

RFQ 26-D-00017 Howard F. Curren Advanced Wastewater Treatment Plant (HFC AWTP) Supervisory Control and Data Acquisition (SCADA) Migration and Fiber Replacement Design

Public Announcement in Compliance With Requirements of Section 287.055 Florida Statutes (Consultants' Competitive Negotiation Act) Applicable Law, Executive Orders, Rules, Regulations, and The City's Standard Procedures. Notice of Intent to Award Shall be posted, if at all, on the City's Website accessible by utilizing the website link: www.tampagov.net/contract-administration/programs/architectural-engineering-construction-and-related-rfqs.

The City of Tampa Wastewater Department desires to obtain Professional Engineering services for the work necessary to complete the migration of Howard F. Curren AWTP (HFC AWTP) Supervisory Control and Data Acquisition (SCADA) system from HSQ software to VTScada software. The project also includes the design for the replacement of the treatment plant's fiber optic cable network. The project aims to improve efficiency, monitoring, control, and security of the HFC AWTP processes by implementing a unified and updated SCADA system.

Background: Howard F. Curren AWTP is permitted to treat 96-MGD with a Type I two-stage, high rate (pure oxygen and fine bubble aeration) activated sludge biological nitrification/denitrification domestic wastewater treatment plant. This plant is operated to discharge advanced wastewater treated, high-level disinfected and de-chlorinated effluent to Hillsborough Bay. Currently annual average daily flows are 60 MGD and peak flows of 200 MGD.

The City currently uses HSQ Technologies Miser software as the in-plant SCADA platform to monitor and control the majority the plant facilities. The off-site facilities (i.e.. pumping stations) are monitored and controlled through Trihedral, Inc. VTScada software. Some facilities at the plant were recently rehabilitated and these facilities are operating on both the HSQ software and VTScada software. The

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objective of the project is to migrate the remaining facilities operating on HSQ software to the VTScada software so that the entire plant is monitored and controlled through the VTScada software system.

The City has recently completed new SCADA and Process Control System (PCS) programming, configuration and design standards. The project will ensure that the plant's monitoring and control systems meet these standards.

The objectives of the project will include, but not limited to:

- Migrate the SCADA system from the existing HSQ software to VTScada software while ensuring continuous operation of the treatment plant.
- Ensure that the new monitoring and control system aligns with the City's standards, including the use of approved widgets and graphic symbols for operator screens.
- Implement a new software system that can generate plant operating reports needed for regulatory requirements and for monitoring plant performance. The new software system shall retain historical data from HSQ and shall be capable of generating reports using both historical and current data.
- Ensure the system is scalable for future expansions and upgrades.
- Provide the design and implementation plan for replacing the treatment plant's fiber optic cable network.

Services will include, but will not be limited to the following:

- Complete an assessment of the existing SCADA system and related infrastructure to determine the requirements, scopes of work, priorities, and cost estimates to complete the migration to the VTScada software.

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- Complete work needed to migrate monitoring and control capabilities to the VTScada software.
- Document SCADA network diagrams and control system programming.
- Assist the City with selecting and implementing a new software system that can generate plant operating reports needed for regulatory requirements and for monitoring plant performance.
- Develop and evaluate alternatives for replacing the fiber optic cable network, prepare cost estimates and construction sequencing for the alternatives, prepare contract documents for the selected alternative, including signed and sealed construction plans with specifications, final cost estimate, and preparation of contract documents for bidding. Provide services during the construction of the fiber optic cable replacement including shop drawings review, responding to request for information (RFI's), and associated activities.

Estimated fee is \$2,000,000 – \$4,000,000.

Reference Drawings and any additional material may be found at: www.tampagov.net/contract-administration/programs/architectural-engineering-construction-and-related-rfqs

Questions may be directed to Jim Greiner, P.E., Contract Administration, City of Tampa, (813) 274-8598, or E-Mail jim.greiner@tampagov.net.

A pre-submission conference will be conducted at 2 PM March 2, 2026, in the City Council Chambers, third floor Old City Hall, 315 E. Kennedy Blvd. Tampa, FL 33602. Attendance is not required.

In accordance with the Americans with Disabilities Act ("ADA") and Section 286.26, Florida Statutes, persons with disabilities needing a reasonable accommodation to participate in this public hearing or meeting should contact the City of Tampa's ADA Coordinator at least 48 hours prior to the proceeding. The ADA Coordinator may be contacted via phone at 813-274-3964, email at TampaADA@tampagov.net, or by submitting an ADA - Accommodations Request form available online at tampagov.net/ADARquest.

An individual or entity ("Firm") responding to this RFQ must provide evidence of any required licenses, certificates, or registrations with its submission or within 10 days thereof in order to be considered. The City shall own all ideas, documents, plans, and materials developed as a result of this solicitation and Firm

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is informed same shall be subject to reuse in accordance with Section 287.055(10), Florida Statutes. Firm (i) confirms it has read and is familiar with Section 119.071(3), Florida Statutes regarding certain building plans, blueprints, schematic drawings, which depict the internal layout and structural elements of a building, facility, or other structure owned or operated by the City or other agency that are per said section exempt from Section 119.07(1), Florida Statutes and Section 24(a), Art. I of the Florida Constitution (“Exempt Plans”) and (ii) agrees Firm shall remain in compliance with same, including maintaining the exempt status of such Exempt Plans for so long as they are held by Firm or otherwise in its possession. Pursuant to Section 2-282, City of Tampa Code, during the solicitation period, including any protest or appeal,

NO CONTACT with City officers or employees is permitted from any proposer, other than as specifically stated in this solicitation. The City may cancel, withdraw, or modify this RFQ at any time and reserves the right to reject any or all responses and to waive irregularities, formalities, and informalities as it determines in the City’s best interest. The City of Tampa will not request documentation of or consider a bidder’s (proposer’s) social, political, or ideological interests when determining if the bidder (proposer) is a responsible vendor and will not give preference to a proposer based on the proposer’s social, political, or ideological interests.

Firms should consider applicable concepts in the City’s Climate Action And Equity Plan as posted at <https://www.tampa.gov/document/climate-action-and-equity-plan-122846> .

In order to apply for 5 “Ban-The-Box” bonus points, a firm must provide the documentation required pursuant to the “Ban-The-Box” ordinance listed at https://library.municode.com/fl/tampa/ordinances/code_of_ordinances?nodeId=1171018,

Firms desiring to provide these services to the City must submit a single electronic file in searchable PDF format, Smaller than 10MB, that includes the attached RFQ Transmittal Memorandum completed as appropriate, a Letter of Interest addressed to Brad L, Baird, P.E., Chairman, and referring to this RFQ by number, together with a Statement of Qualifications and any supplemental material allowing evaluation for further consideration (short-listing) based upon the following criteria/point system: Successful Comparable Project Experience, (35 pts); Qualifications, (30 pts); Workload and Availability, (5 pts); Past Performance/Low

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amount of City Work, (5 pts); Standard Form SF330, (5 pts); “Ban-The-Box”, (5pts); Planned SLBE Solicitation & Utilization, Form DMI 10, 20, & 50, (15 pts).

The PDF file must be **E-Mailed to ContractAdministration@tampagov.net BEFORE 2 P.M., March 19, 2026.**

As a courtesy, the City will endeavor to provide an email acknowledgement usually sent within a few days after submission receipt (submissions received on the day of the deadline may not be acknowledged before the deadline or at all). It is Firm’s responsibility to confirm its submission (PDF file) has been received.



Howard F. Curren AWTP – Master Plan Improvements: SCADA Design Criteria

Technical Memorandum

City Project NO. 20-C-00001

Reliable Tampa Partners Project No. 20-500

Hazen and Sawyer Project No. 41077-013 AAR6

June 2022

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List of Acronyms

Abbreviation	Definition
AI	Analog Input
AO	Analog Output
CMMS	Computerized Maintenance Management System
CPU	Central Processing Unit
DI	Digital Input
DO	Digital Output
FOR	Forward Off Reverse
HFC AWTP	Howard F Curren Advanced Wastewater Treatment Plant
HMI	Human Machine Interface
HOA	Hand Off Auto
HSQ	HSQ Technology
I/O	Inputs and Outputs
ISA	Instrumentation Society of America
L/R	Local / Remote
mgd	million gallons per day
OIT	Operator Interface Terminal.
ORP	Oxidation Reduction Potential
P&ID	Process and Instrumentation Diagram
PLC	Programmable Logic Controller
RTP	Reliable Tampa Partners
SCADA	Supervisory Control and Data Acquisition
STAR	System Tampa Area Reuse
TN	Total Nitrogen
UPS	Uninterruptible Power Supply
VFD	Variable Frequency Drive
VPN	Virtual Private Network

Glossary

Ethernet: A computer networking standard that defines a family of protocols, communication media, and device interfaces.

Human Machine Interface (HMI): A computer that runs graphical interface software for monitoring and supervisory control of a control system.

Local Area Network (LAN): Made up of the connection media, networking components, and nearby devices that communicate with each other.

Remote Telemetry Unit: A controller for local equipment that communicates with the master telemetry unit.

Uninterruptible Power Supply (UPS): A battery-backed source fed by the utility service during normal operation.

Variable Frequency Drive (VFD): A motor control that allows for continuous variations in running speed.

Virtual Private Network (VPN): A secure means of connecting a physically remote host to a local area network, typically via the Internet.

VTScada: The software application used at the HFC AWTP to read and write real-time data to and from controllers.

Win 411: A component of Win 911 that enables simple audio reporting of analog values.

Win 911: A software application used to annunciate and acknowledge alarms to/from remote users.

1. Introduction

1.1 Background

The HFC AWTP is permitted to treat 96 mgd of raw sewage with a Type I two-stage, high rate (pure oxygen and conventional fine bubble aeration) activated sludge biological domestic wastewater treatment plant. This plant is operated to reduce the Total Nitrogen (TN) in the effluent to advanced standards, using biological treatment for nitrification and filtration for denitrification, and to discharge high-level disinfected and dechlorinated effluent to Tampa Bay. Residuals generated by this facility are anaerobically digested and dewatered for land application as a Class B residual. Currently, annual average daily flows are approximately 60 mgd and peak flows are approximately 200 mgd.

The rehabilitation to the HFC AWTP will consist of the implementation of improvements identified in the Facility Master Plan Capital Improvement Project List for Fiscal Years 0-5 to maintain system reliability, increase operating efficiency, and meet current and future regulatory requirements.

This Technical Memorandum details the SCADA Design Criteria. These criteria will be utilized for all instrumentation and control design performed as part of these improvements.

1.2 Workshops

Three (3) workshops were held with the City in developing the SCADA Design Criteria. The findings of these workshops are documented herein and establish the minimum standards to use for developing P&IDs, specifying software and hardware, and guide the overall approach and sequencing for the replacement of the facility wide fiber communications network.

The workshops addressed the following topics:

- Workshop 1 – P&ID standards, facility fiber network improvements, approach to PLC/HMI software development, and internet/site security protection
- Workshop 2 – Hardware standards
- Workshop 3 – Design approach

Meeting notes are provided in Appendix E for reference.

2. Design Criteria

2.1 P&ID Format and Tag Conventions

During the workshops, the HFC AWTP Master Plan Improvements Dewatering Facility Replacement project was used to create a template of the format the P&ID format. The instrumentation legend and example P&IDs from that project are provided in **Appendix C**. The Tagging protocol will be different for process equipment versus instrumentation tags.

P&IDs will be developed using AutoCAD Plant 3D, 2022, Smart P&ID software. This software will aid in creating more accurate I/O lists, developing instrument lists using stored mega data, and ease in entering and editing tags.

In order to develop tags for each design, building numbers and acronyms will be required. Refer to **Table 2-2** for all known building identification. Prior to developing P&IDs for each improvement, coordination with the City will occurred to confirm all building designations. For separate buildings with the same designation, revised designations may be warranted.

2.1.1 Equipment Tags / Location Description

Equipment will be identified on the drawings and tagged on the equipment in accordance with the City's CMMS. This format is as follows:

XXXXYY-ZZZ-BB, where:

XXXXYY	CMMS Equipment ID – Refer to Table 2-1 for common designations
ZZZ	Building Number – Refer to Table 2-2 for a list of HFC AWTP building numbers
BB	Equipment Number – Items with the same equipment ID and Building Number will be numbered sequential from 01 to 99 to establish a unique equipment tag for all equipment.

Tag numbers will be affixed to non-movable surface (not motor or pump) to associate the tag number to a location. Example equipment tags from the HFC AWTP Master Plan Improvements Dewatering Facility Replacement:

- Sludge Feed Pump 2 at new sludge pump station – SFP156-066-02
- Truck Loading Conveyor 2 – SC258-065-22 (see P&ID for clarity)

Table 2-1: Common CMMS Equipment Identification

Equipment	ID	Equipment	ID
Air Blower	AB018	Main Sewage Pump	MSP015
Air Compressor	AC020	Motor Operated Valve	MOV125
Air Dryer	AD021	Motor	MTR056
Air Conditioning Unit	AHU051	Methanol Feed Pump	MFP096
Air Release Valve	ARV266	Methanol Storage Tank	MST100
Camera	CAM	Methanol Transfer Pump	MTP095
Chemical Feed Pump	CFP146	Mixed Sludge Pump	MSP153
Chemical Storage Tank	CST098	Ozone Generator	OZ027
Check Valve	CV122	Polymer Blending Unit	PBU087
Dewatering Centrifuge	DC400	Polymer Feed Pumps	PFP075
Electrical Lighting Panel	EPL240	Polymer Storage Tank	PST065
Eye Wash	EEWS322	Polymer Transfer Pump	PTP067
Exhaust Fan	EF056	Pressure Relief Valve	PRV126
Engine Generator	EG170	Pressure Regulating Valve	PRV333
Effluent Water Pump	EWP062	Plug Valve	PV119
Filter Backwash Pump	FBP217	Return Sludge Pump	RSP033
Filter Effluent Pump	FEP216	Raw Sewage Pump	RSP034
Fuel Oil Storage Tank	FOT282	Screening Conveyor	SC002
Grit Collector	GC003	Screw Conveyor	SC258
Grit Conveyor	GC006	Sludge Feed Pump	SFP156
Grit Pump	GP007	Sludge Grinder	SG162
Grit Separator	GS004	Solenoid Valve	SV086
Grit Washer	GW005	Sluice Gate	SG012
Gate Valve	GV120	Slide Gate	SG013
Internal Recycle Pump	IRP020	Switch Gear	SG039
Knife Gate	KV047	Sump Pump	SP008
LOX Storage Tank	LST117	Sample Pump	SP032
Lube System	LS401	Thickened Sludge Pump	TSP082
Mechanical Aerator	MA029	Uninterruptable Power Supply	UPS310
Motor Control Center	MCC190	Variable Frequency Drive	VFD277
Main Control Panel	MCP159	Waste Sludge Pump	WAS316
Machine Hoist	MH009	Water Booster Pump	WBP163
Mixer	MIX028	Washing Compactor	WCT

Table 2-2: HFC AWTP Building Identification

Building	No.	Acronym	Building	No.	Acronym
Raw Sewage Pump Station	001	RSP	Sludge Heat Drying	035	HD1
Junction Chamber No. 1	002	JC1	JC-1 Odor Control No. 1	036	JC1
Meter Vault No. 1	003		JC-1 Odor Control No. 2	037	JC1
Lube Storage Building	004		Tech Services Building	039	
Screen & Grit No. 2	005	S\$G	Operation & Maintenance Building	040	
Junction Chamber No. 2	006		Oxygen Plants Area Generation	041	OXY
Meter Vault No. 2	007		Chemical Handling Platform	042	
Junction Chamber No. 3	008		Chemical Storage Tanks	043	
Primary Sedimentation Tanks 1-4	009	PRI	Plant Switchgear Building	044	OSG
Main Pumping Station	010	MPS	Filter Access Tunnel	045	
HPO Reactors	011		Dechlorination Facility	046	
Final Sedimentation Tanks 1-12	012		Filter Building No. 2	047	FB2
Intermediate Pump Station	013	IPS	Denitrification Filters 21-26, 31-36	048	
Denitrification Filters 1-20	014		Junction Chamber No. 6	049	
Filter Building No. 1	015	FBC	Junction Chamber No. 5	050	
Post Aeration Chlorination Tanks	016		Carpenter Shop	051	
Junction Chamber No. 4	017		Welding Shop	052	
Outfall Structure	018		Car Port and Repair Shop	053	
Warehouse	019		Sludge Storage Tanks / Building	054	SCB
Primary Sludge Pump Station No. 1	020		Sludge Drying Beds	055	
Anaerobic Digester Tanks	021		Belt Thickener Building	056	ST2
Return Sludge Station No. 1	022	RS1	Nitrification Pump Station	057	
Return Sludge Station No. 2	023	RS2	Blower Building	058	
Return Sludge Station No. 3	024	RS3	Screen & Grit No. 1	059	SG2
Diffused Air Reactors	025	DAR	Administration Building	060	
Sludge Thickener Tanks	026		Final Sedimentation Tanks 13-20	061	
Sludge Drying Beds (old)	027		Return Sludge Station No. 4	062	RS2
Digester Control Building A	028	DC1	Return Sludge Station No. 5	063	RS3
Digester Control Building B	029	DC1	Vehicle Maintenance Facility	064	
Sludge Treatment Building	030	STB	Sludge Dewatering Building (under construction)	065	DWB
Filtrate Pump Station	031		Dewatering Feed Pump Station (under construction)	066	SCB
Sludge Dewatering Building (existing – to be replaced)	032	DWB	Scum Thickener Facility	070	
Waste Gas Burners (dig 1 – 5)	033		Mixed Sludge Pump Station	071	MSP
Anaerobic Digesters 6 and 7	072		Primary Sludge Pump Station 2	083	
Digester Control Building C	074	DCC	Switchgear No. 60	085	
TECO Partnership Station	077	TEC	Reclaimed Water Station	086	STR
Stand-by Power Facility	078	SPF	Water Reuse Pilot Plant	087	
Waste Gas Burners (dig 6 and 7)	079		Fuel Station Gas & Diesel	089	
Generator Building and Filter Room	080	GEN	Collections Admin Building	091	
Old Generators Building	081		Septage Receiving Station	NBN-1	
Primary Sedimentation Tanks 5-8	082		Leachate Discharge Station	NBN-2	
Heat Drying Silos		HD2	Methanol Station		MTH

* GREEN indicates where there are unused building numbers

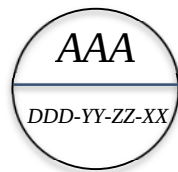
** Designations in RED are duplicates which may need some revision

2.1.2 Instrument Tags

P&ID Instrument Tags

Instrument tags on the P&IDs will use standard ISA format bubbles, with the building acronym representing the process area. Loops within a building will be numbered consecutively through the process flow path.

The instrument tag format will be:

	AAA	<i>ISA Instrument Designation – Refer to Appendix C Drawing I001 for additional information</i>
	DDD	<i>Building Acronym – Refer to Table 2-2 for a list of HFC AWTP building acronyms</i>
	YY	<i>Loop Number – Loop numbers are established and confirmed during the Preliminary P&ID phase of each design</i>
	ZZ	<i>Instrument Number – Numerical sequence 01 through 99</i>
	XX	<i>Unique Numerical Identifier – Items with a duplicate tag shall be numbered sequential from 01 to 99 to establish a unique tag</i>

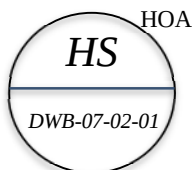
Example 1: Sludge Feed Pump 2 flow meter in the new dewatering feed pump station:



Example 2: The level transmitter on loading diverter gate 2 on truck loading conveyor 3 in the new sludge dewatering building:



Example 3: The HOA hand switch for the main drive on the VFD for centrifuge 2 in the new sludge dewatering building:



PLC Instrument Tags

The PLC instrument tagging shall follow the same format as P&IDs. Additionally, these tags shall include any modifiers. The below signal tags correlate to the examples provided for the P&ID tags above.

Example 1: FIT-SCB-04-02

Example 2: LIT-DWB-25-03-02

Example 3: HS-DWB-07-02-01-Hand (For the hand position)

HMI Tag Names

HMI tags shall be the same as the PLC tag with the addition of the “HFC” as a prefix . This will differentiate devices at the HFC AWTP from those at different locations, such as lift stations.

Example 1: HFC-FIT-SCB-04-02

Example 2: HFC-LIT-DWB-25-03-02

Example 3: HFC-HS-DWB-07-02-01-Hand (For the hand position)

Unique Instrument AAA Designations

The City uses the follow unique ISA instrument designations:

MN	Run Status (ON or OFF)
MF	Failure
LH/LL	Level High/Low
PH/PL	Pressure High/Low
SH/SL	Speed High/Low
TH/TL	Temperature High/Low
JF	Breaker Status
ZH	Valve/Gate Status

2.2 Fiber Optic Network

2.2.1 Existing Network

The existing fiber network is installed in a “spoke-hub” distribution, or “star” configuration, with separate fiber lines branching out from the network rack located in the Main Pump Station near PLC 19. The current HFC AWTP fiber network layout is shown in **Appendix A**. As shown in the appendix, the network is color-coded and labeled with line numbers, refer to **Table 2-3** for a list of zone colors and lines. Fibers are generally installed in a single conduit along the paths shown, with conduit installed in a concrete encased duct. If a critical conduit is damaged any PLC downstream of that damage will no longer be accessible on the plant SCADA. There are 11 main fiber trunk lines that run out to the various processes within these regions (Lines 0 through 10).

PLC 1, PLC 9, and PLC 18 are considered weakest links as each of these are hubs that direct communications from several PLCs back to this Main Pump Station network switch. Loss of communication to these PLCs will impact the PLCs that are connected to them.

Table 2-3: Fiber Zones

Zone Color	Zone Lines
Red	Line 0
Pink	Line 8
Blue	Lines 1 & 5
Brown	Line 10
Green	Lines 2 & 6
Orange	Lines 3 & 7
Light Blue	Lines 4 & 9

A listing of all the plant PLCs and the building locations for each is provided in Appendix F.

2.2.2 Field Investigation

In order to verify the exact routing of the fiber network, site investigations were performed. The following observations were made during these investigations:

- PLC 19 in the Main Pump Station is connected to the facility network rack directly over a CAT6 cable, fiber is not used.
- There are eleven main trunk fiber cables landed at a fiber patch panel for process connections located at the Main Pump Station that then are connected to the facility network rack.
- There are additional fiber cables landed at a separate fiber patch panel in the network rack room, however these fiber lines were installed by the City for various staff workstations and not part of the facility process fiber network.
- The Red Zone was found to consist of the following fiber runs:
 - One fiber cable that connects the network to PLC 11, PLC 12, PLC 13, and PLC10 as follows:
 - Patch panel near PLC 12 has a trunk cable back to the network rack patch panel
 - PLC 12 connects by fiber to the patch panel near PLC 12
 - PLC 11 connects by fiber to the patch panel near PLC 12
 - PLC 13 connects by fiber to a patch panel near PLC 13 which then connects to the patch panel near PLC 12
 - PLC 10 connects by fiber to the patch panel near PLC 13
 - One fiber cable that connects the network to PLC 5 and PLC 39 as follows:
 - PLC 39 connects by fiber to a patch panel at PLC 5
 - PLC 5 connects by fiber to the patch panel in PLC 5 panel

- Patch panel at PLC 5 has a trunk cable back to the network rack patch panel
- One fiber cable that connects the network to PLC 4, PLC 37, and PLC7 as follows:
 - PLC 7 connects by fiber to a patch panel at PLC 37
 - PLC 37 connects by fiber to a patch panel in PLC 4
 - PLC 4 connects by fiber to the patch panel in PLC 4 panel
 - Patch panel at PLC 4 has a trunk cable back to the network rack patch panel
- Fiber from PLC17 to PLC16 will need to be re-routed as structure that houses PLC 16 will be removed.

At this time the exact configuration of the Red Zone cannot be fully verified as the fiber terminations are either not labeled or incorrectly labeled. Additionally, the electrical manholes were not readily accessible. Based on the best information available, **Figure 2-1** has been developed to provide approximate configuration of the fiber runs in the Red Zone. It is recommended to verify the exact fiber runs of each zone during the design of improvements associated with that zone.

Junction Chamber No. 1 (Bldg. 002)

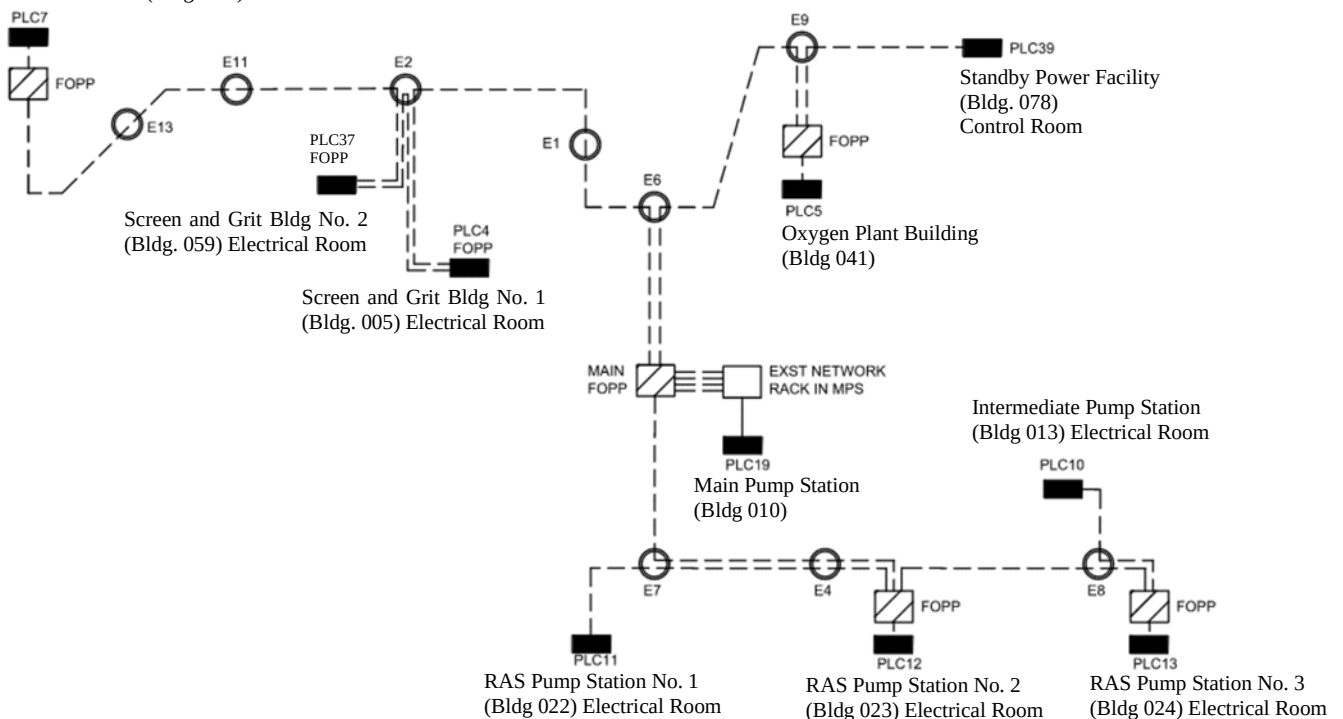


Figure 2-1 Line 0 Fiber Runs

This, plus the 8 lines from the remaining quadrants (Lines 1 & 5 from the NW, Lines 2 & 6 from the SW, and Lines 4 & 9 and 7 & 3 from the SE) is consistent with the 11 lines found at the main patch panel in the Main Pump Station.

Replacement of the Existing Fiber Cables: The existing fiber cables included in the network are past their useful life having been installed several decades ago. If the cables were to be replaced, it would have to be done with parallel new fiber cables that allow the existing network to function without interruption. However, the 11 fiber cables entering through a conduit beneath the main patch panel in the Main Pump Station Building network room leave the conduit with very little room to pass through additional fiber. Although it's possible to utilize MaxCell sleeves to snake new fiber cables through the one existing conduit, it would be easier to install a new conduit run if the network rack were to remain where it is currently located.

2.2.3 Recommended Fiber Network Upgrades

Given the available documentation on the fiber network and the site investigation, the following is recommended for upgrading the network:

- Run new fiber cable in existing fiber cable conduit from new control systems at each building installed under each individual amendment package (to the HFC AWTP Master Plan Improvement project) to connect to a new patch panel near the existing network rack. New fiber runs from this new patch panel are to be connected to the existing network equipment. The existing network rack is located within the existing Main Pump Station network equipment room.
- Install new fiber cables from the upgraded PLCs associated with process improvement, utilizing existing conduit duct bank and manholes, through either electrical manhole E-6 or E-7, then through the new conduits to the new network rack.
- Gradually remove existing fiber runs as associated processes are upgraded and successfully running off the new network.
- Keep both networks operational until the last replacement fiber run is complete. The existing plant fiber patch panel located near the existing network rack is to be kept in service until all processes have been updated and connected with new fiber runs upon which the existing patch panel can be removed.
- Provide redundant fiber loops at the outer edges. As an example, a new fiber run between PLC 17 and PLC 7 would allow data transmission for PLCs in either quadrant back to the main network rack regardless of where conduit runs might be lost. PLC 18 (located in Filter Building No. 1) is the most critical to have fiber redundancy as loss of this PLC would result in loss of the plant's permit analyzers and flow-proportional chemical feeds and samplers, which could shut down STAR. Fiber loops would require some reconfiguration of the programming to designate the "normal" communication path and a backup path if normal route is lost.

During the design phase of each improvement to HFC AWTP, the existing network diagram and the new network diagram will be updated to maintain accurate records of the both systems until the existing is fully removed from service.

Camera feeds are on the same fiber cable as SCADA, utilizing separate fibers. This approach shall be continued for new fiber cables.

During the installation of new fiber cables, the existing cables shall be left in place. It is recommended to perform field investigations during the design phases to verify new fiber cable can to installed utilizing the existing infrastruce.

2.3 HMI Software Conversion

2.3.1 VTScada

The City is in the process of creating VTScada screens to replace the existing HSQ system. Currently, the City has implement monitoring only screens for some of the facilities through VTScada, this application is running in parallel the existing HSQ application. The following facilities have VTScada screens for monitoring only:

- Junction Chamber #1
- Screen and Grit Buildings
- Primary Sedimentation Tanks
- Digestion
- STAR

The following City preferences have been identified for implementing the HMI software conversion:

- Migrate all monitoring and control capabilities to VTScada. All new HMI software applications and screens will be based on using VTScada.
- Screens developed in VTScada are to be similar to existing screens, matching the layout of the P&IDs.
- An Overview of each facility is to be provided that is similar to existing overview displays.
- Control and monitoring of particular process areas within the facility shall be accessible by clicking on that area on the overview display to bring up the “P&ID” type display for the area.
- Individual equipment control shall be accessible by clicking on that equipment to bring up dashboard style pop up control screens similar to existing.
- During development of displays, City staff will be provided examples of high-performance graphic displays for their review to decide if such displays offer a better grasp of overview for each process area.

At this time, the plant processes, collection system pump stations, and stormwater stations have separate VTScada realms within one application on the same server. The City is considering implementing separate VTScada applications for each of these areas.

HFC AWTP Master Plan Improvement projects will include some high-performance screens following ISA101 Design Standard. Workshops for operators will be held as part of each project. Control descriptions will be developed prior to those workshops. High performance displays will be discussed at these workshops to decide design of such displays and if they are to be provided.

The historical data from HSQ is to be saved and made available in the VTScada system. This shall be addressed in the Main Pump Station and HPO Reactor Improvements project currently under design. At a minimum, data starting from the beginning of 2000 shall be transferred.

2.3.2 PLC / HMI Software Integration

The design team will coordinate with the process integrator and the City to develop the software. City staff will participate in actual development of graphics, tag creation, and programming to become more familiar with VTScada for future development and system troubleshooting. At the beginning of each construction phase, a pre-construction instrumentation coordination meeting will be held to review software development scope of work and to determine the role and responsibilities. The City staff will provide oversight of the HMI screen and PLC controls development.

For the HFC AWTP Master Plan Improvements Dewatering Facility Replacement project, RTP will be developing the HMI screens with oversight from the City. These displays will be used to set standards for displays to provide for all improvements.

2.3.3 HMI Security

The following extent of exposure to internet connectivity will be incorporated into the SCADA design for each process improvement:

- VPN connection for remote setup for vendor access to HMI when allowed by the City.
- Similar to existing, access to HMI by City staff through handheld devices and laptops to connect through internet VPN over wireless cellular means. Previous efforts to create wireless hotspots proved to be inadequate at this site.
- New controls at the PLC level on the fiber network shall be accessible through similar wireless internet VPN connectivity.

2.4 Site Security & Monitoring

The existing plant camera system only includes ten (10) cameras. These are listed in Appendix G. With each improvement, design will include new cameras to eventually be able to monitor all areas within the plant. Location, number, and type of cameras will be discussed with City staff as part of the detail design phase of each HFC AWTP Master Plan Improvement. The existing SONY system is to be replaced with a GENETEC system, including a new server. The initial upgrade will occur during the HFC AWTP Master Plan Improvements Dewatering Facility Replacement, which is concurrently under construction. All existing cameras will be transitioned to the new GENETEC system once it is operational.

Entry gates will utilize GENETEC card reader system with interface to the new base system to allow monitoring of entry points, two-way voice communication for visitors, and remote operation of gates. Additionally, the City may replace the site perimeter fence with an eight-foot (8') tall fence at some point in the future.

