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00	Issued for Software Development – 976-2016	2017-04-05	F. Ataei	T. Church	E. Ryczkowski
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1 OVERVIEW

1.1 Scope of Document

The logic specified in this document is intended to provide functional requirement samples for HVAC systems utilized in the SEWPCC Upgrading/Expansion Project. The HVAC systems listed here are samples of systems used throughout the SEWPCC facility. Refer to each process area HVAC FRS for how these samples are to be utilized. Refer to document A-0102-AFRS-A001 for general requirements and standard equipment classes.

This Functional Requirement Specification (FRS) document is intended to provide an initial basis for development of the PLC and HMI application functionality for the specific process area described herein. The Contractor must provide further development of the PLC and HMI functionality described in this document for a complete and functional system. It is written from a technical perspective and is intended to be read in parallel with the Process Control Narratives (PCNs), the associated Process and Instrument Diagrams (P&IDs), the Instrument Loop Drawings (ILDs) and the other PLC related contract documents. In the event of any discrepancy or any ambiguity, the PCNs, P&IDs, ILDs and other contract documents take precedence (in no specific order of importance) over the FRS documents. Any significant discrepancy should be clarified with the Contract Administrator. All discrepancy resolutions should be documented and submitted as part of the as-built markups. If there are discrepancies from a scope of work perspective, the more stringent requirement shall apply. All scope of work discrepancies should be clarified with the Contract Administrator.

Control functions are described using pseudo code and encapsulated in classes (some of which are commonly applicable for similar or identical equipment systems). These classes may therefore be instantiated as necessary to control similar types of equipment throughout the facility. Each class defines a control interface whose inputs and outputs are interconnected to implement the overall process control strategy as defined by the PCNs, P&IDs, ILDs, etc. and the FRS document. The specific area FRS documents are supported by the General FRS document which provides common definitions for software development required throughout the entire facility.

While the FRS documents provide specific guidance with respect to software development, they should not be presumed to be comprehensive of all software development requirements. Ultimately the P&IDs, the PCNs and the ILDs will govern and take precedence. It is the responsibility of the Contractor to utilize its expertise to provide a fully functional set of developed software in accordance with the contract documents even if not described within the FRS document at no additional cost to the contract. It is the specific responsibility of the Contractor to identify, seek clarification and ultimately resolve any issues of ambiguity, interpretation, uncertainties or discrepancies between the FRS documents and the associated contract documents. This responsibility extends to the need for consultation, as necessary, with the process designers, process equipment vendors, the Engineer, the Owner and any other relevant stakeholders to resolve any issue in accordance with the Contractor's legal obligations for the delivery of the work.

1.2 Systems Included

The following systems are included as samples:

Table 1.2-1 Systems Included

System	Description	Basis
1	Air Handling Unit (Hot Water Heating) and Exhaust Fans	HVAC requirements for the Clarifier Room in the HRC facility. Includes AHU-K610, EF-K611, and EF-K612

System	Description	Basis
2	Air Handling Unit (With Burner) and Exhaust Fans	HVAC requirements for the RDT Room in the Fermenter/Thickener Area. Includes AHU-D610, EF-D611 and EF-D612.
3	Electrical Room Pressurization System	HVAC requirements for the Grit/Screening Electrical Room in the Grit and Screening Building. Includes AHU-G640.
4	Mechanical Room Heating and Ventilation System	HVAC requirements for the Mechanical Room in the Grit and Screening Building. Includes SF-G612.
5	Lighting, Security, and Miscellaneous	Requirements for the HRC Building (K Area)

1.3 Typical Inputs from other PLCs

Some variables will be shared among different areas of the plant. They will be communicated via the Fibre Ethernet redundant ring connecting the PLCs. Typical variables for each HVAC PLC that are read from other PLCs are listed below, along with their default value in the event of a communication failure.

The following table provides guidance on the minimum anticipated variables that are read from other PLC along with their default value in the event of a communication failure, however, these should not be considered as fully defined and modifications and additions may be required.

Input	Description	Source PLC	Value On Communication Error
GBL_C800_Standby_Power_Run_Inhibit	Standby Power Generation Run Inhibit	PLC-C800	Last
GBL_C800_Standby_Power_State_Number	Standby Power Generation State Number	PLC-C800	Last
GBL_C800_Standby_Power_Manual_Enable	Standby Power Generation Manual Operation Enable	PLC-C800	Last
GBL_M800_SecurityEnabled	Security Enabled Signal	PLC-M800	Last
GBL_M800_LightBypEnb	General Lighting Control Bypass Signal	PLC-M800	Last
GBL_M800_LightEnbTime	Lighting Enable Time	PLC-M800	Last
GBL_M800_LightDisTime	Lighting Disable Time	PLC-M800	Last

2 SYSTEM 1 – AIR HANDLING UNIT (HOT WATER HEATING) AND EXHAUST FANS

2.1 System Description

The heating and ventilation system serving the Clarifier Room consists of air handling unit AHU-K610 and two exhaust fans EF-K611 and EF-K612, working in conjunction with terminal unit heaters to maintain the desired indoor ventilation and temperature.

2.2 Associated Documents

The documents associated with the functional requirements are listed below. Additional P&ID drawings may be referenced in this document.

Table 2.2-1 Associated Documents

Document Number	Description
A-0102-AFRS-A001	FUNCTIONAL REQUIREMENTS SEPCIFICATION - GENERAL CLASS DEFINITION
A-0102-PPCN-K601	HRC HVAC PROCESS CONTROL NARRATIVE
1-0102-PPID-K601	AIR HANDLING UNIT AHU-K610
1-0102-PPID-K607	CLARIFIER ROOM AND WASTE SLUDGE SUMP EXHAUST FANS EF-K611, EF-K612
1-0102-PPID-K901	MISCELLANEOUS

2.3 Graphic Displays

The following tables provide guidance on the minimum anticipated groupings of process displays, however, these should not be considered as fully defined and modifications and additions may be required.

Note that only major or representative equipment and devices are explicitly shown in the graphic display tables. Include other devices as required for a complete HMI.

Table 2.3-1 Part of Level 2 Area K Graphic Displays

Group	Content
HVAC Clarifier Room and Waste Sludge Sump	TIC-K6132 Bar Graph and Text (Clarifier Room Temperature) YC_K6100_State Text (Current Ventilation State) AAH-K6910 Gas Detection Alarm Status AI-K6911 (Methane Gas Content) Bar Graph and Text Via Third Party communications AI-K6912 (H2S Gas Content) Bar Graph and Text Via Third Party communications YI-K6108 / YI-K6109 Text (Clarifier Room Ventilation Normal / Do Not Enter Indication) FI-K6105 Bar Graph and Text (AHU-K610 Clarifier Room & Waste Sludge Sump Air Handling Unit Total Flow) YC-K6100 Status (AHU-K610 Clarifier Room & Waste Sludge Sump Air Handling Unit)

Group	Content
	FI-K6109 Bar Graph and Text (EF-K611 and EF-K612 Clarifier Room & Waste Sludge Sump Exhaust Fans Total Flow) YC-K6110 Status (EF-K611 Clarifier Room & Waste Sludge Sump Exhaust Fan) YC-K6120 Status (EF-K612 Clarifier Room & Waste Sludge Sump Exhaust Fan)

Table 2.3-2 Part of Level 3 and Level 4 Area K Graphic Displays

Display Group	Level	Content
HVAC Clarifier	3	AHU-K610, EF-K611, EF-K612, GDC-K960, Clarifier Room and Waste Sludge Sump HVAC equipment
Clarifier Room Gas Detection	4	GDC-K960 (via third party communications) and related information

2.4 Trends

Create, at minimum, the following trend displays, with the indicated pens. Create appropriate links from the various graphic screens to the trend displays.

Table 2.4-1 Trends

Trend Group	Content	
Outodoor and Clarifier Room Temperatures	TI-K6624.Out	HRC Outdoor Ambient Temperature
	TIC-K6132.Out	Clarifier Room Temperature
Gas Detection	AI-K6911	Clarifier Room METHANE % LEL via third party communications
	AI-K6912	Clarifier Room H2S ppm via third party communications
Clarifier Air Flows	FI-K6105.Out	AHU-K610 Clarifier Room & Waste Sludge Sump Air Handling Unit Total Flow
	FI-K6109.Out	EF-K611 and EF-K612 Clarifier Room & Waste Sludge Sump Exhaust Fans Total Flow
	FI-K6112.Out	EF-K611 Clarifier Room & Waste Sludge Sump Exhaust Fan Flow

Trend Group	Content	
	FI-K6122.Out	EF-K612 Clarifier Room & Waste Sludge Sump Exhaust Fan Flow

2.5 Simple Class Instances

The following tables show simple class instance implementations, other instances are shown in the rest of the document.

2.5.1 DiscreteIA (Discrete Indication and / or Alarming)

Table 2.5-1 Simple DiscreteIA Instances

Instance	Source	Description	Alarms (Priority)	Notes
TAL-K6104	TSL-K6104	AHU-K610 Clarifier Room & Waste Sludge Sump AHU Temperature Low Trip	(3)	P&ID: 1-0102-PPID-K601 AutoRst: **TBDC Seconds**
HL-K6100	AHU-K610.BypOn	AHU-K610 Clarifier Room & Waste Sludge Sump Air Handling Unit VFD By-Pass	(4)	P&ID: 1-0102-PPID-K601 AutoRst: 2 Seconds
AAH-K6910	ASH-K6910	AAH-K6910 / Clarifier Room Gas Detected	(1)	P&ID:1-0102-PPID-K607
YL-K7222	YS-K7222	Clarifier Room Occupied	Err(3)	P&ID:1-0102-PPID-K901
YL-K7225	YS-K7225	Sump Access Platform Occupied	Err(3)	P&ID:1-0102-PPID-K901
YL-K0900	YS-K0900	Effluent Inlet Gates and Effluent to Primary Channel Gate confirmed closed	(3)	P&ID:1-0102-PPID-K601

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Notes:

1- Alarm priority as per as per default class definition or as shown between parentheses.

