reset FQI-Z0060 to this value.	
P-Z005	YK-Z0050	Mtr	RunInp = PLH-Z0050	I/O: YC-Z5050
P-Z004	YK-Z0040	Mtr	RunInp = 1 Intlk = (NOT(P-Z004.Run) AND LAL-Z0041) OR FAL-Z0042 Note: LAL-Z0041 is only a permissive for starting.	I/O: P-Z004.CmdRun, SF-Z004.(Run, Flt, Rem),

5.2 Effluent Monitoring HVAC

P&ID Drawing: 1-0103-PPID-Z601
PLC: CP-Z800

5.2.1 Class Instances

Equipment	Instance	Class	Control Input Links	I/O Links & Fieldbus Links
TT-Z6101	TI-Z6101	IndA_FBus	SP_AlmHiHi = User Settable Setpoint initially set at 40°C SP_AlmHi = User Settable Setpoint initially set at 35°C SP_AlmLo = User Settable Setpoint initially set at 6°C SP_AlmLoLo = User Settable Setpoint initially set at 2°C TAHH-Z6101 initiates a priority 3 alarm TLH-Z6101 initiates SF-Z604 TAL-Z6101 initiates a priority 2 alarm TALL-Z6101 initiates a priority 1 alarm	FB: Input = TT-Z6101
TT-Z6030	TIC-Z6030	IC	Input = TT-Z6030	FB: Input = TT-Z6030 CV = HCE-Z603.CmdT
PDSH-Z6020	PDAH-Z6020	Alm_TD	Set = SF-Z604.Run AND PDSH-Z6020	I/O: Inp = PDSH-Z6020

Equipment	Instance	Class	Control Input Links	I/O Links & Fieldbus Links
			Dly = 2 sec Rst = NOT(PDAH-Z6020) AND (SF-Z604.Run for 60 sec) OR HMI Manual Reset	
SF-Z604	FK-Z6040	EMBV	RunInp = HS-9802 OR MK-Z6050 OR TY-Z6101; MK-Z6050 and TY-Z6101 shall have a user settable timer off delay. MK-Z6050 shall have an HMI enable/disable setting. Dly = 5 sec Pri = 3	I/O: SF-Z604.(Run, Flt, Rem, CmdRun), Vlv1_ZSC = ZSC-Z6010, Vlv1_ZSO = ZSO-Z6010, Vlv2_ZSC = ZSC-Z6060, Vlv2_ZSO = ZSO-Z6060
	MK-Z6050	Alm_TD	Rst = NOT(MLH-Z6050) for an adjustable time delay initially set to 10 min Dly = 1 sec	I/O: Inp = MSH-Z6050

5.3 Miscellaneous

P&ID Drawing: 1-0103-PPID-Z001

PLC: CP-Z800

5.3.1 Class Instances

Equipment	Instance	Class	Control Input Links	I/O Links & Fieldbus Links
ZSC-Z9801	ZA-Z9801	Alm_TD	Dly = 300 sec during Working Hours OR 0 sec during Non-Working Hours Rst = ZSC-Z9801-1 AND ZSC-Z9801-2 during Workings Hours or Manual Reset during Non-Working Hours	I/O: Inp = ZSC-Z9801-1 OR ZSC-Z9801-2
HS-Z9802	HI-Z9802	Alm_TD	Set = HS-Z9802 Dly = 8 hrs	I/O: Inp = HS-Z9802
ES-Z7030	EI-Z7030	Alm_TD	Dly = 0 sec Pri = 3	I/O: Inp = ES-Z7030
ES-Z8001	EI-Z8001	Alm_TD	Dly = 0 sec	I/O: Inp = ES-Z8001
ES-Z8002	EI-Z8002	Alm_TD	Dly = 0 sec Pri = 3	I/O: Inp = ES-Z8002
ES-Z8003	EI-Z8003	Alm_TD	Dly = 0 sec Pri = 3	I/O: Inp = ES-Z8003
XT-Z8000	XI-Z8000	Wdog_Cnt	Enb = 1	

Equipment	Instance	Class	Control Input Links	I/O Links & Fieldbus Links
			Cnt = 1000 Note: Coordinate with City of Winnipeg.	