2.5 Hardware

2.5.1 General Requirements

All improvements shall adhere the following requirements:

- All programmers, whether vendor or integrator, are to follow the same standards for hardware and software.
- Provide computer workstations in key buildings as directed by the City to allow full control and monitoring of entire plant from each location. Existing computer workstations will not be replaced.
- Provide independent vendor PLC hardware for individual equipment systems that interface with overall system PLCs provided by integrator. Signals to vendor supplied controls shall be hard-wired for all control I/O. Supplemental information such as power usage or other diagnostics can be over Ethernet link from vendor supplied PLCs.
- Provide a local control station at each piece of equipment (HOR, L/R, FOR, Start/Stop, etc) for local control with a means to lockout the equipment (lockout stop pushbutton) when in the off position. All such controls to be NEMA4X industrial grade and Square D 9001SK series.
- Provide spare parts for CPUs, I/O Cards, Network Switches, fuses, and other components that are critical for operation or prone to wearing out.
- Instrument specifications will be in data sheet format for specific make and model numbers rather than lengthy descriptions intended for “or equal” interpretation.
- Electrical gear shall be provide with the manufacturer’s standard power monitoring devices.
- Witnessed factory testing will not be required. Specifications will require onsite checkout with City staff followed by a 48-hour demonstration test.
- Project specifications will require training for both operations and maintenance staff. Operation and maintenance manuals shall be required to be on hand for associated training.

2.5.2 Control Panels

Control Panels shall be specified to be provided with the components outlined in **Table 2-4**, for panel components not listed in this table the HFC AWTP Master Plan Improvements Dewatering Facility Replacement project will be used as a standard.

Improvements shall include the following requirements:

- Dual OITs will be provided on all panels with PLCs, this includes main process panels and individual equipment panels. Both OITs shall have full redundancy, generally one will be used for setpoints and the other for monitoring.
- Within panels, CAT6 cable shall be shielded industrial cable and rated for 600V if exposed to 480V power.
- Wiring within panels shall separate for different voltages and purposes.

- New PLCs can connect directly to plant fiber network, they do not have to connect through a remote telemetry unit.
- Uninterruptible power supplies shall be an APC UPS without ethernet connections and with a bypass switch for easy change out. Relays shall be used on UPS outputs to provide alarm when panel is on UPS power.
- Panels shall be provided with twenty-percent (20%) spare capacity for I/O with ten-percent (10%) installed spare I/O.

Table 2-4: Standard Control Panel Components

Component	Specified Model
PLC CPU	GE Rx3i IC695CPE305 for single CPUs IC695CPE410 for hot swappable CPUs Critical processes (O2 Plant, Filter Building, and Standby Power systems) are to have hot swappable CPUs on separate racks with shared Remote I/O.
AI Module	IC694ALG223 16-channel single, 8 differential, Isolated
AO Module	IC694ALG392 8 Channel
DI Module	IC694MDL241 16 input – 24VDC
DO Module	IC694MDL940 16 relay outputs
PLC Power Supply	IC695PSA140
PLC	Proficy v9.8 with latest SIMs City maintains updates from GE through TMMI
OIT	Maple Systems cMT2158X cMT2078X 7" display for vendor panels cMT2158X 15" display for main process panels by integrator All industrial grade for harsh environments (Class 1, Div. 2).
Split core current transmitter for small/medium submersible pumps	Enercorp Instruments SC200
Process Meters	Precision Digital PD765-X2 (large display)
Analog Signal Splitters / Isolators	Acromag
DIN Rail	Aluminum

2.5.3 Field Instruments

Field instruments shall be specified to be provided with the components outlined in **Table 2-5**. Additionally, the following requirements will be incorporated for all improvements:

- Surge Protection for field devices shall be screw type lightning protection barriers
- Locate instruments out of sun when possible and facing north as best practical. Provide covers for the screen displays not sunshields.
- Provide spares for each type of instrument.
- Special warranties on instruments shall not be required.

Table 2-5: Standard Instruments

Instrument Type	Specified Model
Flow Meters	ABB or Krohne magmeters Submerged service – Ensure manufacturer will guarantee expected operational conditions as ABB meters have been known to fail if buried or submerged
Pressure Transmitters	Yokogawa EJA
Pressure Switches	ITT 1193P
Pressure Gauges	Ashcroft 1279 or 1009 with diaphragm seal, oil filled
Level Transmitters	Pulsar Ultra 4 using radar setting
Level Float Switches	Anchor Scientific
Limit / Proximity Switches	Allen Bradley 802X, Nema4/13 lever type
Valve Actuators	Bernard 480V for open/close service Beck 480V for modulating service Small valves can be 120V Bernard or Worchester
Temperature Sensors	Dwyer “hockey puck”, 100 ohms, platinum
Weigh Scales	Mettler-Toledo
Gas Meters (LEL)	Sensidyne Series 823 for methane, oxygen, and hydrogen sulfide
Vibration Sensors	Robertshaw vibration sensor switches
Vibration Monitors	CTC Inc. VPR100-xxx
Analyzers	
On-line Nutrient	ChemScan
Dissolved Oxygen	YSI IQ SensorNet controller and probes
pH / ORP	YSI IQ SensorNet controller and probes
Turbidity	Swan AMI Turbiwell 7027
Residual Chlorine	Hydro Instruments RAH-210 (reagentless type) *Note: City is currently evaluating a new system from Halogen DWSS

3. Recommend Network Sequencing

3.1 Maintaining Monitoring and Reporting

Once the P&IDs are developed and preliminary control descriptions are available, discussion on where new PLC panels will be located and how I/O will be connected to the new PLC modules will be made at milestones for each project. A detailed sequence on how to maintain monitoring and reporting will be developed as part of these discussions. These sequencing plans will be reviewed with City staff prior to completing the 90% Design.

3.2 Replacing Fiber Cables

All fiber cables for each process, which includes fibers for the camera feeds, will be replaced as part of any improvement to that process. During development of the Preliminary P&IDs a thorough site investigations shall be performed to verify the existing fiber runs from the associated PLCs back to the main network fiber patch panel. This includes removing electrical manhole covers and draining the manholes. The purpose of these investigations is to determine what existing conduit runs will be used to best show on the design site plans for the fiber installation. At any point thereafter, investigations shall be performed to confirm new cable can be run through the existing conduits without removing the existing fiber cables.

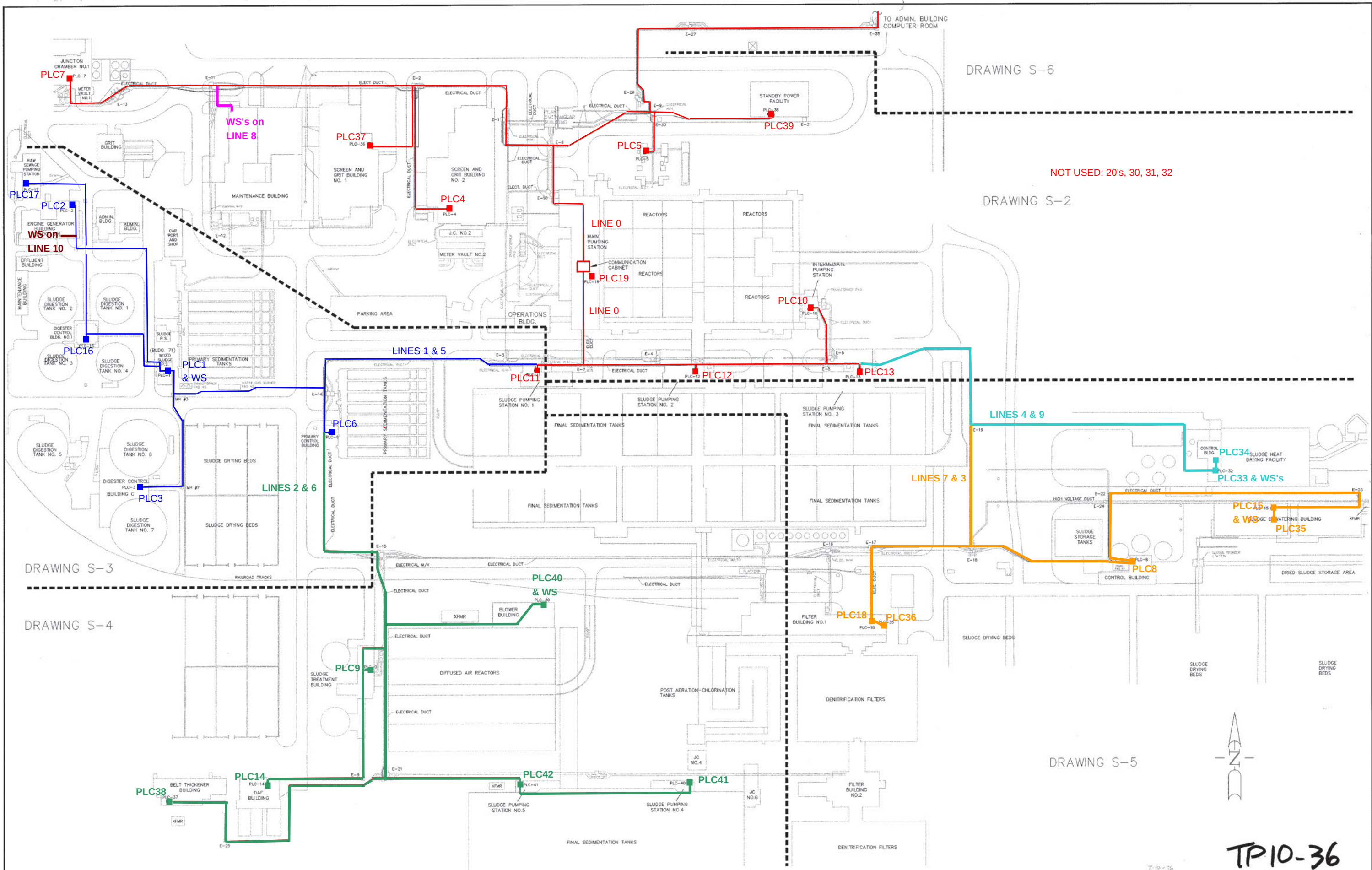
Final network diagram will include fiber cable labeling. Labeling for the cables and for the ports at patch panels will be installed in the field to match the network diagram. Multiple cables run through the same conduits and manholes will be depicted on the network site plan.

3.3 Conversion to VTScada

VTScada HMI programming will be developed and placed in service parallel to the existing HSQ HMI system on a separate network rack and made available for interface on new workstations throughout the plant, as well as on wireless devices. As a process is made available on the VTScada HMI and is installed, tested, and passed an approved reliability demonstration period, the associated HSQ HMI display screens could be removed or made view only. The goal will be to get each process on the VTScada HMI to use for setpoint adjustment, monitoring, and/or manual override. However, there will be some parameters that may impact separate processes still controlled only through HSQ. A plan will need to be developed for such situations to provide a protocol to operations until all control parameters have been switched over to VTScada.



Appendix A: Fiber Network Map





Appendix B: Building Number Map

Howard F Curren AWTP Building Numbers



Building #	Building Name	As-Built Number
001	RAW SEWAGE PUMPING STATION	[4L-8C]
002	JUNCTION CHAMBER NO 1	[4H-7] + [5H-3A] + [14-C-00025]
003	METER VAULT NO 1	[4H-7]
004	LUBE STORAGE BUILDING (FORMER SCREEN AND GRIT BUILDING NO 1)	[L2] + [L3] + [K5]
005	SCREEN & GRIT NO 2 (OLD)	[4H-4] + [9-17A] + [4H-25] + [4H-1] + [4H-2] + [4H-3]
006	JUNCTION CHAMBER NO 2	[4H-1] + [4H-2] + [4H-3] + [4H-4] + [4H-11] + [13-98]
007	METER VAULT NO 2	[4H-1] + [4H-2] + [4H-3] + [4H-4] + [4H-11] + [13-98]
008	JUNCTION CHAMBER NO 3 AND BYPASS STRUCTURE	[4H-7] + [K4] + [K5] + [K6] + [L5] + [M1]
009	PRIMARY SEDIMENTATION TANKS NO 1 TO 4	[4H-24] + [K2/K3]
010	MAIN PUMPING STATION	[4H-1] + [4H-2] + [4H-3] + [4H-4] + [4H-8] + [J-91] + [J-93] + [5H-4] + [9-178] + [4H-26] + [4H-23]
011	HPO REACTORS	[4H-1] + [4H-3] + [4H-4] + [4H-18] + [4H-19] + [4H-23] + [8-98] + [5-C-5] + [15-C-00021]
012	FINAL SEDIMENTATION TANKS NO 1-12	[4H-1] + [4H-2] + [4H-3] + [4H-4] + [4H-4] + [4H-22] + [4H-18] + [08-C-00019]
013	INTERMEDIATE PUMPING STATION	[4H-3] + [4H-4]
014	DENITRIFICATION FILTERS NO 1 TO 20	[4H-6] + [9-176] + [C-95] + [15-C-00008]
015	FILTER BUILDING NO 1	[4H-6] + [4H-19] + [5H-1] + [D-90] + [5-C-53] + [7-C-79]
016	POST AERATION CHLORINATION TANKS	[4H-6] + [5H3-8] + [5H-4] + [13-C-00004]
017	JUNCTION CHAMBER NO 4	[4H-7]
018	OUTFALL STRUCTURE	[H-3] + [K-5] + [4H-7]
019	WAREHOUSE	[4H-16]
020	PRIMARY SLUDGE PUMPING STATION NO 1	[K4] + [K5] + [K6] + [L5] + [M1]
021	ANAEROBIC DIGESTER TANKS NO 1 TO 5	[K4] + [K5] + [K6] + [L5] + [M1] + [PROJECT 14] + [4H-10]
022	RETURN SLUDGE STATION NO 1	[4H-1] + [4H-2] + [4H-3] + [4H-4] + [4H-23] + [4H-4] + [4H-22]
023	RETURN SLUDGE STATION NO 2	[4H-1] + [4H-2] + [4H-3] + [4H-4] + [4H-22] + [4H-23]
024	RETURN SLUDGE STATION NO 3	[4H-1] + [4H-2] + [4H-3] + [4H-4] + [4H-22]
025	DIFFUSED AIR REACTORS (DARs)	[4H-6] + [5H-4]
026	SLUDGE THICKENER TANKS	[4H-6] + [5H-4] + [M-90]
027	OLD SLUDGE DRYING BEDS	[K2] + [PROJECT 14]
028	DIGESTER CONTROL BUILDING A	[K4] + [K5] + [K6] + [L5] + [M1] + [PROJECT 14] + [4H-10] + [J-91] + [TPB016-040]
029	DIGESTER CONTROL BUILDING B	[PROJECT 14] + [4H-10]
030	SLUDGE TREATMENT BUILDING	[4H-6] + [4H-12] + [4H-19] + [5H-4] + [M-90] + [14-C-00029]
031	FILTRATE PUMPING STATION	[5H-3A]
032	SLUDGE DEWATERING BUILDING	[4H-14] + [A-92] + [D-92] + [5H-2A] + [18-01] + [D0-03] + [5-C-54] + [11-00] + [TPB009-015]
033	WASTE GAS BURNERS FOR DIGESTER NO 1 TO 5	[PROJECT 14] + [4H-10] + [TPB016-040]
035	SLUDGE HEAT DRYING	[4H-20] + [E-90] + [J-90] + [11-00] + [5-02] + [7-C-81]
036	J.C.-1 ODOR CONTROL NO 1	[4L-4]
037	J.C.-1 ODOR CONTROL NO 2	[4L-4]
039	TECH SERVICES BUILDING	[K7/M2]
040	OPERATION AND MAINTENANCE BUILDING	[4H-5] + [5H-20]
041	OXYGEN PLANTS AREA GENERATION	[4H-4] + [4L-1] + [TPB008-072]
042	CHEMICAL HANDLING PLATFORM	[4H-6] + [9-172] + [13-C-00041] + [TPB013-001] + [4H-21]
043	CHEMICAL STORAGE TANKS	[4H-6]
044	PLANT SWITCHGEAR BUILDING	[4H-6]
045	FILTER ACCESS TUNNEL	[4H-6]
046	DECHLORINATION FACILITY	[4H-21] + [7-C-79]
047	FILTER BUILDING NO 2	[5H-1]
048	DENITRIFICATION FILTERS NO 21 TO 26 AND NO 31 TO 36	[5H-1]
049	JUNCTION CHAMBER NO 6	[5H-1]
050	JUNCTION CHAMBER NO 5	[5H-4]
051	CARPENTER SHOP (FORMER CHLORINE STORAGE YARD)	[K4] + [K5] + [K6] + [L5] + [M1]
052	WELDING SHOP (FORMER EFFLUENT BUILDING)	[K4] + [K5] + [K6] + [L5] + [M1]
053	CAR PORT AND REPAIR SHOP	[K7] + [M2]
054	SLUDGE STORAGE TANKS AND DRIED SLUDGE CONTROL BUILDING	[4H-9] + [5H3-8]
055	SLUDGE DRYING BEDS (32)	[4H-9]
056	BELT THICKENER BUILDING - NOT IN USE	[5H-2A]
057	NITRIFICATION PUMPING STATION	[5H-4]
058	BLOWER BUILDING	[5H-4]
059	SCREEN & GRIT NO 1 (NEW)	[5H-1] + [TPB009-001]
060	ADMINISTRATION BUILDING	[5H-28]
061	FINAL SEDIMENTATION TANKS NO 13 TO 20	[5H-4]
062	RETURN SLUDGE STATION NO 4	[5H-4]
063	RETURN SLUDGE STATION NO 5	[5H-4]
064	VEHICLE MAINTENANCE FACILITY	[5H-38]
070	SCUM THICKENER FACILITY (DAFs) - NOT IN USE	[4H-12]
071	MIXED SLUDGE PUMPING STATION	[4H-12] + [M-92] + [TP001-002]
072	ANAEROBIC DIGESTION TANKS NO 6 AND 7	[4H-12] + [E-90]
074	DIGESTER CONTROL BUILDING C	[4H-12] + [E-90] + [TPB016-040]
077	TECO PARTNERSHIP STATION	
078	STAN-BY POWER FACILITY	[5H-38]
079	WASTE GAS BURNERS FOR DIGESTER NO 6 AND 7	[4H-12] + [TPB016-040]
080	NEW GENERATOR BUILDING AND FILTER ROOM	[4H-12] + [4L-7]
081	OLD GENERATORS BUILDING	[4H-10] + [K4] + [K5] + [K6] + [L5] + [M1]
082	PRIMARY SEDIMENTATION TANKS NO 5 TO 8	[4H-11]
083	PRIMARY SLUDGE AND DEWATERING PUMPING STATION NO 2	[4H-11]
085	SWITCHGEAR NO 60	[4H-10]
086	RECLAIMED WATER STATION	[TP044-002] + [13-C-00055]
087	WATER REUSE PILOT PLANT	[TP047-107] + [TP004-021]
089	FUEL STATION GAS & DIESEL	[N-92] + [13-C-00040]
091	COLLECTIONS ADMINISTRATION BUILDING (FORMER TPD K-9 BUILDING)	
NBN-1	SEPTAGE RECEIVING STATION	
NBN-2	LEACHATE DISCHARGE STATION	

Appendix C: Instrumentation Legend and Typical P&ID

INSTRUMENT AND FUNCTION SYMBOLS

	PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNT	AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	NORMALLY INACCESSIBLE OR BEHIND THE PANEL DEVICES OR FUNCTIONS
DISCRETE INSTRUMENTS				
SHARED DISPLAY, SHARED CONTROL (TOUCH PANEL)				
PROGRAMMABLE LOGIC CONTROL				
SUPERVISORY COMPUTER FUNCTION (HMI/SERVER)				

SINGLE INSTRUMENT OR OTHER COMPONENT
HAVING MULTIPLE FUNCTIONS OR SHARING A COMMON HOUSING

SOFTWARE LOGIC OR CONTROL MODULE (XXXX) AND SUB-MODULE (YYY)
RESIDENT IN DISTRIBUTED CONTROL SYSTEM
(DCS) OR PROGRAMMABLE LOGIC CONTROLLER (PLC)
REFER TO CONTRACT DOCUMENTS FOR CONTROL
AND MODULE DESCRIPTIONS.

DESIGNATIONS OF CONTROL FUNCTIONS (ZZZ) ASSOCIATED
WITH INSTRUMENT OR OTHER COMPONENTS.

AHC - AUTO/HOLD/CLOSE
AM - AUTO/MANUAL
DEV - DEVIATION
MOA - MANUAL/OFF/AUTO
HOR - HAND/OFF/REMOTE
LOS - LOCKOUT STOP
LR - LOCAL/REMOTE
00 - ON / OFF
OC - OPEN/CLOSE

OSC - OPEN/STOP/CLOSED
POT - POTENTIOMETER
RL - RAISE/LOWER
RSL - RAISE/STOP/LOWER
SD - SHUTDOWN
SEL - SELECT
SP - SET POINT
SR - START/RESET
SS - STOP/START

INSTRUMENT PANEL MOUNTED WITH INDICATION, COMPUTING
OR CONVERTING FUNCTION

CONVERT

E - VOLTAGE
I - CURRENT
P - PNEUMATIC
A - ANALOG
B - BINARY

COMPUTE

SUMMING

SUBTRACTOR

MULTIPLYING

DIVIDING

ROOT
EXTRACTION

PROPORTIONAL

DERIVATIVE

OR FUNCTION

AND FUNCTION

AVERAGING

RATIO

DIFFERENCE

HIGH SELECTING

LOW SELECTING

INTEGRAL

PID

CALCULATION
(RUNTIME, TOTALIZE, ETC)

LOGIC INTERLOCK

ANALYTICAL

XXXX =

COMB - COMBUSTIBLE GAS
COND - CONDUCTIVITY
DO - DISSOLVED OXYGEN
H₂S - HYDROGEN SULFIDE
LEL - LOWER EXPLOSIVE LIMIT
O₂ - OXYGEN CONCENTRATION
pH - HYDROGENION CONCENTRATION
ORP - OXIDATION/REDUCTION POTENTIAL

VALVE SYMBOLS

GATE VALVE	PLUG VALVE	GLOBE VALVE	BALL VALVE
BALL VALVE (3 WAY)	3-WAY VALVE (GENERAL)	PINCH VALVE	COMBINATION VACUUM AND PRESSURE RELIEF VALVE
BUTTERFLY VALVE	SWING CHECK VALVE	BALL CHECK VALVE	DIAPHRAGM VALVE
NEEDLE VALVE	ANGLE VALVE	ROTARY VALVE	THROUGH PLUG VALVE
PRESSURE RELIEF OR SAFETY VALVE	VACUUM RELIEF VALVE	PRESSURE-REDUCING REGULATOR	BACKPRESSURE REGULATOR
BACKFLOW PREVENTOR	SLUICE GATE	STOP/SLIDE GATE	STRAINER
PUMP CONTROL VALVE	AIR RELEASE VALVE		

FLOW METERS

MAGNETIC FLOWMETER	VORTEX SENSOR	PADDLE WHEEL	FLUME
SONIC FLOW METER "DOPPLER" OR "TRANSIT TIME" TEXT MAY BE ADDED	ORIFICE PLATE (MOUNTED IN FLANGE UNION)	VENTURI/INSERT TYPE FLOW TUBE	WEIR
VARIABLE AREA INDICATING ROTAMETER(R)	POSITIVE-DISPLACEMENT TYPE	SINGLE PORT PITOT TUBE	TURBINE-OR PROPELLER TYPE

VALVE ACTUATORS

SOLENOID	ROTARY MOTOR	VALVE ACTUATOR ELECTRO- PNEUMATIC CONVERTER	ELECTROHYDRAULIC
PNEUMATIC	HAND WHEEL	ELECTRIC	

EQUIPMENT TAG NUMBERS

XXXXYY ZZZ - BB

NUMBER USED FOR MULTIPLE EQUIPMENT / DEVICES
WITH THE SAME PROCESS AREA / INSTRUMENT
TYPE AND DEVICE / EQUIPMENT NUMBER

EQUIPMENT NUMBER

BUILDING NUMBER
065 = DEWATERING BUILDING
066 = SLUDGE STORAGE

EQUIPMENT TYPE
(XXX IS LETTER DESIGNATION, YYY IS NUMBER DESIGNATION)
SG162 - GRINDERS
SP1156 - SLUDGE FEED PUMP
DC400 - DEWATERING CENTRIFUGE
LS401 - LUBE SYSTEM
WBP163 - WATER BOOSTER PUMP
SV086 - SOLENOID VALVE
EEWS322 - EYE WASH STATION
PRV126 - PRESSURE RELIEF VALVE

SC268 - CAKE CONVEYOR
PBU087 - POLYMER BLEND UNIT
PST065 - POLYMER STORAGE TANK
PTP067 - POLYMER TRANSFER PUMP
ELP240 - ELECTRICAL
SG013 - SLIDE GATE
MTR056 - MOTOR
ARV266 - AIR RELEASE VALVE

DEVICE NUMBER

AAA BBB CC DD EE

LOOP NUMBER

BUILDING LETTER DESIGNATION
DWB = DEWATERING BUILDING
SCB = SLUDGE STORAGE TANK AREA

SEE TABLE UPPER RIGHT THIS SHEET
INSTRUMENT TYPE DESIGNATION

PUMP AND COMPRESSOR SYMBOLS

CENTRIFUGAL PUMP OR BLOWER	PROGRESSIVE CAVITY PUMP	VERTICAL TURBINE PUMP	COMPRESSOR (CENTRIFUGAL), OR TURBINE
SCREW PUMP	PISTON PUMP	DIAPHRAGM PUMP	COMPRESSOR (PISTON)
GEAR PUMP OR BLOWER (POSITIVE DISPLACEMENT)	VERTICAL PUMP	CHEMICAL FEED PUMP	SUBMERSIBLE PUMP

MISCELLANEOUS SYMBOLS

DIAPHRAGM SEAL	BLIND FLANGE	FILTER	MIXER	ROTARY FEEDER
ELECTRIC MOTOR	VENT TO ATMOSPHERE	AIR GAP	DRAIN	PIPE MATERIAL CHANGE
HORN	ANNULAR DIAPHRAGM SEAL	EXPANSION TANK	REDUCER	RUPTURE DISK
CALIBRATION CYLINDER	PULSATION DAMPENER	INJECTOR	LOOP AND CONTROL STRATEGIES	EQUIPMENT TAG
AIR FILTER	STATIC MIXER	HORN/STROBE LIGHT	QUICK CONNECT	ULTRA SONIC SENSOR

PROCESS LEGEND

DR	DRAIN		PRIMARY
V	VENT		SECONDARY
CW	CITY WATER		TERTIARY
PA	PLANT AIR		
SA	SAMPLE		
CD	CENTRATE DRAIN		
SL	FEED SLUDGE		
NP	NEAT POLYMER		
DPS	DILUTE POLYMER SOLUTION		
EW	EFFLUENT WATER		

LINE SYMBOLS AND LEGEND

EXISTING	NEW	
		MAJOR PROCESS PIPES OR CHANNELS SECONDARY PROCESS OR MECHANICAL CONNECTION AIR SUPPLY OR SIGNAL
		ELECTRICAL/SIGNAL (HARDWIRED)
		ANALOG ELECTRICAL SIGNAL
		FIBER OPTIC CABLE
		INTERNAL SOFTWARE LINK
		DISCRETE ELECTRICAL SIGNAL WITH LIGHTNING SURGE ARRESTOR (INPUTS) INTERPOSING RELAYS (OUTPUTS)
		ANALOG ELECTRICAL SIGNAL WITH LIGHTNING SURGE ARRESTOR (INPUTS AND OUTPUTS)
		PROCESS/SIGNALS NOT CONNECTED (CROSSING)
		PROCESS/SIGNALS CONNECTED
		TERMINATION POINT(S) TO FUTURE EQUIPMENT TIE-IN CONTINUED ELSEWHERE AS INDICATED

PLC INPUT/OUTPUT

x	DIGITAL INPUT	x	ANALOG INPUT	X = NONE, HARD-WIRED I/O
x	DIGITAL OUTPUT	x	ANALOG OUTPUT	X = R, REMOTE I/O
				X = L, SERIAL NETWORK LINKED I/O

NOTES

- SYMBOLS AND NOMENCLATURE ARE BASED ON ISA STANDARDS S5.1, S5.2, S5.4.
- SEE ASSOCIATED ELECTRICAL AND MECHANICAL SYMBOL SHEETS FOR ADDITIONAL SYMBOLS AND ABBREVIATIONS.
- POWER SUPPLIES FOR LOOPS OR SYSTEMS SHALL BE FURNISHED BY THE INSTRUMENTATION SUPPLIER TO MEET THE PARTICULAR CHARACTERISTICS
- (E.G. VOLTAGE AND CURRENT REQUIREMENTS) OF COMPONENTS IN EACH CIRCULAR SYSTEM.

UNDERSCORE(S) REQUIRED FOR ALL EQUIPMENT TYPES LESS THAN FOUR

PROJECT ENGINEER:	J. PORTER
DESIGNED BY:	D. SCHMIDT
DRAWN BY:	D. SCHMIDT
CHECKED BY:	D. SCHMIDT
ISSUED FOR CONSTRUCTION	11/2021
ISSUED FOR	DATE
BY	BY

PROFESSIONAL ENGINEER
DANIEL B. SCHMIDT
LICENSE NO. 40233
1000 NORTH ASHLEY DRIVE, SUITE 1000
TAMPA, FL 33602

THE ABOVE NAMED PROFESSIONAL ENGINEER
SHALL BE RESPONSIBLE FOR THIS SHEET IN
ACCORDANCE WITH RULE 61615-23.004,
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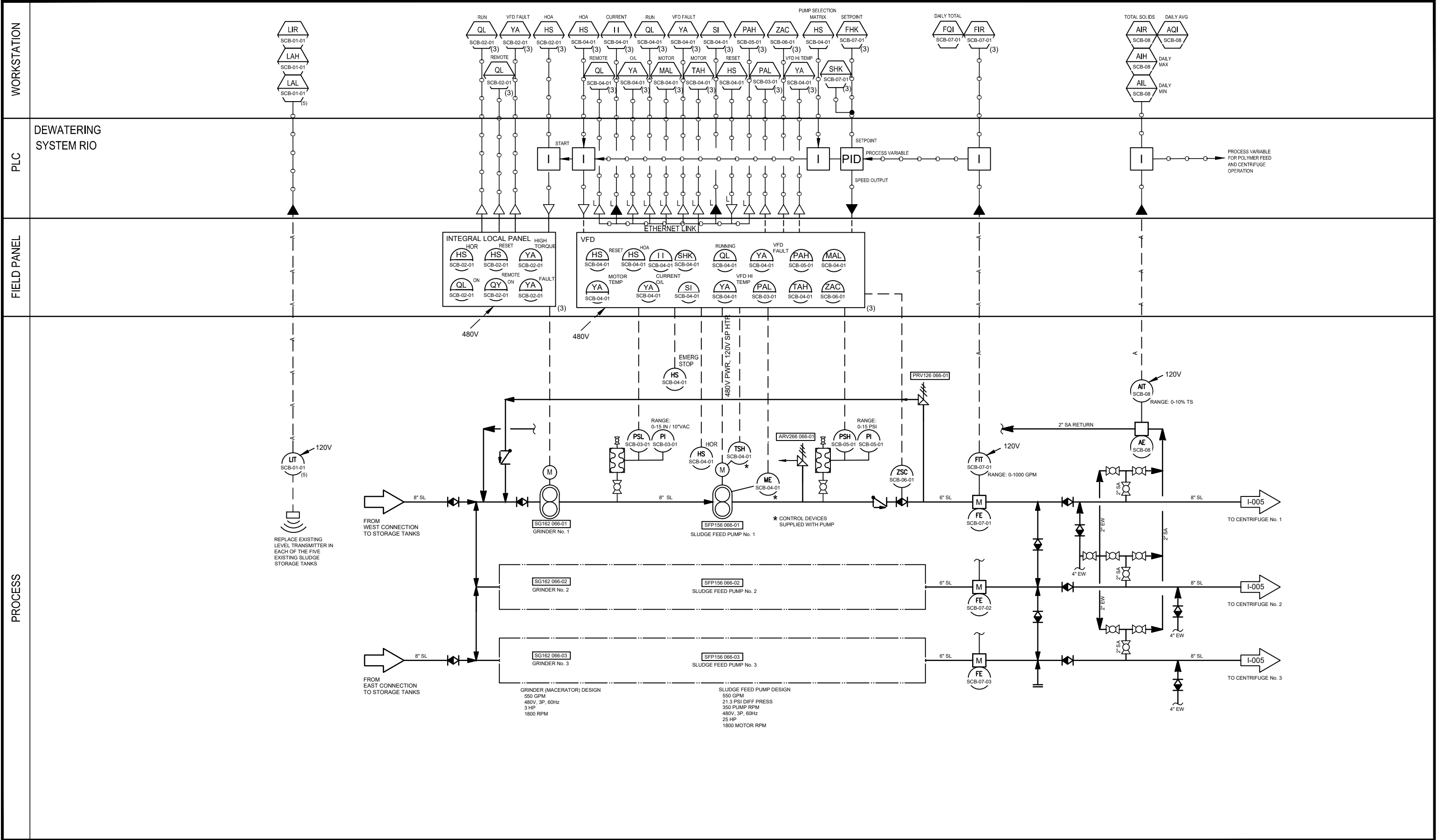