2- Lights at Sump Access platform are not disabled

2.5.2 AnalogIAC (Analog Indication, Alarming and / or On Off Control)

Table 2.5-2 Simple AnalogIAC Instances

Instance	Source	Description	Alarms (priority)	Notes
FI-K6105-1/2/3/4	FT-K6105-1/2/3/4	AHU-K610 Clarifier Room & Waste Sludge Sump Air Handling Unit Fan 1/2/3/4 Flow	Lo(3): **TBDC** Err(3)	P&ID:1-0102-PPID-K601 Enable AlmLo if YC-K6100.Running for more than **TBDC** seconds
FI-K6105	FI-K6105-1.Out + FI-K6105-2.Out + FI-K6105-3.Out + FI-K6105-4.Out	AHU-K610 Clarifier Room & Waste Sludge Sump Air Handling Unit Total Flow	Lo(3): **TBDC**	P&ID:1-0102-PPID-K601 AmlLoDly: **TBDC** Enable AlmLo if (YC_K6100_State > 1) OR YC_K6100_IntermittentCmdRun for more than **TBDC** seconds Alarm priority 1 if YC_K6100_State > 1, 2 otherwise
PDI-K6103	PDT-K6103	AHU-K610 Clarifier Room & Waste Sludge Sump AHU Filter Diff Pressure	Hi (3): **TBDC** Err(3)	P&ID:1-0102-PPID-K601
FI-K6109	If(YC-K6110.Running,	EF-K611 and EF-K612 Clarifier Room & Waste		

Instance	Source	Description	Alarms (priority)	Notes
	FIC-K6112.Out,0) + If(YC-K6123.Running, FIC-K6122.Out,0)	Sludge Sump Exhaust Fans Total Flow	Lo(2): **TBDC**	P&ID:1-0102-PPID-K607
TI-K6624	TT-K6624	Outdoor Temperature	Err(3)	P&ID:1-0102-PPID-K605

Note: Alarm priority as per as per default class definition or as shown between parentheses.

2.5.3 ValveStatus (open/closed status of a non-PLC controlled discrete valve or damper)

Table 2.5-3 Simple ValveStatus Instances

Instance	Source	Description	Alarms (Priority)	Notes
XL-K6101	XV- K6101	AHU-K610 Air Handling Unit Outside Air Damper	(3)	P&ID:1-0102-PPID-K601
XL-K6102	XV- K6102	AHU-K610 Air Handling Unit Discharge Damper	(3)	P&ID:1-0102-PPID-K601
XL-K6111	XV- K6111	EF-K611 Clarifier Room & Waste Sludge Sump Exhaust Fan Inlet Damper	(3)	P&ID:1-0102-PPID-K607
XL-K6113	XV- K6113	EF-K611 Clarifier Room & Waste Sludge Sump Exhaust Fan Discharge Damper	(3)	P&ID:1-0102-PPID-K607
XL-K6121	XV- K6121	EF-K612 Clarifier Room & Waste Sludge Sump Exhaust Fan Inlet Damper	(3)	P&ID:1-0102-PPID-K607
XL-K6123	XV- K6123	EF-K612 Clarifier Room & Waste Sludge Sump Exhaust Fan Discharge Damper	(3)	P&ID:1-0102-PPID-K607

2.6 Clarifier Room & Waste Sludge Sump Heating and Ventilation

2.6.1 Air Flow Capacity Control

The heating and ventilation system is designed with a total system exhaust airflow capacity higher than the total system supply airflow capacity. While the AHU fan speed is determined during commissioning to provide the air supply capacity for each state (the speed is fixed for each state), the exhaust fan speed is controlled by the PLC to maintain a certain flow for each ventilation state.

2.6.1.1 Ventilation States

Clarifier Room & Waste Sludge Sump ventilation states are Maximum, Normal, Reduced and Intermittent. The ventilation rates are based on outdoor air temperature, HRC facility operation mode and occupancy.

The local control panel of AHU-K610 is provided with an across-the-line manual bypass starter. In the event that the VFD fails, the air handling unit can be operated in a fixed high rate speed through the bypass switch. Accordingly, the exhaust fans EF-K611 and EF-K612 will be ramped up to the maximum speed (Maximum Ventilation State) attempting to maintain the desired slight negative room pressure.

YC-K6000_TempHiFlow Instance will determine if normal or reduced flows are required in classified areas due to outdoor temperature.

Table 2.6-1 YC-K6000_TempHiFlow / Normal HVAC Flow Required Due to Outdoor Temperature

Instance	YC-K6000_TempHiFlow		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	(TI-K6624.Out > 10°C for more than 1 minute) OR (YC-K6000_TempHiFlow.Out AND (NOT ((TI-K6624.Out < 8°C) for more than 10 minutes)))	Link
Alarms	N/A		

YC-K6000_Inactive Instance will enable intermittent ventilation in the HRC. To enable intermittent ventilation the HRC should be Inactive and process equipment cleaned. If any HRCinfluent gate is open, inactive mode will automatically disabled.

Table 2.6-2 YC-K6000_Inactive / HRC Facility Operations Inactive Selection

Instance	YC-K6000_Inactive		
Class	OnOffSel		
Inputs	**Parameter**	**Source**	**Type**
	SelOnText	“HRC Inactive And Process Equipment Clean”	
	SelOffText	“HRC Active Or Process Equipment Not Clean”	
	IntlkOff	NOT YL-K0900.Out	I

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2.6.1.2 Ventilation States Determination (YC_K6100_State)

YC_K6100_State stores the current operating state (1 – Intermittent, 2 – Reduced, 3 – Normal and 4-Maximum).

```
// Maximum speed required for exhaust fans
If HL-K6100.Out Then
        YC_K6100_State := 4
Else
        // HRC Inactive AND process equipment clean
        If YC-K6000_Inactive.SelOut Then

                // Not occupied
                If NOT YL-K7222.Out AND NOT YL-K7225.Out Then
                        YC_K6100_State := 1                    // Intermittent Ventilation
                // Occupied
                Else
                        YC_K6100_State := 2                    // Reduced Ventilation
                EndIf

        // HRC Active Or Process Equipment Not Clean
```

```
        Else
                // Not occupied AND No Gas Detected AND Outside temp not low
                If (NOT YL-K7222.Out AND NOT YL-K7225.Out AND NOT AAH-K6910.Alm AND NOT YC-
                K6000_TempHiFlow.Out) Then
                        YC_K6100_State := 2                     // Reduced Ventilation
                // Occupied OR Gas Detected OR Outside temp is higher than 10C
                Else
                        YC_K6100_State := 3                     // Normal Ventilation
                EndIf
        EndIf
EndIf
```

2.6.1.3 Intermittent Ventilation Run Command (YC_K6100_IntermittentCmdRun)

YC_K6100_IntermittentCmdRun turns on and off to provide the intermittent ventilation. *YC_K6100_IntermittentOn* is ON for 30 minutes (*YC_K6100_IntermittentOnTime* setting by operator) and OFF for 90 minutes (*YC_K6100_IntermittentOff* Time setting by operator). *YC_K6100_IntermittentOn* and *YC_K6100_IntermittentOff* are real numbers in minutes and can be modified by the operator with security level M or higher.

2.6.1.4 AHU Fans Speed and Exhaust Fans Flow Set points

Air Handling Unit fans speed set points will be determined during commissioning to obtain the required flows for Normal and Reduced ventilation for AHU-K610. If one of the AHU-K610 four fans fails, the PLC will continue to run the remaining fans at the required preset speed value. The fan speeds for each state will be stored in setting variables that will be read and displayed by the HMI.

The fan speeds for AHU-K610 are *YC_K6100_Normal* for Normal state and *YC_K6100_Reduced* for Reduced and Intermittent states.

EF-K611 and EF-K612 have individual flow controllers. For Normal ventilation the total required exhaust flow set point is stored in *YC_K6115_NormalFlow*. For Reduced ventilation the total required exhaust flow set point is stored in *YC_K6115_ReducedFlow*. If both exhaust fans are running the flow set point to each fan is the total flow required divided by two. Flow settings will be determined during commissioning and displayed in the HMI.

```
                        // Intermittent
If YC_K6100_State == 1 Then
                                // Intermittent Run Command
        If YC_K6100_IntermittentCmdRun Then

                YC-K6100.CV_In := YC_K6100_Reduced              //AHU

                If YC-K6110.Running AND YC-K6120.Running Then   //Both EFs running
                        FIC-K6112.Auto_SP := YC_K6115_ReducedFlow / 2       //EF
                        FIC-K6122.Auto_SP := YC_K6115_ReducedFlow / 2       //EF
                Else                                            //Not all EFs Running
                        FIC-K6112.Auto_SP := YC_K6115_ReducedFlow           //EF
                        FIC-K6122.Auto_SP := YC_K6115_ReducedFlow           //EF

                Endif
        Else
```

```
                YC-K6100.CV_In := 0                                  //AHU
                FIC-K6112.Auto_SP := 0                                       //EF
                FIC-K6122.Auto_SP := 0                                       //EF

                        // Reduced
Elseif YC_K6100_State == 2 Then

        YC-K6100.CV_In := YC_K6100_ Reduced              //AHU

        If YC-K6110.Running AND YC-K6120.Running Then      //Both EFs running
                FIC-K6112.Auto_SP := YC_K6115_ReducedFlow / 2                //EF
                FIC-K6122.Auto_SP := YC_K6115_ReducedFlow / 2                //EF

        Else                                                 //Not all EFs Running
                FIC-K6112. Auto_SP := YC_K6115_ReducedFlow                   //EF
                FIC-K6122.Auto_SP := YC_K6115_ReducedFlow                    //EF
        Endif

                        // Normal
Else

        If YC-K6110.Running AND YC-K6120.Running Then      //Both EFs running
                YC-K6100.CV_In := YC_K6100_Normal                    //AHU
                FIC-K6112.Auto_SP := YC_K6115_NormalFlow / 2                 //EF
                FIC-K6122.Auto_SP := YC_K6115_NormalFlow / 2                 //EF
        Else
                YC-K6100.CV_In := YC_K6100_ Reduced                          //AHU
                FIC-K6112.Auto_SP := YC_K6115_ReducedFlow                    //EF
                FIC-K6122.Auto_SP := YC_K6115_ReducedFlow                    //EF
        End if
Endif
```

2.6.1.5 AHU-K610 Air Handling Unit

Table 2.6-3 YC-K6100 / AHU-K610 Clarifier Room & Waste Sludge Sump Air Handling Unit

Instance	YC-K6100		
Class	VFDBasic		
Inputs	**Parameter**	**Source**	**Type**
	CtrlRem	AHU-K610.Rem	I
	Run	AHU-K610.Run	I
	Flt	AHU-K610.Flt	I
	AlmRunFltRdyInNoStop	True (Run Fault Alarm, Fault and not RdyIn do not generate equipment stop so that dampers stay open)	Const
	Intlk	TAL-K6104.Alm OR NOT ((YC-K6110.Running OR YC-K6120.Running) for more than 60 seconds	Link
	CV_Min	**TBDC**	Const
	MaxRC	3%/Sec - **TBDC**	Const
	RunAuto	(YC_K6100_State > 1) OR YC_K6100_IntermittentCmdRun	Link
	CV_In	See 2.6.1.4 AHU Fans Speed and Exhaust Fans Flow Set points	Link
Outputs	**Parameter**	**Destination**	**Type**
	CmdRun	AHU-K610.CmdRun	O
	CV	AHU-K610.CmdS	O
Alarms	(3)		

Table 2.6-4 ZA-K6100 / AHU-K610 Air Handling Unit Damper Alarm

Instance	ZA-K6100		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	((YC-K6100.Running OR YC-K6100.CmdRun) AND NOT (XV-K6101.ConfOpn AND XV-K6102.ConfOpn)) OR NOT (YC-K6100.Running OR YC-K6100.CmdRun) AND NOT (XV-K6101.ConfCls AND XV-K6102.ConfCls))	Link
	Dly	60 seconds **TBDC**	Const
	AutoRst	60 seconds **TBDC**	Const
Alarms	Alm(1) - Emergency / Call Out if HRC is not Inactive AND process equipment clean (NOT YC-K6000_Inactive) , otherwise Alm(3) Low Priority		

2.6.1.6 EF-K611

Table 2.6-5 FIC-K6112 / EF-K611 Clarifier Room & Waste Sludge Sump Exhaust Fan Flow Control

Instance	FIC-K6112		
Class	PID_Controller		
Inputs	**Parameter**	**Source**	**Type**
	PV	FT-K6112	I
	Auto_SP	See 2.6.1.4 AHU Fans Speed and Exhaust Fans Flow Set points	Link
	AlmLoEnb	YC-K6110.Running for more than **TBDC** seconds	Link
	AlmLoLmt	**TBDC** (Setting by Operator)	SR
	AlmLoDly	60 Seconds **TBDC** (Setting by Operator)	SR
	Tracking	YC-K6110.NotRdy OR (YC_K6100_State == 1 AND NOT YC_K6100_IntermittentCmdRun) OR YC_K6100_State == 4	Link
	TrackingCV	YC-K6110.CV	Link
	ReverseAct	1 (Reverse)	Const
Alarms	Lo(2), Err(2)		

Table 2.6-6 YC-K6110 / EF-K611 Clarifier Room & Waste Sludge Sump Exhaust Fan

Instance	YC-K6110		
Class	VFDBasic		
Inputs	**Parameter**	**Source**	**Type**
	CtrlRem	EF-K611.Rem	I
	Run	EF-K611.Run	I
	Flt	EF-K611.Flt	I
	RdyIn	EF-K611.StarterRdy	I
	Intlk	TAL-K6104.Alm OR FI-K6112.AlmLo OR FI-K6112.AlmErr	Link
	CV_Min	**TBDC**	Const
	MaxRC	3%/Sec - **TBDC**	Const
	RunAuto	(YC_K6100_State > 1) OR YC_K6100_IntermittentCmdRun	Link
	CV_In	IF((YC_K6100_State == 1 AND NOT YC_K6100_IntermittentCmdRun), 0%, IF(YC_K6100_State == 4, 100%, FIC-K6112.CV))	Link
Outputs	**Parameter**	**Destination**	**Type**
	CmdRun	EF-K611.CmdRun	O
	CV	EF-K611.CmdS	O
Alarms	(2)		

Table 2.6-7 ZA-K6110 / Exhaust Fan EF-K611 Damper Alarm

Instance	ZA-K6110		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	(YC-K6110.Running OR YC-K6110.CmdRun) AND NOT (XV-K6111.ConfOpn AND XV-K6113.ConfOpn) OR NOT (YC-K6110.Running OR YC-K6110.CmdRun) AND NOT (XV-K6111.ConfCls AND XV-K6113.ConfCls)	Link
	Dly	**TBDC** see note	Const
	AutoRst	60 seconds **TBDC**	Const
Alarms	Alm(2) - if HRC is not Inactive AND process equipment clean (NOT YC-K6000_Inactive) , otherwise Alm(3) Low Priority		

Note: Alarm delay should be more that than that required to open the damper but less than exhaust fan feedback delay.

2.6.1.7 EF-K612

Similar to EF-K611.

2.6.1.8 EF-K611& EF-K612 Exhaust Fans Alarm

An Alarm is generated if no Exhaust fan is running when required

Table 2.6-8 YA-K6119 / No Exhaust Fan Running Alarm

Instance	YA-K6119		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	NOT(YC-K6110.Running OR YC-K61120.Running) AND ((YC_K6100_State > 1) OR YC_K6100_IntermittentCmdRun)	Link
	Dly	60 seconds **TBDC**	Const
	AutoRst	60 seconds **TBDC**	Const
Alarms	Alm(1) Emergency /Call Out- if HRC is not Inactive AND process equipment clean (NOT YC-K6000_Inactive) , otherwise Alm(3) Lo Priority		

2.6.2 Temperature Control

Clarifier Room heating is achieved via a combination of the AHU heat coil and local unit heaters.

The Clarifier Room temperature controller (TIC-K6132) controls the AHU heat coil via a cascade loop with the AHU-K610 Air Handling Unit Discharge Temperature Controller (TIC-K6104).

The unit heaters are started and stopped by comparing YC_K6100_UH_OnSP and YC_K6100_UH_OffSP with the room temperature. YC_K6100_UH_OnSP and YC_K6100_UH_OffSP are calculated with offset from the current clarifier room temperature controller TIC-K6132 set point so that the room is heated by the AHU first. If the Heating provided by the AHU is no enough or not running, the local heaters will start.

YC_K6100_UH_OnSP := Max(TIC-K6132.SP-YC_K6100_UH_OnOffset,5.5 (**TBDC**))

YC_K6100_UH_OffSP := Max(TIC-K6132.SP-YC_K6100_UH_OffOffset, 6 (**TBDC**))

YC_K6100_UH_OnOffset (1°C **TBDC**) and *TIC-K6132.SP-YC_K6100_UH_OffOffset* (0.5°C **TBDC**) are positive real numbers in Celsius that can be modified by the operator with security level M or higher. The values should be range checked so that *YC_K6100_UH_OnOffset > TIC-K6132.SP-YC_K6100_UH_OffOffset >= 0*.

2.6.2.1 Heating Set points

If the facility is Active, the Clarifier room temperature set point is 18°C (YC_K6100_H_Occupied setpoint by operator) while occupied and 10°C (YC_K6100_H_Reduced set point by operator) if the room is not occupied.

If the facility is not Active, the Clarifier room temperature set point is 5°C (YC_K6100_H_Inactive setpoint by operator).

YC_K6100_H_Occupied, YC_K6100_H_Reduced and YC_K6100_H_Inactive can be modified by the operator with security level M or higher. As always, the operator HMI set points should be range checked before being used.

```
                    // Clarifier room occupied
If YL-K7222.Out Then
    TIC-K6132.Auto_SP:= YC_K6100_H_Occupied
                    // Clarifier room Not occupied and Not Inactive
Elseif NOT YC-K6000_Inactive.SelOut Then
    TIC-K6132.Auto_SP:= YC_K6100_H_Reduced
Else
                    // Clarifier room Not occupied and Inactive
    TIC-K6132.Auto_SP:= YC_K6100_H_Inactive
EndIf
```

2.6.2.2 AHU Heating States

There are three AHU heating states Normal, Cold and Stopped.

The Normal state is used when the unit is running or commanded to run by the PLC. This state also includes the case when the unit does not start as requested but the dampers are left opened to allow flow through the unit. In Normal state the heating coil control valve is controlled by the discharge temperature.

When the unit is not running and not commanded to run, the AHU is in the Stopped state. In Stopped state the heating coil control valve is controlled to maintain AHU cabinet temperature at desired set point.

The Cold state is used to prime the heating coil control valve when the AHU is commanded to run and outdoor temperature is less than 3°C. YC_K6100_HeatingStarting lasts for 60 seconds (YC_K6100_HeatingStartingTime setting by operator) and sets the heating coil control valve to 20 % (YC_K6100_HeatingTVPrime setting by operator). YC_K6100_HeatingStartingTime [minutes] and YC_K6100_HeatingTVPrime [%] are real numbers and can be modified by the operator with security level M or higher.