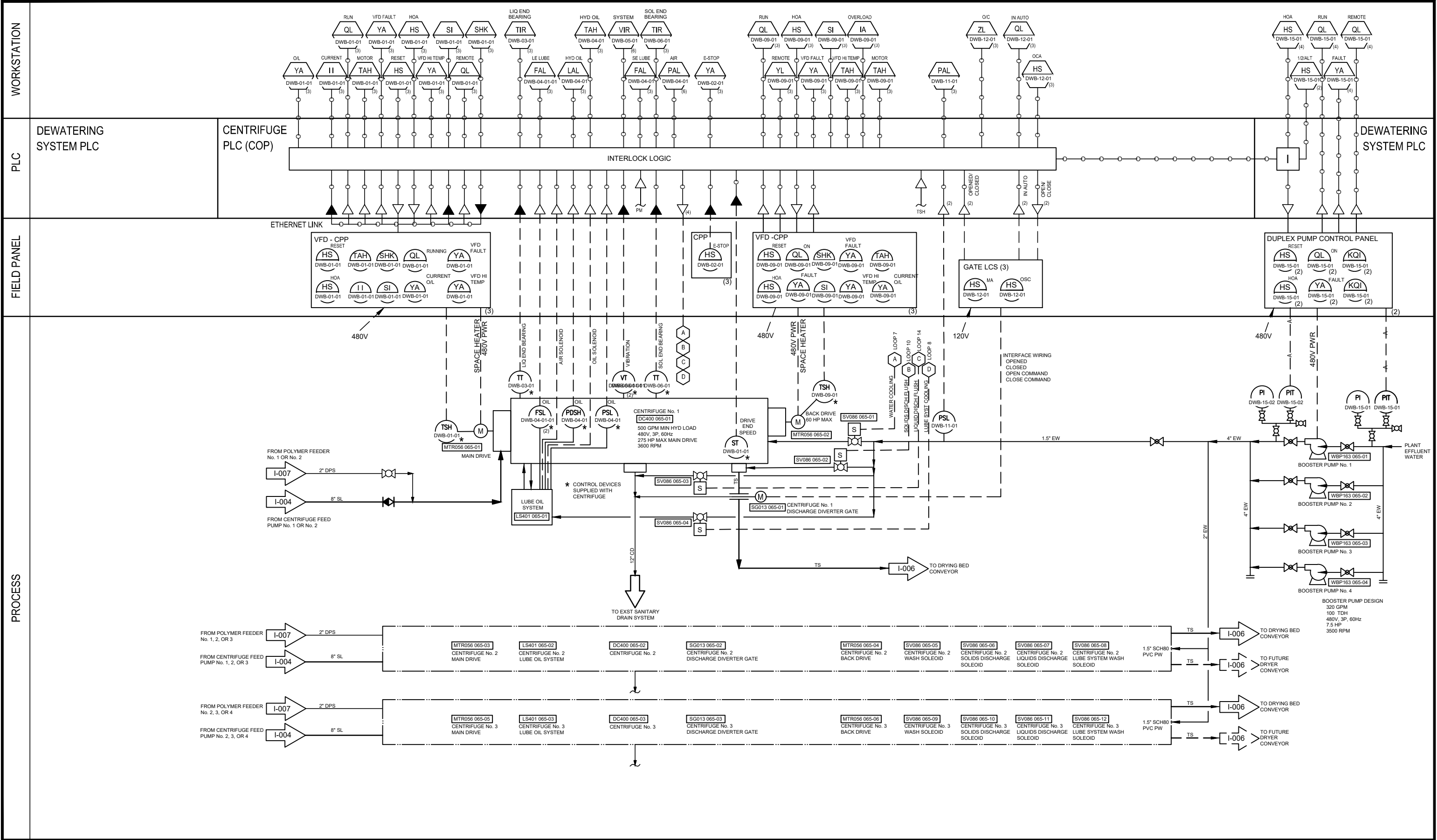
CITY OF TAMPA
WASTEWATER DEPARTMENT

HOWARD F. CURREN AWTP
MASTER PLAN IMPROVEMENTS -
DEWATERING FACILITY
REPLACEMENT

INSTRUMENTATION LEGEND AND SYMBOLS

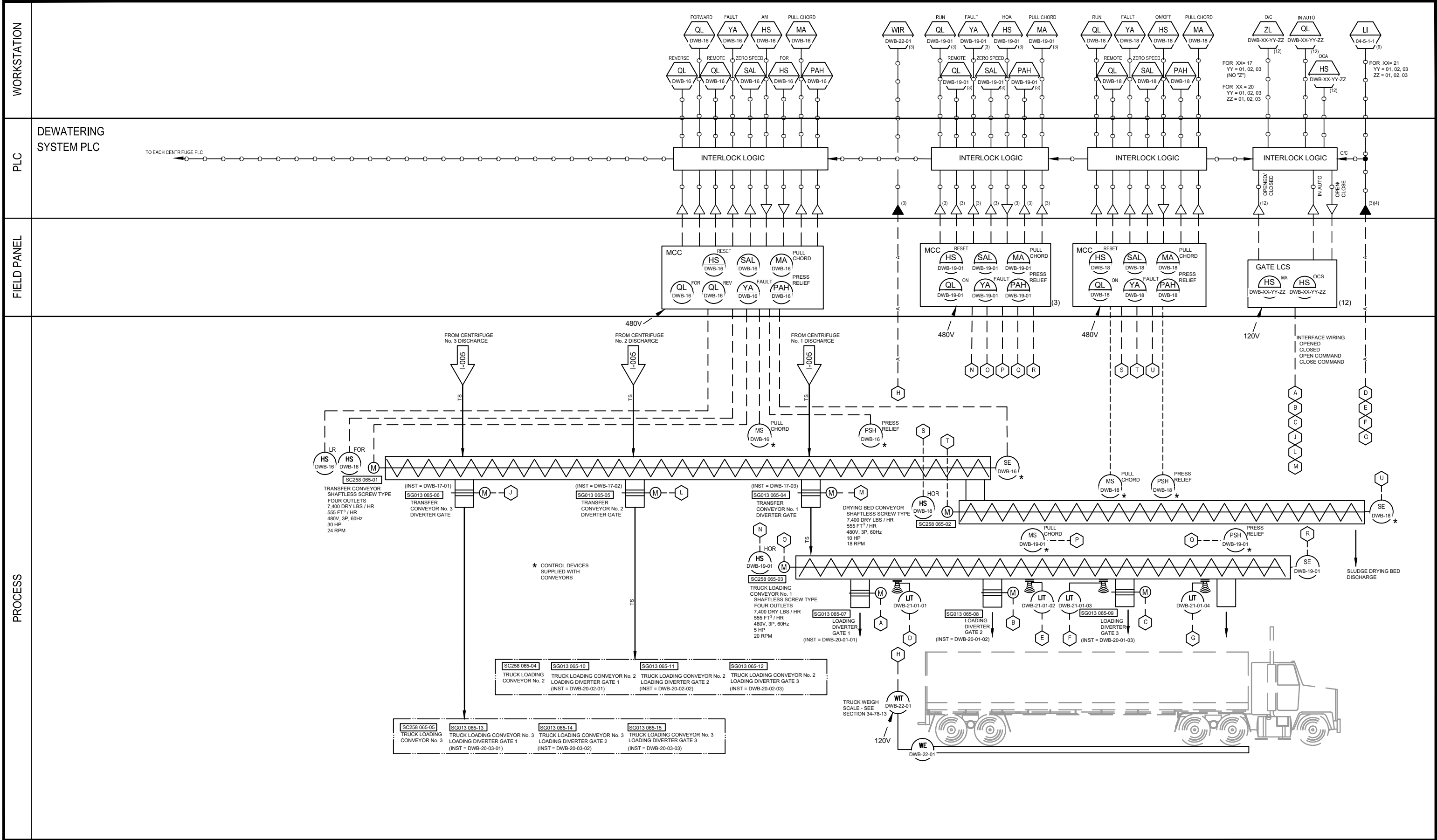
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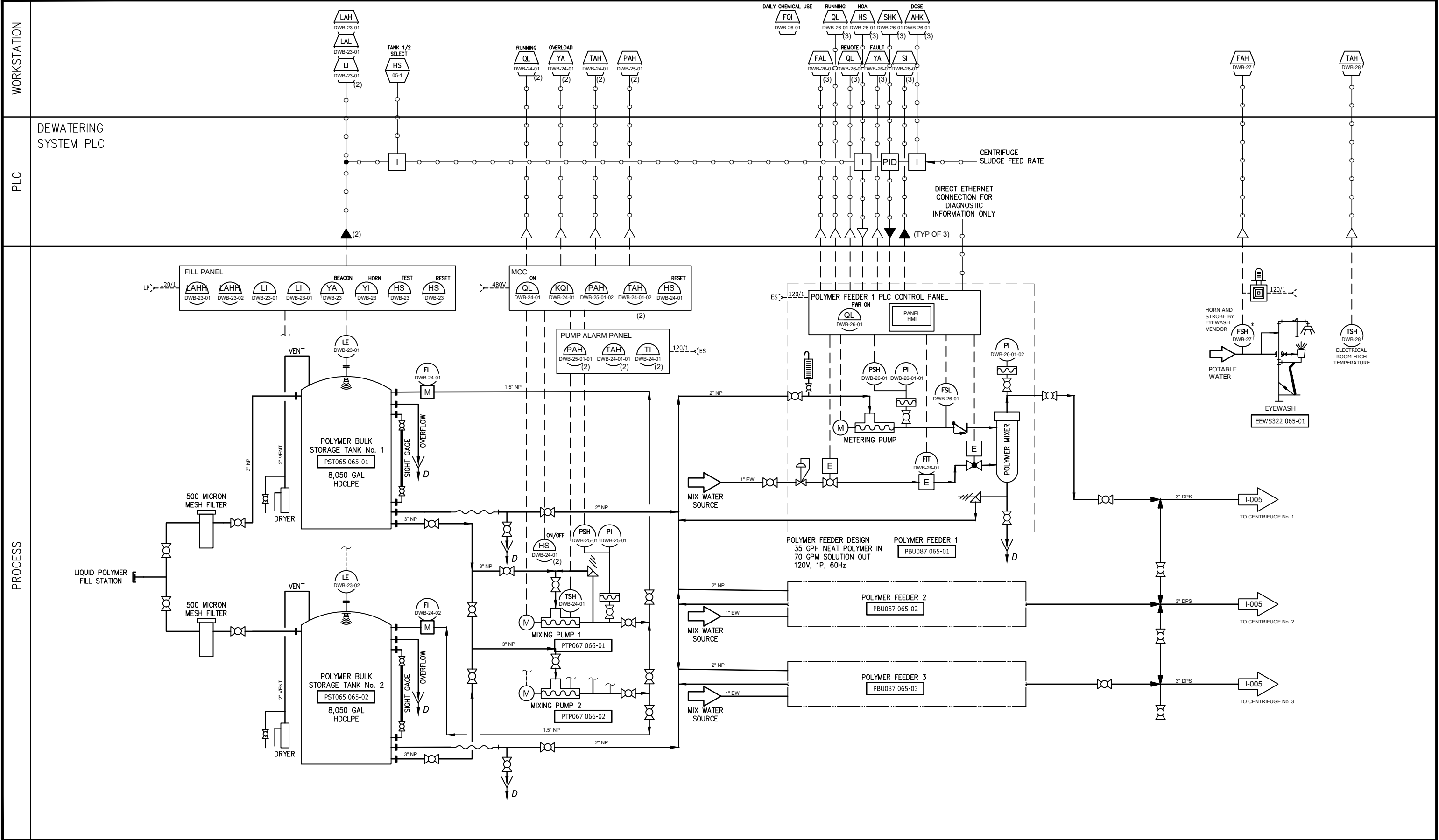




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Appendix D: Complete Listing of Two-Part Equipment Types

ID	Description
AB018	AIR BLOWER
ABEF302	AFTERBURNER EXHAUST FAN
ABF301	AFTERBURNACE FURNACE
ABS220	ATOMIC ABSORPTION UNIT
ABV012	AIR OPERATED BLOCK VALVE
AC020	AIR COMPRESSOR
ACD300	DAMPER
ACP100	PANEL, AERATION CONTROL
ACS102	ACTIVATED CARBON SYSTEM
AD021	AIR DRYER
ADM127	GENERAL ADMIN SUPPORT
ADS341	AIR DFFUSER SYSTEM
AFS193	AIR FILTRATION UNIT
AHU051	AIR CONDITIONING UNIT
ALG500	AIR LEAKS GENERAL
AOV124	AIR OPERATED VALVE
APFP068	ACTIVATED POLYMER FEED PUMP
APFT101	TANK, ACTIVATED POLYMER FEED
APST101	TANK, ACTIVATED POLYMER STORAGE TANK
AR147	AIR RECEIVER
ARF057	AUTO ROLL FILTER UNIT
ARPV330	AIR REGULATOR PILOT VALVE
ARV266	AIR RELEASE VALVE
AS139	AIR SEPERATOR
AS342	ASPIRATOR SILO
AUTO214	AUTO ANALYZER
AVV240	AIR/VACUUM VALVE
AW011	ADJUSTABLE WEIR
BAV144	BACKWASH AIR VALVE
BC279	BATCH COUNTER
BDV143	BACKWASH DRAIN VALVE
BE340	BUCKET ELEVATOR
BFV01	BUTTERFLY VALVE
BI222	BACTERIAL INCUBATOR

ID	Description
BIO200	BIO-FILTER
BLW	BLOWERS
BP263	BACKFLOW PREVENTERS
BS001	BAR SCREEN
BST099	BREWERY WASTE STORAGE TANK
BTM104	BRINE TANK MIXER
BTP111	BRINE TRANSFER PUMP
BWS062	STRAINER BACKWASH WATER PUMP
BWV131	BACKWASH WATER VALVE
CA073	CHLORINE ANALYZER
CA149	ANAEROBIC DIGESTION TANK COVER ASSY
CA209	ANALYZER
CAM	CAMERA
CB052	CIRCUIT BREAKER
CB236	OXYGEN PLANT COLD BOX
CC202	CONTROL CONSOLE
CCU063	AIR COOLED COMPRESSOR CONDENSOR UNIT
CDU219	CHLORINE DISINFECTION UNIT
CEF319	CIRCULATING EXHAUST FAN
CF037	SEDIMENTATION TANKS CHAINS AND FLIGHTS
CFP146	CHEMICAL FEED PUMP
CH070	CHLORINATOR
CH235	COMPUTER HARDWARE SOFTWARE
CL205	CONTROL LOOPS
CLUP265	CHLORINE UNLOADING PLATFORM
CMP112	CAUSTIC METERING PUMP
CRC103	CHEMICAL REACTION CHAMBER
CRP106	CELL RECYCLE PUMP
CS294	CYCLONE SEPERATOR
CS298	CYCLONIC SEPERATOR
CS444	COURIER SERVICES
CSN267	CHEMICAL SPRAY NOZZLES
CSP024	CHEMICAL CIRCULATING PUMP
CST098	CHEMICAL STORAGE TANK

ID	Description
CT287	COOLING TOWER
CV122	CHECK VALVES
CWP053	CHILLED WATER PUMP
CWP083	CONDENSOR WATER PUMP
CWP218	CLEAR WELL PUMP
DBP	DIESEL BYPASS PUMP
DBS194	DEEP BED SCRUBBER
DC304	DUST COLLECTOR
DCP254	PANEL, DECHLORINATION CONTROL
DCR332	DIESEL COOLANT RADIATOR
DF247	FLOW DEFLECTORS AND BAFFLES
DI206	DEIONIZED UNIT
DO076	DISSOLVED OXYGEN METER
DO223	DRYING OVEN
DP017	DEWATERING PUMP
DR228	DISTILLATION RACK
DSC090	DRIED SLUDGE CONVEYOR
DSC296	DRIED SLUDGE CRUSHER
DSG092	DRIED SLUDGE GRINDER
DSP085	DIGESTED SLUDGE PUMP
DSP245	DUCT SCRUBBER PUMP
DST256	DRIED SLUDGE PRODUCT STORAGE TANK (PELLETS)
DSW	DISCONNECT SWITCH
DT133	DRIP TRAPS
DU323	DEMISTER UNIT
EBB191	EMERGENCY BATTERY BANKS
EEWS322	EMERGENCY EYE WASH STATION
EF056	EXHAUST FAN
EF192	ELECTRICAL FACILITY
EG170	ENGINE GENERATOR
EJ071	CHLORINE EJECTORS
ELEV172	ELEVATOR
ELP240	PANEL, ELECTRICAL LIGHTING
EM280	ELECTRICAL MANHOLES

ID	Description
EP244	EQUIPMENT REPAIRS
ER238	EQUIPMENT ROUNDS
ERS152	EXHAUST RECOVERY SILENCER
ERV328	EXPLOSION RELIEF VALVE
ET138	EXPANSION TANK
EUS	EMISSION UNITS TITLE V AIR PERMIT
EV069	CHLORINE EVAPORATOR
EV250	SULPHUR DIOXIDE EVAPORATOR
EWP062	EFFLUENT WATER PUMP
EWS060	EFFLUENT WATER STRAINER
FAC127	FACILITY
FBM200	FILTER BASIN MEDIA
FBP217	FILTER BACKWASH PUMP
FC109	FLOW CONVERTOR
FCU314	FAN COIL COOLING UNIT
FCV101	FLOW CONTROL VALVE/ACTUATOR
FE242	FIRE EXTINGUISHERS
FEP216	FILTER EFFLUENT PUMP
FG185	FENCES AND GATES
FGC181	FACILITY GRASS CUTTING
FGST167	FUEL GAS SURGE TANK
FH312	FIRE HYDRANTS
FOP046	FUEL OIL PUMP
FOT282	FUEL OIL STORAGE TANK
FP177	FACILITY PAINTING
FPAT334	FAN POWERED AIR TERMINAL
FPS329	FIRE PROTECTION SYSTEM
FR208	FLOW RECORDERS
FTA128	FLAME ARRESTOR & TRAP ASSEMBLY
GAS288	GENERATOR AIR STARTER
GBX	GEARBOX
GC003	GRIT COLLECTOR
GC006	GRIT CONVEYER
GC225	GAS CHROMATICGRAPH

ID	Description
GCC150	SLUDGE GAS CONDENSATE COLLECTOR
GCP188	PANEL, GENERATOR CONTROL
GCT151	SLUDGE GAS CONDENSATE TANK
GD044	GAS DETECTOR SENSOR
GD072	CHLORINE GAS LEAK DETECTOR
GDT311	GAS DRAIN TRAPS
GMC019	GAS MIXING COMPRESSOR
GMP189	PANEL, GENERATOR MONITORING
GP007	GRIT PUMP
GS004	GRIT SEPARATOR
GSV325	GAS SYSTEM VALVES
GV120	GATE VALVE
GW005	GRIT WASHER
HC054	ELECTRIC HEATER COIL
HCU269	HURRICANE DAMAGE CLEAN UP
HE136	SLUDGE HEAT EXCHANGER
HEQ123	HEAVY EQUIPMENT
HP268	HURRICANE PREPAREDNESS
HPP313	HOT WATER FEED PUMP
HWP315	HOT WATER CIRCULATING PUMP
IC195	ICE MACHINES
ICAC142	INNERCOOLER AND AFTERCOOLER
IDF299	INDUCED DRAFT FAN
IH197	INTERCEPT HOPPER
INST200	INSTRUMENTATION
IRP020	INTERNAL RECYCLE PUMP
IS029	DISTRIBUTION & CONTROL ISOLATING SWITCH
IWP072	INDUSTRIAL PERMITTED WASTE DISCHARGE
JS196	JANITORIAL SERVICES
JWP023	JACKET WATER PUMP
KV047	KNIFE VALVE
LC030	LONGITUDINAL COLLECTOR DRIVE
LCC031	LONGITUDINAL AND CROSS COLLECTOR DRIVE
LCS249	PNEUMATIC LEVEL CONTROL SYSTEM

ID	Description
LCS250	ULTRANSONIC LIQUID LEVEL CONTROL SYSTEM
LIS180	LAWN IRRIGATION SYSTEM
LSO100	LIFT STATION OPERATION FACILTY
LST117	LOX STORAGE TANK
MA029	MECHANICAL AERATOR
MB229	METTLER BALANCER
MBS096	METHANOL BASKET STRAINER
MCC190	MOTOR CONTROL CENTERS
MCP159	PANEL, MAIN CONTROL
MDU420	PERMISSIBLE METHANE MONITOR
MET036	METER
MEV145	MODULATING EFFLUENT VALVE
MF224	MUFFLE FURNACE
MFP096	METHONAL FEED PUMP
MH009	HOIST
MIX028	MIXER
MIX029	MIXER--WET WELL MIXER
MLSS077	MIXED LIQUOR SUSPENDED SOLIDS METER
MOV125	MOTOR OPERATED VALVE
MP025	METERING PUMP
MPM075	MULTIPARAMETER METER
MS040	MACHINE SHOP EQUIPMENTS
MS132	MOISTURE SEPERATOR
MSP015	MAIN SEWAGE PUMP
MSP153	MIXED SLUDGE PUMP
MST100	METHONAL STORAGE TANK
MTP095	METHONAL TRANSFER PUMP
MTR056	MOTORS
MV118	MANUAL VALVES
NA059	NITRITE-NITRATE ANALYZER
NGP321	NATURAL GAS PIPING
NP331	NITRIFICATION PUMP
NPS286	NITROGEN PURGE SYSTEM
OC211	OIL COOLER

ID	Description
OCFM335	OPEN CHANNEL FLOW METER
OFH079	OIL FIRED HEATING UNIT
OP253	OIL PUMP
OPA043	OXYGEN PURITY ANALYZER
OS276	OIL SEPERATOR
OSM555	OUTSIDE SEWER MAINTENANCE
OZ027	OZONE GENERATOR
PA045	PHOSPHATE ANALYZER
PAM199	PORTABLE GAS MONITOR
PAT155	PNEUMATIC AIR TANK
PAU066	POLYMER ACTIVATION UNIT MIXER
PAV111	PURGE AIR VALVE
PBU087	POLYMER BLENDING UNIT
PBX345	TELEPHONE SYSTEM
PC338	PELLET COOLER
PCU113	PEPCON CELL UNIT
PDP480	PANEL, POWER DISTRIBUTION
PE121	POTS & EJECTORS
PE234	PORTABLE EQUIPMENT
PE307	PORTABLE EQUIPMENT
PF041	PARSHELL FLUME
PFP075	POLYMER FEED PUMPS
PFS308	PRODUCT FLOW SCALE
PH074	PH ANALYZER
PM261	PUG MILL
PRV126	PRESSURE RELIEF VALVES
PRV130	GAS PRESSURE REGULATING VALVE
PRV264	PRESSURE REDUCING VALVE
PRV333	PRESSURE REGULATING VALVE
PST065	POLYMER STORAGE TANK
PT137	PIPING AND TUBING
PTE244	PORTABLE TEST EQUIPMENT
PTP067	POLYMER TRANSFER PUMP
PU026	PEAKING UNIT 1 SOUTH WAUKESHA

ID	Description
PV119	PLUG VALVES
PW093	PARTS WASHER
PWBT210	PLANT WATER BREAK TANK
PWJP154	PLANT WATER JOCKEY PUMP
PWP022	PLANT WATER PUMP
RB293	RECYCLE BIN
RC014	RATE CONTROLLER
RC207	RATIO CONTROLLER
RCU114	PEPCON REMOTE UNIT
RDD260	ROTATING DRYER
REF050	ROOF EXHAUST FAN
REF231	REFRIGERATOR UNIT
RF049	RETURN FAN
RFS309	RECYCLE FLOW SCALE
RH271	REACTIVATION HEATER
ROAD186	ROADS
ROD080	OVER HEAD ROLLING DOOR
RP327	RETENTION POND
RR243	RAILROAD TRACK MAINTENANCE
RSCS285	RETURN SLUDGE CONTROL SYSTEM
RSP033	RETURN SLUDGE PUMP
RSP034	RAW SEWAGE PUMP
RTDT317	RECEIVER TANK DRAIN TIMERS
RTS337	FIRE TEMPERATURE SENSOR
RTU201	REMOTE TERMINAL UNIT
RU233	RADIO UNITS
RV292	ROTARY VALVE
SAS262	SECURITY ALARM SYSTEM
SAS343	STATION ALARM SYSTEM
SC002	SCREENING CONVEYER
SC258	SCREW CONVEYER
SC291	SETTLING CHAMBER
SCBA241	SELF CONTAINED BREATHING APPARATUS
SCMPIT-01	SCUM PIT FOR ANY PIT CONTAINING SCUM

ID	Description
SCN	SREEN SEWAGE
SCU246	SHOP CLEAN UP
SCWP326	SPENT COOLING WATER PUMP
SDAS289	SULPHUR DIOXIDE ADDER/SUBTRACTOR
SDB000	SECONDARY DRYING BEDS
SDF259	SLUDGE DRYING FURNACE
SDLD252	SULPHUR DIOXIDE LEAK DETECTOR
SEP320	SCUM EQUALIZATION PUMP
SF048	SUPPLY FAN
SFP084	SLUDGE FILTER PRESS
SFP156	SLUDGE FEED PUMP
SFU115	SILENCER FILTER UNIT
SG012	SLUICE GATE
SG013	SLIDE GATE
SG026	STANDBY GENERATOR
SG039	SWITCHGEAR
SG162	SLUDGE GRINDER
SGF168	SLUDGE GAS FILTER
SGFC089	GAS BOOSTER COMPRESSOR
SGST278	SCUM GATE SEQUENTIAL TIMER
SH055	ELECTRIC STEAM HUMIDIFIER
SHP105	SODIUM HYPOCHLORIDE PUMP
SL248	STREET LIGHTING
SLG270	STOP LOG GATES
SLM078	SLUDGE BLANKET LEVEL METER
SP008	SUMP PUMP
SP032	SAMPLE PUMP
SP255	SLUDGE PLOW
SP402	INDUSTRIAL SCIENTIFIC SAMPLING PUMP
SRP035	SLUDGE RECIRCULATION PUMP
SS042	SAMPLER STATION
SS276	SOFTSTART
SSB256	SLUDGE STORAGE BIN
SSP010	SAMPLE SUMP PUMP

ID	Description
ST171	SEDIMENT TRAP
STP016	SCUM TRANSFER PUMP
STP088	SLUDGE TRANSFER PUMP
STW174	SCUM TILTING WEIRS
SU251	SULFONATOR
SV086	SOLENOID VALVE EFFLUENT WATER PUMPS STAR
SV237	SWITCH VALVES
SV306	SLUDGE VIBRATOR
SWBP086	SEAL WATER BOOSTER PUMP
T038	TRANSFORMERS
T203	TRANSMITTERS
TCD081	THICKENER TANK COLLECTOR DRIVE
TD091	TRIP OFF DEVICE
TE116	TURBINE EXPANDER
TEF107	TOWER EXHAUST FAN
TG094	TIDE GATE
TI166	TEMPERATURE INDICATOR
TLC318	TRUCK LOADING CHUTE
TMX019	INDUSTRIAL SCIENTIFIC TMX CHARGERS
TOC058	TOTAL ORGANIC CARBON ANALYZER
TOX213	TOX ANALYZER
TP303	THERMOPILE
TRAN273	TRAINING
TRP281	TOWER RECYCLE PUMP
TRV283	THERMAL RELIEF VALVE
TS040	TRANSFER SWITCH
TS183	TREES AND SHRUBS
TSM161	TANK SKIMMER MECHANISM
TSP082	THICKENED SLUDGE PUMP
TSS011	TOTAL SUSPENDED SOLIDS ANALYZER
TWV123	THREE WAY VALVES
UH064	UNIT HEATER
UPS310	UNINTERRUPTIBLE POWER SUPPLY
UU215	ULTRAFILTRATION UNIT

ID	Description
UV059	UV MONITOR
VAP	VACUUM PUMP
VBA239	VACUUM BREAKING ASSEMBLY
VEH198	VEHICLES
VFD277	VARIABLE FREQUENCY DRIVES
VS295	VIBRATORY SCREEN
VS297	VENTURI SCRUBBER
VS339	VIBRATING SCREEN
WAS316	WASTE SLUDGE PUMP
WASH060	LABWARE G7783AE
WBP163	WATER BOOSTER PUMP
WBT101	WATER BREAK TANK
WC230	WATER COOLER
WCR	WASHING COMPACTOR
WCU052	WATER CHILLER UNIT
WEC284	WAUKESHA ENGINE CARBERATOR
WGB169	WASTE GAS BURNER
WH134	WATER HEATER/BOILER
WH232	WATER HEATER
WHFP135	WATER HEATER FEED PUMP
WI257	WEIGHT INDICATOR
WLC110	WATER LEVEL CONTROLLER
WOPP290	WASTE OIL PIT PUMP
WS227	WATER SOFTENER
WS305	WEIGHT SCALE
WS336	WEATHER STATION



Appendix E: Work Shop meeting notes

Hazen *Meeting Minutes*



October 5, 2021

Location: Howard F. Current AWTP and Microsoft Teams
Subject: SCADA Workshop No.1
HFC AWTP Master Plan Improvements Design-Build – SCADA Workshop 1
Attendees: See sign-in sheet

The objective of the SCADA Workshops is to setup standards for the Design Criteria for the HFC AWTP Master plan improvements design-build I&C elements for the various amendments. This first work shop was specifically for standards to use for P&IDs, Plant Network improvements, approach to PLC/HMI software development, and internet/site security protection.

DISCUSSION ITEMS:

A. P&ID Format – Review of sample from dewatering project

1. *Legend and Symbols – reference dewatering sheet I-001 – Instrumentation Legend and Symbols sheet (attached) in the dewatering facility project will be used throughout the various amendments of the design-build project.*
2. *Tagging System – reference dewatering sheet I-001 and Master Plan*
 - a. *Equipment tags – City uses CMMS System. Equipment tags are alpha numeric. Hazen to review and generate similar tags to be shown on P&IDs with a prefix of the building number based on the location of the equipment. Building numbers are 1 through 91 as listed on the attached HFC Building Numbers Map and last two pages of these notes.*

The equipment tag format is to follow City's asset list (City will send Hazen the asset list) and generally will be:

DDDDYY-XXX-ZZ where

DDD = first two letters are for the plant area followed by the equipment type (some but not all examples) listed below

P – pump (symbol on P&ID shows what type)

B – blower

M – motor (mixers, drives, etc)

C – conveyor

T – tank

V – valve

YYY = unit number

XXX = the building number

ZZ = device number for multiple devices

Example: Pump 2 equipment tag at the main pump station would be MSP002-010

- b. *P&ID Instrument tags* - Each building as a building number but some are also designated with a letter code. Building letter designations are listed along with the building numbers on the last two pages of these notes (some additional letter designations will be needed for buildings/areas that aren't already designated). Instrument tags on the P&IDs will use standard ISA format bubbles but the process area will utilize the building letter code. This was not done on the dewater project P&IDs so tags on those sheets will need to be updated. Loops within a building or area will then be numbered consecutively through the process flow path.

The instrument tag format will be:



AAA = ISA instrument designation (see table on I001)

DDD = building letter designation (see list on last two pages of notes)

YY = loop number

ZZ = device number for multiple devices

XX = sub-device number if needed

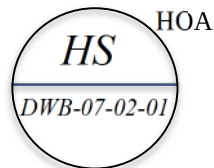
Example: Sludge Feed Pump 2 flow meter for the new dewatering structure would be:



The level transmitter on loading diverter gate 2 on truck loading conveyor 3 would be:



The HOA hand switch for the main drive on the VFD for centrifuge 2 would be:



- c. *PLC Tag Names* – Same as instrument tags including modifiers (upper right designation on bubbles on P&ID). The signal tags for the instruments tags listed above would be:

FIT-DWB-04-02

LIT-DWB-25-03-02

HS-DWB-07-02-01-Hand (for the hand position)

- d. *HMI Tag Names* – Same as the PLC tag name but with the prefix “HFC” before each tag name to differentiate these from lift station tags.
- e. Based on information sent from the City after the meeting, some unique ISA instrument designations used by the City include:

MN	Run Status (ON or OFF)
MF	Failure
LH/LL	Level High/Low
PH/PL	Pressure High/Low
SH/SL	Speed High/Low
TH/TL	Temperature High/Low
JF	Breaker Status
ZH	Valve/Gate Status

- 3. *P&ID format* – The format used for the dewatering project P&IDs will be used. Hazen proposed using Smart P&IDs. Benefits of using the smart P&IDs was presented at the meeting, including ability to create tag lists and ease of creating P&IDs from extensive previous work by Hazen done using Smart P&IDs (cannot convert these to standard AutoCAD). City will get back to RTP on whether to use Smart P&IDs.

B. *Fiber Optic Network*

1. *Existing network partitioning*

- o Attached Fiber Network Site Diagram view was presented.
- o The current fiber is laid out in “star” topology with separate lines to the color coded areas indicated in the diagram (attached to these notes). Fibers all run back to the network rack located in the main pump station (near PLC19). Fibers are generally run in a single conduit along the paths shown. If a critical conduit is damage (unlikely as all conduits are encased in concrete duct bank), any PLC downstream of that damage will no longer be accessible on the plant SCADA.
- o PLC1, PLC9, and PLC18 are considered weakest links as each of these are hubs that direct communications from several PLCs back to this Main Pump Station network switch. Loss of communication will impact the PLCs that are connected to PLC6.
- o City would like the fibers tested to determine if replacement is recommended. Fibers were installed over 30 years ago. RTP can perform a fiber survey following an approved test plan under an allowance.

2. *Network reliability improvements*

- a. *Paths and redundancy* – Extensive discussion on upgrades to network reliability was reviewed and discussed. Hazen recommended providing some redundant fiber loops at the outer edges (PLC17 to PLC7 as an example). PLC18 is the most critical to have

fiber redundancy as loss of this PLC would lose the plant's permit analyzers and flow-proportional chemical feeds and samplers and will shut down STAR. Fiber loops would require some reconfiguration programming to designate the "normal" communication path and a backup path if normal route is lost. Proposed revised paths will be presented in the basis of design report under this task.

- b. *Hardware and configuration* – Items used under dewatering project will be implemented for proposed designs. Bill of Materials will be provided under Workshop No.2 for City to comment on proposed hardware. B&B Electronics (<https://www.bb-elec.com/>) is the City's preferred hardware provider for network equipment.

C. *HMI Software Conversion*

1. *Current status of City upgrade to VTSCADA*

- a. The City is in the process of creating VTSCADA screens to replace the existing HSQ system. Work created thus far is monitoring only. Two separate HMI applications are running now, one for VTSCADA and the existing HSQ system.
- b. Currently, the plant processes, collection system pump stations, and stormwater stations have separate VTSCADA realms on one server. City wants to consider having separate VTSCADA applications for each of these areas.
- c. The following facilities have VTSCADA screens for monitoring only:
 - i. Junction Chamber #1
 - ii. Screen and Grit Buildings
 - iii. Primary Sedimentation Tanks
 - iv. Digestion
 - v. STAR
- d. The City desires to have monitoring and control capabilities at all the process buildings. RTP SCADA end product is to be based on using VTSCADA.

2. *Standard HMI displays – reference example screens*

- a. Sample screens were displayed. The City desires to have screens developed in VTSCADA similar to existing screens matching the layout of the P&IDs.
- b. An Overview of each facility is to be provided that is similar to existing overview displays. Control and monitoring of particular areas within a facility can then be accessed by clicking on that area on the overview to bring up the "P&ID" type display for that area. Individual equipment control would then be accessible by clicking on that equipment to bring up dashboard style pop up control screens similar to existing. During development of displays, City would like to review high-performance graphic displays for better grasp of overview for each process area.

D. *Integrator / Hazen / City Roles*

- 1. The roles of Hazen and Rocha are for RTP to determine in regards to the HMI development.

2. City staff will want oversight for the HMI screen development and PLC controls development. This can be done during individual review meetings per process prior to developing the controls and screen displays. In addition, select City staff will participate in actual development of graphics, tag creation, and programming to become more familiar with VTSCADA for future development and system troubleshooting.

E. HMI security – extent of exposure to internet

1. VPN connection for remote setup is desired for vendor access to HMI.
2. City staff currently uses hand held devices and laptops to connect via VPN through internet connection via wireless cellular means. Previous efforts to create wireless WIFI hotspots proved to be inadequate at this site.
3. All new controls on the fiber network are to be accessible through similar wireless internet connectivity through the existing VPN.

F. Site surveillance and entry

1. Existing plant camera system only includes 9 cameras. City wants to add cameras to be able to monitor all areas within the plant and replace the existing SONY system with a GNETEC system. Existing cameras will work with GNETEC.
2. Hazen to contact and meet with City site surveillance personal (Michael Kocsis from T&I) to plan updates and replacement of the existing base system along with number and location of cameras to be added to the system over time. Hazen to investigate the number of cameras that can be added to various levels of GNETEC.
3. Gates are all to have the card reader system used by the City now (GNETEC). City will want to eventually replace the perimeter fence to be at least 8 feet high.

G. Building access security

4. This item will be part of a future task for cyber locks on entry ways to buildings as well as motion detectors and other building security measures.

Key Decisions

1. Smart P&ID decision on whether or not to use (send email)
2. HMI Screens development – Hazen and Integrator staff working with select City staff
3. Fiber Survey – RTP to send proposed scope and testing plan
4. Building Access Security

Building Number and Building Abbreviations

001	RSP	RAW SEWAGE PUMPING STATION
002	JC1	JUNCTION CHAMBER NO 1
003		METER VAULT NO 1
004		LUBE STORAGE BUILDING
005	S\$G	SCREEN & GRIT NO 2 (east)
006	S\$G	JUNCTION CHAMBER NO 2
007	S\$G	METER VAULT NO 2
008	PRI	JUNCTION CHAMBER NO 3 AND BYPASS STRUCTURE
009	PRI	PRIMARY SEDIMENTATION TANKS NO 1 TO 4
010	MPS	MAIN PUMPING STATION
011	MPS	HPO REACTORS
012		FINAL SEDIMENTATION TANKS NO 1-12
013	IPS	INTERMEDIATE PUMPING STATION – NOT IN USE
014	FBC	DENITRIFICATION FILTERS NO 1 TO 20
015	FBC	FILTER BUILDING NO 1
016		POST AERATION CHLORINATION TANKS
017		JUNCTION CHAMBER NO 4
018	BTB	OUTFALL STRUCTURE
019		WAREHOUSE
020		PRIMARY SLUDGE PUMPING STATION NO 1
021	DC1	ANAEROBIC DIGESTER TANKS NO 1 TO 5
022	RS1	RETURN SLUDGE STATION NO 1
023	RS2	RETURN SLUDGE STATION NO 2
024	RS3	RETURN SLUDGE STATION NO 3
025	DAR	DIFFUSED AIR REACTORS (DARs)
026	STB	SLUDGE THICKENER TANKS
027		OLD SLUDGE DRYING BEDS
028	DC1	DIGESTER CONTROL BUILDING A
029	DC1	DIGESTER CONTROL BUILDING B
030	STB	SLUDGE TREATMENT BUILDING
031	SCB	FILTRATE PUMPING STATION
032	DWB	SLUDGE DEWATERING BUILDING (being built – used by existing dewatering now)
033	DC1	WASTE GAS BURNERS FOR DIGESTER NO 1 TO 5
035	HD1	SLUDGE HEAT DRYING (discontinued)
036	JC1	J.C.-1 ODOR CONTROL NO 1
037	JC1	J.C.- 1 ODOR CONTROL NO 2
039		TECH SERVICES BUILDING
040		OPERATION AND MAINTENANCE BUILDING
041	OXY	OXYGEN PLANTS AREA GENERATION
042	OXY	CHEMICAL HANDLING PLATFORM
043	MTH	CHEMICAL STORAGE TANKS
044	OSG	PLANT SWITCHGEAR BUILDING
045	FBC	FILTER ACCESS TUNNEL
046	FBC	DECHLORINATION FACILITY
047	FB2	FILTER BUILDING NO 2
048	FB2	DENITRIFICATION FILTERS NO 21 TO 26 AND NO 31 TO 36
049	RS4	JUNCTION CHAMBER NO 6

Building Number and Building Abbreviations (continued)

050	DAR	JUNCTION CHAMBER NO 5
051		CARPENTER SHOP
052		WELDING SHOP
053		CAR PORT AND REPAIR SHOP
054	SCB	SLUDGE STORAGE TANKS AND DRIED SLUDGE CONTROL BUILDING
055		SLUDGE DRYING BEDS (32)
056	ST2	BELT THICKENER BUILDING (not used except to monitor outfall structure)
057	DAR	NITRIFICATION PUMPING STATION
058	DAR	BLOWER BUILDING
059	SG2	SCREEN & GRIT NO 1 (west)
060	ADM	ADMINISTRATION BUILDING
061		FINAL SEDIMENTATION TANKS NO 13 TO 20
062	RS4	RETURN SLUDGE STATION NO 4
063	RS5	RETURN SLUDGE STATION NO 5
064		VEHICLE MAINTENANCE FACILITY
070		SCUM THICKENER FACILITY (DAFs) – NOT IN USE
071	MSP	MIXED SLUDGE PUMPING STATION
072	DCC	ANAEROBIC DIGESTION TANKS NO 6 AND 7
074	DCC	DIGESTER CONTROL BUILDING C
077	TEC	TECO PARTNERSHIP STATION (no longer in use)
078	SPF	STAND-BY POWER FACILITY
079	DCC	WASTE GAS BURNERS FOR DIGESTER NO 6 AND 7
080	GEN	NEW GENERATOR BUILDING AND FILTER ROOM
081	RSP	OLD GENERATORS BUILDING
082	PST	PRIMARY SEDIMENTATION TANKS NO 5 TO 8
083	PST	PRIMARY SLUDGE AND DEWATERING PUMPING STATION NO 2
085	RSP	SWITCHGEAR NO 60
086	STR	RECLAIMED WATER STATION (STAR)
087		WATER REUSE PILOT PLANT
089		FUEL STATION GAS & DIESEL
091		COLLECTIONS ADMINISTRATION BUILDING
NBN-1		SEPTAGE RECEIVING STATION
NBN-2		LEACHATE DISCHARGE STATION
	HD2	HEAT DRYING SILOS
	MTH	METHANOL STATION



620500-001, Change 03, Project 20-500 – HFCAWTF Master Plan

SCADA DESIGN CRITERIA – WORK SHOP 2 Meeting Notes

Date: October 21, 2021
Location: 2545 Guy N. Verger Blvd., Tampa, FL 33605 & Teams Virtual Meeting
Time: 01:30pm EST
Attendees: See Sign-in Sheet

DISCUSSION ITEMS:

A. Hardware & Commissioning– Review of sample from Dewatering & Grit projects

1. Hardware

- a. PLCs – In general, provide independent vendor PLC hardware for individual equipment systems (like presses, centrifuges, pump VFDs, etc) that interface with overall system PLCs provided by integrator. Signals to vendor supplied controls should be hard-wired for all control I/O. Supplemental information such as power usage or other diagnostics can be over Ethernet link from vendor supplied PLCs.
- b. Redundancy – Critical processes include the O2 Plant, Filter Building, and Standby Power systems. These need to have hot swappable CPUs on separate racks with shared RI/O. Redundant PLC CPUs should be CPU410's.

2. Control Panels Design Concept

- a. Components - Bill of Materials (BOM) supplied for the grit system vendor panel and main control panel were reviewed along with the proposed Andritz centrifuge vendor panel. The City did not have preferences for most components. If parts go bad, City just replaces with the standard at that time. Items that are City preferences include (Hazen to verify full model numbers for specific features noted):
 - 1) PLC CPU – GE Rx3i IC695CPE305 for single CPUs and IC695CPE410 for hot swappable CPUs.
 - 2) AI module – IC694ALG223, 16-channel single, 8 differential, isolated
 - 3) AO module – IC694ALG392, 8 channel
 - 4) DI module – IC694MDL241, 16 input, 24Vdc
 - 5) DO module – IC694MDL940, 16 relay outputs
 - 6) PLC power supply – IC695PSA140

- 7) PLC Prophecy v9.8 with latest SIMs – City maintains updates from GE through TMMI
 - 8) Maple Systems OIT HMI5070LB and HMI5100B – 7” display for vendor panels, 15” display for main process panels by integrator, all industrial grade for harsh environments (Class 1, Div 2). City noted to avoid L series as these do not hold up (they noted the San Carlos screen panels had these and they are already out).
 - 9) CAT6 cable to be shielded industrial cable within panels (rated 600V if exposed to 480V power). Keep wiring within panels separated for different voltages and purposes. New PLCs can drop directly onto plant fiber network (do not have to go through an RTU).
 - 10) APC UPS without Ethernet connections. Keep UPS simple with a bypass switch for easy change out. Use a relay on UPS output to provide alarm when panel is on UPS power.
- b. Spare Capacity & Spare Parts – provide 20% spare capacity space for I/O with 10% installed spare I/O. Provide spare parts for CPUs, I/O Cards, Network Switches, fuses, and other components that are critical for operation or prone to wearing out. City maintains an organized parts inventory.
 - c. Stations – Provide a local control station at each piece of equipment (HOR, L/R, FOR, Start/Stop, etc) for local control with a means to lockout the equipment (lockout stop pushbutton) when in the off position. All such controls to be NEMA4x industrial grade – Square D 9001k series.
 - d. HMI – provide PC workstations in each building to allow full control/monitoring of entire plant from each location. No need to replace existing workstation PCs
3. Vendor Vs Integrator – all programmers, whether vendor or integrator, are to follow the same standards for hardware and software.

B. Instrumentation Standards

1. Instruments

- a. Flow Meters – ABB magmeters. There have been some issues with these meters for submerged service. If this type of service is needed, special follow up with manufacturer is needed. Could go with Krohne if needed.
- b. Pressure Transmitters – Yokogawa EJA
- c. Pressure Switches – ITT 1193P
- d. Pressure gauges – Ashcroft 1279 or 1009 with diaphragm seal, oil filled
- e. Level Transmitters – Pulsar Ultra 4 using radar setting

- f. Level float switches – Anchor Scientific
- g. Limit/ Proximity Switches – Allen Bradley 802X, Nema4/13 lever type
- h. Valve Actuators – Bernard 480V for open/close service, Beck 480V for modulating service. Small valves can be 120V Bernard or Worchester.
- i. Analyzers
 - 1) On-line Nutrient – ChemScan
 - 2) DO – YSI IQ SensorNet controller and probes
 - 3) pH/ORP – YSI IQ SensorNet controller and probes
 - 4) Turbidity – Swan AMI Turbiwell 7027
 - 5) Residual Chlorine – Hydro Instruments RAH-210 (reagentless type). City is also trying out new system from Halogen DWSS
- j. Temperature Sensors – Dwyer “hockey puck”, 100 ohms, platinum
- k. Weigh Scales - Metler
- l. Power Monitors – manufacturer’s standard that comes with gear
- m. Surge Protection for field devices – “pipe bomb” style
- 4. Sunshield – locate instruments out of sun if possible, facing north as best practical, and provide covers for the screen displays (sunshields covering the whole unit tends to invite wasps).
- 5. Spares – provide spares for each type of instrument
- 6. Warranty – special warranty on instruments not necessary
- C. Testing – Factory testing not necessary (vendors should be doing loop checks as part of their QC program). Require site tests using City’s standard 48 hour test after City participates in witnessing checkout of every point from field to HMI display (alarms, status, controls, analog values, control logic, etc). Require check lists to be submitted for review before scheduling tests.
- D. Training and O&M Manuals – provide training for different types of personnel (operations vs maintenance). Provide hard copy and digital searchable pdf copies of O&M manuals to use with training.
- E. Review of Workshop No.1 meeting notes – see revised meeting notes. City to send Hazen asset list to best describe what City uses now for types of equipment designations.



620500-001, Change 03, Project 20-500 – HFCAWTF Master Plan

**SCADA DESIGN CRITERIA – WORK SHOP 3
Design Approach Confirmation
Meeting Notes**

Date: November 2nd, 2021
Location: 2545 Guy N. Verger Blvd., Tampa, FL 33605 & Teams Virtual Meeting
Time: 10:30am EST
Attendees: See Sign-in Sheet

DISCUSSION ITEMS:

- A. Review of Workshop No.1 & 2 Meeting Notes for any Open Items
- B. Additional & Open Items

1. Review of Control Panel Drawing – Sample - Dewatering Project

- a. Equipment tagging shown on revised P&IDs was not correct. Correct format is:

XXXXYY ZZZ-AAA-BB, where:

XXXXYY = two-part equipment type from attached list

ZZZ = building number

AAA = equipment number

BB = number used for multiple items with same equipment number

For the dewatering project, the two-part equipment types are

SG162 – grinders

SFP156 – sludge feed pumps

DC400 – dewatering centrifuges (new designation, not on list)

LS401 – lube system (new designation, not on list)

WBP163 – water booster pump

SV086 – solenoid valve

SC258 – cake conveyor

PBU087 – polymer blend unit

PST065 – polymer storage tank

PTP067 – polymer transfer pump

ELP240 – electrical

SG013 – slide gate

MTR056 – motor

For the dewatering project, the two building numbers that were newly assigned to the new dewatering structure and the new sludge feed pump structure are 065 and 066, respectively.

- b. The instrument tagging shown on revised P&IDs is correct
 - c. Fiber optic network recommendations will require a walk through of the facility. Hazen to send Karloren a service request to set up a date for Javier to host this walk through with Dan, Jacob, Cogburn, and Rocha. Suggested to be held next week.
2. Specifications – Data Sheets for Instruments & Control Panel Components. Submittal on control panel for dewatering project has not been made yet. Hazen will review this and resubmittal on centrifuge panel against the component list from Work Shop 2.
3. Open Items
- a. Dual OITs on Main Panel – dual OITs will be provided on all panels with PLCs (main process panels and individual equipment panels). Both OITs are to be able to do all functions (full redundancy). Referring to one as “setpoints” and the other as “monitoring” is just how the two will normally be used.
 - b. Fiber – all fiber cable is to be eventually be replaced as each project is completed. No need to perform a fiber test on existing fibers. Fiber will be replaced in the sequence of amendments, starting with line “0” for the oxygen system. The fiber cable designated as “city fiber” will not be replaced (cable installed by City IT). Camera feeds are on the same fiber cable as SCADA, just on separate fibers. Therefore, camera fiber will be all new as well.
 - c. Old fiber may be left in place as a pull string. If new fiber cable can’t be pulled through existing conduit, solution on how to replace existing fiber will need to be worked out at that time.
 - d. Switchover of fiber communications for the filter process will need to be on-line at all times (new and existing working at the same time). Switchover of fiber cables will need to be practiced and tested out on less critical processes before touching the filter process.
 - e. Fiber from PLC17 to PLC16 will need to be re-routed as structure that houses PLC16 will be removed.
 - f. HMI Screens – Projects will include some high performance screens following ISA101 Design Standard. Workshops for operators will be held per process as part of each project. Control descriptions will be developed prior to those workshops. High performance displays will be discussed at these workshops to decide design of such displays and if they are to be provided.

- g. HMI Screens – Graphics that City will develop will be decided at SCADA workshops for each process. For the dewatering project, City will be developing the HMI screens. These will be needed prior to startup which may not be until spring of 2023. Dewatering displays will help set standards for displays to provide for all processes.
- h. All network equipment is to be new to replace existing. New network equipment to be located in the existing operations area where it is now until (or if) a new operations building is constructed. Designers to note that PLC speed is 100mbs. Network equipment would be good to match this.
- i. A plan will be needed to save and store HSQ historical data from HSQ to the VTSCADA system. Hazen to investigate what this will require. City will see how far back data collection is stored (possibly to 1991) and how much memory is used. May not need to copy over data older than the year 2000.



Appendix F: Plant PLC Listing

HFC AWTP Programmable Controller Listing

PLC Number	Building Location
PLC1	Mixed Sludge Pump Station (071)
PLC2	New Engine Generator Building (080)
PLC3	Digester Control Building C (074)
PLC4	Screen and Grit Building No. 2, Building (005)
PLC5	Oxygen Plants Area (041)
PLC6	Primary Sludge Pumping Station No. 2 Control Building (083)
PLC7	Junction Box No. 1 (002)
PLC8	Sludge Storage Tanks Building (054)
PLC9	Sludge Treatment Building (030)
PLC10	Intermediate Pump Station (013)
PLC11	Sludge Pumping Station No. 1 (022)
PLC12	Sludge Pumping Station No. 2 (023)
PLC13	Sludge Pumping Station No. 3 (024)
PLC14	DAF Building (025)
PLC15	Sludge Dewatering Building (existing) (032)
PLC16	Digester Control Building No. 1 (028)
PLC17	Old Engine Generator Building (081)
PLC18	Filter Building No. 1 (015)
PLC19	Main Pump Station (010)
PLC33	Sludge Heat Drying Building (035)
PLC34	Sludge Heat Drying Building (035)
PLC35	Sludge Dewatering Building (existing) (032)
PLC36	Filter Building No. 1 (015)
PLC37	Screen and Grit Building No. 1 (059)
PLC38	Belt Thickener Building (056)
PLC39	Standby Power Building (078)
PLC40	Blower Building (058)
PLC41	Sludge Pumping Station No. 4 (062)
PLC42	Sludge Pumping Station No. 5 (063)
PLC43	Sludge Dewatering Building (new) (065)

Appendix G: Existing Surveillance Equipment

HFC AWTP Existing Surveillance Equipment

Device	Make / Model
Chlorine Room Camera	Sony Ipela Fixed SNC-CS11
JC-5 Railcar camera	Sony Ipela 360-degree SNC-RZ50N
Chlorine Railcar camera	Sony Ipela Fixed SNC-CS11
DAR Railcar camera	Sony Ipela 360-degree SNC-RZ50N
Sulfur Dioxide Room camera	Sony Ipela Fixed SNC-CS11
Outdoor Switchgear south camera	Sony Ipela Fixed SNC-DH260
Outdoor Switchgear north camera	Sony Ipela Fixed SNC-DH260
Maritime gate PTZ camera	Sony Ipela 360-degree SNC-ER580
Admin gate PTZ camera	Sony Ipela 360-degree SNC-ER580
Guy Verger gate PTZ camera	Sony Ipela 360-degree SNC-ER580
Railcar area transmit	5.7 GHz Cambium Canopy Subscriber Module
Railcar area transmit	5.7 GHz Cambium Canopy Access Point
Switchgear bldg transmit	5.7 GHz Cambium Canopy Subscriber Module
Admin gate transmit	5.7 GHz Cambium Canopy Subscriber Module
Admin Build transmit	5.7 GHz Cambium Canopy Access Point
Main Pump Station receive	5.7 GHz Cambium Canopy Access Point
Maritime intercom	Aiphone IE-SSR
Guy Verger gate intercom	Aiphone IE-SSR
Admin intercom	Aiphone IE-SSR

Hazen *PLC Hardware Evaluation*



Howard F. Curren AWTP - SCADA System

PLC Hardware Evaluation

City Project NO. 20-C-00001

Reliable Tampa Partners Project No. 20-500

Hazen and Sawyer Project No. 41077-013 Task 263

January 2024



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Hazen *PLC Hardware Evaluation*



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Appendix A: HFC AWTP PLC Network

Appendix B: Plant PLC Listing

Appendix C: PLC Evaluation Matrix



List of Acronyms

Abbreviation	Definition
AI	Analog Input
AO	Analog Output
CMMS	Computerized Maintenance Management System
CPU	Central Processing Unit
DI	Digital Input
DO	Digital Output
FOR	Forward Off Reverse
HFC AWTP	Howard F Curren Advanced Wastewater Treatment Plant
HMI	Human Machine Interface
HOA	Hand Off Auto
HSQ	HSQ Technology
I/O	Inputs and Outputs
ISA	Instrumentation Society of America
OIT	Operator Interface Terminal.
P&ID	Process and Instrumentation Diagram
PLC	Programmable Logic Controller
RTP	Reliable Tampa Partners
SCADA	Supervisory Control and Data Acquisition
UPS	Uninterruptible Power Supply
VFD	Variable Frequency Drive
VPN	Virtual Private Network



Glossary

Ethernet: A computer networking standard that defines a family of protocols, communication media, and device interfaces.

Human Machine Interface (HMI): A computer that runs graphical interface software for monitoring and supervisory control of a control system.

Local Area Network (LAN): Made up of the connection media, networking components, and nearby devices that communicate with each other.

Remote Telemetry Unit: A controller for local equipment that communicates with the master telemetry unit.

Uninterruptible Power Supply (UPS): A battery-backed source fed by the utility service during normal operation.

Variable Frequency Drive (VFD): A motor control that allows for continuous variations in running speed.

Virtual Private Network (VPN): A secure means of connecting a physically remote host to a local area network, typically via the Internet.

VTScada: The software application used at the HFC AWTP to read and write real-time data to and from controllers.

Win 411: A component of Win 911 that enables simple audio reporting of analog values.

Win 911: A software application used to annunciate and acknowledge alarms to/from remote users.

1. Introduction

The Howard F. Curren Advanced Water Treatment Plant (HFC AWTP) owns and operates a Supervisory Control and Data Acquisition (SCADA) system currently composed mainly of General Electric (GE) PACSystems Rx3i and 90-30 series programmable logic controllers (PLCs) at the field level. General Electric was acquired by Emerson in February, 2019. This document refers to GE equipment as GE to maintain familiarity with City's existing Standards.

As manufacturers continue to make advancements in product development, older versions of hardware advance towards "legacy" status. Products in legacy status are taken out of production and typically are no longer commercially available from the manufacturer. Replacement parts must then be sourced from third party sellers, increasing the risk for price inflation and long lead times. In that case, a set of spares must be stringently maintained to prevent unnecessary down time in the event of a failure. Additionally, manufacturers eventually stop developing and releasing software updates for legacy controllers, which may pose a security risk on network connected systems.

A majority of HFC AWTP's PLC hardware has entered the legacy phase. While PLC upgrades may be costly up front, updating the PLCs reduces the risk of unplanned downtime and enhances network security.

2. Objectives

A majority of the existing PLCs reached legacy status in 2018 (GE 90-30 and GE 90-70 series). PLC hardware for these products are no longer supported by the manufacturer. With the impending replacement of all PLC hardware as part of the on-going design-build project, the City has chosen to evaluate alternatives to develop a new standard for PLCs at the plant.

Existing PLCs at the plant were evaluated by the City. As a result, Hazen and Sawyer (Hazen) was asked to review the existing PLC hardware to determine equivalent alternatives. Four major PLC vendors were evaluated for consideration whenever existing PLC line ups are to be replaced as part of on-going process improvements at HFC AWTP. The different PLC models were compared including features and budgetary costs for full system replacement. The findings are summarized in this PLC Hardware Evaluation along with a recommendation for the standard PLC hardware platform going forward.

3. Assessment of Existing PLCs & Industry Review

3.1 Existing PLCs

An audit was performed by McKim & Creed & Hazen in June 2018 with assistance from HFC AWTP staff to quantify the number of existing PLCs installed at the facility. HFC AWTP staff provided information about the existing PLCs at these sites including existing network diagrams, model of PLC at each location, quantity, for review and use for this evaluation.

Existing network diagrams are provided in the Appendix 1 of this evaluation report. Table 3-1 summarizes some of the information from both audits.

Table 3-1: PLC Hardware Inventory

Equipment / Plant Location	Tag	Type	Life Cycle States
Building 31	PLC-01	GE PACSystems Rx3i	Active
Building 80	PLC-02	GE PACSystems Rx3i	Active
Building 80	PLC-17	GE PACSystems Rx3i	Active
Building 80	PLC-17 RIO	GE 90-30	Legacy
Building 74	PLC-03	GE PACSystems Rx3i	Active
Building 41	PLC-05	GE PACSystems Rx3i	Active
Building 41	PLC-05 RIO	GE 90-30	Legacy
Building 2	PLC-07	GE PACSystems Rx3i	Active
Building 2	PLC-44	GE 90-30	Legacy
Building 15	PLC-36	GE 90-30	Legacy
Building 15	PLC-5:1	GE 90-70	Legacy
Building 15	PLC-5:1 RIO	GE Genius	Legacy
Building 15	PLC-5:33	GE 90-70	Legacy
Building 15	PLC-5:33 RIO	GE Genius	Legacy
Building 15	PLC-49	GE PACSystems Rx3i	Active
Building 15	PLC-5:2	GE PACSystems Rx3i	Active
Building 15	PLC-5:34	GE PACSystems Rx3i	Active
Building 15	PLC-18	GE PACSystems Rx3i	Active
Building 15	PLC-18 RIO-1	GE 90-30	Legacy
SO2 Building	PLC-18 RIO-2	GE 90-30	Legacy
Building 35	PLC-5:3	GE 90-70	Legacy
Building 35	PLC-5:35	GE 90-70	Legacy
Building 35	PLC-34	GE 90-30	Legacy
Building 83	PLC-6	GE PACSystems Rx3i	Active
Building 54	PLC-8	GE PACSystems Rx3i	Active
Building 54	PLC-8 RIO	GE 90-30	Legacy
Building 30	PLC-9	GE PACSystems Rx3i	Active
Intermediate Pump Station	PLC-10	GE PACSystems Rx3i	Active
Building 4	PLC-41	GE PACSystems Rx3i	Active
Building 4	PLC-41 RIO	GE 90-30	Legacy
Building 21	PLC-11	GE PACSystems Rx3i	Active
Building 21	PLC-11 RIO	GE 90-30	Legacy
Building 23	PLC-12	GE PACSystems Rx3i	Active
Building 23	PLC-12 RIO	GE 90-30	Legacy
Building 24	PLC-13	GE PACSystems Rx3i	Active
Building 24	PLC-13 RIO	GE 90-30	Legacy
Building 70	PLC-14	GE PACSystems Rx3i	Active
Building 32	PLC-15	GE PACSystems Rx3i	Active
Building 32	PLC-15 RIO	GE 90-30	Legacy
Building 28	PLC-16	GE PACSystems Rx3i	Active
Building 28	PLC-16 RIO	GE 90-30	Legacy
Building 10	PLC-19	GE PACSystems Rx3i	Active

Building 10	PLC-19 RIO	GE 90-30	Legacy
Building 10	PLC-19 RIO-1	GE 90-30	Legacy
Building 10	PLC-19 RIO-2	GE 90-30	Legacy
Building 10	PLC-43	GE 90-30	Legacy
Building 5	PLC-4	GE PACSystems Rx3i	Active
Building 59	PLC-37	GE PACSystems Rx3i	Active
Building 59	PLC-37 RIO	GE 90-30	Legacy
Belt Thickener Building	PLC-38	GE PACSystems Rx3i	Active
Building 78	PLC-39	GE PACSystems Rx3i	Active
Building 30	PLC-33	GE PACSystems Rx3i	Active
Building 25	PLC-40	GE PACSystems Rx3i	Active
Building 25	PLC-40 RIO	GE 90-30	Legacy
Building 25	Alkalinity PLC	GE PACSystems Rx3i	Active
Building 25	Chemscan PLC	Automation Direct	Active
Building 63	PLC-42	GE PACSystems Rx3i	Active
Building 63	PLC-42 RIO	GE 90-30	Legacy
Building 40	PLC-99	GE PACSystems Rx3i	Active
Administration Building	ADM	GE PACSystems Rx3i	Active

3.2 Assessment Summary

Of the PLCs assessed, most are GE PACSystems Rx3i series or GE 90-30 series. GE 90-30 series, as well as the GE 90-70 series, reached legacy status as of 2018. The Rx3i I/O modules are still in production but may reach legacy status 7 years after an End of Life will be announced.

3.3 Industry Reviews

The GE product line used at the HFC AWTP is one of many PLC manufacturers in the United States and this product line has a significant share of the municipal wastewater industry. Two other prominent PLC manufacturers that have significant market share in the municipal wastewater include:

- **Rockwell (Allen Bradley - Logix series)**
- **Schneider (Modicon - M540/580)**

The products of these manufacturers, along with those of **GE (RX3i series)**, were selected as viable options to be considered for further evaluation in the PLC upgrades at the HFC AWTP as all three are widely known, utilized, and recognized in the municipal wastewater treatment market. The PLC evaluation performed here focused on PLC using a centralized architecture with a single processing unit and not Distributed Control Systems (DCS) such as Ovation, Foxboro and PlantPAX and thereby no reference to DCS is covered in this evaluation.

According to the CONTROL 2023 Readers' Choice Awards, as shown in the link here, (<https://www.controlglobal.com/home/article/21546009/2023-readers-choice-awards>) the survey rankings are presented below for these three product lines under the Water & Wastewater Processing category. GE and Rockwell products were consistently in the top 3 with Schneider being consistently listed in the top 10.

- Sequential Logic Control:
 - Rockwell - #1
 - Emerson – #3
 - Schneider - #4
- Supervisory Control & Data Acquisition:
 - Emerson – #1
 - Rockwell - #2
 - Schneider - #5
- Safety/Emergency Shutdown:
 - Schneider - #1
 - Emerson – #2
 - Rockwell - #3
- Continuous Regulatory Control:
 - Emerson – #1
 - Rockwell - #3
 - Schneider - #6
- Batch Process Automation:
 - Emerson – #1
 - Rockwell - #2
 - Schneider - #7
- Continuous sheet/web monitoring & control
 - Emerson – #1
 - Rockwell - #3
 - Schneider - #7

4. PLC Comparison

Selecting the best programmable logic controller for HFC AWTP application is crucial for achieving optimal performance and efficiency. Nineteen essential factors applicable to this facility, as described here below, were considered for PLC evaluation and comparison of the three selected manufacturers. Representatives for each of the three manufacturers were given the opportunity to provide input on each of these parameters. Their responses are included in an Appendix to this evaluation.

4.1 PLC Comparison Factors:

4.1.1 Functionality w/ Ethernet

An important function to consider for PLC evaluation is to review the impact on functionality of the PLC when more process equipment is added to the network to communicate with the PLC via any communication protocol. Evaluation is performed with Ethernet (widely used) considered as communication protocol between the various equipment such as VFDs, MCC, and vendor supplied control panels and if the functionality of the PLC would be stable.

4.1.2 Market Share

This shows the size of a company, a useful metric in illustrating a company's dominance and competitiveness in a given field. This factor is a key indicator of a company's competitiveness, it can also be an indicator of growth, success, and stability. It is considered for the evaluation as key indicator in view of reliability of the PLC and dependability.

4.1.3 PLC Features

This is a critical factor when looking at PLC selection criteria and its suitability for the intended application. Adequate number and type of I/O, High-speed processor, large memory capacity, multiple communication options, redundancy and safety features are key factors used for selection.

4.1.4 Support

Technical support and service from the manufacturer or vendor is an important evaluation criterion. Reliable customer support, training resources, and a warranty or maintenance program along with local distribution network is key to ensure product availability and quick response in keeping systems in service.

4.1.5 Programmers Availability

Local assistance and access to knowledge and resources are invaluable in ensuring PLC system's smooth operation, maintenance and troubleshooting. In any new construction effort, having multiple programmers employed by local integrators will help keep new construction on schedule and affordable.

4.1.6 Local Availability

PLC components that are readily available, including spare parts in the event of equipment failure to minimize downtime and ensure that the control system is rapidly operational again, supply chain and lead times are key factors in selecting a PLC lineup.

4.1.7 Longevity

Established and reputable PLC manufacturers have a proven track record of delivering quality products and reliable support. Based on customer reviews, industry feedback, and the company's history to gauge its product line implementation and commitment to customer satisfaction were used for ranking.

4.1.8 Compatibility with HMI (VT SCADA) software

HFC AWTP uses VT SCADA as HMI software. Evaluated PLCs were ranked based on the compatibility with VT SCADA. This is to ensure that the PLC can be easily incorporated into the existing control system and that the operator interface is simple.

4.1.9 Library Components

Common industrial protocol (CIP) represents a well-defined data representation, connection management, and messaging protocol that operates over an independent transport and physical layer. A PLC using a CIP is considered flexible for integrating to any HMI software like VT SCADA, it provides simplicity in Automatic Tag Creation, a huge benefit. PLCs are compared and ranking is based on availability and extent of library components in VT SCADA.

4.1.10 Cost

Another important issue for evaluation is cost of PLC, which includes the cost of hardware, software, overall value and also considering factors beyond the initial purchase cost. Additionally, factored in with the evaluation are the cost of communication modules, and accessories required for HFC AWTP applications.

4.1.11 Asset and Program management

PLC brands with a centralized tool capable of securing, managing, versioning, tracking and reporting automation-related asset information are evaluated within this category.

4.1.12 Functionality and Diagnostics feasibility

A wide variety of software and hardware are necessary to enhance the functionality and diagnostics of PLCs. Best choice is given to the PLC that has diagnostics and troubleshooting tools for swiftly identifying defects and difficulties. This can help with troubleshooting the various faults so as to reduce downtime.