YC_K6100_HeatingState stores the current operating state (1 – Stopped, 2 – Cold and 3 – Normal).

```
                    // Unit is not running or and not commanded to run
If NOT (YC-K6100.Running OR YC-K6100.CmdRun) Then
    YC_K6100_HeatingState := 1 // Stopped

                    // Unit is running or commanded to run
Else
    If YC_K6100_HeatingState == 1 Then    //Current state Stopped so it is now starting
        If TT-K6624.Out < 3°C Then        //Outdoor temperature is less than 3°C, Prime Valve
            YC_K6100_HeatingState := 2
            Start Starting Timer
        Else                              //Outdoor temperature 3°C or more, No prime required
            YC_K6100_HeatingState := 3
        Endif
    EndIf
                        // Unit finished Starting
    If YC_K6100_HeatingState == 2 AND Start Starting Timer >= YC_K6100_HeatingStartingTime Then
        YC_K6100_HeatingState := 3
    EndIf
EndIf
```

2.6.2.3 TIC-K6132 Clarifier Room Temperature Controller

Table 2.6-9 TIC-K6132 / Clarifier Room Temperature Controller

Instance	TIC-K6132		
Class	PID_Controller		
Inputs	**Parameter**	**Source**	**Type**
	PV	TT-K6132	I
	Auto_SP	See 3.4.2.1 Heating Set points	Link
	CtrlHiSP	YC_K6100_UH_OffSP	Link
	CtrlLoSP	YC_K6100_UH_OnSP	Link
	CtrlHiDly	60 seconds **TBDC**	Const
	CtrlLoDly	5 seconds **TBDC**	Const
	AlmHiLmt	40°C (Setting by Operator)	SR
	AlmHiDly	300 seconds (Setting by Operator)	SR
	AlmLoLmt	5°C (Setting by Operator)	SR
	AlmLoDly	300 seconds (Setting by Operator)	SR
	AutoRst	60 seconds	Const
	CV_Max	**TBDC**	Const
	CV_Min	5°C	Const
	Tracking	NOT TIC-K6104.CtrlAuto OR NOT (YC_K6100_HeatingState == 3)	Link
	TrackingCV	If(TIC-K6104.CtrlOp,TIC-K6132.SP, TIC-K6104.Out)	Link
	ReverseAct	1 (Reverse)	Const
Alarms	Priority as per class		

Note: Limit TIC-K6132.Auto_SP and TIC-K6132.Oper_SP to a minimum of 5°C

Table 2.6-10 TIC-K6104 / AHU-K610 Air Handling Unit Discharge Temperature Controller

Instance	TIC-K6104		
Class	PID_Controller		
Inputs	**Parameter**	**Source**	**Type**
	PV	TT-K6104	I
	Auto_SP	IF(YC_K6100_HeatingState > 1 , TIC-K6132.CV, 5°C)	Link
	AlmLoLmt	4°C **TBDC**	Const
	AlmLoDly	60 seconds	Const
	DevAlmDB	5°C (Setting by Operator)	SR
	DevAlmDly	300 seconds (Setting by Operator)	SR
	DisDevAlmDB	TI-K6624.Out>TIC-K6132.SP OR YC_K6100_HeatingState < 3 OR TK-K6104.NotRdy	Link
	AutoRst	60 seconds	Const
	Tracking	TK-K6104.NotRdy OR YC_K6100_HeatingState == 2 (see Note 3)	Link
	TrackingCV	TK-K6104.CV (see Note 3)	Link
	ReverseAct	1 (Reverse) (see Note 2)	Const
Alarms	Priority as per class		

Notes:

1. Limit TIC-K6104.Auto_SP and TIC-K6104.Oper_SP to a minimum of 5°C.
2. Assumes full glycol flow through the heating coil when CV is at 100%.
3. When YC_K6100_State transitions from 2 (Reduced) to 3 (Normal), initially set the CV to be double the last CV while in state 2. When YC_K6100_State transitions from 3 (Normal) to 2 (Reduced), initially set the CV to be half the last CV while in state 3. The CV changes can be performed by pulsing tracking on and setting tracking CV with the new CV.

Table 2.6-11 TK-K6104 /TV-K6104 AHU-K610 Air Handling Unit Heating Coil Glycol Three-Way Valve

Instance	TK- K6104		
Class	AnalogCS		
Inputs	**Parameter**	**Source**	**Type**
	CV_In	IF(*YC_K6100_HeatingState == 2,* YC_K6100_HeatingTVPrime, TIC-K6104.CV)	Link
Outputs	**Parameter**	**Destination**	**Type**
	CV	TV-K6104.CmdZ	O
Alarms	Priority as per class		

Note: Although the three-way control valve may be close at 20mA (i.e. coil bypass opens at 20mA) the notation for this FRS will be that a CV at 100% implies coil bypass closed with all the glycol going through the heating coil. Three-way control valve may require inversion (100%-CV) in the conditioning routine before updating the physical output.

2.6.2.4 UH-K613-1/2/3/4 Unit Heaters

Table 2.6-12 TK-K6130 / UH-K613-1,2,3&4 Unit Heaters

Instance	TK-K6130		
Class	DiscreteCS_OnOff		
Inputs	**Parameter**	**Source**	**Type**
	OnAuto	TIC-K6132.CtrlLo OR (TK-K6130.CmdOn AND NOT TIC-K6132.CtrlHi)	Link
	EnbManual	True	Const
Outputs	**Parameter**	**Destination**	**Type**
	CmdOn	TK-K6130.CmdOn	O
Alarms	Priority as per class		

2.7 Gas Detection

Detection of more than 10% LEL Methane OR 10 PPM of H2S is summarized by gas detection controller GDC-K690. See 2.5.1 DiscreteIA (Discrete Indication and / or Alarming) for more information.

2.8 Ventilation Failure

Table 2.8-1 UA-K6100 / Clarifier Room & Waste Sludge Sump Ventilation Failure

Instance	UA-K6100		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	YC-6100.Fail OR YC-K6110.Fail OR YC-K6120.Fail OR YC-6100.Intlked OR YC-K6110.Intlked OR YC-K6120.Intlked	Link
Alarms	Alm (1) - Emergency / Call Out if HRC is not Inactive AND process equipment clean (NOT YC-K6000_Inactive) , otherwise priority 2		

The area horns and strobes will be activated intermittently (2 seconds On, 5 seconds Off) to indicate ventilation failure if the clarifier room is occupied as determined by the light switches.

Table 2.8-2 UA-K6910 / Clarifier Room & Waste Sludge Sump Ventilation Failure Output

Instance	UA-K6910		
Class	DiscreteCS_OnOff		
Inputs	**Parameter**	**Source**	**Type**
	OnAuto	(UA-K6100.Alm AND YL-K7222.Out) AND (2 seconds On, 5 seconds Off pulse) OR AAH-K6910.Out	Link
	EnbManual	False	Const
Outputs	**Parameter**	**Destination**	**Type**
	CmdOn	AC-K6910	O
Alarms	Priority as per class		

2.9 Occupancy Determination

The occupancy is determined by the light switches in the Clarifier Room (K-109). See 2.5.1 DiscreteIA (Discrete Indication and / or Alarming) for more information.

2.10 Clarifier Room Entry

The Clarifier Room East and West doors have lights to indicate the ventilation status of the room. Before entering the Clarifier Room the operator will turn on the light switch which in turn will set the ventilation levels to normal (note that ventilation rate may already be normal due to other conditions.

The “Ventilation Normal” light will turn on after 15 seconds in the new state (TC-K6100_State = 3) if:

- there is no gas detected,
- AHU and both EFs have been running for more than 60 seconds, and

- there is no ventilation failure.

The “Do Not Enter” light is on if:

- The room is not occupied as determined by the light switches, or
- The ventilation is not normal as defined above

The “Do Not Enter” light will flash to indicate the operator that occupancy was requested but ventilation is not normal.

Table 2.10-1 YI-K6108 / Clarifier Room Ventilation Normal

Instance	YI-K6108		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	(NOT ASHH-K6910.Alm AND ((AHU-K610.Running AND EF-K611.Running AND EF-K612.Running) for more than 60 seconds) AND NOT UA-K6100.Alm) for more than 15 seconds	Link
Alarms	-		

Table 2.10-2 YC-K6108 / Clarifier Room Ventilation Normal Output

Instance	YC-K6108		
Class	DiscreteCS_OnOff		
Inputs	**Parameter**	**Source**	**Type**
	OnAuto	YI-K6108.Out	Link
	EnbManual	False	Const
Outputs	**Parameter**	**Destination**	**Type**
	CmdOn	YL-K6108	O
Alarms	Priority as per class		

Table 2.10-3 YI-K6109 / Do Not Enter Indication

Instance	YI-K6109		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	NOT YI-K7222.Out OR NOT YI-K6108.Out	Link
Alarms	-		

Table 2.10-4 YC-K6109 / Do Not Enter Output

Instance	YC-K6109		
Class	DiscreteCS_OnOff		
Inputs	**Parameter**	**Source**	**Type**
	OnAuto	YI-K6109.Out AND NOT (YI-K7222.Out AND (1 second On, 1 second Off pulse))	Link
	EnbManual	False	Const
Outputs	**Parameter**	**Destination**	**Type**
	CmdOn	YL-K6109	O
Alarms	Priority as per class		

3 SYSTEM 2 – AIR HANDLING UNIT (WITH BURNER) AND EXHAUST FANS

3.1 Graphic Displays

The following tables provide guidance on the minimum anticipated groupings of process displays, however, these should not be considered as fully defined and modifications and additions may be required.

Note that only major or representative equipment and devices are explicitly shown in the graphic display tables. Include other devices as required for a complete HMI.

Table 3.1-1 L2 Area Graphic Displays

Group	Content
HVAC	AAH-D6910 Gas Detection Alarm Status
	AI-D6911 (Methane Gas Content) Bar Graph and Text Via Third Party communications
	AI-D6912 (H2S Gas Content) Bar Graph and Text Via Third Party communications
	TIC-D6132 Bar Graph and Text (RDT Room Temperature)
	TI-D6711, Outdoor Air Temperature
	YC_D6100_State Text (Current Ventilation State)
	FI-D6105 Bar Graph and Text (AHU-D610 RDT Room Air Handling Unit Total Flow)
	FI-D6109 Bar Graph and Text (EF-D611 and EF-D612 RDT Room Exhaust Fans Total Flow)
	YC-D6110 Status (EF-D611 RDT Room Exhaust Fan status)
	YC-D6120 Status (EF-D612 RDT Room Exhaust Fan status)
	YC-D6100 Status (AHU-D610 Air Handling Unit Status)

Table 3.1-2 L3 and L4 Graphic Displays

Display Group	Level	Content
HVAC	3	AHU-D610, EF-D611, EF-D612, GDC-D960, RDT Room HVAC equipment
Room Gas Detection	4	GDC-D960 (via third party communications) and related information

3.2 Trends

Create, at minimum, the following trend displays, with the indicated pens. Create appropriate links from the various graphic screens to the trend displays.