4.1.13 Maintenance

PLC requires routine maintenance and upkeep, software upgrades and version controls are necessary to mitigate PLC downtime. PLCs with tools to manage software version, notification feature and license upgrades are ranked based on the available options.

4.1.14 Disaster Recovery

PLCs hard drives occasionally are inoperable for a variety of reasons, such as power quality event impacting the central processing unit (CPU). A PLC with ability to hold program within a USB or SD card or a monitoring tool to provide PLC health condition is an important factor used for evaluation.

4.1.15 PLC change management

PLCs program modifications are necessary when operational changes occur. The ability of the PLC to monitor and store the user actions is helpful in change management. PLC evaluation is based on the best tools available within the PLC to monitor user actions.

4.1.16 SCADA Software version control

A PLC monitoring the HMI and ease of auditing for program management is a useful feature. PLCs with a cyber security plan are ranked top in this category.

4.1.17 PLC Size

Choosing a PLC supplier who offers a diverse choice of PLCs will benefit as each process within the HFC AWTP requires various number of monitoring and control I/O. Availability of wide range of size selection within each PLC supplier is considered for evaluation.

4.1.18 PLC Security and Recovery

HFC AWTP safety is a critical consideration. PLC suppliers that offer integrated safety features or compatibility with safety modules are recommended. These features include safety inputs, relay outputs, and the ability to implement safety functions according to relevant safety standards. Compliance with safety requirements adds a layer of protection to the HFC AWTP and is an important factor for evaluation.

4.1.19 Ease of Integration with equipment

PLCs with predeveloped custom function blocks between instruments and PLC CPUs, VFDs and MCCs are crucial for ease of integration. Rankings are based on ease of integration with major equipment used at HFC AWTP.

4.2 PLC Evaluation Matrix:

The three PLC suppliers, GE (RX3i), Rockwell (Logix series), and Schneider (M540/M580) are all reliable PLCs, and within each of the evaluation factors, no one supplier was always top ranked rendering a final recommendation challenging. Therefore, matrix decision analysis using weighted factors was used. Each product line was first ranked relative to the other products for each parameter. A 3 was given if the product lineup was considered the best, a 2 if good, and a 1 if adequate. Then a weight factor was applied to each parameter, a five was the most important down to a 1 if of least importance. Rankings were assigned based on the review of the PLCs representative responses (provided in the Appendix) as well as further research when needed. Weight factors were assigned based on Hazen's perception of what would be most important to HFC AWTP staff. A summation of each of the rankings times the respective weight factor was made. The PLC supplier with the highest overall number was then determined to be the best choice based on Hazen's evaluation.

Table 4-1 summarizes the evaluation matrix. The responses to the vendor questionnaire used to assist in the rankings is provided in Appendix 2 of this evaluation report.

Table 4-1: PLC Evaluation Matrix

Number	Evaluation Criteria	Weighted Factor (*)	Emerson Rank (+)	Rockwell Rank (+)	Schneider Rank (+)
1	Impact on functionality as more Ethernet is added	4	3	2	1
2	Market share	4	1	3	1
3	Useful features provided by one type of PLC vs another	3	1	3	2
4	Level of support from PLC hardware/software suppliers	5	2	3	2
5	Availability of programmers experienced with each brand of PLC	5	1	3	1
6	Local availability of components	4	1	3	1
7	Longevity of Rx3i product line after purchase by Emerson vs other products' estimated longevity	4	2	2	2
8	Up to date drive to communicate with VTSCADA	4	1	3	2
9	Availability and extent of library components in VTSCADA	5	1	3	2
10	Cost	1	3	1	2
11	Available support software for asset and program management	2	2	2	2

12	Additional software or hardware offerings to enhance the functionality and diagnostics of the controllers, including but not necessarily limited to, I/O offerings, third-party card support (i.e. Prosoft), diagnostic software, controller fault tables, etc	2	2	3	3
13	Ability to provide daily uploads from PLCs to check latest version of the current PLC program	2	2	2	2
14	Ease of disaster recovery (backup files for latest programming)	3	2	2	2
15	Extent of monitoring of user actions (PLC changes by rung - change management)	4	2	2	2
16	Extent of monitoring of VTS changes (MDT autosave as an example vs what comes with PLC) vs VTS built in version control	4	2	2	2
17	Standards for models from each manufacturer for various capacity of PLC	2	3	2	2
18	Offline backup for ransomware protection and procedures for recovery in even of an attack	5	2	2	2
19	Ease of integration to other systems (predeveloped custom function blocks between instruments and PLC CPUs)	4	2	3	2
	Sum of Ranking		35	46	35
	Sum of Ranking x Weight Factor		116	169	119

(*) - Weighted Factor range is 1 to 5 with 5 considered as most important factor.

(+) – Rank range is 1 to 3 with 3 considered as top rank.

4.3 PLC standardization recommendations

The following major equipment within the facility and its communication medium with the PLC is discussed. Recommendations are presented here based on previous discussions (SCADA workshops, March 2022) and design review meetings held with the City.

Communication protocols listed here have been updated based on the review comments from the City and intentions to use Rockwell PLC. The protocols are in the order of priority and also based on the availability of from the equipment supplier. These communication protocols shall be implemented on all future projects within this facility.

- a. General – Ethernet/ IP, PROFINET, MODBUS TCP/ IP, PROFIBUS DP/PA (depending on number of devices on the network), Modbus RTU, HART, Traditional I/O (DI, DO, AI & AO).
- b. Instruments – Ethernet/ IP, PROFINET, Modbus TCP/IP, ProfiBUS DP/PA, Hart, Traditional I/O.
- c. VFDs – Traditional I/O for Critical signals and control and for status signals use Ethernet/ IP, PROFINET, Modbus TCP/IP
- d. Power Monitoring – Ethernet/ IP, PROFINET, Modbus TCP/IP
- e. Digital Communication protocols – Ethernet/ IP, PROFINET, Modbus TCP/IP

4.4 PLC Manufacturer Comparison

The following section compares the relative advantages and disadvantages of each manufacturer considered in this evaluation.

4.4.1 Allen-Bradley

Advantages

Allen-Bradley is one of the top two manufacturers of PLC equipment in the Southeast market. Their products are widely used in water and wastewater facilities and are typically familiar to most maintenance personnel. The PLCs have the capacity to operate in ladder logic, structured text, and functional block diagram. Their software also abides by IEC 61131-3 standards, the standard most commonly used when looking at PLC software. Their products were ranked second in reader satisfaction of the four manufacturers considered (as listed in paragraph 5.1)

Disadvantages

While A-B equipment is well known for its powerful processing systems, lack of coordination between hardware, software, firmware and proper programming can sometimes result in a “buggy” feel.

4.4.2 GE / Emerson

Advantages

Hardware in the GE digital family, now manufactured by Emerson, has arguably the third largest market share in the Southeast among PLC manufacturers. Their products are generally good, were ranked highest of the four in reader satisfaction (as listed in paragraph 5.1), and are already in use at the HFC AWTP.

Disadvantages

General Electric Corporate has recently been experiencing well-publicized financial trouble, as indicated by the digital hardware line being sold to Emerson. With the future of the company unclear, uncertainty about the longevity of their products becomes a big question.

4.4.3 Schneider

Advantages

Schneider is one of the top two manufacturers of PLC equipment in the Southeast market. Their products are generally regarded as very capable regarding processing power and have the capacity to operate extremely well in function block. Their software also abides by IEC 61131-3 standards, the standard most commonly used when looking at PLC software. This also ensures the software can facilitate some cross-platform portability. Their products are well known for being easier to configure and program without issue than their competitors.

Disadvantages

While Schneider's equipment is renowned for stability, this fact inherently does not lend itself to superior flexibility. Ladder logic capabilities in Schneider PLCs are significantly lacking compared to competitors.

4.5 PLC Manufacturer Recommendation

Based on the outcome of the decision matrix and bolstered by both the highest market share and wide acceptance in the wastewater market, Allen-Bradley products are the recommended PLC manufacturer to utilized in PLC replacement projects at the HFC AWTP facility. The Allen-Bradley product line is recommended to become the new standard in PLCs for this facility.

5. Hardware Options

5.1 Allen-Bradley Hardware

The three models of PLCs manufactured by A-B considered for this project are ControlLogix, CompactLogix, and MicroLogix. The ControlLogix is comparable to the GE/Emerson Rx3i, the CompactLogix series has options that are comparable to the GE 90-30, and the MicroLogix is also comparable to the GE 90-30. The MicroLogix controllers are suitable for smaller, less critical processes and generally not recommended for large wastewater treatment facilities. The CompactLogix controllers would be best used for larger pump stations and less critical processes in the plant. The ControlLogix is the more appropriate replacement for GE/Emerson Rx3i PLCs, especially for RIO applications, and is well suited for use in a large wastewater treatment facility.

Table 6-1 compares the CompactLogix and ControlLogix brands. Although either product is generally adequate for most wastewater treatment needs, the ControlLogix is the more powerful option and, between the two, is the product line best suited for more complicated applications.

Table 6-1: Rockwell Hardware

Type	CompactLogix	ControlLogix	Analysis
Analog scaling and alarming on I/O module	No	Yes	Not a major concern because of the ability to do scaling and alarm in programming
Number of local I/O modules	Less	More	Either is more than adequate for most water/wastewater applications
Scan time and processing power	Slower/Less	Faster/More	Either is more than adequate for most water/wastewater applications
Module removal and insertion under power (RIUP)	No	Yes	Preferred if the process cannot be momentarily interrupted
Accuracy of analog I/O modules	12 to 16 bit	15 to 24 bit	Either is more than adequate for most water/wastewater applications
Relative Cost	Approximately half the ControlLogix price	----	Budget dependent
Memory	Less	Significantly more	Either is more than adequate for most water/wastewater applications
Controller Tasks/Programs	3 to 32 tasks and 100 programs/task	32 tasks and 100 to 1000 programs/task	Process dependent, but typically either are adequate for most

			water/wastewater applications
Ethernet Network Connections	256 (model dependent)	500	Not a major concern with careful planning
Native Communication Protocol Support	Ethernet/IP, DeviceNet, USB Client	Ethernet/IP, ControlNet, DH+, RIO, SynchLink, DeviceNet, Foundation Fieldbus, USB Client	Application dependent, but Ethernet/IP is adequate for most applications
Local I/O Modules	AC/DC in/out, relay out, current/voltage in/out combo, RTD/thermocouple in, counter, serial, ASCII, DPI, DSI, third party modules	(All provided in CompactLogix), flowmeter, hart, motion; more choices	Either is more than adequate for most water/wastewater applications; specialty modules are rarely used
Chassis/Rack Requirement	Modular w/o rack, specific module placement requirements, placeholder available	Rack/chassis-based, no module placement requirements	Rack and preplanning are preferred to allow for easy module additions
Footprint	Approximately half of ControlLogix	----	Size of footprint directly proportional to cost; larger footprints may be problematic

5.2 Network Considerations for Allen-Bradley Hardware

The existing GE PLCs communicate on an Ethernet I/P network. Ethernet/IP is a native protocol for most A-B PLC hardware. However, adding devices will create higher demands on the controller and network. Configuration tools like Integrated Architecture Builder should be used to size the automation system based on lab tested characterization. This would allow optimum performance for future flexibility.

6. PLC Summary

6.1 PLC Proposed Models

Following is a summary of potential replacement models for equivalent Rockwell PLC models compared to the existing GE product. The goal of this recommendation is to indicate the reduction of the number of PLC controllers on the site using redundancy and remote IO racks. This table is preliminary and not a definite design.

Table 6-1: Recommended PLC Updates

Tag	Existing GE	Allen-Bradley
PLC-01	GE PACSystems Rx3i	ControlLogix
PLC-02	GE PACSystems Rx3i	ControlLogix
PLC-17	GE PACSystems Rx3i	ControlLogix
PLC-17 RIO	GE 90-30	R-IO
PLC-03	GE PACSystems Rx3i	ControlLogix
PLC-05	GE PACSystems Rx3i	ControlLogix

Hazen *PLC Hardware Evaluation*

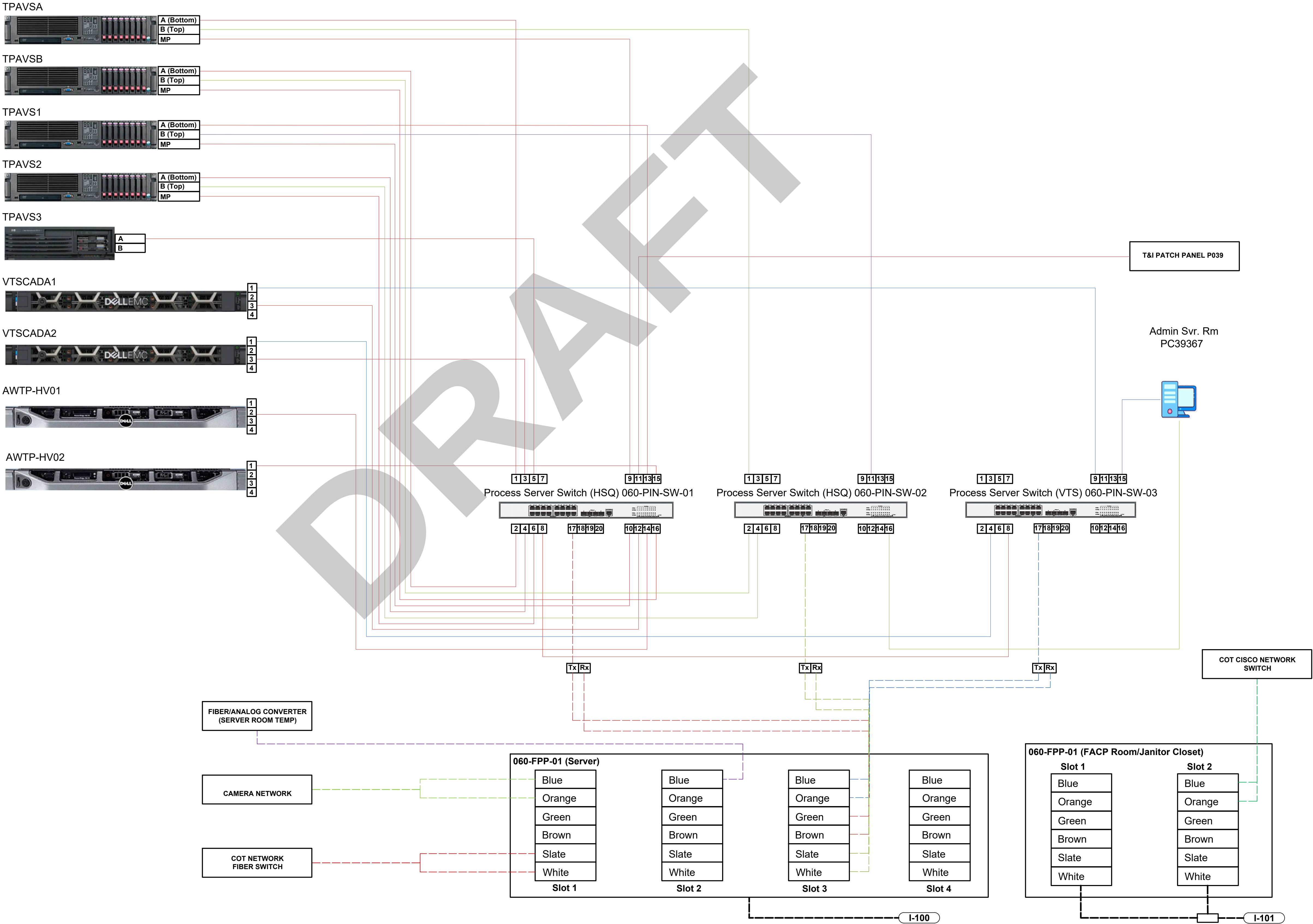


PLC-05 RIO	GE 90-30	ControlLogix
PLC-07	GE PACSystems Rx3i	ControlLogix
PLC-44	GE 90-30	R-IO
PLC-36	GE 90-30	CompactLogix
PLC-5:1	GE 90-70	CompactLogix
PLC-5:1 RIO	GE Genius	R-IO
PLC-5:33	GE 90-70	CompactLogix
PLC-5:33 RIO	GE Genius	R-IO
PLC-49	GE PACSystems Rx3i	ControlLogix
PLC-5:2	GE PACSystems Rx3i	ControlLogix
PLC-5:34	GE PACSystems Rx3i	ControlLogix
PLC-18	GE PACSystems Rx3i	ControlLogix
PLC-18 RIO-1	GE 90-30	R-IO
PLC-18 RIO-2	GE 90-30	R-IO
PLC-5:3	GE 90-70	CompactLogix
PLC-5:35	GE 90-70	CompactLogix
PLC-34	GE 90-30	CompactLogix
PLC-6	GE PACSystems Rx3i	ControlLogix
PLC-8	GE PACSystems Rx3i	ControlLogix
PLC-8 RIO	GE 90-30	R-IO
PLC-9	GE PACSystems Rx3i	ControlLogix
PLC-10	GE PACSystems Rx3i	ControlLogix
PLC-41	GE PACSystems Rx3i	ControlLogix
PLC-41 RIO	GE 90-30	R-IO
PLC-11	GE PACSystems Rx3i	ControlLogix
PLC-11 RIO	GE 90-30	R-IO
PLC-12	GE PACSystems Rx3i	ControlLogix
PLC-12 RIO	GE 90-30	R-IO
PLC-13	GE PACSystems Rx3i	ControlLogix
PLC-13 RIO	GE 90-30	R-IO
PLC-14	GE PACSystems Rx3i	ControlLogix
PLC-15	GE PACSystems Rx3i	ControlLogix
PLC-15 RIO	GE 90-30	R-IO
PLC-16	GE PACSystems Rx3i	ControlLogix
PLC-16 RIO	GE 90-30	R-IO
PLC-19	GE PACSystems Rx3i	ControlLogix
PLC-19 RIO	GE 90-30	R-IO
PLC-19 RIO-1	GE 90-30	R-IO
PLC-19 RIO-2	GE 90-30	R-IO
PLC-43	GE 90-30	CompactLogix
PLC-4	GE PACSystems Rx3i	ControlLogix
PLC-37	GE PACSystems Rx3i	ControlLogix
PLC-37 RIO	GE 90-30	R-IO
PLC-38	GE PACSystems Rx3i	ControlLogix
PLC-39	GE PACSystems Rx3i	ControlLogix
PLC-33	GE PACSystems Rx3i	ControlLogix
PLC-40	GE PACSystems Rx3i	ControlLogix
PLC-40 RIO	GE 90-30	R-IO
Alkalinity PLC	GE PACSystems Rx3i	ControlLogix
Chemscan PLC	Automation Direct	N/A
PLC-42	GE PACSystems Rx3i	ControlLogix
PLC-42 RIO	GE 90-30	R-IO
PLC-99	GE PACSystems Rx3i	ControlLogix
ADM	GE PACSystems Rx3i	ControlLogix



Appendix A: HFC AWTP PLC Network

060 - Administration Building



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				DESIGNED BY:	T. THOMAS
				DRAWN BY:	J. THOMAS
				CHECKED BY:	G. WALKER
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WASTEWATER DEPARTMENT

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MASTER PLAN IMPROVEMENTS
MAIN PUMP STATION AND HPO
REACTOR IMPROVEMENTS

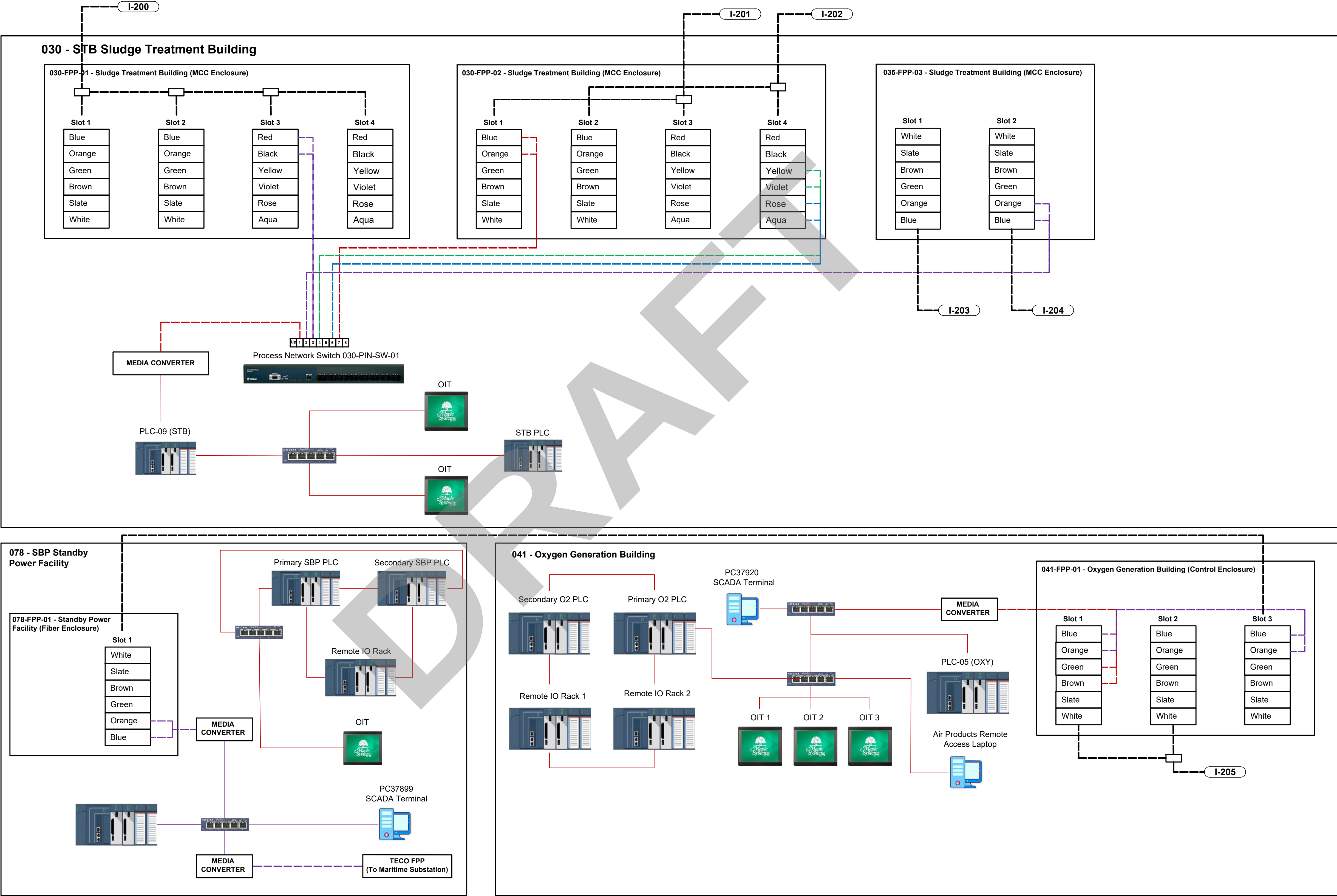
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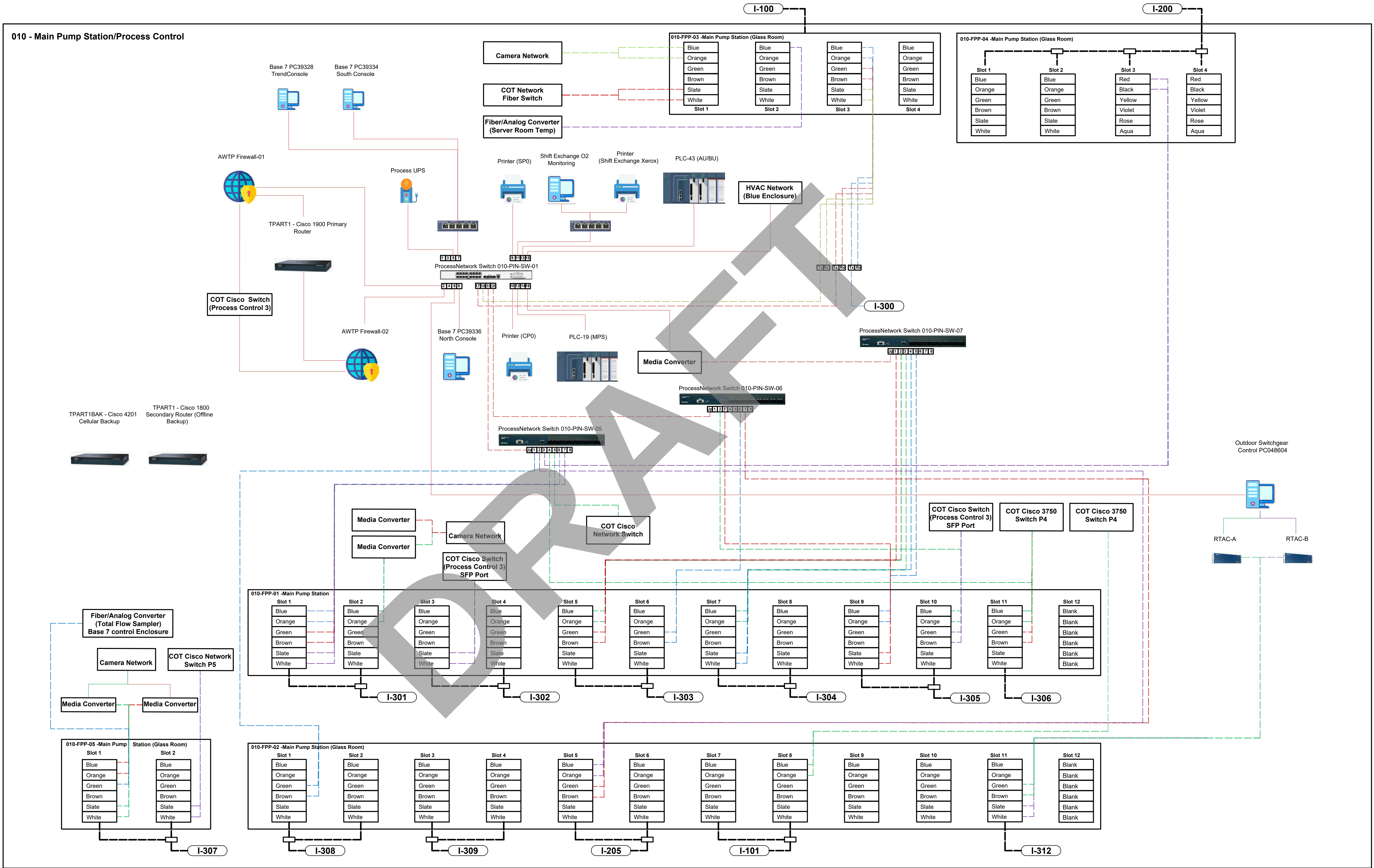
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010 - Main Pump Station/Process Control



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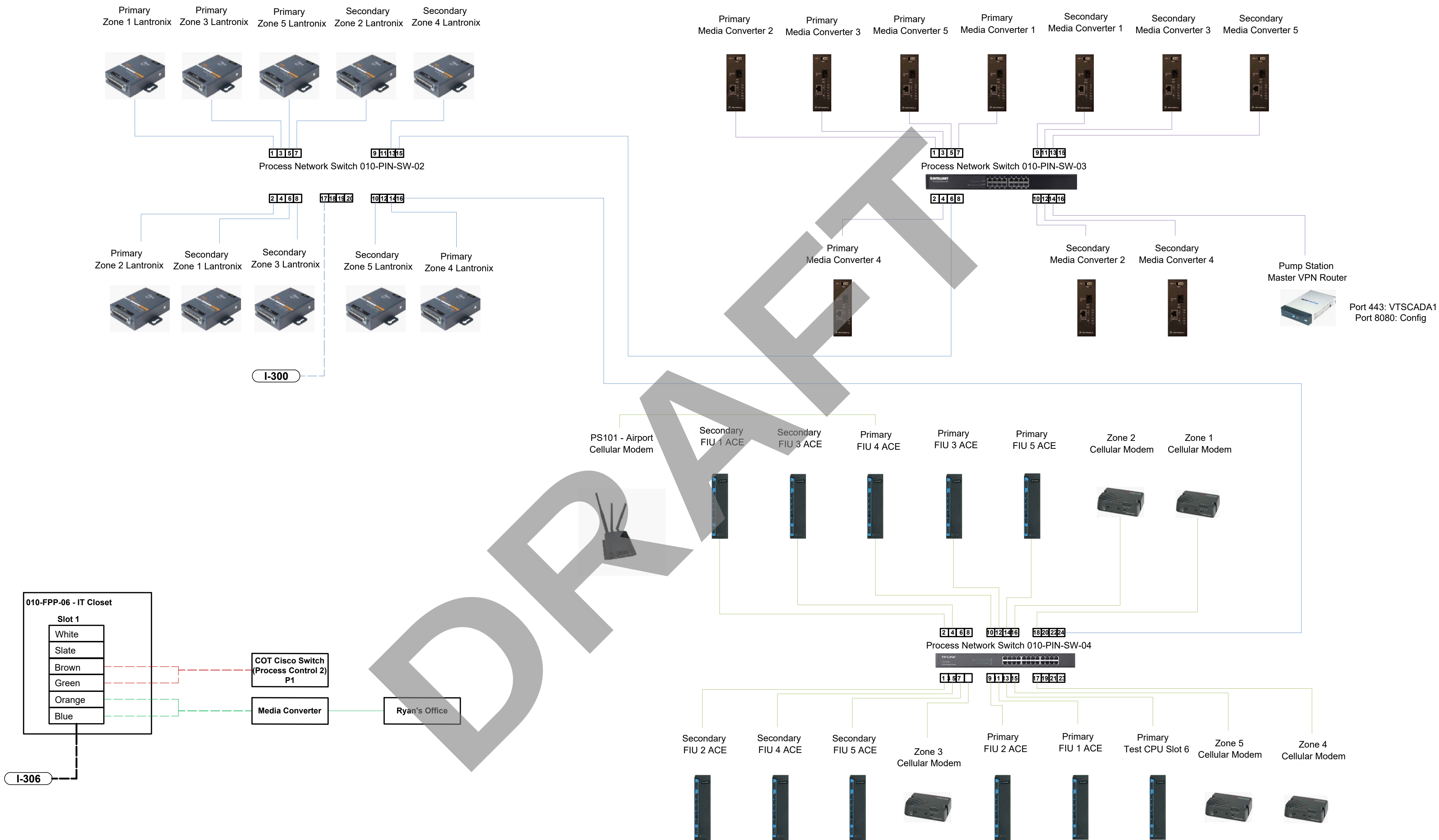
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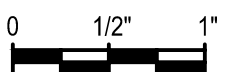
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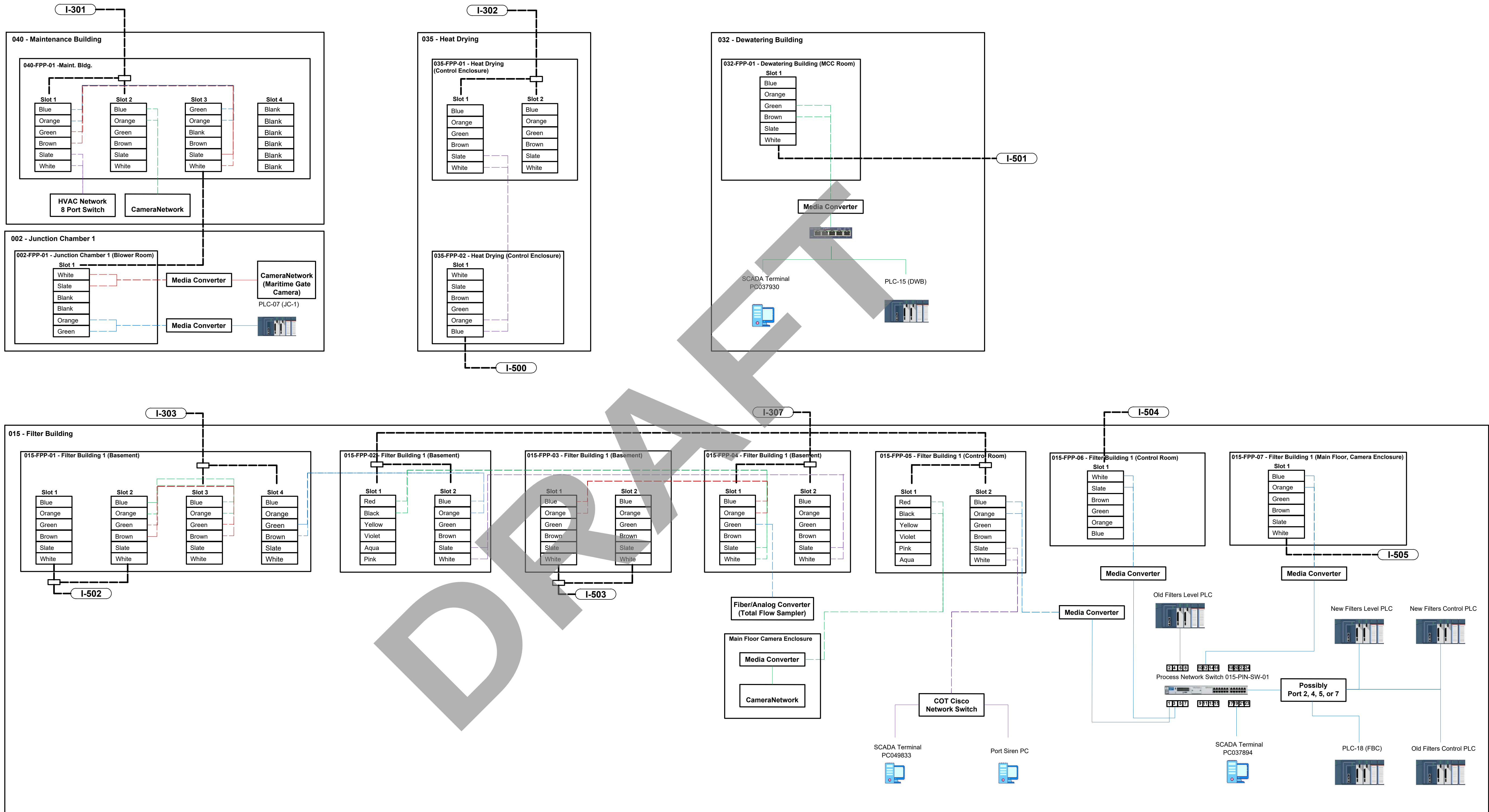
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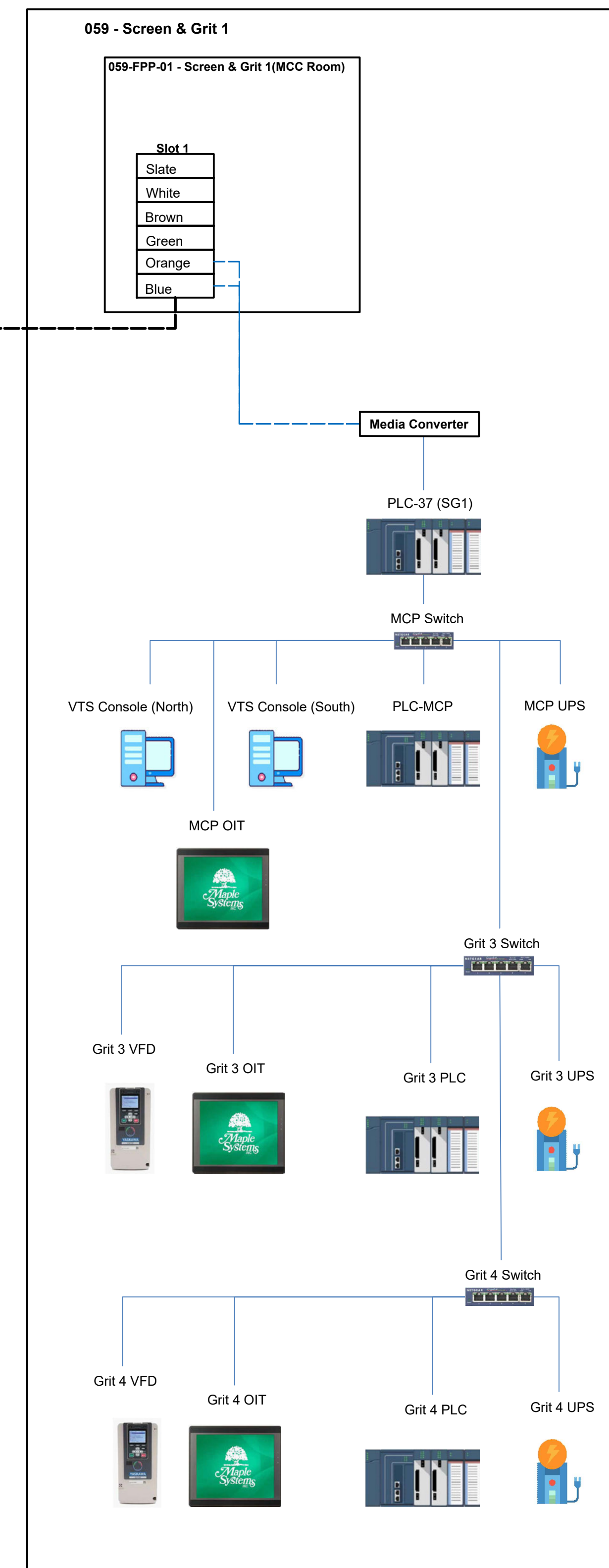
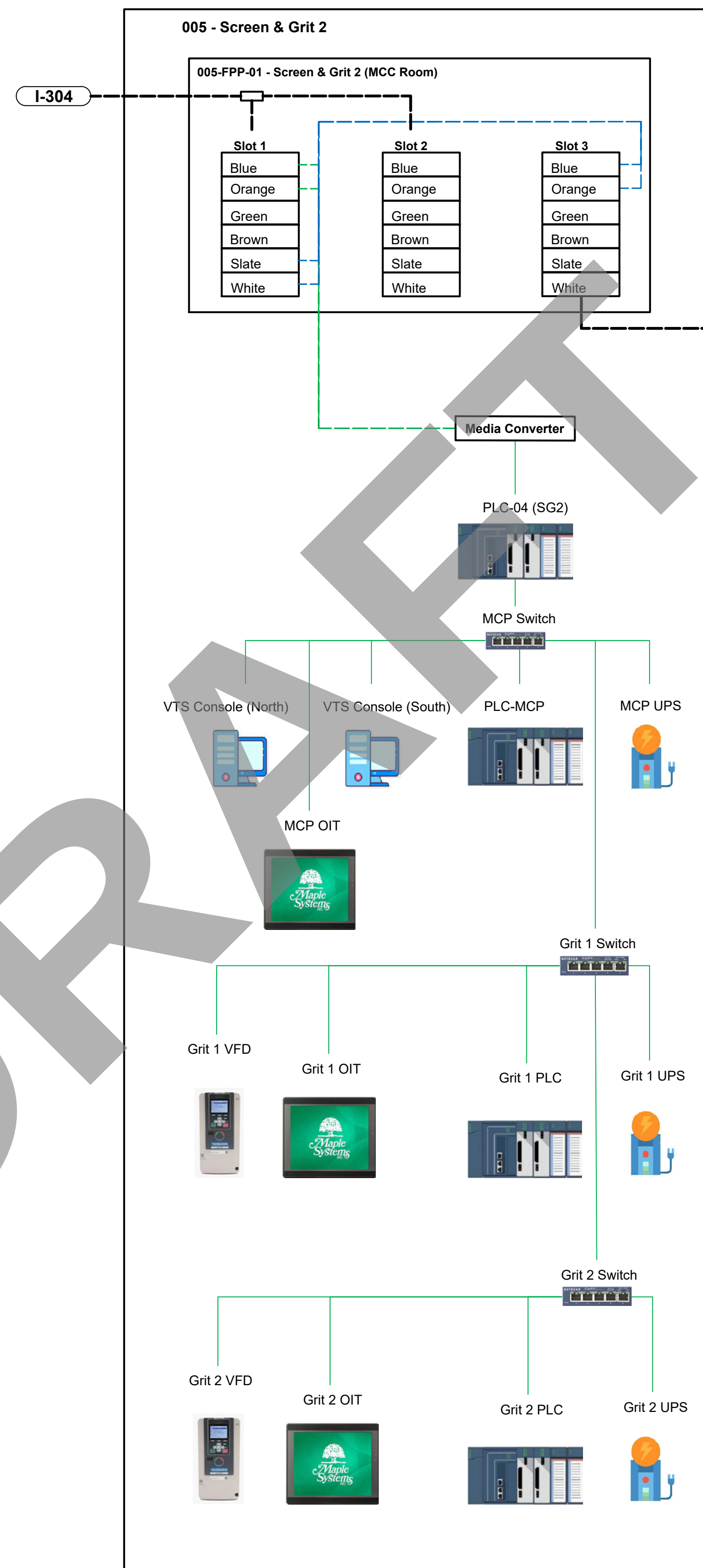
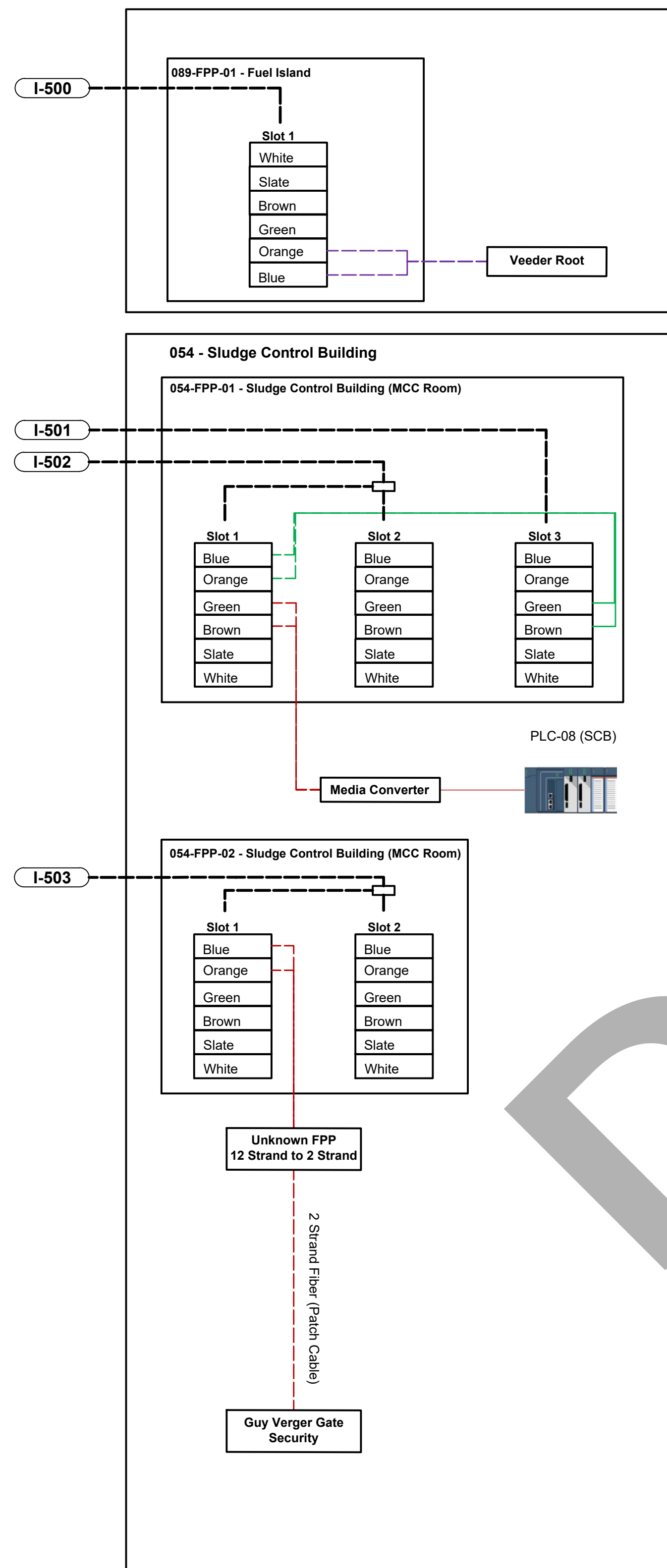
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Hazen

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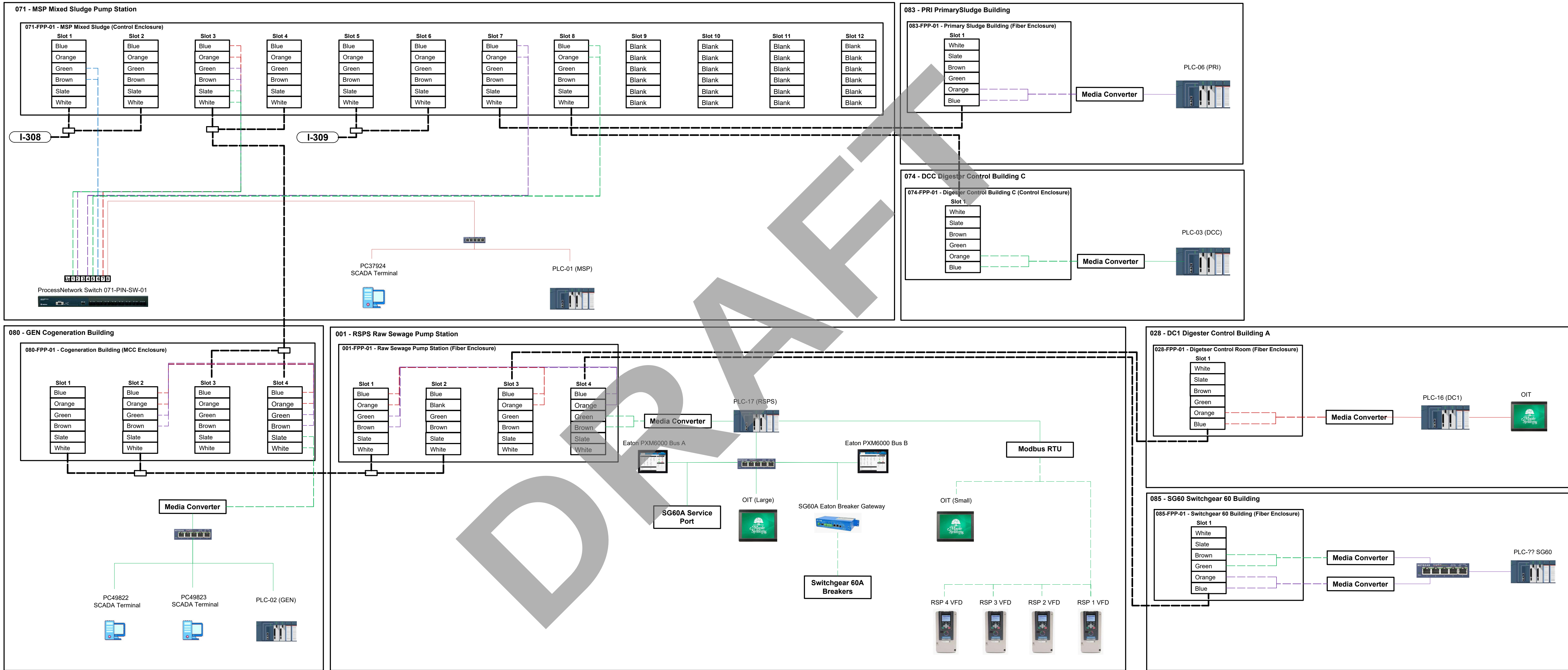
CITY OF TAMPA
WASTEWATER DEPARTMENT

HOWARD F. CURREN AWTP
MASTER PLAN IMPROVEMENTS
MAIN PUMP STATION AND HPO
REACTOR IMPROVEMENTS

NETWORK DIAGRAM
SHEET No. 6

DATE:	APRIL 2023
HAZEN NO.:	41077-013E
CONTRACT NO.:	20-C-00001
DRAWING NUMBER:	I-06

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PLOT DATE: 10/2024 9:19 AM BY: LGONZALEZ



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1	ISSUED FOR CONSTRUCTION	04/2023	TD

PROJECT ENGINEER:	J. PORTER
DESIGNED BY:	T. THOMAS
DRAWN BY:	J. THOMAS
CHECKED BY:	G. WALKER
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CITY OF TAMPA
WASTEWATER DEPARTMENT

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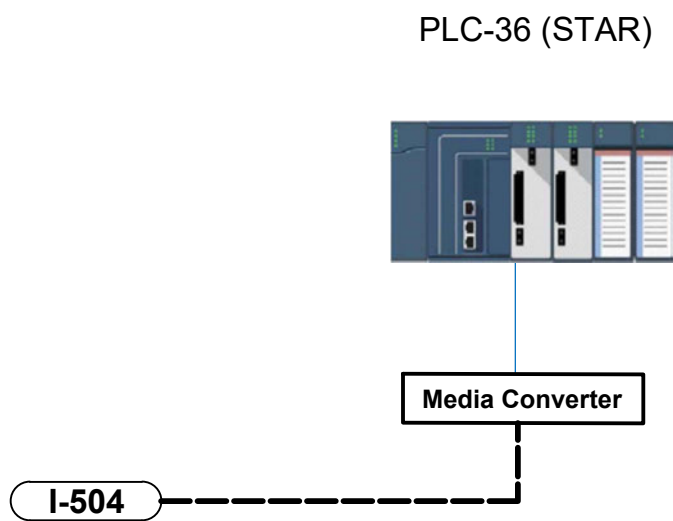
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CONTRACT NO.:	20-C-00001
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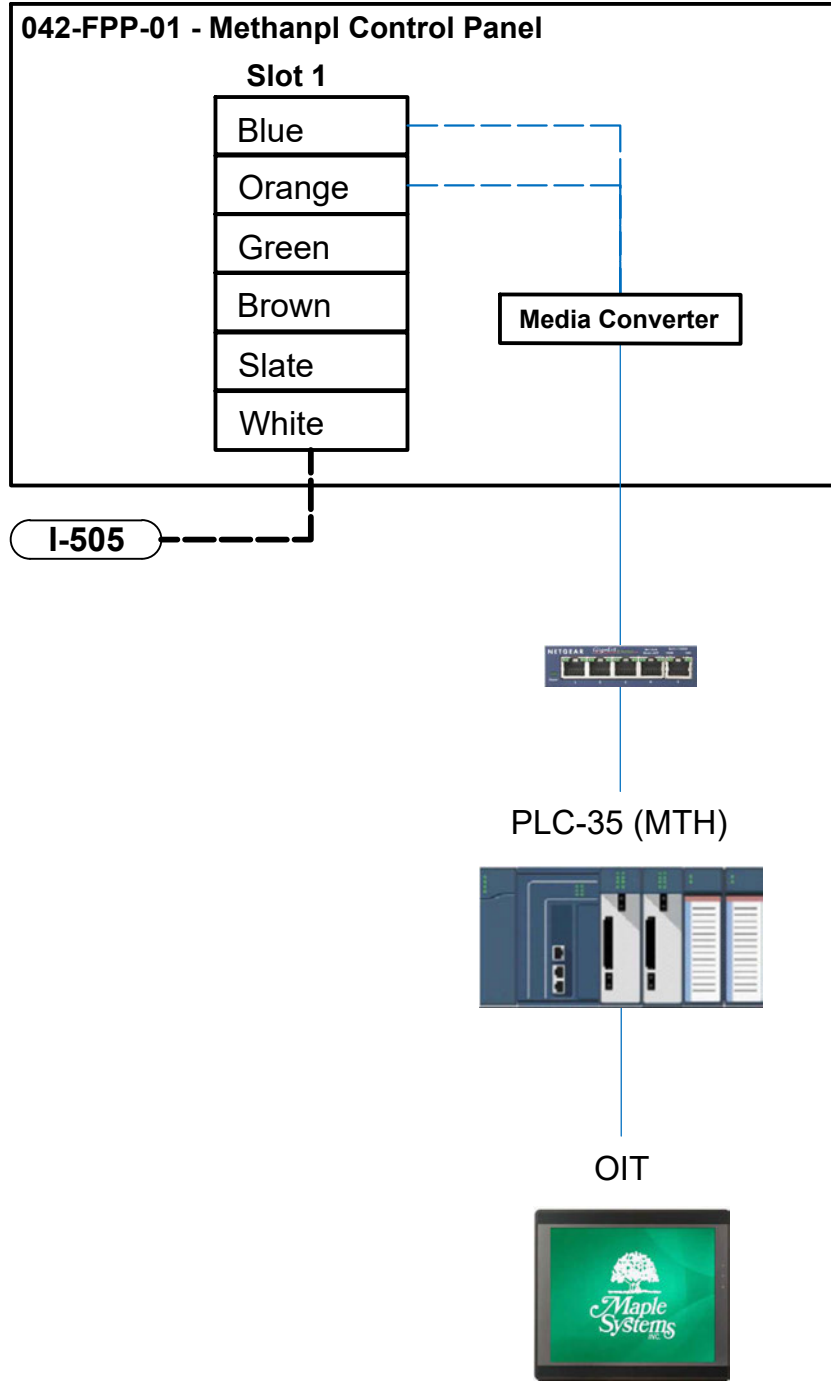
NOT FOR CONSTRUCTION - 60% DESIGN SUBMITTAL

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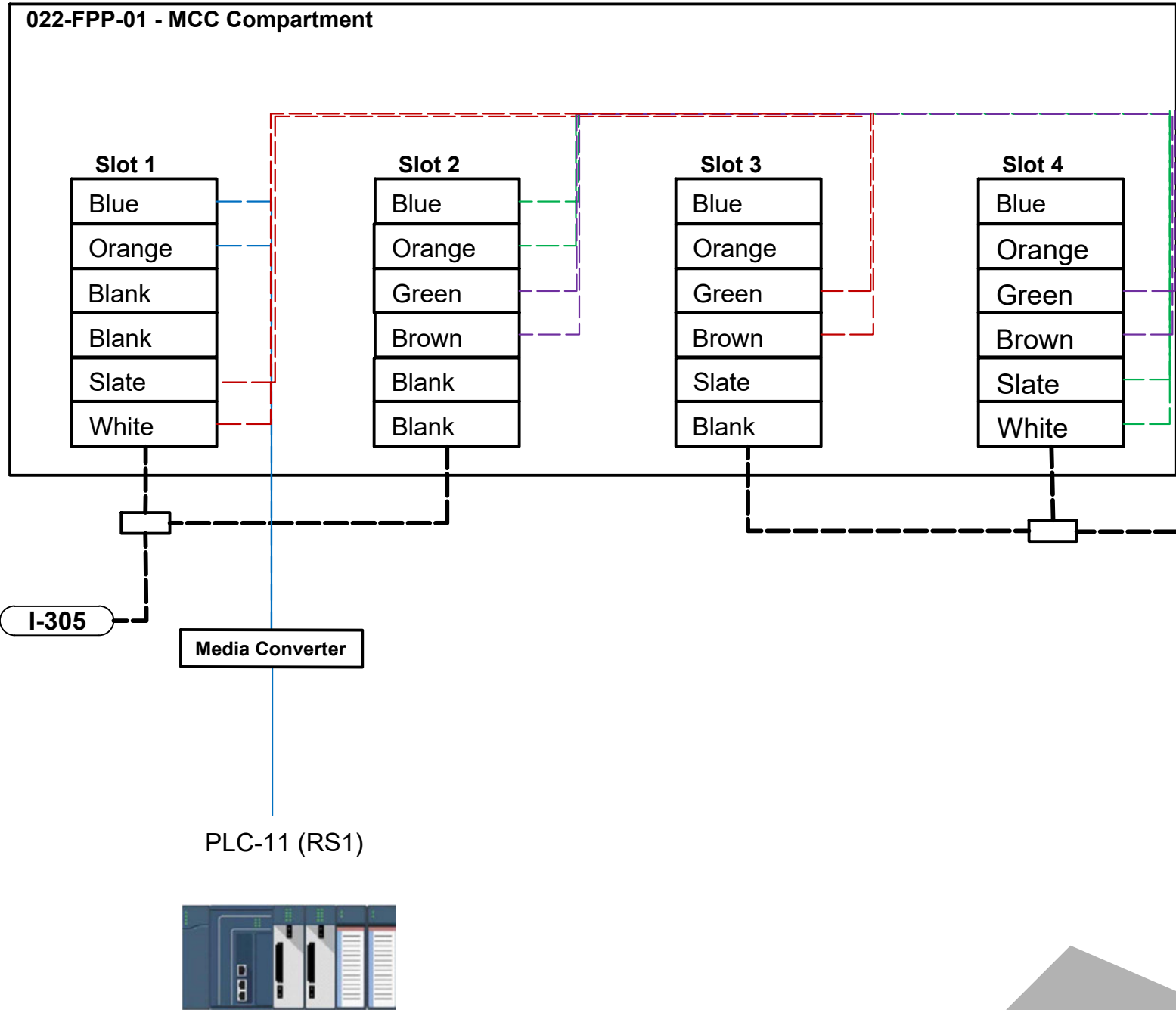
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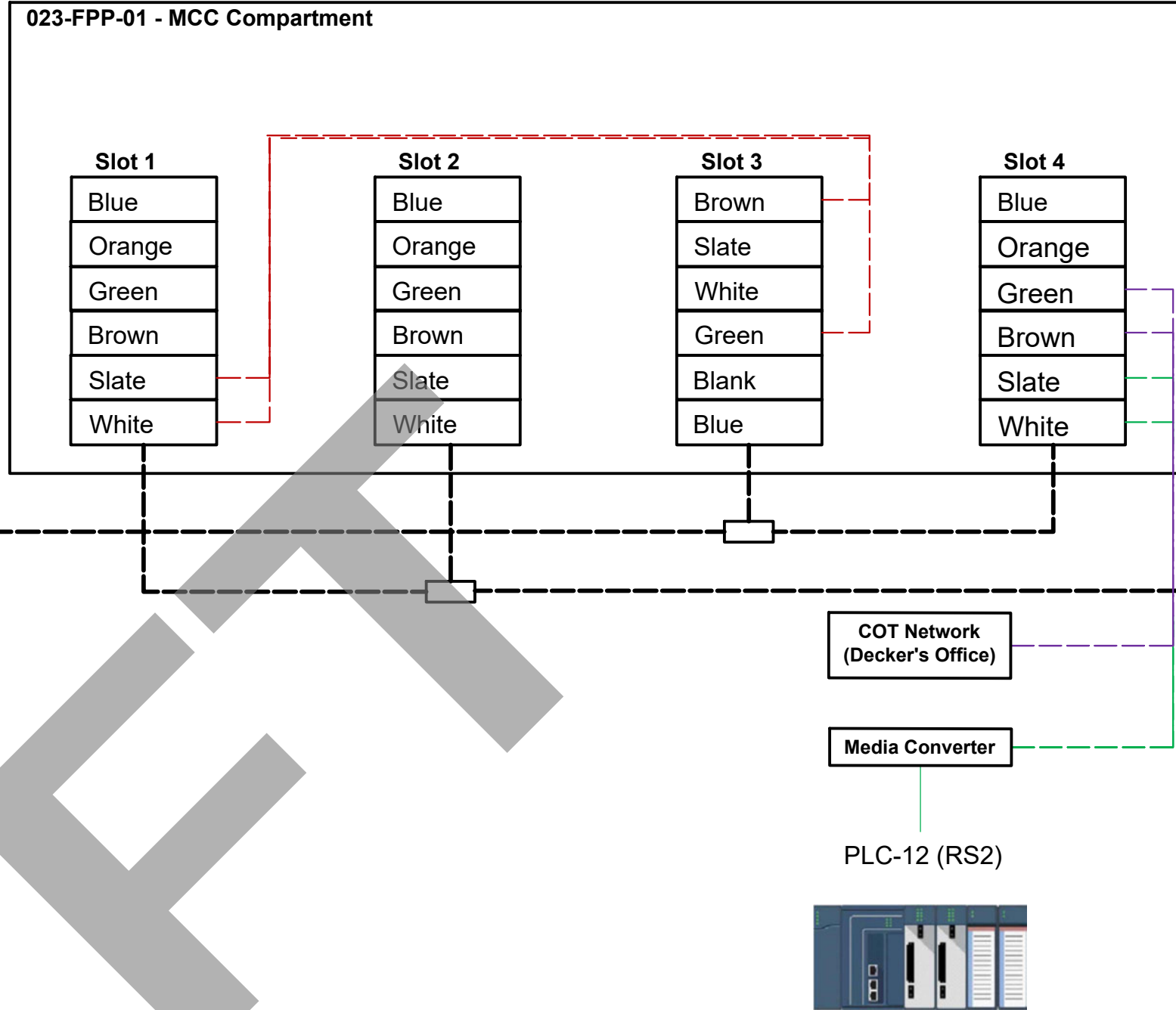
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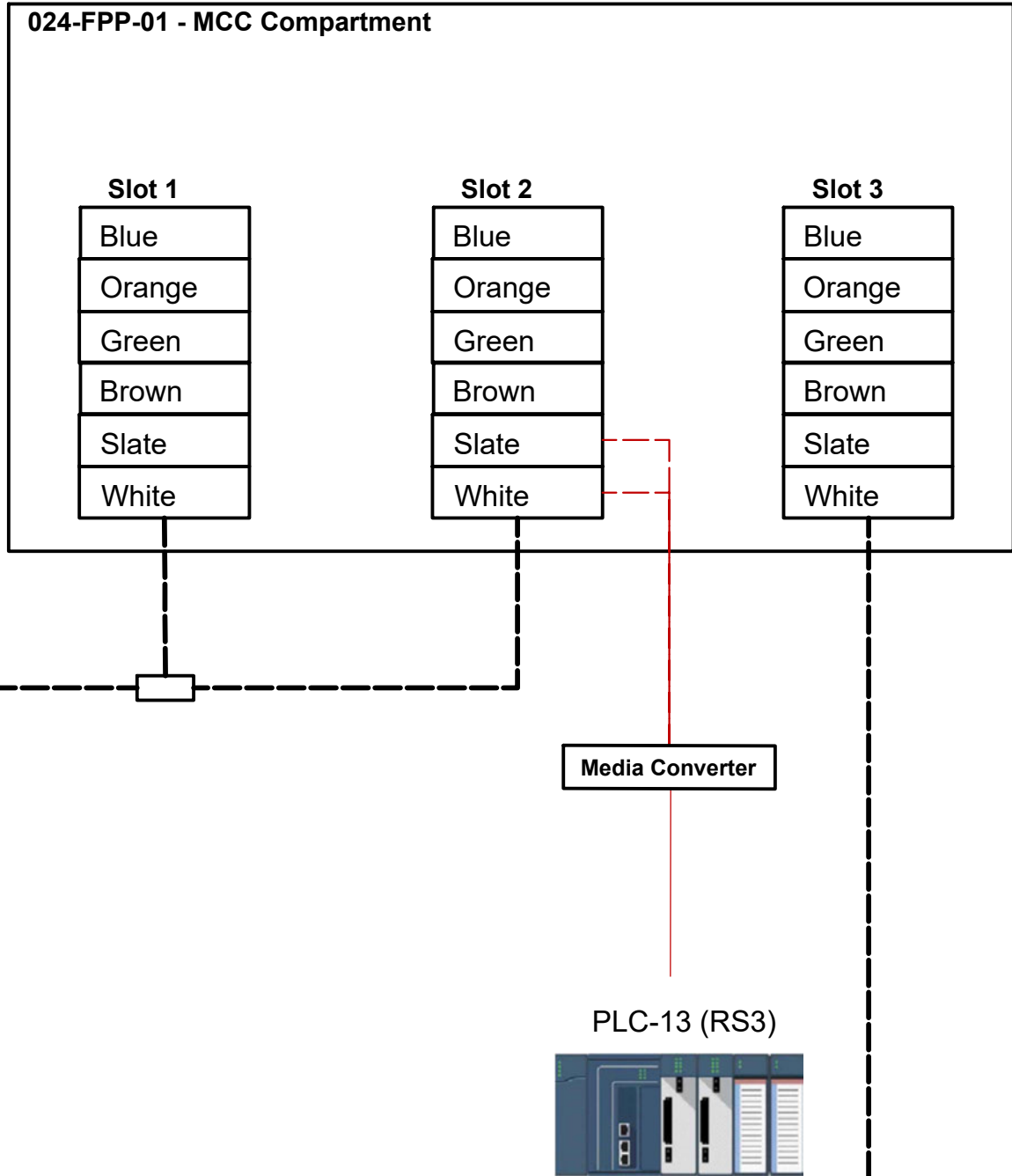
022 - Return Pump Station 1



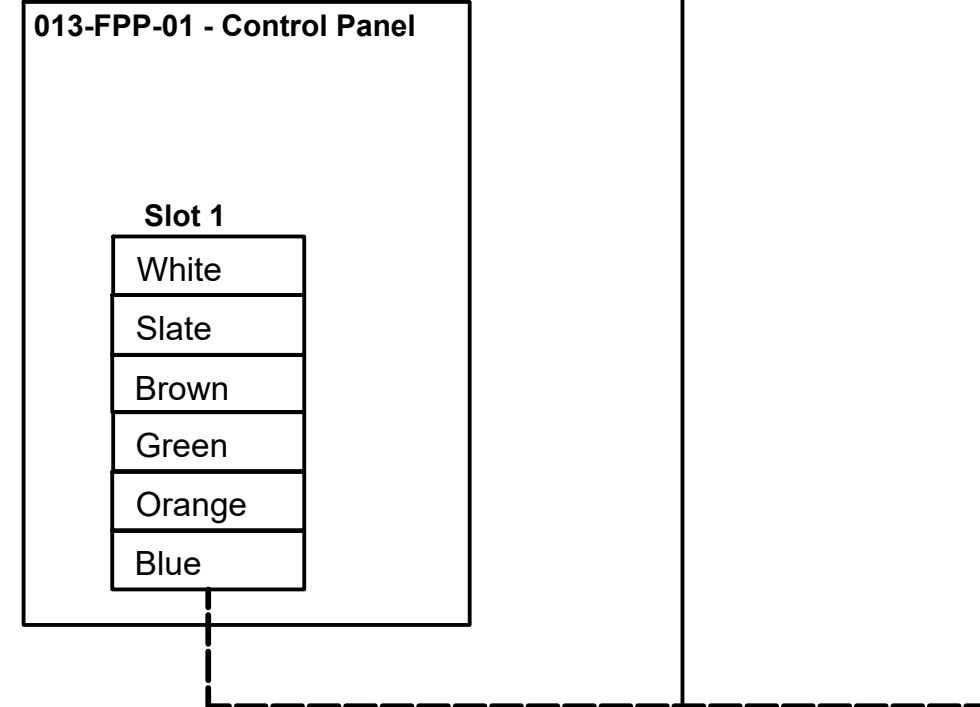
023 - Return Pump Station 2



024 - Return Pump Station 3



013 - Intermediate Pump Station



				PROJECT ENGINEER:	J. PORTER
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				DRAWN BY:	J. THOMAS
				CHECKED BY:	G. WALKER
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REV	ISSUED FOR	DATE	BY		



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WASTEWATER DEPARTMENT

HOWARD F. CURREN AWTP
MASTER PLAN IMPROVEMENTS
MAIN PUMP STATION AND HPO
REACTOR IMPROVEMENTS

NETWORK DIAGRAM
SHEET No. 9

DATE:	APRIL 2023
HAZEN NO.:	41077-013E
CONTRACT NO.:	20-C-00001
DRAWING NUMBER:	I-09

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Appendix B: Plant PLC Listing