Table 3.2-1 Trends

Trend Group	Content	
Outdoor and RDT Room Temperatures	TI-D6711.Out	Outdoor Ambient Temperature
	TIC-D6132.Out	RDT Room Temperature
Gas Detection	AI-D6911	RDT Room METHANE % LEL via third party communications
	AI-D6912	RDT Room H2S ppm via third party communications
RDT Air Flows	FI-D6105.Out	AHU-D610 RDT Room Handling Unit Total Flow
	FI-D6109.Out	EF-D611 and EF-D612 RDT Room Exhaust Fans Total Flow
	FI-D6112.Out	EF-D611 RDT Room Exhaust Fan Flow
	FI-D6122.Out	EF-D612 RDT Room Exhaust Fan Flow

3.3 Simple Class Instances

The following tables show simple class instance implementations, other instances are shown in the rest of the document.

3.3.1 DiscreteIA (Discrete Indication and / or Alarming)

Table 3.3-1 Simple DiscreteIA Instances

Instance	Source	Description	Alarms (Priority)	Notes
TAL-D6103	TSL-D6103	AHU-D610 RDT Room AHU Temperature Low Trip	(1)	P&ID: 1-0102-PPID-D601 AutoRst: **TBDC** Seconds
HL-D6100	AHU-D610.BypOn	AHU-D610 RDT Room Handling Unit VFD By-Pass	(4)	P&ID: 1-0102-PPID-D601 AutoRst: 2
AAH-D6910	AIT-D6910	AAH-D6910 / RDT Room Gas Detected	(1)	P&ID:1-0102-PPID-D605
YL-S7111	YS-S7111 Area Light Switch	RDT Room Occupied	Err(3)	P&ID:1-0102-PPID-D901 Lighting panel feeding this area is in the Secondary Clarifier area.

Note: Alarm priority as per as per default class definition or as shown between parentheses.

3.3.2 AnalogIAC (Analog Indication, Alarming and / or On Off Control)

Table 3.3-2 Simple AnalogIAC Instances

Instance	Source	Description	Alarms (priority)	Notes
FI-D6105-1/2/3/4	FT-D6105-1/2/3/4	AHU-D610 RDT Room Handling Unit Fan 1/2/3/4 Flow	Lo(3): **TBD** Err(3)	P&ID:1-0102-PPID-D601 Enable AlmLo alarms if YC-D6100.Running for more than **TBDC** seconds
FI-D6105	FI-D6105-1.Out + FI-D6105-2.Out + FI-D6105-3.Out + FI-D6105-4.Out	AHU-D610 RDT Room Handling Unit Total Flow	Lo(3): **TBDC**	P&ID:1-0102-PPID-D601 AmlLoDly: **TBDC** Enable AlmLo if AHU-D610.Running for more than **TBDC** seconds
PDI-D6102	PDT-D6102	AHU-D610 RDT Room AHU Filter Diff Pressure	Hi(3): **TBDC** Err(3)	P&ID:1-0102-PPID-D601

FI-D6109	If(YC-D6113.Running, FIC-D6112.Out,0) +
	If(YC-D6123.Running,
	FIC-D6122.Out,0)
		EF-D611 and EF-D612 RDT Room Exhaust Fans Total Flow	Lo(2): **TBDC**	P&ID: 1-0102-PPID-D605

TI-D6711	TT-D6711	Outdoor Temperature	Err(3)	P&ID:1-0102-PPID-D601
TI-D6104	TT-D6104	AHU-D610 Discharge Air Temperature	Hi/Lo(3), Err(3)	P&ID: 1-0102-PPID-D601

Note: Alarm priority as per as per default class definition or as shown between parentheses.

3.3.3 EqmtStatus (indication and alarming for equipment not controlled by the PLC)

Table 3.3-3 Simple EqmtStatus Instances

Instance	Source	Description	Alarms (Priority)	Notes
YL-D6107	U-D610	RDT Room AHU Natural Gas Burner	(**TBDC**)	P&ID: PPID-D601

3.3.4 ValveStatus (open/closed status of a non-PLC controlled discrete valve or damper)

Table 3.3-4 Simple ValveStatus Instances

Instance	Source	Description	Alarms (Priority)	Notes
XL-D6101	XV- D6101	AHU-D610 Air Handling Unit Outside Air Damper	(3)	P&ID:1-0102-PPID-D601
XL-D6111	XV- D6111	EF-D611 RDT Room Exhaust Fan Inlet Damper	(3)	P&ID:1-0102-PPID-D605
XL-D6113	XV- D6113	EF-D611 RDT Room Exhaust Fan Discharge Damper	(3)	P&ID:1-0102-PPID-D605
XL-D6121	XV- D6121	EF-D612 RDT Room Exhaust Fan Inlet Damper	(3)	P&ID:1-0102-PPID-D605
XL-D6123	XV- D6123	EF-D612 RDT Room Exhaust Fan Discharge Damper	(3)	P&ID:1-0102-PPID-D605

3.4 RDT Room Heating and Ventilation

P&ID Drawing: PPID-D601, PPID-D605 & PPID-D901

Heating and ventilation for the RDT Room is provided by an air handling system, which consists of an air handling unit AHU-D610 and two exhaust fans EF-D611 and EF-D612, working in conjunction to maintain the desired indoor ventilation and temperature.

3.4.1 Air Flow Capacity Control

Supply air for the RDT Room is provided by AHU-D610, which includes a 2x2 array of fans, driven by a single variable frequency drive (VFD) with a bypass starter.

The heating and ventilation system is designed with a total system exhaust airflow capacity higher than the total system supply airflow. While the AHU fan speed is determined during commissioning to provide the air supply capacity for each state (the speed is fixed for each state), the exhaust fan speed is controlled by the PLC to maintain a certain flow for each ventilation state.

3.4.1.1 Ventilation States

RDT Room ventilation states are Normal, Reduced and Maximum. The ventilation rates are based on outdoor air temperature and gas detection.

The local control panel of AHU-D610 is provided with an across-the-line manual bypass starter. In the event that the VFD fails, the air handling unit can be operated in a fixed high rate speed through the bypass switch. Accordingly, the exhaust fans EF-D611 and EF-D612 will be ramped up to the maximum speed (Maximum Ventilation State) in attempting to maintain the desired slight negative room pressure.

Whenever one of the AHU fan fails to contribute to the required airflow capacity, the PLC will continue to run the remaining fans at the required preset speed value. It is possible that under this condition, the room pressure will be slightly more negative.

YC-D6000_TempHiFlow will determine if normal or reduced flows are required in RDT room due to outdoor temperature.

Table 3.4-1 YC-D6000_TempHiFlow / Normal HVAC Flow Required Due to Outdoor Temperature

Instance	YC-D6000_TempHiFlow		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	(TI-D6711.Out > 10°C for more than 1 minute) OR (YC-D6000_TempHiFlow.Out AND (NOT ((TI-D6711.Out < 8°C) for more than 10 minutes)))	Link
Alarms	N/A		

3.4.1.2 Ventilation States Determination (YC_D6100_State)

YC_D6100_State stores the current operating state (1 – Reduced, 2 – Normal and 3-Maximum).

```
                        // Maximum speed required for exhaust fans
If HL-D6100.Out Then
        YC_D6100_State := 3
Else

                                // No Gas Detected AND Outside temp is less than or equal 10°C for 20 minutes
        If (NOT AAH-D6910.Alm AND NOT YC-D6000_TempHiFlow) Then
                YC_D6100_State := 1                     // Reduced Ventilation

                                // Gas Detected OR Outside temp is higher than 10°C for 20 minutes
        Else
                YC_D6100_State := 2                     // Normal Ventilation
        EndIf
Endif
```

3.4.1.3 AHU Fans Speed and Exhaust Fans Flow Set points

Air Handling Unit fans speed set points will be determined during commissioning to obtain the required flows for Normal and Reduced ventilation for AHU-D610. The fan speeds for each state will be stored in setting variables that will be read and displayed by the HMI.

The fan speeds for AHU-D610 are *YC_D6100_Normal* for Normal state and *YC_D6100_Reduced* for Reduced state.

EF-D611 and EF-D612 have individual flow controllers. For Normal ventilation the total required exhaust flow set point is stored in YC_D6115_NormalFlow. For Reduced ventilation the total required exhaust flow set point is stored in YC_D6115_ReducedFlow. If both exhaust fans are running the flow set point to each fan is the total flow required divided by two. Flow settings will be determined during commissioning and displayed on the HMI.

```
                        // Reduced
If YC_D6100_State == 1 Then
        YC-D6100.CV_In := YC_D6100_ Reduced

        If YC-D6110.Running AND YC-D6120.Running Then      //Both EFs running
                FIC-D6112.Auto_SP := YC_D6115_ReducedFlow / 2          //EF
                FIC-D6122.Auto_SP := YC_D6115_ReducedFlow / 2          //EF

        Else                                               //Not all EFs Running
                FIC-D6112. Auto_SP := YC_D6115_ReducedFlow             //EF
                FIC-D6122.Auto_SP := YC_D6115_ReducedFlow              //EF
        Endif

                        // Normal
Else
        If YC-D6110.Running AND YC-D6120.Running Then      //Both EFs running
```

YC-D6100.CV_In := YC_D6100_Normal //AHU
FIC-D6112.Auto_SP := YC_D6115_NormalFlow / 2 //EF
FIC-D6122.Auto_SP := YC_D6115_NormalFlow / 2 //EF
Else //Not all EFs Running
YC-D6100.CV_In := YC_D6100_ Reduced //AHU
FIC-D6112.Auto_SP := YC_D6115_ReducedFlow //EF
FIC-D6122.Auto_SP := YC_D6115_ReducedFlow //EF
Endif
Endif