HFC AWTP Programmable Controller Listing

PLC Number	Building Location
PLC1	Mixed Sludge Pump Station (071)
PLC2	New Engine Generator Building (080)
PLC3	Digester Control Building C (074)
PLC4	Screen and Grit Building No. 2, Building (005)
PLC5	Oxygen Plants Area (041)
PLC6	Primary Sludge Pumping Station No. 2 Control Building (083)
PLC7	Junction Box No. 1 (002)
PLC8	Sludge Storage Tanks Building (054)
PLC9	Sludge Treatment Building (030)
PLC10	Intermediate Pump Station (013)
PLC11	Sludge Pumping Station No. 1 (022)
PLC12	Sludge Pumping Station No. 2 (023)
PLC13	Sludge Pumping Station No. 3 (024)
PLC14	DAF Building (025)
PLC15	Sludge Dewatering Building (existing) (032)
PLC16	Digester Control Building No. 1 (028)
PLC17	Old Engine Generator Building (081)
PLC18	Filter Building No. 1 (015)
PLC19	Main Pump Station (010)
PLC33	Sludge Heat Drying Building (035)
PLC34	Sludge Heat Drying Building (035)
PLC35	Sludge Dewatering Building (existing) (032)
PLC36	Filter Building No. 1 (015)
PLC37	Screen and Grit Building No. 1 (059)
PLC38	Belt Thickener Building (056)
PLC39	Standby Power Building (078)
PLC40	Blower Building (058)
PLC41	Sludge Pumping Station No. 4 (062)
PLC42	Sludge Pumping Station No. 5 (063)
PLC43	Sludge Dewatering Building (new) (065)



Appendix C: PLC Evaluation Matrix

Appendix C - HFC AWTP PLC Evaluation Matrix

Number	Evaluation Criteria	Weighted Factor (1worst Stop)	Emerson (Rx3i)	Emerson Rank	Rockwell (Allen Bradley LOGIX Series)	Rockwell Rank	Schneider (Modicon M540/580)	Schneider Rank
1	Impact on functionality as more Ethernet is added	4	Each processor supports a certain number of Profinet remote drops. Scanning of additional IO typically has no impact on PLC functionality.	3	Adding devices will create higher demands on the controller and network. Configuration tools like Integrated Architecture Builder should be used to size the automation system based on lab tested characterization. This allow optimum performance and future flexibility.	2	The more Ethernet devices there are on a network segment, the greater the chance of collisions that will limit the effective bandwidth.	1
2	Market share	4	Approximately 20% to 30%	1	Approximately 70-80% market share in the U.S. Slightly lower in FL.	3	Approximately 30%	1
3	Useful features provided by one type of PLC vs another	3	Lower cost, much easier to implement redundancy solutions. Single software license to program all Emerson products. Built-in OPC-UA Server on processor. Single/unique software license for all PLC/PAC families and OI Quickpanel units. Migrations from older platforms are typically inexpensive with little downtime for the conversion.	1	Premier integration between FactoryTalk software, Logix controllers and Allen Bradley devices. Auto device mapping, descriptive tagging, automatic diagnostics and controller based alarming.	3	High of performance CPU, communication capabilities, built-in Cyber security features and migration options (backwards compatibility) that reduce time and risk associated with upgrade projects.	2
4	Level of support from PLC hardware/software suppliers	5	Free phone support from CIMTEC. Low annual cost for support from Emerson that provides version upgrades to all SW, firmware access to PLC/PAC, etc. CIMTEC can provide on-site support as necessary. Costs range from \$185-225/hr. depending on nature of support.	2	Rockwell Automation online knowledgebase, telephone tech support and tech specialist and field support engineers located throughout the country. Partner network including distributors and system integrators.	3	Priority support through Schneider with 8-5pm or 24/7/365 options. Cost is based on PLC configuration software license type and quantity. There are online tools, chat, and call-in options for support along with an app for smart phones.	2
5	Availability of programmers experienced with each brand of PLC	5	Rocha Controls, Electro Design Engineering, CEC (former Wood PLC). Other integrators located in Florida could also be interested in supporting customers in different parts of the state.	1	Estimated 5-10. Some examples in the Tampa area include Rocha, Revere, GCS, EDE, CCI.	3	There are (4) really strong integrators that are well established in the Florida market.	1
6	Local availability of components	4	Some products are kept locally in Florida but mostly for testing and demo purposes. Larger inventory products can be shipped overnight from headquarters in Charlotte, NC.	1	Rexel is the local authorized distributor and stocks parts at their location in Tampa.	3	Yes, they are Advantage Industrial, Graybar and CED. Advantage and Graybar carry Modicon inventory.	1
7	Longevity of Rx3i product line after purchase by Emerson vs other products' estimated longevity	4	No EOL (end of life) announced at this time. When an EOL is announced, customers will be given a minimum of 7 years notice. A replacement product would also be released along with a migration plan.	2	ControlLogix was introduced in the late '90's. Continued investments in development of this product line with no announced plans for retirement or replacement.	2	20-25 years	2
8	Up to date drive to communicate with VTSCADA	4	Typically OPC-UA is used, but other options include: SRTP or Modbus TCP	1	VTScada CIP and Rockwell driver provides interface to ControlLogix	3	Yes, there are many system using VTSCADA on top of Modicon PLCs	2
9	Availability and extent of library components in VTSCADA	5	Not available from Emerson but several qualified integrators with experience in developing embedded applications can develop specific objects for this as required.	1	VTScada CIP and Rockwell driver provides interface to ControlLogix. The VTScada Rockwell driver is able to query the ControlLogix's tag configuration supporting the Import function to create tags in the VTScada application automatically.	3	Yes. There are many systems that have Schneider PLCs with VTSCADA in operation.	2
10	Cost	1	CPU for the RX3i line of PAC systems range from ~ US 3.3k\$ to 7.3k\$ list price. Machine Edition licenses are ~ US 2.2k\$ for the Professional version that covers all PLC and PAC systems and also Quickpanel HMI/OI/DO and DO modules are available from ~US 275\$ to 1.7k\$ depending of density, diagnostics, etc. AI and AO modules are typically between US 580\$ to 3k\$ depending of density and capabilities. Power supplies are ~ US \$300 to \$600. Communication modules for Serial, Profinet, Ethernet, etc. are ~ US 1.5k\$ to 2k\$.	3	\$10k for software, \$5-\$20k for CPU, \$1k for DI, \$1k for DO, \$2k for AI, \$3k for AO, \$5k for network, and \$2k for power supply.	1	\$8.5k for software, \$16.5k for CPU, \$282 for DI, \$341 for DO, \$869 for AI, \$827 for AO, \$2.5k for CPU, \$2.1k for ethernet module, and \$818 for power supply.	2
11	Available support software for asset and program management	2	Emerson offers Change Management software that covers all PLC, PAC, etc. Usually all software packages come with a support contract.	2	FactoryTalk AssetCentre provides a centralized tool for securing, managing, versioning, tracking and reporting automation-related asset information.	2	Communication over Modbus TCP and Ethernet I/P natively are the protocols that would be used by the asset management software to interact with the PLCs.	2
12	Additional software or hardware offerings to enhance the functionality and disagnostics of the controllers, including but not necessarily limited to, I/O offerings, third-party card support (i.e. Prosoft), diagnostic software, controller fault tables, etc	2	DNP3 support, HART, several modules have alternate versions with advanced diagnostic options. Some controllers also offer health check capabilities.	2	There are diagnostics built into Logix controllers and enhanced diagnostics functionality can be added using Logix Diagnostic Objects in the Device Libraries.	3	The controllers, communications and some IO modules have diagnostics words built in that can be accessed by the user. Also, there are some library blocks that facilitate some of the available diagnostics to be pulled into the application code. Schneider has a full lineup of automation products such as VFDs, Smart Overloads, Ethernet switches and other devices that provide additional information and diagnostics about the systems to enhance alarming and notifications.	3
13	Ability to provide daily uploads from PLCs to check latest version of the current PLC program	2	Yes, this can be obtained by signing up for notifications for software updates through the technical support website.	2	FactoryTalk ActivationManager and FactoryTalk Updater are free tools to manage software version and licenses.	2	The priority support contract gives customer access to a tool that tells what version of Control Expert software you have and where to access the latest versions of software.	2

Appendix C - HFC AWTP PLC Evaluation Matrix

Number	Evaluation Criteria	Weighted Factor (1worst Stop)	Emerson (Rx3i)	Emerson Rank	Rockwell (Allen Bradley LOGIX Series)	Rockwell Rank	Schneider (Modicon M540/580)	Schneider Rank
14	Ease of disaster recovery (backup files for latest programming)	3	Can be done via USB or Ethernet	2	FactoryTalk AssetCentre disaster recovery	2	SD cards are available for purchase, and highly recommended, for the M580 and included with the M340 PLCs. The user would put the existing SD card in the replacement PLC and then power up the new unit and the PLC code will automatically download to the new PLC. The typical option is to download a backup from the configuration software, or use a 3rd part software like Auvesy MDT to do a full system backup and restore.	2
15	Extent of monitoring of user actions (PLC changes by rung - change management)	4	This is a function of Change Management software	2	FactoryTalk AssetCentre audit trail	2	A syslog can be configured and implemented within the controller and will give a detailed report of user actions. This option is recommended as part of any Cyber security plan.	2
16	Extent of monitoring of VTS changes (MDT autosave as an example vs what comes with PLC) vs VTS built in version control	4	This is a function of Change Management software	2	FactoryTalk AssetCentre audit trail	2	A syslog can be configured and implemented within the controller and will give a detailed report of user actions. This option is recommended as part of any Cyber security plan.	2
17	Standards for models from each manufacturer for various capacity of PLC	2	Yes, please see attached the RX3i and PAC information for more details on this	3	ControlLogix – 5580 and 5570. CompactLogix – 5480, 5380, 5370	2	Yes, see attached. M580 & M340 are the PLCs and they both use x80 IO system	2
18	Offline backup for ransomware protection and procedures for recovery in even of an attack	5	Backups can be restored via USB	2	FactoryTalk AssetCentre disaster recovery	2	SD Cards are highly recommended	2
19	Ease of integration to other systems (predeveloped custom function blocks between instruments and PLC CPUs)	4	Yes. UDFBs are also supported	2	Rockwell Automation Library of Process Objects is a predefined library of controller code (Add-On Instructions), display elements (global objects), and faceplates.	3	Yes. Device (general purpose) and segment specific libraries if the customer is interested.	2
Sum of Ranking				35		46		35
Sum of Ranking x Weight Factor				116		169		119



Howard F. Curren AWTP - SCADA System

Report Creator Software Evaluation

City Project NO. 20-C-00001

Reliable Tampa Partners Project No. 20-500

Hazen and Sawyer Project No. 41077-013 Task 261

December 2024



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List of Acronyms and Abbreviations

CFR - Code of Federal Regulations

DMZ - Demilitarized Zone

EPA - Environmental Protection Agency

GE - General Electric

HFC AWTP - Howard F. Curren Advanced Water Treatment Plant

HMI - Human-Machine Interface

HSQ - High-Speed Query

LIMS - Laboratory Information Management System

NIST - National Institute of Standards and Technology

PAC - Programmable Automation Controller

PLCs - Programmable Logic Controllers

SCADA - Supervisory Control and Data Acquisition

SQL - Structured Query Language



Introduction

The Howard F. Curren Advanced Water Treatment Plant (HFC AWTP) owns and operates a comprehensive Supervisory Control and Data Acquisition (SCADA) system. This system is primarily composed of General Electric (GE) PAC System Rx3i and 90-30 series programmable logic controllers (PLCs) at the field level, and VTScada by Trihedral at the SCADA/HMI level. SCADA systems are critical for monitoring and controlling industrial processes, providing real-time data, and enabling remote control and automation of plant operations.

As part of ongoing improvement efforts, the City is currently in the process of upgrading the controllers throughout all facilities to more advanced Allen Bradley controllers, which are manufactured by Rockwell Automation. These new controllers are expected to enhance the reliability and efficiency of the plant's operations, offering improved performance and extended capabilities.

The data generated by the SCADA system is stored in a robust database, which serves as the backbone for gathering insights into the plant's performance. This data includes various metrics such as water flow rates, chemical usage, and equipment status, among others. It is essential for ensuring that the plant meets stringent regulatory requirements for water quality, which are set by environmental authorities to protect public health and the environment.

To maintain these high standards, the data needs to be analyzed periodically. This analysis involves examining trends, identifying any anomalies or deviations, and generating reports that summarize the plant's performance. These reports are crucial for the plant's operators and management, as they provide a clear overview of the plant's operations and highlight any areas that may require attention or improvement.

Therefore, selecting the right report creation software is of paramount importance. The software must integrate seamlessly with the existing database, ensuring that the data is accurately captured and processed. It should also offer user-friendly interfaces for creating and customizing reports, allowing users to easily interpret the data and make informed decisions. Consistency and reliability in report generation are critical, as these reports play a vital role in maintaining the plant's operational excellence and regulatory compliance.



1. Objectives

With the changes being implemented at the HFC AWTP, the City aims to select a new report creation software to ensure efficient identification of plant performance and regulatory compliance. Given the critical nature of these reports, it is vital that the chosen software integrates seamlessly with the existing database systems and offers comprehensive functionality for data analysis and reporting.

To achieve this goal, the City has tasked Hazen and Sawyer (Hazen) with reviewing and evaluating various software platforms capable of meeting the plant's rigorous requirements. As part of this mandate, Hazen conducted a thorough assessment of multiple report creation software options to determine the most suitable solution for the HFC AWTP's needs.

The evaluation process involved comparing the features, capabilities, and budgetary costs of each software platform. Hazen's objective was to identify a software solution that not only provides robust reporting capabilities but also enhances the overall operational efficiency of the plant. This includes the ability to generate accurate, real-time reports that offer insight into key metrics such as water flow rates, chemical usage, and equipment status.

Moreover, the ideal software should facilitate user-friendly report creation and customization, enabling plant operators and management to easily interpret data and make informed decisions. Ensuring consistency and reliability in report generation is paramount, as these reports play a crucial role in maintaining the plant's operational excellence and regulatory compliance.

The findings of Hazen's comprehensive evaluation are summarized in the Report Generator Software Evaluation document, which outlines the strengths and weaknesses of each software platform considered. Based on this evaluation, Hazen has provided a recommendation for the standard software platform to be adopted for report creation moving forward. This recommendation is aimed at optimizing the plant's reporting processes and supporting the City's ongoing commitment to operational improvement and regulatory adherence.



2. Software Platforms

The following software platforms were evaluated

DreamReport, Ignition, PI System with PIVision and XLReport

2.1 DreamReport

Ocean Data Systems, founded in 2004 and headquartered in Europe, is a lean company of 11-50 employees according to LinkedIn. Ocean Data Systems created DreamReport, a reporting software first released in 2005. Currently, their presence is robust, with over 8,000 installations globally, and about 75 million search results on Google, indicating strong industry penetration. DreamReport serves a range of industries from government agencies like the EPA to water and wastewater plants, including installations throughout the U.S. In Florida for example they work with the City of St. Petersburg and the Seminole Tribe of Florida.

DreamReport works off a licensing agreement that revolves around tag numbers, and the number of users editing reports simultaneously. Licenses are available either as a subscription, where regular feature updates are provided, or as a permanent license, which only offers security patches but no new features. Optional addons such as a redundancy license agreement and optional remote development license enhance flexibility. On-site installation allows DreamReport to interface with databases. Users can access the reports through the web interface that gives the capability to generate reports on any device that can access the website. Report editing is done through their report creator application that is installed on-site, which supports multiple users editing reports concurrently, depending on the license. Contact was established by reaching out through their website where Richard Kaye (Richard.Kaye@dreamreport.com), the account manager for Florida, becoming the primary point of contact.



2.2 Ignition

Inductive Automation, founded in 2003 and headquartered in Folsom, California, has over 20 years of experience in industrial automation. The company specializes in SCADA systems and industrial automation software, with Fortune 500 customers among its client base. Their flagship software, Ignition, is designed for a variety of industrial applications. Inductive Automation's industry presence is significant, with approximately 9 million search results on Google and installations across the United States, including clients like the City of Orlando in Florida.

Ignition operates using a single-server license model that provides unlimited clients, tags, and connections, with the only limitation being the performance of the installed hardware. Redundancy can be added for 50% of the main license cost. To meet specific needs, such as multi-user sign-on, a hybrid model was proposed by the sales representative, involving both an on-site server and a cloud server. The cloud edition supports multiple user logins, a feature unavailable in the non-cloud version, and operates on a cost framework based on usage time. Ignition's flexibility allows for a range of setup options to suit different requirements.

Ignition's flexibility enables various configurations to suit different operational needs. Contact with Inductive Automation was established through their website, where Abran Mathews (amathews@inductiveautomation.com) became the primary point of contact for software information.



2.3 PI System with PIVision

AVEVA, a British multinational software company, originated as the Computer-Aided Design Centre in Cambridge in 1967, created by the UK Ministry of Technology and Cambridge University. Over its 40+ years as an engineering software leader in the plant, power, and marine industries, AVEVA became publicly traded in 1996 and later merged with Schneider Electric's industrial software business in March 2018. In January 2023, Schneider completed its acquisition, privatizing AVEVA. The company has a prominent industry presence, with approximately 170 million search results on Google and installations worldwide, supporting clients from San Jose, California, to Rotterdam, Netherlands.

AVEVA's PI System, available through a subscription model, provides a comprehensive platform featuring the PI Server, PI System Connections, and PI System Tools. The PI Server is hosted onsite, managing and storing plant data, while PI System Connections enable data collection from various sources, offering over 200 interfaces, including SCADA, DCS, equipment databases, text files, and HTML pages. PI System Tools include a suite of add-ons for data visualization and analysis; for instance, PIVision allows data access from any device through a browser based interface, enabling report creation and viewing. PIData Link supports data export to Excel, where users can save reports in any Excel-compatible format. Additionally, the software can be configured to automate alerts, sending notifications via email when specified conditions are met.

The PI System's subscription model ensures continuous support and access to the latest software updates from AVEVA. The system accommodates extensive storage, with some customers managing over a million tags on a single system. PI's integration capabilities with VTScada allow seamless configuration with virtually any data source by selecting the appropriate interface, connector, or adapter.

Contact with AVEVA was established through their website, with Andrew Primeaux (andrew.primeaux@aveva.com) serving as the main point of contact.



2.4 XLReport

SmartSights, founded in 1993 and headquartered in Austin, Texas, is known for delivering advanced industrial reporting and data analysis solutions, including products like XLReport, WIN911, and SyTech. The company, with a team of 50-200 employees according to LinkedIn, has a modest but growing industry presence, with around 79,000 search results on Google.

Launched in 2000, XLReport is SmartSights' reporting software, featuring a licensing system based on the number of users needed for editing and custom report creation, with unlimited tag tracking available. On-site installation allows XLReport users to access reporting software through a web browser, making reporting quick and flexible on any device that is able to access the plant network. With support for various report formats and automated email reporting, XLReport's capabilities are powered by Microsoft Excel, though it operates independently of the Excel application itself.

SmartSights offers XLReport under both perpetual and subscription-based licenses, with the latter providing software upgrades and support. For enhanced reliability, a redundancy server can be added at 50% of the main server cost. The software can also be bundled with WIN911, SmartSights' alarming platform, to enable fast, reliable plant alerts via SMS or email.



3. Software Comparison

3.1 Software Requirements

3.1.1 Cost

The software should be priced competitively and not require unnecessary expenses. This is important for a wastewater operator because managing a wastewater treatment plant involves many ongoing costs, and budget constraints are often a significant concern. By ensuring that the software is price competitive, operators can allocate resources more effectively across various critical areas, including maintenance, staffing, and system upgrades. Competitive pricing also allows for the possibility of adopting other necessary technologies or services without stretching the budget too thin. Moreover, avoiding unnecessary expenses helps in achieving long-term financial sustainability, ensuring that the plant can continue to operate efficiently and respond to any emergent needs without financial strain. Due to the financial importance of this requirement, it is given an importance factor of 5.

3.1.2 User Dashboard customization

On the user's own dashboard, the software should have the ability to create data trends and graphs saved to the user's account for private viewing or public access by other users. The dashboard will include customization for the user to create their own pages with tag linking for simple key performance indicators and allow the display to be saved for future viewing or sharing. This functionality is particularly important for plant operators as it enables efficient monitoring of critical plant metrics, such as water quality indicators and equipment performance. By having the ability to customize and save a dashboard, operators can quickly access vital information, make informed decisions, and ensure compliance with regulatory standards. Due to the operational impact of this requirement, it is given an importance factor of 5.

3.1.3 Custom Report Creation

On the user's own dashboard, the software should have the ability to create data trends and graphs saved to the user's account for private viewing or public access by other users. The dashboard should include customization for the user to create their own pages with tag linking for simple key performance indicators and allow the display to be saved for future viewing or sharing. This functionality is particularly important for plant operators as it enables the efficient monitoring of critical plant metrics, such as water quality indicators and equipment performance. By having the ability to customize and save specific data points, operators can quickly access vital information, make informed decisions, and ensure compliance with regulatory standards. Due to the operational impact and importance of this requirement it is given an importance factor of 5.



3.1.4 VTScada integration

The software must be able to pull data from the VTScada database without the user having access to the VTScada system or database. This capability is crucial for a plant operator because it ensures seamless integration and data flow without compromising the security and integrity of the VTScada system. By allowing data to be accessed and utilized without direct interaction with the VTScada environment, plant operators can streamline operations, improve data handling efficiency, and minimize the risk of unauthorized access or potential system disruptions. This feature also facilitates the creation of comprehensive reports and dashboards, enabling integrators to monitor and optimize plant performance while maintaining stringent security protocols. Due to the level of importance of ensuring that the software platform is well integrated with the report creating platform this requirement is given an importance factor of 5.

3.1.5 Other Databases

The software must be able to pull data from sources other than VTScada such as LIMS for lab works, HSQ for data not yet available in VTScada. This capability is crucial for a wastewater plant operator because it ensures comprehensive data integration and accessibility. By allowing the software to gather information from multiple databases, operators can obtain a holistic view of the plant's operations. This integrated approach facilitates better monitoring and management of plant metrics, enhances decision-making processes, and ensures compliance with regulatory standards. Moreover, it minimizes the risk of data silos, improves operational efficiency, and supports the creation of detailed and accurate reports, which are essential for optimizing plant performance and maintaining environmental safety. Due to the importance of being able to link to other databases this requirement is given an importance factor of 5.

3.1.6 Automated Report Generation

The software must have the ability to automatically generate reports and email these reports to users on a schedule. This feature is particularly vital for operators as it ensures timely access to essential data without the need for manual report generation. Automated reports can include critical metrics such as water quality indicators, equipment performance data, and regulatory compliance status. By receiving these reports on a predefined schedule, operators can swiftly identify and address potential issues, streamline operational workflows, and maintain adherence to environmental regulations. Additionally, automated report generation reduces administrative burden, allowing operators to focus on more strategic and high-priority tasks. Due to the level critical nature of this requirement, it is given an importance factor of 5.

3.1.7 Security

The software must be compliant with NIST standards for cybersecurity to ensure safety for use in the plant. This is crucial for a wastewater operator because it guarantees that all data and operations are protected from cyber threats. Given the sensitive nature of wastewater treatment processes, any breach could lead to significant environmental, and risk to human health and lives. Robust cybersecurity ensures the integrity and reliability of the system, allowing operators to focus on maintaining plant performance



and compliance without worrying about potential cyber-attacks. Due to the impact of plant safety this requirement it is given an importance factor of 5.

3.1.8 21 CFR Part 11 Compliance

The software should be able to meet 21 CFR Part 11 compliance. This ensures that electronic records and signatures are trustworthy, reliable, and equivalent to paper records. Compliance with 21 CFR Part 11 means that the software adheres to strict standards for data integrity, security, and traceability, which are essential for regulatory audits and inspections. This level of compliance helps operators maintain accurate records of plant operations, ensure the validity of data used for decision-making, and demonstrate adherence to legal and environmental regulations. Ultimately, 21 CFR Part 11 compliance provides a framework that supports the integrity and reliability of the plant's data management system. Due to the non-critical but important nature of this requirement it is given an importance factor of 3.

3.1.9 Browser Usability

The software should have the ability to operate out of a browser setting to generate reports and to allow for the quick ability to view trends, and other plant information. This is crucial for a wastewater operator as it provides flexibility to access real-time data and reports from any device with internet connectivity, without being confined to a specific workstation. This ensures that operators can monitor plant performance, track water quality indicators, and respond promptly to any issues, no matter where they are. As this requirement directly impacts plant performance it is given an importance factor of 5.

3.1.10 Scalability

The software should be flexible enough to expand if The City requires an expansion without incurring a significant increase in cost or complexity. The software should allow the system to grow and adapt in response to the changing needs and demands of the plant. As the plant expands, either through increased capacity or the addition of new processes and technologies, the software must be able to accommodate these changes seamlessly. Scalable software ensures that operators can continue to manage and monitor the plant effectively without facing major disruptions. Due to the non-critical aspect of this requirement and lower level of importance it is given an importance factor of 2.

3.1.11 Specialized functions

Running custom SQL queries enables operators to extract specific datasets from the database, facilitating in-depth analysis and troubleshooting. This flexibility ensures that the software can be adapted to evolving operational requirements and provides the operator with powerful tools to maintain optimum plant performance, identify trends, and make data-driven decisions. Overall, these features contribute to a more responsive, efficient, and innovative wastewater management system. Due to the non-critical importance of this requirement, it is given an importance factor of 3.



3.1.12 HMI Integration

The software should be easy to integrate into The City's HMI - VTScada. This integration is crucial for a wastewater operator because VTScada is a widely used HMI system that provides real-time monitoring and control of plant operations. By ensuring compatibility with VTScada, the software allows operators to seamlessly access and manage all relevant data through a single interface, enhancing operational efficiency and reducing the risk of errors. This not only supports proactive maintenance and troubleshooting but also helps in ensuring regulatory compliance and optimizing plant performance. Due to the non-critical importance of this requirement, it is given an importance factor of 3.

3.1.13 Software support and maintenance

The software should have support security updates and technical support. This is important for a wastewater operator because security is paramount in protecting sensitive data and ensuring the integrity of the system. Regular security updates help safeguard the system against potential cyber threats, vulnerabilities, and unauthorized access, which can compromise the operation of the plant. By having these updates included without extra charges, operators can maintain a high level of security consistently, ensuring continuous protection without worrying about additional expenses. This proactive approach not only secures the plant's operations but also aligns with regulatory standards and best practices for infrastructure management. Due to the non-critical importance of this requirement, it is given an importance factor of 3.

3.1.14 Redundancy

The software should be able to be set up with a redundant system to allow for the use of the report creator even if the main server is taken offline. This is crucial for a wastewater operator because redundancy ensures continuous access to critical reporting tools, minimizing downtime and maintaining smooth operations. In the event of a system failure or maintenance, having a redundant setup means that data analysis can proceed without interruption, thus supporting timely decision-making and regulatory compliance. This resilience is essential in safeguarding the plant's functionality and ensuring that operators can respond promptly to any issues that arise. Due to the non-critical importance of this requirement, it is given an importance factor of 3.

3.1.15 Company prominence

The software company should be a reputable company with good industry presence and expertise. This is important for a wastewater operator because a reputable company ensures that the software is reliable, secure, and compliant with industry standards. A company with a strong industry presence is more likely to be aware of the latest advancements and regulatory changes, ensuring that the software remains up-to-date and effective in managing the complex requirements of wastewater treatment. Expertise in the field means that the company can provide high-quality support and tailored solutions, addressing specific operational challenges and improving overall plant performance. Due to the non-critical importance of this requirement, it is given an importance factor of 3.



3.1.16 Customer service

The company must have representatives that are easy to reach out to and get in touch with, the representatives must also be well versed with the software and its capabilities. The company must have representatives that are easy to reach out to and get in touch with, and the representatives must also be well-versed with the software and its capabilities. This is crucial for a wastewater operator because having accessible and knowledgeable support ensures that any issues or questions can be promptly addressed, minimizing downtime and maintaining smooth operations. Quick and efficient customer service can make a significant difference in resolving technical problems, optimizing the use of the software, and ensuring that the wastewater treatment plant operates at peak efficiency. This level of support is essential for handling the complex and critical nature of wastewater management, where delays or errors can have significant consequences. Due to the non-critical importance of this requirement, it is given an importance factor of 3.

3.2 Software comparison matrix

The software platforms DreamReport, Ignition, PI System, and XLReport are all reliable reporting software platforms and within each of the evaluation factors no one supplier was always top ranked as each software has differences in making a recommendation difficult.

A matrix decision analysis will be used with weighted values to identify the most optimal software solution. Each Software was ranked relative to each other on a scale of 1-4 with 4 being considered the most favorable and 1 being the least favorable for that category. Then a requirement importance factor will be applied to each parameter, a 5 being considered the highest importance and 1 being considered the of least importance.

Rankings were assigned based on the review of the software representative responses as well as further research when needed. Weight factors were assigned based on Hazen's perception of what would be most important to HFC AWTP staff. A summation of each of the ranking score times the respective weight factor was made. The Software supplier with the highest overall number was determined to be the best choice based on Hazen's evaluation.



Importance Factor	Evaluation Criteria simplified	DreamReport Rank	Ignition Rank	PI System Rank	XLReport Rank
5	Pricing	2	3	1	4
5	User dashboard configuration	3	2	4	1
5	Custom report creation	3	1	4	2
5	VTScada integration	4	1	3	2
5	Database integration	4	1	3	2
5	Automated reports	3	1	4	2
5	Security	3	2	4	1
3	21 CFR Part 11 compliance	4	1	3	2
5	Browser usability	3	1	4	2
2	Scalability	1	4	2	3
3	Specialized functions	4	1	3	2
3	HMI integration	4	1	3	2
3	Software support and maintenance	3	1	4	2
3	Redundancy	4	2	1	3
3	Company Prominence	3	2	4	1
3	Customer service	4	3	1	2
	Unweighted score	52	27	48	33
	Weighted score	205	101	196	128

3.3 Cost Comparison and cost extrapolation

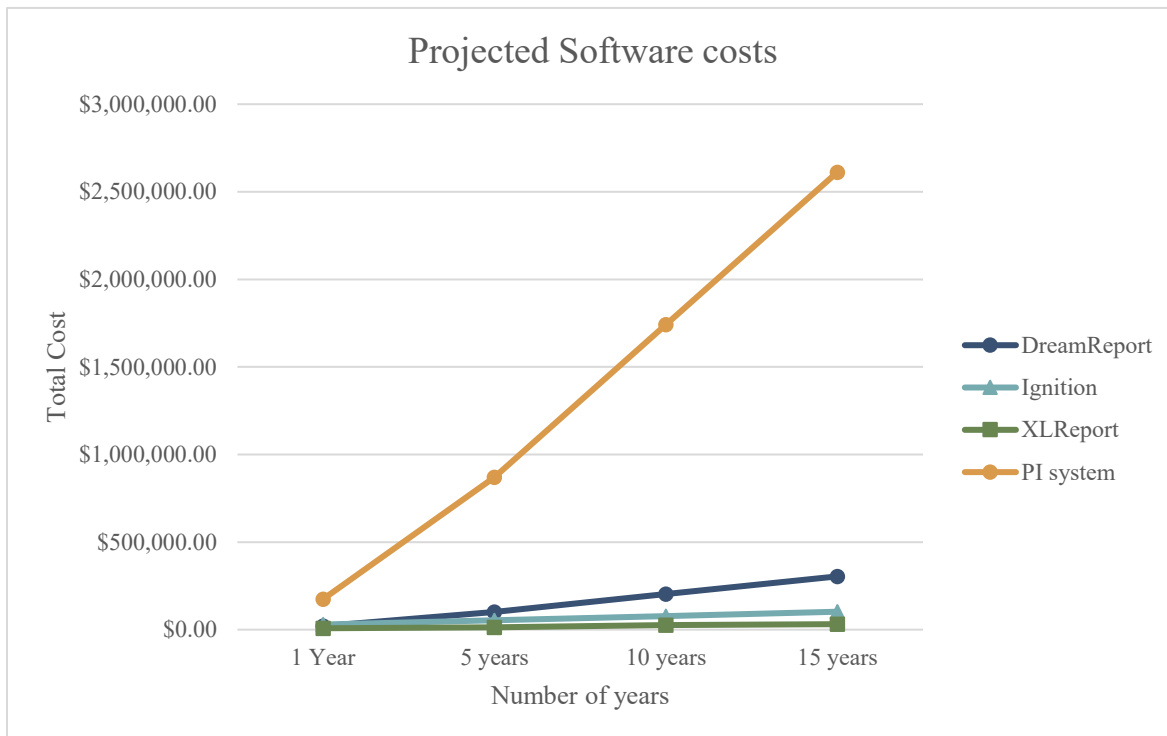


Figure 1 Software Cost Comparison

	1 Year	5 years	10 years	15 years
DreamReport	\$20,266.00	\$101,330.00	\$202,660.00	\$303,990.00
Ignition	\$29,205.00	\$53,542.50	\$77,880.00	\$102,217.50
XLReport	\$7,850.00	\$13,700.00	\$25,400.00	\$31,250.00
PI system	\$174,126.62	\$870,633.10	\$1,741,266.20	\$2,611,899.30



4. Report Generation Software Overview

This section compares the relative advantages and disadvantages of each software platform considered.

4.1 DreamReport

Cost

DreamReport has a yearly license cost of \$20,266 per year. Extrapolating into the future with an assumed fixed licensing cost DreamReport will cost \$101,330 for 5 years, \$202,660 for 10 years, and \$303,990 for 15 years. Comparing this cost to other options over the long term nets a ranking of 2 on the pricing category.

Overview

DreamReport has good dashboard usability, with specific data metrics being able to be displayed for a range of time on a user's dashboard. Additional dashboards can be created that can aid in the viewing of additional performance metrics. Because of this the software platform scored a ranking of 3 on the user dashboard configuration category for this reason.

Users can create custom reports, but are limited by the number of licenses available, additional licenses can be added to the system, the look of these reports and the ease of use the software platform scored a ranking of 3 on the custom report creation category for this reason.

Integration with VTScada is supported as they have a multitude of over 100 drivers available to connect different databases to the system. This also means that the software should be able to work with LIMS or HSQ for data that's not yet in VTScada. The software platform scored a ranking of 4 on the VTScada integration category and a ranking of 4 for database integration since there is a large number of available drivers for the software.