3.4.1.4 AHU-D610 Air Handling Unit

Table 3.4-2 YC-D6100 / AHU-D610 RDT Room Air Handling Unit

Instance	YC-D6100		
Class	VFDBasic		
Inputs	**Parameter**	**Source**	**Type**
	CtrlRem	AHU-D610.Rem	I
	Run	AHU-D610.Run	I
	Flt	AHU-D610.Flt	I
	AlmRunFltRdyInNoStop	True (Run Fault Alarm, Fault and not RdyIn do not generate equipment stop so that dampers stay open)	Const
	Intlk	TAL-D6103.Alm OR NOT ((YC-D6110.Running OR YC-D6120.Running) for more than 60 seconds	Link
	CV_Min	**TBDC**	Const
	MaxRC	3%/Sec - **TBDC**	Const
	RunAuto	True	Link
	CV_In	See 3.4.1.3 AHU Fans Speed and Exhaust Fans Flow Set points	Link
Outputs	**Parameter**	**Destination**	**Type**
	CmdRun	AHU-D610.CmdRun	O
	CV	AHU-D610.CmdS	O
Alarms	(3)		

Table 3.4-3 ZA-D6100 / AHU-D610 Air Handling Unit Damper Alarm

Instance	ZA-D6100		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	(YC-D6100.Running OR YC-D6100.CmdRun) AND NOT XV-D6101.ConfOpn) OR (NOT (YC-D6100.Running OR YC-D6100.CmdRun) AND NOT XV-D6101.ConfCls)	Link
	Dly	60 seconds **TBDC**	Const
	AutoRst	60 seconds **TBDC**	Const
Alarms	(3)		

3.4.1.5 EF-D611

Table 3.4-4 FIC-D6112/ EF-D611 RDT Room Exhaust Fan Flow Control

Instance	FIC-D6112		
Class	PID_Controller		
Inputs	**Parameter**	**Source**	**Type**
	PV	FT-D6112	I
	Auto_SP	See 3.4.1.3 AHU Fans Speed and Exhaust Fans Flow Set points	Link
	AlmLoLmt	**TBDC** (Setting by Operator)	SR
	AlmLoDly	60 Seconds **TBDC** (Setting by Operator)	SR
	Tracking	YC-D6110.NotRdy OR *YC_D6100_State == 3*	Link
	TrackingCV	YC-D6110.CV	Link
	ReverseAct	1 (Reverse)	Const
Alarms	Lo(2), Err(2)		

Notes: Enable AlmLo if EF-D611.Running for more than **TBDC**

Table 3.4-5 YC-D6110 / EF-D611 RDT Room Exhaust Fan

Instance	YC-D6110		
Class	VFDBasic		
Inputs	**Parameter**	**Source**	**Type**
	CtrlRem	EF-D611.Rem	I
	Run	EF-D611.Run	I
	Flt	EF-D611.Flt	I
	RdyIn	EF-D611.StarterRdy	I
	Intlk	TAL-D6104.Alm OR FI-D6112.AlmLo OR FI-D6112.AlmErr	Link
	CV_Min	**TBDC**	Const
	MaxRC	3%/Sec - **TBDC**	Const
	RunAuto	True	Link
	CV_In	IF(YC_D6100_State == 3, 100%, FIC-D6112.CV)	Link
	Fbk	EF-D611.S	I
Outputs	**Parameter**	**Destination**	**Type**
	CmdRun	EF-D611.CmdRun	O
	CV	EF-D611.CmdS	O
Alarms	(2)		

Table 3.4-6 ZA-D6110 / Exhaust Fan EF-D611 Damper Alarm

Instance	ZA-D6110		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	(YC-D6110.Running OR YC-D6110.CmdRun) AND NOT (XV-D6111.ConfOpn OR XV-D6113.ConfOpn) OR NOT (YC-D6110.Running OR YC-D6110.CmdRun) AND NOT (XV-D6111.ConfCls OR XV-D6113.ConfCls)	Link
	Dly	**TBDC** see note	Const
	AutoRst	60 seconds **TBDC**	Const
Alarms	(2)		

Note: Alarm delay should be more that the required to open the damper but less than exhaust fan feedback delay.

3.4.1.6 EF-D612

Similar to EF-D611.

3.4.1.7 EF-D611 & EF-D612 Exhaust Fans Alarm

An Alarm is generated if no Exhaust fan is running when required

Table 3.4-7 YA-D6119 / No Exhaust Fan Running Alarm

Instance	YA-D6119		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	NOT(YC-D6110.Running OR YC-D6120.Running)	Link
	Dly	60 seconds **TBDC**	Const
	AutoRst	60 seconds **TBDC**	Const
Alarms	**TBD**		

3.4.2 Temperature Control

Whenever AHU-D610 is in operation, the PLC continuously monitors the unit's discharge air temperature as sensed by TT-D6104. The PLC maintains the RDT Room temperature at its set point by sending a 4-20mA temperature control signal to the gas burner controller, which modulates the burner heating capacity accordingly. The desired temperature in the RDT Room is 18°C when the space is occupied, and when the space is unoccupied the desired temperature is 10°C. All temperature set points are adjustable through the HMI.

3.4.2.1 Heating Set points

The RDT room temperature set point is generated based on room's occupancy status. The set point value is 18°C (TK_D6107_Occupied set point by operator) when room is occupied and 10°C (TK_D6107_NotOccupied setpoint by operator) when room is unoccupied.

// RDT room occupied
If YL-D7222.Out Then
TIC-D6132.AutoSP:= TK_D6107_Occupied

// RDT room Not occupied
If NOT YL-D7222.Out Then
TIC-D6132.AutoSP:= TK_D6107_NotOccupied

EndIf

3.4.2.2 RDT Room Temperature Control

Table 3.4-8 TIC-D6132 / RDT Room Temperature Controller

Instance	TIC-D6132		
Class	PID_Controller		
Inputs	**Parameter**	**Source**	**Type**
	PV	TT-D6132	I/O
	Auto_SP	See 4.4.2.1 Heating Set points	Link
	AlmHiLmt	40°C (Setting by Operator)	SR
	AlmHiDly	300 seconds (Setting by Operator)	SR
	AlmLoLmt	5°C (Setting by Operator)	SR
	AlmLoDly	300 seconds (Setting by Operator)	SR
	AutoRst	60 seconds	Const
	CV_Max	**TBDC**	Const
	CV_Min	10°C	Const
	Tracking	AHU-D610.NotRdy OR YC-D6100_Starting	Link
	TrackingCV	IF(YC-D6100_Starting,TK_D6107_HeatingInitialCV, TK-D6107.CV)	Link
	ReverseAct	1 (Reverse)	Const
Outputs	**Parameter**	**Destination**	**Type**
	CV	TK-D6107.CV	
Alarms	(3)		

Notes:
-Limit TIC-D6132.Auto_SP and TIC-D6132.Oper_SP to a minimum of 10°C

-YC-D6100_Starting is a 20 second (**TBDC**) pulse on YC-D6100.Running
-The RDT Room Temperature Controller has an initial AHU Heating set point of 20 °C (TK_D6107_HeatingInitialCV setting by the operator).

Table 3.4-9 TK-D6107 / Burner U-D610 Temperature Control Signal

Instance	TK-D6107		
Class	AnalogCS		
Inputs	**Parameter**	**Source**	**Type**
	CV_In	TIC-D6132.CV	Link
	DevAlmDB	5°C (Setting by Operator)	SR
	DevAlmDly	300 seconds (Setting by Operator)	SR
	DisDevAlmDB	TI-D711.Out > TK-D6107.CV OR NOT (YC-D6100.Running OR YC-D6100.CmdRun) OR TK-D6107.NotRdy	Link
	Fbk	TI-D6104.Out	Link
Outputs	**Parameter**	**Destination**	**Type**
	CV	U-610.CmdT	O
Alarms	(3)		

3.4.3 Gas Detection

Detection of more than 10% LEL Methane is summarized by gas detection controller GDC-D690. See 3.3.1 DiscreteIA (Discrete Indication and / or Alarming) for more information.

3.4.4 Ventilation Failure

Table 3.4-10 UA-D6100 / RDT Room Ventilation Failure

Instance	UA-D6100		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	YC-D6100.Fail OR YC-D6110.Fail OR YC-D6120.Fail OR YC-D6100.Intlked OR YC-D6110.Intlked OR YC-D6120.Intlked	Link
Alarms	Alm (1) - Emergency / Call Out		

The area horns and strobes will be activated intermittently (2 seconds On, 5 seconds Off) to indicate ventilation failure if the clarifier room is occupied as determined by the light switches.

Table 3.4-11 UA-D6910 / RDT Room Ventilation Failure Output

Instance	UA-D6910		
Class	DiscreteCS_OnOff		
Inputs	**Parameter**	**Source**	**Type**
	OnAuto	(UA-D6100.Alm AND YL-S71112.Out) AND (2 seconds On, 5 seconds Off pulse) OR AAH-D6910.Out	Link
	EnbManual	False	Const
Outputs	**Parameter**	**Destination**	**Type**
	CmdOn	AC-D6910	O
Alarms	Priority as per class		

3.5 Occupancy Determination

The occupancy is determined by the light switches in the RDT room. See 3.3.1 DiscreteIA (Discrete Indication and / or Alarming) for more information.

4 SYSTEM 3 –ELECTRICAL ROOM PRESSURIZATION SYSTEM

4.1 Graphic Displays

The following tables provide guidance on the minimum anticipated groupings of process displays, however, these should not be considered as fully defined and modifications and additions may be required.

Note that only major or representative equipment and devices are explicitly shown in the graphic display tables. Include other devices as required for a complete HMI.

Table 4.1-1 L2 Area Graphic Displays

Group	Content
Pressurization System Overview	FIC-G6405 (Supply Air Flow to Electrical Room) , Bar Graph and Text FIC-G6108 (AHU-G640 Intake Air Flow) , Bar Graph and Text TI-G6407 (Electrical Room temperature), Bar Graph and Text

Table 4.1-2 L3 Graphic Displays

Display Group	Level	Content
Air Handling Unit AHU-G640/ Electrical Room	3	AHU-G640 Electrical Room Air Handling Unit
		FV-G6108 Electrical Room Supply Air
		ACU-G641/2/3 Electrical Room Air Conditioning Units

4.2 Trends

Create, at minimum, the following trend displays, with the indicated pens. Create appropriate links from the various graphic screens to the trend displays.

Table 4.2-1 Trends

Trend Group	Content	
Air Flows	FI-G6405.Out	Supply Air Flow to Electrical Room
	FI-G6108.Out	AHU-G640 Intake Air Flow
Electrical Room Temperature	TI-G6407.Out	Electrical Room Temperature

4.3 Simple Class Instances

The following table show simple class instance implementations, other instances are shown in the rest of the document.

4.3.1 AnalogIAC (Analog Indication, Alarming and / or On Off Control)

Table 4.3-1 -Simple AnalogIAC Instances

Instance	Source	Description	Alarms (priority)	Notes
PDI-G6402	PDIT-G6402	AHU-G640 Pre-Filter Differential Pressure	Hi (3): **TBDC** Err(3)	P&ID: 1-0102-PPID-G619
PDI-G6403	PDIT-G6403	AHU-G640 Post-Filter Differential Pressure	Hi (3): **TBDC** Err(3)	P&ID: 1-0102-PPID-G619
PDI-G6404	PDIT-G6404	AHU-G640 Final Filter Differential Pressure	Hi (3): **TBDC** Err(3)	P&ID: 1-0102-PPID-G619
TI-G6407	TT-G6407	Electrical Room Temperature	Hi (3): 30°C HiHi (1): 35°C Lo (3): 5°C Err(3)	P&ID: 1-0102-PPID-G619 AlmHiDly: 600 seconds **(TBDC)** AlmHiHiDly: 600 seconds **(TBDC)** AlmLoDly: 600 seconds **(TBDC)**

4.3.2 EqmtStatus (indication and alarming for equipment not controlled by the PLC)

Table 4.3-2 Simple EqmtStatus Instances

Instance	Source	Description	Alarms (Priority)	Notes
YL-G6410	ACU-G641	ACU-G641 Air Conditioning Unit status	(3)	P&ID: 1-0102-PPID-G619
YL-G6420	ACU-G642	ACU-G642 Air Conditioning Unit status	(3)	P&ID: 1-0102-PPID-G619
YL-G6430	ACU-G643	ACU-G643 Air Conditioning Unit status	(3)	P&ID: 1-0102-PPID-G619

4.4 AHU-G640 Intake Air Flow Control

Intake air flow to AHU-G640 is controlled by modulating a motorized damper (FV-G6108) located at the Air Handling Unit air intake to maintain the flow measured by FT-G6108 at the desired set point. Intake air to AHU-G640 is supplied by AHU-G610. The intake air flow setpoint is stored in YC-G6400_IntakeAirSP.

4.4.1 FV-G6108 Outdoor Air Damper

Table 4.4-1 - FIC-G6108 / AHU-G640 Outdoor Air Flow Control

Instance	FIC-G6108		
Class	PID_Controller		
Inputs	**Parameter**	**Source**	**Type**
	PV	FT-G6108	I
	Auto_SP	YC-G6400_IntakeAirSP	Link
	Tracking	FK-G6108.NotRdy	I (Link)
	TrackingCV	FK-G6108.CV	I (Link)
	ReverseAct	1 (Reverse)	Const
Alarms	**TBD**		

Note: P&ID: 1-0102-PPID-G617

Table 4.4-2 - FK-G6108 / Outdoor Air Motorized Damper FV-G6108

Instance	FK-G6108		
Class	AnalogCS		
Inputs	**Parameter**	**Source**	**Type**
	CV_In	FIC-G6108.CV	I (Link)
	Fbk	FV-G6108.ZT (0-100%)	I
	Intlk	NOT YC-G6400.Running AND NOT YC-G6100.Running	I (Link)
	DevAlmDB	**TBDC**	SR
	DevAlmDly	**TBDC**	SR
Outputs	**Parameter**	**Destination**	**Type**
	CV	FV-G6108.CmdZ	O
Alarms	Priority as per class		

Note: P&ID: 1-0102-PPID-G617

4.5 Supply Air Flow to Electrical Room Control

This system provides a constant airflow capacity of purified air to maintain the Electrical Room under slight positive pressure with respect to the surrounding spaces.

Supply air flow to electrical room is controlled by modulating the supply fan speed to maintain the supply air flow measured by FT-G6405 at desired set point.

4.5.1 AHU-G640 Electrical Room Air Handling Unit

Electrical Room air flow supply is controlled. The air flow supply setpoint is stored in YC-G6400_SupplySP.

Table 4.5-1 - FIC-G6405 / Supply Air Flow to Electrical Room Control

Instance	FIC-G6405		
Class	PID_Controller		
Inputs	**Parameter**	**Source**	**Type**
	PV	FT-G6405	I
	Auto_SP	YC-G6400_SupplySP	Link
	Tracking	YC-G6400.NotRdy	I (Link)
	TrackingCV	YC-G6400.CV	I (Link)
	ReverseAct	1 (Reverse)	Const
	AlmLoEnb	YC-G6400.Running for more than **TBDC** seconds	I (Link)
	AlmLoLmt	**TBDC** (Setting by Operator)	SR
	AlmLoDly	60 Seconds **TBDC** (Setting by Operator)	SR
Alarms	(3)		

Note: P&ID: 1-0102-PPID-G619

Table 4.5-2 YC-G6400 / AHU-G640 Electrical Room Air Handling Unit

Instance	YC-G6400		
Class	VFD_Basic		
Inputs	**Parameter**	**Source**	**Type**
	CtrlRem	AHU-G640.Rem	I
	Run	AHU-G640.Run	I
	Flt	AHU-G640.Flt	I
	RunAuto	**True**	Link
	RdyIn	AHU-G640.StarterRdy	I
	RunFbkDly	**TBDC**	Const
	CV_In	FIC-G6405.CV	I (Link)
	CV_Min	**TBDC**	Const
Outputs	**Parameter**	**Destination**	**Type**
	CmdRun	AHU-G640.CmdRun	O
	CV	AHU-G640.CmdS	O
Alarms	(3)		

Note: P&ID: 1-0102-PPID-G619

5 SYSTEM 4 – MECHANICAL ROOM VENTILATION AND HEATING SYSTEM

5.1 Graphic Displays

The following tables provide guidance on the minimum anticipated groupings of process displays, however, these should not be considered as fully defined and modifications and additions may be required.

Note that only major or representative equipment and devices are explicitly shown in the graphic display tables. Include other devices as required for a complete HMI.

Table 5.1-1 L2 Area Graphic Displays

Group	Content
Heat Relief Ventilation System	TIC-G6162(Mechanical Room Temperature), Text and Bar Graph XL-G6122 (Outdoor Air Damper Position Status), Text and Bar Graph TI-G6735 (Outdoor Air Temperature) UH-G616 (Unit Heater On/Off Status) SF-G612 (Supply Fan Status) YL-G7522 (Mechanical Room Occupancy Status)

Table 5.1-2 L3 Graphic Displays

Display Group	Level	Content
Mechanical Room / Exhaust Fan	3	SF-G612 (Supply Fan Status) UH-G616 (Unit Heater On/Off Status) XL-G6122 (Outdoor Air Damper Position Status), Text TIC-G6162 (Mechanical room temperature), Text

5.2 Trends

Create, at minimum, the following trend displays, with the indicated pens. Create appropriate links from the various graphic screens to the trend displays.

Table 5.2-1 Trends

Trend Group	Content	
Mechanical Room Temperature	TIC-G6162.Out	Mechanical Room Temperature

5.3 Simple Class Instances

The following table show simple class instance implementations, other instances are shown in the rest of the document.

5.3.1 DiscreteIA (Discrete Indication and / or Alarming)

Table 5.3-1 Simple DiscreteIA Instances

Instance	Source	Description	Alarms (Priority)	Notes
YL-G7522	YS-G7522 Mechanical Room Light Switch	Mechanical Room Occupied/Not Occupied		P&ID: 1-0102-PPID-G902

5.3.2 ValveStatus (open/closed status of a non-PLC controlled discrete valve or damper)

Table 5.3-2 Simple ValveStatus Instances

Instance	Source	Description	Alarms (Priority)	Notes
XL-G6122	XV- G6122	Mechanical Room Exhaust Air Damper Position	(3)	P&ID:1-0102-PPID-G620

5.4 Mechanical Room Temperature Control (Heating)

Heating for the room is provided by the local Unit Heater (UH-G616). During the heating season, room temperature is controlled by on-off control of the heater. The heating temperature set points are selected based on occupancy of the room.

5.4.1 Mechanical Room Heating Set Point

The Mechanical room temperature heating set point is generated based on room's occupancy status. The set point value is 18 °C (TK_G6160_Occupied*)* when room is occupied and 10 °C (TK_G6160_NotOccupied*)* when room is unoccupied and they are adjustable by the operator. Range check so that *TK_G6160_Occupied >= TK_G6160_Not_Occupied*

// Mechanical room occupied
If YL-G7522.Out Then
TIC-G6162.CtrlLoSP:= TK_G6160_Occupied - TIC-G6162_CtrlLoDB
TIC-G6162.CtrlHiSP:= TK_G6160_Occupied + TIC-G6162_CtrHiDB

// Mechanical room Not occupied
If NOT YL-G7522.Out Then
TIC-G6162.CtrlLoSP:= TK_G6160_NotOccupied - TIC-G6162_CtrlLoDB
TIC-G6162.CtrlHiSP:= TK_G6160_NotOccupied + TIC-G6162_CtrlHiDB

5.4.2 UH-G616 Unit Heater

Table 5.4-1 TIC-G6162 / Mechanical Room Temperature Control (Heating)

Instance	TIC-G6162		
Class	AnalogIAC		
Inputs	**Parameter**	**Source**	**Type**
	PV	TT-G6162	I
	CtrlHiSP	See 5.4.1 Mechanical Room Heating Set Point	Link
	CtrlLoSP	See 5.4.1 Mechanical Room Heating Set Point	Link
	CtrlHiDly	**TBDC**	Const
	CtrlLoDly	**TBDC**	Const
	AlmHiLmt	40°C (Setting by Operator)	SR
	AlmHiDly	300 seconds (Setting by Operator)	SR
	AlmLoLmt	5°C (Setting by Operator)	SR
	AlmLoDly	300 seconds (Setting by Operator)	SR
Alarms	(3)		

Note: P&ID: 1-0102-PPID-G620

Table 5.4-2 TK-G6160 / Mechanical Room Unit Heater (UH-G616) Control

Instance	TK-G6160		
Class	DiscreteCS_OnOff		
Inputs	**Parameter**	**Source**	**Type**
	OnAuto	TIC-G6162.CtrlLo OR (TK-G6160.CmdOn AND NOT TIC-G6162.CtrlHi)	I (Link)
Outputs	**Parameter**	**Destination**	**Type**
	CmdOn	TK-G6160.CmdOn	O
Alarms	Priority as per class		

Note: P&ID: 1-0102-PPID-G620

5.5 Mechanical Room Temperature Control (Cooling)

Mechanical room heat relief ventilation system consists of a Supply Fan (SF-G612) working on conjunction with exhaust air damper (XV-G6122). The exhaust air damper is hardwired to supply fan motor starter control circuit such that fan is energized only after the damper has been proven open.

5.5.1 Mechanical Room Cooling Set Point

When the room temperature sensor TT-G6162 detects temperature above the set point, initially set by operator at 25°C (YC_G6120_Cooling), and the outdoor air temperature TT-G6735 is below this set point, the supply fan SF-G612 is energized. Range check so that YC_G6120_Cooling > (TK_G6160_Occupied + TIC-G6162_CtrHiDB + TIC-G6120_CtrLoDB). The outlet air damper position is monitored by control system.

TIC-G6120.CtrlLoSP:= YC_G6120_Cooling - TIC-G6120_CtrlLoDB
TIC-G6120.CtrlHiSP:= YC_G6120_Cooling + TIC-G6120_CtrHiDB

5.5.2 SF-G612 Supply Fan

Table 5.5-1 TIC-G6120 / Mechanical Room Temperature Control (Cooling)

Instance	TIC-G6162-1		
Class	AnalogIAC		
Inputs	**Parameter**	**Source**	**Type**
	PV	TIC-G6162.Out	Link
	CtrlHiSP	See 5.5.1 Mechanical Room Cooling Set Point	Link
	CtrlHiLo	See 5.5.1 Mechanical Room Cooling Set Point	Link
	CtrlHiDly	**TBDC**	Const
	CtrlLoDly	**TBDC**	Const
Alarms	**TBD**		

Note: P&ID: 1-0102-PPID-G620

Table 5.5-2 YC-G6120 / Supply Fan (SF-G612) Control

Instance	YC-G6120		
Class	DiscreteCS		
Inputs	**Parameter**	**Source**	**Type**
	RunAuto	TIC-G6120.CtrlHi OR (YC-G6120.Running AND NOT TIC-G6120.CtrlLo)	I (Link)
	CtrlRem	SF-G612.Rem	I
	Run	SF-G612.Run	I
	Flt	SF-G612.Flt	I
	RdyIn	SF-G612.StarterRdy	I
Alarms	Priority as per class		

Note: P&ID: 1-0102-PPID-G620

Table 5.5-3 ZA-G6121 / Mechanical Room Exhaust Air Damper Alarm

Instance	ZA-G6121		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	(YC-G6120.Running OR YC-G6120.CmdRun) AND NOT XV-G6122.ConfOpn OR (NOT YC-G6120.Running OR YC-G6120.CmdRun) AND NOT XV-G6122.ConfCls	Link
	Dly	**TBDC** see note	Const
	AutoRst	60 seconds	Const
Alarms	(3)		

Notes: Alarm delay should be more that the required to open the damper but less than supply fan feedback delay.

P&ID: 1-0102-PPID-G620

6 SYSTEM 5 - LIGHTING, SECURITY, AND MISCELLANEOUS

6.1 Graphic Displays

The following tables provide guidance on the minimum anticipated groupings of process displays, however, these should not be considered as fully defined and modifications and additions may be required.

Note that only major or representative equipment and devices are explicitly shown in the graphic display tables. Include other devices as required for a complete HMI.

Table 6.1-1 L3 Graphic Displays

Display Group	Level	Content
Lighting	3	Status of Lighting Switches Lighting Control Bypass Switch “Lighting Control Bypassed Message”
Security	3	Security Layout Start and End time for Security enabled period for each day of the week Status of Door Switches and Motion Detectors Security Alarm Bypass Switch “Security Alarm Bypassed Message”
Power Meters	3	Third Party Information
UPS	3	Third Party Information
HVAC PLC Status	3	Status and Basic Diagnostics for Main Controller Rack Remote I/O Racks Networking Components (Including switch diagnostic when available) RIO, DIO

6.2 Trends

None.

6.3 Simple Class Instances

Refer to each area HVAC FRS for Simple Class Instances for Lighting and Security Systems.

6.4 Lighting Control

The PLC will control the lighting system by generating an Enable signal to allow the lighting system to be operational for specific periods of the day (adjustable by operator). The PLC control can be overridden by the operator through an override selector switch on the Lighting Panels or through the HMI. The General Override and Enable Time signals (*GBL _M800_LightBypEnb, GBL_M800_LightEnbTime, GBL_M800_LightDisTime)* will be stored in PLC-M800 and communicated to other area PLCs. In the event of communication failure, the lighting control variables will retain their last value.

For each area that has occupancy status based on the lighting for the area with an associated lighting control station, generate an alarm if the occupancy status activates when lighting is enabled in the morning. This will give an indication that the lights have been left on in an area. For any area that has occupancy status based on lighting for the area without an associated lighting control station, generate an alarm if the occupancy status has been activated for more than 8 hours.

6.4.1 HRC Building Lighting Control Stations

Table 6.4-1 YC-K7241 / Loading Area, Walkway, Mechanical Room and Clarifier Room

Instance	YC –K7241		
Class	LightingCS		
Inputs	**Parameter**	**Source**	**Type**
	OvrdOn	HS-K7241	I
	GeneralOvrOn	GBL_M800_LightBypEn	Link
	EnableTime	GBL_M800_LightEnbTime	Link
	DisableTime	GBL_M800_LightDisbTime	Link
Outputs	CmdEnb	YY-K7241.CmdEnb	O
Alarms	(3)		

Note: P&ID: PPID-K901

Table 6.4-2 YC-K7242 / Pump Room

Instance	YC –K7242		
Class	LightingCS		
Inputs	**Parameter**	**Source**	**Type**
	OvrdOn	HS-K7241	I
	GeneralOvrOn	GBL _M800_LightBypEnb	Link
	EnableTime	GBL_M800_LightEnbTime	Link
	DisableTime	GBL_M800_LightDisTime	Link
Outputs	CmdEnb	YY-K7242.CmdEnb	O
Alarms	(3)		

Note: P&ID: PPID-K901

Table 6.4-3 YC-K7243 / Service Gallery

Instance	YC –K7243		
Class	LightingCS		
Inputs	**Parameter**	**Source**	**Type**
	OvrdOn	HS-K7243	I
	GeneralOvrOn	GBL_M800_LightBypEnb	Link
	EnableTime	GBL_M800_LightEnbTime	Link
	DisableTime	GBL_M800_LightDisTime	Link
Outputs	CmdEnb	YY-K7243.CmdEnb	O
Alarms	(3)		

Note: P&ID: PPID-K901

6.4.2 HRC Building Lighting Left On Alarms

Table 6.4-4 YA-K7222_LeftOn / Clarifier Room Lights Left On

Instance	YA-K7222_LeftOn		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	YL-K7222.Out AND (5 second pulse on YC-K7241.CmdEnb)	Link
Alarms	(4)		

Note: P&ID: PPID-K901

Similar for alarm for YL-K7221, YL-K7223, and YL-K7224.

Table 6.4-5 YA-K7225_LeftOn / Clarifier Room Lights Left On

Instance	ZA-G6121		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	In	YL-K7225.Out for more than 8 hours	Link
Alarms	(4)		

Note: P&ID: PPID-K901

6.5 Security System

The security system at SEWPCC includes motion detectors and door switches which will generate alarms, during a time period defined by the operator (non-manned hours period), if motion is detected or door is opened. The Operator will define the start and end time of the security enable period for each day of the week through the HMI. Each security alarm can be overridden by the operator through the HMI. Provide summary alarms of each process area on the HMI. See AFRS-M001 for logic associated with the security system.

6.5.1 PLC-M800 Security Logic

Enable/Disable Time variables for each day of the week are stored in PLC-M800 and Security Enabled signal is generated based on defined times for each day of the week and this signal is communicated to other area PLCs. In the event of communication failure, this signal will retain its last value.

// Security Enabled, Sunday
If "Current Time" and "Day of Week" is equal to "Security Enable Time on Sunday" Then
GBL_M800_SecurityEnabled:=TRUE
Else

// Security Disabled, Sunday
GBL_M800_SecurityEnabled:=FALSE

The logic for other days of the week is similar to the above.

6.5.2 HRC Building

Table 6.5-1 ZL-K9601 / Stairwell RM-K-101 West Door Security Alarm

Instance	ZL-K9601		
Class	DiscreteIA		
Inputs	**Parameter**	**Source**	**Type**
	AutoRst	**TBDC**	Const
	DisAlm	NOT GBL_M800_SecurityEnabled	Link
	Dly	**TBDC**	Const
	In	ZSC-K9601	I
Alarms	Alm (1)		

The logic for other security signals of the HRC Building is similar to the above.