Automatic triggered reports can be created upon certain conditions being triggered, this can be set up for when a specific water parameter or equipment function reaches a certain threshold or a schedule can be established for report generation. These reports can be sent out to specific individuals through email as a PDF or other formats. The software platform scored a ranking of 3 on the automatic report creation category for this reason as it gives great flexibility in the ability to set up automations.

NIST cybersecurity compliance is another important feature of the software, alongside this NIST compliance the software platform is also able to be set up to be 21CFR part 11 compliant. The software platform scored a ranking of 3 on the security category and 4 for 21 CFR part 11 compliance categories.

DreamReport can be used through a browser window with individual logins for operators but editing reports cannot be done through the web interface and must be done through their report creator software. The software scored a ranking of 3 on the browser usability category for the ease of use of the browser user interface but lack of report editing.



The scalability of this software is more restrictive than other software platforms as the number of tags and users are licensed, this means that for smaller installations there will be an increase in cost for more tags being added but once a certain threshold is met then an unlimited tag licensing option is available, this is the same case with the number of concurrent users that can create reports. Even though the City's tag licensing would fall under the unlimited category the more restrictive nature of the licensing of the software caused the platform to score a ranking of 1 when comparing against the other platforms on the scalability evaluation criteria.

Specialized functionality allows plant operators to create custom SQL queries and create customized scripts to generate reports or extract data in ways that would not otherwise be available DreamReport is able to run specialized functions and calculations because of this it scores a ranking of 4 on the specialized functions category.

DreamReport is able to be integrated with the HMI through their large number of drivers and connectors, which enables the triggered report functionality. Due to this DreamReport scores a ranking of 4 on the HMI integration category.

DreamReport security updates and general updates are provided as part of the subscription-based model, the software scores a ranking of 3 for the software support and maintenance category.

A redundancy license is available for 50% of the cost of the main license, this is comparable to other offerings, the software scores a ranking of 4 on the redundancy category.

Ocean Data Systems, the company that makes DreamReport is a small company of 11-50 employees based out of Europe, with 75 million matches on Google, it scores a ranking of 3 on the company prominence category.

Ocean Data Systems had by far the quickest responding and most knowledgeable sales representatives who were able to be reached quickly and provided exceptional knowledge of the uses of the software platform and had the required documentation quickly available the platform scored a ranking of 4 on the customer service category.

Advantages

DreamReport has several different advantages that make it a unique and useful tool for The City. The software has some useful advantages such as the ability to automatically generate reports upon specific triggers. For example, a water sample parameter going above a certain threshold could trigger an automatic report generation that could display the historical trendline of the parameter alongside other important data to figure out the reason for parameter deviation. This gives the ability to streamline meeting regulatory compliance.

Another advantage for DreamReport is the multitude of drivers that are available to The City. DreamReport's large number of drivers make it easy to integrate with other software and other databases that make integration much easier than other reporting platforms including manual data entry.



DreamReport has the advantage of being NIST certified for cybersecurity. Wastewater treatment is a critical part of everyday life that the environment and many people's lives depend on. Being certified for adequate cybersecurity standards ensures adequate safety and security is being followed. DreamReport also can meet 21 CFR part 11 compliance requirements, this makes the reports and findings trustworthy, reliable, and equivalent to paper records and handwritten signatures. DreamReport is extensively used in the life sciences industry due to this ability.

Additionally, DreamReport can be integrated into HMI and PLCs, readily and easily with the large number of adapters that are available on the software platform. This can make it easy to integrate with the Plant's current system and any potential changes that may happen in the long term. Having this flexibility is a significant advantage

Disadvantages

DreamReport has some disadvantages related to the size of Ocean Data Systems, the company that created the software platform. Although it is not the smallest company out of the set of companies that were reviewed it is a non-domestic company. Although this may not be a significant issue for the usability of the software it should be considered in the case that there are any restrictions on whether or not the City is allowed to operate software from non-domestic companies.

DreamReport's licensing structure for concurrent users is similar to that of the tag numbers but with a small amount of added flexibility with the licensing sizes. DreamReport has licenses that can be combined for the number of concurrent users. Meaning that if the plant requires for example 15 users a 10 user license and a 5 user license can be combined to meet the number of required licenses. This makes increasing the number of users incur an additional recurring cost that should be taken into account.



4.2 Ignition

Cost

Ignition non cloud edition has an upfront cost of \$24,337.50 with a yearly support cost of \$4867.5. The city is expected to spend a total of \$29,205.00 on the first year, \$53,542.50 for five years, \$77,880 for ten years and \$102,217.50 at fifteen years. Because of this cost the software platform lands a ranking of 3 on the pricing as although it has a higher initial cost than DreamReport over the course of a few years the cost is lower than DreamReport.

Overview

Ignition in the non-cloud version of the software lacks the functionality of being able to be set up so that multiple users can access different kinds of data, view and create reports. This would mean that to gain this feature the software would need to be run in a hybrid method that requires a cloud version of the software to be run in parallel. Because of this the software scored a ranking of 2 for the user dashboard configuration, and 1 for custom report creation.

The platform is able to integrate with VTScada depending on how the database is set up. This is comparable to other offerings; Ignition scored a rank of 1 for the VTScada integration category after taking into consideration the need to have a link between the cloud edition of the software to VTScada as well. Ignition can also integrate with LIMS as it has many generic communication systems, and it should be able to pull the data from any system if it uses a generic system. Due to the required cloud link to the plant network, it also scored a 1 in the database integration category.

Ignition can schedule reports that can be emailed out to users, but because it lacks other significant features in this category to make it stand out it scored a ranking of 1 in the category of automated reports.

NIST cybersecurity standards are self-attested to be followed by Ignition however it is not certified to be following these standards which could leave room for uncertainty. Due to this level of uncertainty the software scores a rank of 2 for the Security category.

The software platform can be set up to meet 21 CFR part 11 compliance requirements like the other platforms. The software platform ranks 1 for 21CFR part 11 after taking into consideration other categories' rankings.

Browser usability is not available without having the hybrid model due to this lack of capability from the platform in the non cloud version of the software it scores a rank of 1 for the browser usability category.

Ignition has an exceptional capability to expand without limit with an unlimited number of tags and users being able to be used this unlimited ability to expand allows the software platform to score a rank of 4 for the scalability category due to the lack of any restrictions on the size of the platform.

Ignition is also able to support custom functions and SQL scripts like the other platforms after considering the rankings on other categories it scored a rank of 1 for the specialized functions category



The platform can integrate with the HMI however that depends on how it was set up, if the HMI was not set up in a way that it can integrate with Ignition then it might not adequately integrate, because of this it scored a rank of 1 for the HMI integration category.

Ignition's offering of a permanent license for the on-site server has regular security updates. The cloud version of the server will be updated with the latest features and security updates. Support can be provided by Ignition for the on-site server which would help ensure that the platform runs smoothly. This is comparable to other platforms however the necessity of having to manage a cloud server in addition to the on-site server gives the platform a rank of 1 for the Software support and maintenance category.

Ignition offers a redundancy license that is provided at 50% the cost of the main license which is in line with other offerings and scores it a rank of 2 on the redundancy category.

Inductive Automation is a small company based out of Folsom California. With between 11 to 50 employees and 9 million matches on Google. After considering the size of the other companies reviewed it scores a ranking of 2 in the company prominence category.

Customer service was quick and knowledgeable, with pricing clearly visible on the website. Sales representatives were quick to answer messages, schedule meetings, answer questions and return quotes in a timely manner. Ignition scores a ranking of 3 on the customer service category.

Advantages

Ignition is an all-in-one solution where licensing is based upon the server license and the amount of time that the cloud server is running. The Ignition platform has an unlimited number of tags can be tracked, and an unlimited number of people can edit and create reports at the same time. This allows for great flexibility as once the software is purchased no additional costs will concur for additional licensing for tags or users, so The City is able to expand their processes as much as they desire.

Some other advantages for the Ignition platform include self-attested NIST cybersecurity compliance. Although Ignition has not been directly verified by NIST they still self-report to follow all applicable practices to ensure high cybersecurity and regulatory compliance for their software. This is incredibly important, especially in today's world where cybercriminals pose a constant threat to automated infrastructure systems.

Additionally, ignition can be set up to meet 21 CFR part 11 compliance requirements, another bonus that makes the data and the reports from this platform trustworthy, reliable, and equivalent to paper records and handwritten signatures.

Disadvantages

For multiple users to be able to have access to a web portal to be able to create their own reports the cloud version of this software must be used which requires a different licensing agreement where the cost is related to the amount of time that the service is being used which The City indicated that they did not



wish to run a cloud server. This is a significant issue as this would prevent certain features from being able to be used.

Although Ignition is self-reported to be NIST cybersecurity Ignition has not been certified by the NIST. This is a consideration that must be made as The City would be reliant on Inductive Automation to accurately report their compliance and this might prove to be a risk if Inductive Automation was not through in their own analysis.



4.3 PI System

Cost

The PI System and its required add on platforms have a yearly licensing cost of \$174,126.62, with a 5 year estimated cost of \$870,633.10, a 10 year estimated cost of \$1,741,266.20, and a 15 year estimated cost of \$2,611,899.30 this platform is the highest cost option out of all of the other platforms reviewed, because of this it scored a ranking of 1 on the cost category.

Overview

With the PI system, users can create layouts and save them on their own dashboards with a clean and intuitive user interface. This capability leads the PI system to score a 4 on the user dashboard configuration category.

The PI System can create reports quickly and effectively from the User's dashboard and is able to export them as PDFs and other file formats that are supported by Excel. This ability to create the reports and view them quickly let the PI system platform score a 4 on the Custom Report creation category.

VTScada integration can be provided by using the correct adapter for the PI system as it has adapters for a multitude of different platforms and databases that give it great flexibility. This allowed the PI system platform to score a 3 on the VTScada integration category.

Due to the large number of adapters the PI system is able to integrate with different kinds of databases with the right adapters which means that LIMS and any data not yet available in VTScada can easily be added to the PI System. This allowed the PI System to rank 3 on the database integration category.

The PI System is able to generate reports automatically upon specific conditions and be able to schedule automated reports to be periodically emailed and sent out to users through email or other methods with PI Event Frames, due to this added flexibility the PI system scores a 4 on the automated reports category.

Cybersecurity is a top priority for the PI System, AVEVA has collaborated with leading security bodies such as homeland security, Microsoft SDL, NIST and NCCoE to develop the platform in a secure and safe manner. Due to this commitment, the PI System ranks 4 on the Security category.

The PI System platform is also able to be set up to meet 21 CFR part 11 compliance requirements, this is comparable with the other platforms and gives the PI System a rank of 3 on the 21 CFR part 11 compliance category.

The PI System's addon PIVision is also able to integrate with Microsoft Active Directory accounts so that users can log in and be able to access customized reports that they've been given access to. On top of this the user interface is by far the best looking out of all the other platforms from the media that was able to be found online. Due to this unique advantage the platform ranks 4 for the Browser Usability category.

The PI System can scale well some customers using this system are able to track and pull metrics from over a million tags in some instances with several users being able to pull data at the same time. Sales did



not indicate whether the system cost more for additional tags as the quote was created with 100,000 tags and 5 concurrent users. However, due to the uncertainty of whether an additional cost would be incurred to add more tags the platform scores a ranking of 2 in the scalability category.

The PI System is able to have custom calculations and tracking for KPIs with an expansive built in library, there is also an available bi-directional SQL database toolkit that can read and write data back to the SQL database. Due to the ability for the platform to do these tasks with add on toolkits it scores a ranking of 3 on the specialized functions category.

Integration with the HMI is able to be achieved through the PI Interface for OPC DA or RDBMS tools. The platform scores a ranking of 3 for the HMI integration category.

AVEVA has a commitment to software support and development as their lifecycle practices align with ISO 27034, they also provide a security bulletin every few months to ensure that customers are up to date with alerts on cyber security and compliance. Patches are available whenever bugs or security concerns are found. The Platform ranks 4 in the Software support and maintenance category.

Redundancy can be set up on the PI System with different kinds of disaster recovery at all levels of the system. Sales did not specify the additional cost, but it was requested to have redundancy quoted, on the quote it is not specified how much of the cost can be attributed to redundancy. Due to the uncertainty of the pricing the platform ranks 1 in the redundancy category.

AVEVA is the largest company of the set of companies that were evaluated. AVEVA is not a domestic company, and neither is its parent Schneider Electric. However, due to the large international presence of both companies with over 170 million matches on google for AVEVA alone, it ranks 4 in the Company Prominence category.

Customer service was poor, getting in contact with sales took a considerable amount of effort, several calls and emails had to be made before being able to be connected to a salesperson who was unable to proceed until I was able to disclose information about the client. The sales representative was not very well versed in the capabilities of the PIVision software and only referred to online videos about the platform. There was a large delay as well in receiving a quote and they did not have any wastewater specific sample reports that were easily referenced. Due to the difficulty in acquiring information about the platform it is ranked 1 in the Customer Service category.

Advantages

Some of the unique advantages of PI Platform is the ability to integrate with Microsoft active directory. This will enable users to sign in and access their own reports and data visualization tools in the PIVision system. This integration with Microsoft active directory will allow the operator's own sign in to be used with the software platform, this is incredibly useful as the use of active directory streamlines the IT operations and cybersecurity implementation. This cuts down on the effort required to integrate any new plant operators as IT can use the very sign on that is used by Active Directory onto the PIVision platform



which means that plant managers can more effectively manage password security and requirement compliance.

Another advantage is the cybersecurity of the platform, following several high quality standards for both software lifecycle and security.

In addition to this the large presence of the company and large number of clients across the world it demonstrates that their software platforms and tools are reliable and quality tools. It also gives the company a greater level of resources to improve and refine their products and provide the best quality for their clients.

The user interface looks to be extremely refined and responsive; the level of customization and quality of product is a significant advantage of this platform as none of the other platforms seem to have this level of quality to their products. A responsive and intuitive interface that is quickly able to be learned can aid in the reduction of errors and man hours spent in training and acquiring staff proficiency on the platform can reduce the long term operating costs of a plant.

Disadvantages

One of the most prominent disadvantages of the PIVision software is the cost, the high cost of the software makes this the most expensive option of all the software platforms that are available by a significant number. This high cost is something that The City must take into consideration as it is significantly higher over the long term than the other platforms even with some of the unique advantages that the platform may provide. Such high costs over the long term should be considered heavily as the costs could be used for other plant operations or improvements.

Another disadvantage was the lackluster customer service, the difficulty in getting connected to a sales representative and the lack of knowledge about the software platform might a reflection of how the company might operate. If their sales representatives are difficult to contact and are not very knowledgeable about their product it could be an indication of a company culture of substandard care of their customers and products which could make operating the software difficult in the long term which could have unforeseen expenses in the number of man hours, it might take to remedy an issue with the software or integration of features.

In addition to this the sales representative was not able to provide me with pricing as pricing is handled by their partner company. This made it difficult to gauge the potential scalability of the software platform past 100,000 tags or 5 concurrent users. Although the plant may not end up using over 100,000 tags in the near future, advances with new advanced sensors, tag numbers may significantly increase over the long term which might necessitate a greater number of tags. This could incur an additional recurring expense to the software platform that is currently not being projected.



4.4 XLReport

Cost

XLReport has a licensing cost of \$7,850.00, this is for a 3 year subscription plan which includes a one time \$2000 scoping meeting, software installation services, validation and customized training cost. The recurring subscription cost is \$5,850. A 5 year estimated cost would be \$13,700.00, a 10 year estimated cost of \$25,400 and a 15 year estimated cost of \$31,250 because of the low cost compared to the other options the software platform ranks 4 on the pricing category.

Overview

The XLReport platform is unable to create user dashboards or edit them directly but users can create a report that can function as a dashboard, the software platform scored a ranking of 1 because of this limitation.

Concurrent users can create and edit reports on the XLReport platform, the total number of users that can do this is limited to the number of licensing available, this is in line with other platforms. Because of this XLReport scored a ranking of 2 for the custom report creation category.

Integration with VTScada is possible with the use of the drivers that XLReport has. The platform has adapters for many kinds of databases, as a rule of thumb. If the system uses a generic communication system the platform should be able to pull data from the database. Because of this ability the software scores a rank of 2 for the VTScada integration category and a rank of 2 for the database integration category.

XLReport can automatically schedule reports, these reports are able to be sent automatically as several different file formats including PDFs which can be locked or unlocked. Although the platform meets the requirements it lacks any distinctive features that make it stand out. Because of this it scores a ranking of 2 on the automated reports category.

NIST security compliance is one of the features that the XLReport platform lacks, this lack of verified security compliance gives it a ranking of 1 in the security category. It also appears that XLReport can be set up to meet 21 CFR part 11 compliance requirements which scores the software platform a ranking of 2 for the 21 CFR part 11 compliance category.

The software platform can be used out of a browser window to create reports, this is comparable to the other platforms evaluated however, it is unable to provide a view of live data as that would require the use of their WIN911 alarming software which can be bundled on top of the XLReport platform. Because of this limitation the software platform ranks 2 on the browser usability category.

XLReport is able to scale very well as it has an unlimited number of tags available with additional user licenses being able to be added as the need arises. This extra flexibility gives XLReport a ranking of 3 on the scalability category.



Specialized functions can be used, with custom scripting and SQL capabilities being enabled to search and edit the database if there is a need to do so. This gives the XLReport software platform a ranking of 2 for the specialized functions category.

XLReport can integrate with several different kinds of HMIs as it has a multitude of adapters after considering the ranking of other categories, the software platform ranks 2 for the HMI integration category.

Software security and bug updates are provided for the software platform whenever there are any vulnerabilities identified. maintenance is provided through the subscription model, this is comparable to other offerings, because of this the XLReport platform ranks 2 for the software support and maintenance

A redundant server can be installed at a cost of 50% of the main license which is standard with the other offerings. The software platform ranks 3 on the redundancy category for this reason.

SmartSights is a small company with 50-200 employees that is based out of Austin Texas, it is a medium sized company that brings up about 79,000 matches on google with more employees than the other domestic option. Because of this it ranks 1 on the company prominence category

Customer service was relatively quick with the sales representatives being able to provide technical information on the 2nd call and being able to answer questions relatively quickly. Although the response was quick the quality of the reports that were provided were substandard as they were split over several pages and incomplete. Because of this the company ranks 2 on the customer service category.

Advantages

XLReport has the advantage of having an unlimited number of tags that are available to be tracked, this gives the software great flexibility and a great ability to scale without worry of having to handle an additional expense if more tags are required to be added. This gives the software great flexibility and can allow the plant to grow and expand without worry about the number of tags.

Another advantage for XLReport is that the technology they are based around is Microsoft Excel which makes the software intuitive to use and make it easier for plant operators to be proficient in than other software platforms. Most individuals have worked with or seen Excel before which can decrease training costs.

Like the other software platforms analyzed XLReport is also able to be accessed through a web portal on a browser to get added flexibility for the operators, this will allow the operators to access report making abilities on any device that is able to open a web browser. XLReport is able to communicate with VTScaada and pull from the database to generate reports.

Disadvantages

One of the biggest disadvantages of XLReport is the fact that the software platform is not NIST compliant. This is a significant disadvantage as this means that the software could be vulnerable and provide a backdoor for any potential malicious actors to gain access to The City's systems. This



disadvantage is something that must be kept in mind due to the significant risk that an unsecure application can pose to The City. In addition to this the Sales

Additionally XLReport has a licensing agreement that requires a license for the number of concurrent users that are able to generate reports, this could be an issue if The City decides to increase the number of users that are able to generate reports to increase facility flexibility as this would incur an additional cost to The City.



5. Software recommendation

Based on the outcome of the decision matrix the best choice for report creation software would be Ocean Data System's DreamReport platform. Although other platforms had advantages over the DreamReport platform the overall scores for the DreamReport platform were 205 for the weighted score and 52 for the unweighted score.

DreamReport offers a range of advantages that make it a valuable software platform for various applications. Its dashboard usability is commendable, allowing users to display specific data metrics over a range of time and create additional dashboards for viewing performance metrics. This flexibility in dashboard configuration enhances the user experience by providing tailored views of critical data. The platform supports custom report creation, although it is limited by the number of available licenses. However, additional licenses can be added to the system, which allows for greater customization and scalability in reporting capabilities.

Integration with VTScaDa is available, with over 100 drivers available to connect different databases, making it compatible with many different systems. This extensive integration capability ensures that DreamReport can work seamlessly with various data sources, enhancing its utility in diverse operational environments. The software also excels in database integration due to the large number of available drivers, which facilitates smooth data flow and management across different platforms.

Automatic triggered reports can be set up based on specific conditions or schedules, providing flexibility in automation. For instance, reports can be generated when a specific water parameter or equipment function reaches a certain threshold, or they can be scheduled to run at regular intervals. These reports can be sent out to specific individuals through email in various formats, such as PDF, ensuring timely and efficient communication of critical information. DreamReport is compliant with NIST cybersecurity standards and can be set up to be 21 CFR part 11 compliant, enhancing its security credentials and making it suitable for use in regulated industries.

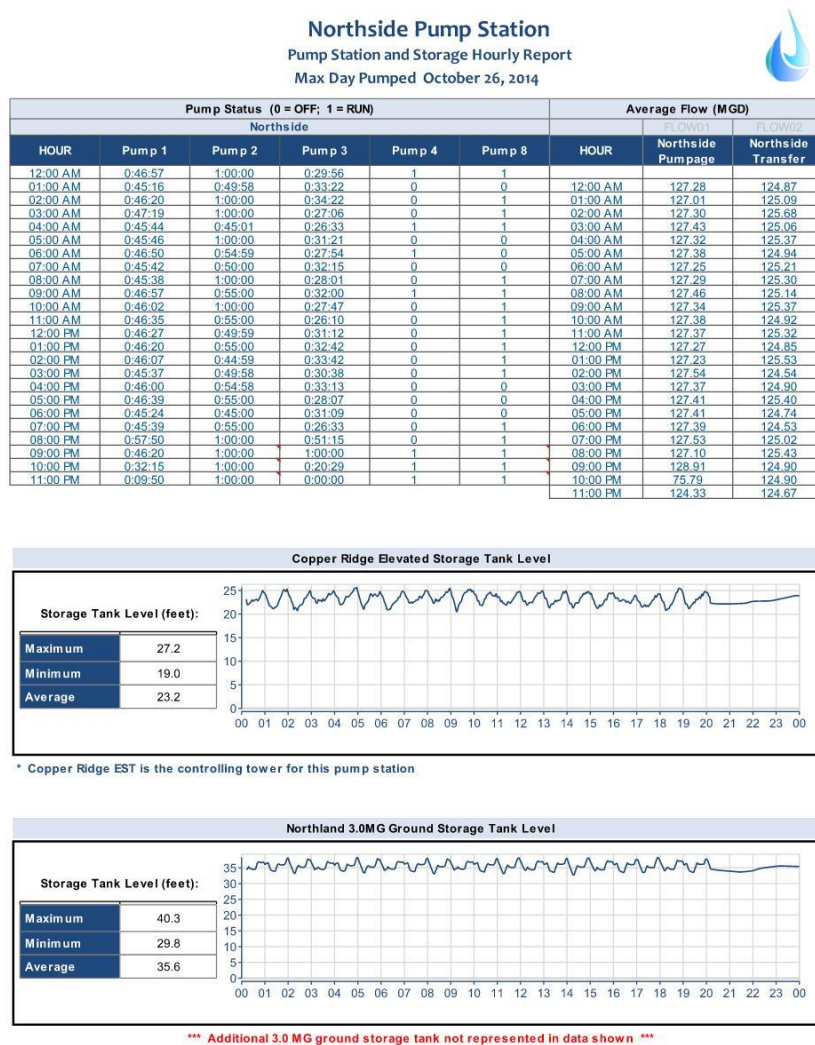
While the browser usability is good for viewing, report editing must be done through the report creator software. This limitation is offset by the ease of use and look of the browser user interface, which scored well in evaluations.

Additionally, DreamReport provides regular security and general updates as part of its subscription model, ensuring that the software remains up-to-date and secure. The availability of a redundancy license at a competitive cost further enhances its appeal, providing a cost-effective solution for ensuring system reliability. The company behind DreamReport, Ocean Data Systems, is noted for its responsive and knowledgeable customer service. Their sales representatives are quick to respond and provide exceptional knowledge of the software platform, which adds to the overall positive user experience.

In summary, DreamReport stands out for its robust integration capabilities, flexible automation options, and strong security compliance. While there are some limitations in terms of scalability and browser-based report creation, the platform's specialized functions, regular updates, and excellent customer service make it a compelling choice for organizations looking to enhance their data reporting and management capabilities.

6. Appendix

6.1 DreamReport Sample Reports



Date Printed: 10/28/2014 14:29:46

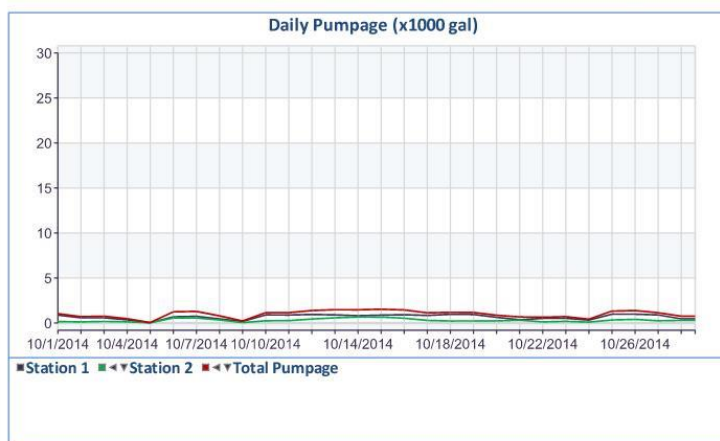
1

Figure 2 DreamReport Sample Report



Northside Region
 Department of Public Services
 Northside Pumpage Report Month of October 2014

Day	Date	Station 1	Station 2	Total Pumpage
Wed	1	0.879	0.157	1.036
Thu	2	0.580	0.124	0.704
Fri	3	0.578	0.173	0.752
Sat	4	0.910	0.332	1.241
Sun	5	0.027	0.018	0.044
Mon	6	0.688	0.556	1.243
Tue	7	0.741	0.550	1.291
Wed	8	0.452	0.338	0.790
Thu	9	0.170	0.045	0.215
Fri	10	0.903	0.247	1.150
Sat	11	0.887	0.263	1.150
Sun	12	0.949	0.437	1.386
Mon	13	0.903	0.574	1.477
Tue	14	0.807	0.660	1.467
Wed	15	0.875	0.655	1.530
Thu	16	0.920	0.532	1.452
Fri	17	0.841	0.288	1.129
Sat	18	0.627	0.096	0.723
Sun	19	0.945	0.227	1.172
Mon	20	0.635	0.228	0.863
Tue	21	0.358	0.314	0.672
Wed	22	0.517	0.123	0.639
Thu	23	0.522	0.183	0.706
Fri	24	0.323	0.099	0.422
Sat	25	0.987	0.334	1.321
Sun	26	0.981	0.402	1.383
Mon	27	0.896	0.245	1.141
Tue	28	0.465	0.291	0.756
Total:		19.36	8.49	27.85
Min:		0.03	0.02	0.04
Max:		0.99	0.66	1.53
Avg:		0.69	0.30	0.99



Date Printed: 10/28/2014 14:27:44

1

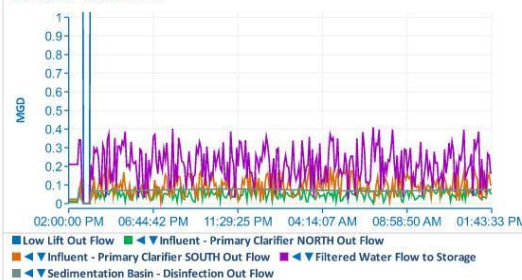
Figure 3 DreamReport Sample Report

Daily Totalization Report - 2023-01-30

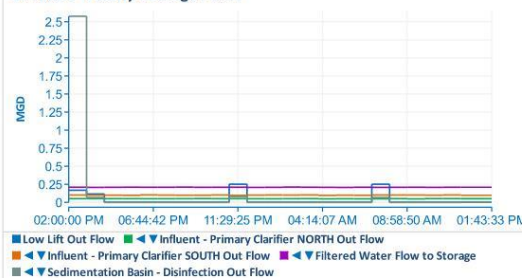
Hourly Totals (gal)

Hour	Low Lift Out Flow	South Flow	North Flow	Filtered H2O Flow	Disinfect. Out Flow
14:00	79,657	1,135	716	6,328	995
15:00	84,635	3,258	1,776	7,067	2,291
16:00	104,387	4,174	2,152	8,704	2,876
17:00	104,396	4,083	2,126	8,667	2,938
18:00	104,404	4,245	2,116	8,717	3,001
19:00	104,413	4,129	2,124	8,727	3,063
20:00	104,421	4,198	2,103	8,751	3,126
21:00	104,430	4,046	2,139	8,714	3,188
22:00	104,439	4,243	2,096	8,717	3,251
23:00	104,447	4,039	2,127	8,665	3,270
00:00	104,453	4,143	2,067	8,621	3,205
01:00	104,460	4,149	2,043	8,654	3,137
02:00	104,467	4,080	2,062	8,814	3,070
03:00	104,474	4,160	2,098	8,757	3,002
04:00	104,480	3,976	2,009	8,669	2,934
05:00	104,487	4,117	2,070	8,538	2,867
06:00	104,494	4,098	1,964	8,673	2,799
07:00	104,484	4,292	2,031	8,606	2,641
08:00	104,440	4,297	2,158	8,679	2,305
09:00	104,396	4,258	1,955	8,690	1,964
10:00	104,352	4,024	2,185	8,659	1,623
11:00	104,308	4,342	2,057	8,737	1,282
12:00	104,264	4,050	2,067	8,684	941
13:00	75,651	3,114	1,589	6,440	470
TOTAL:	2,432,839	94,651	47,830	202,278	60,240

24 Hours - Raw Flows



24 Hours - Hourly Average Flows



Printed: 01/31/2023 01:43 PM

Figure 4 DreamReport Sample Report

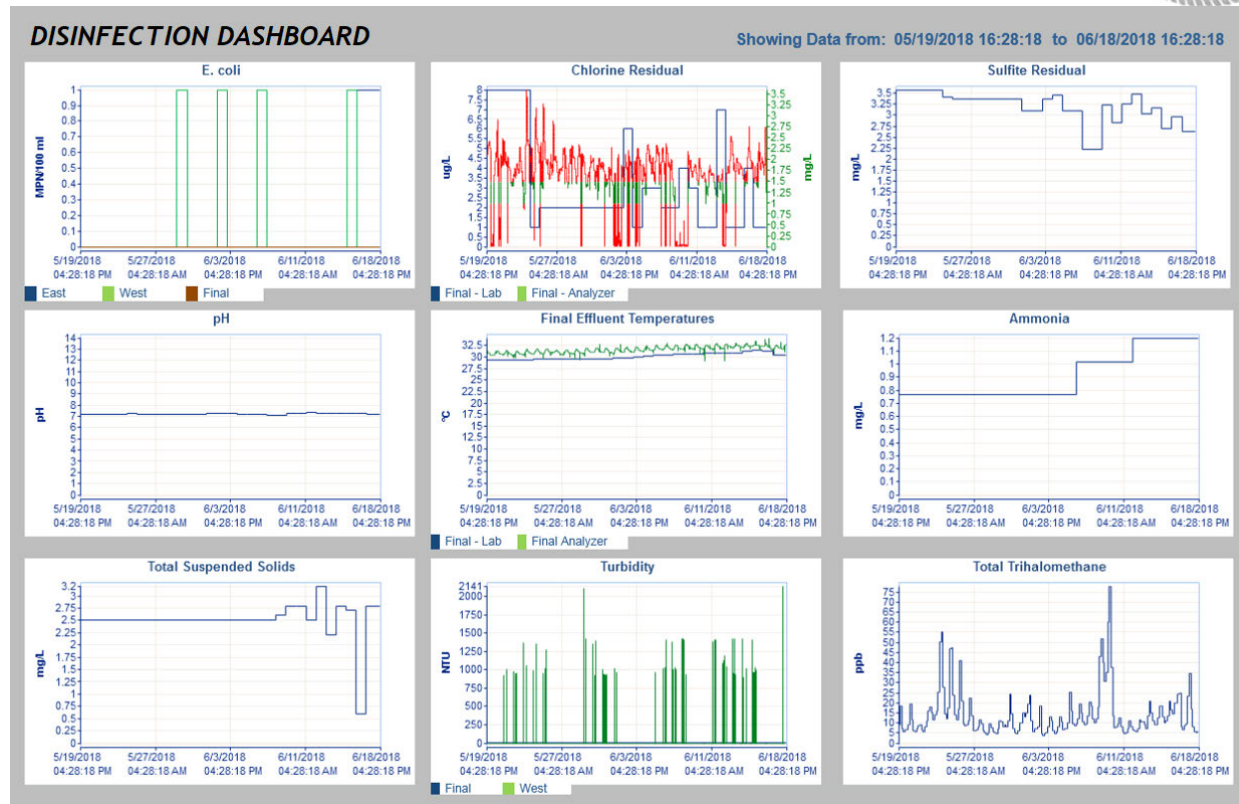


Figure 5 DreamReport Sample Dashboard



6.2 DreamReport Quote



OCEAN DATA SYSTEMS
The Art of Industrial Intelligence

Dream Report®

TO: Alan Madrid Hazen and Sawyer
FROM: Richard Kaye Ocean Data Systems
DATE: September 27, 2024
SUBJECT: Quote # 09272024-05 – Dream Report Subscription License

Dear Alan,

I am pleased to provide you with pricing for the requested Dream Report annual subscription license:

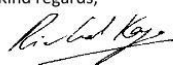
Part #	Description	Price (USD)
DR-UNLIM-SUB	Development and Runtime license for Unlimited Tags - Subscription - All available communication drivers - 200 Web Clients included - Maintenance and Support included - 1-year subscription	\$20,266 /year

Terms of Payment
 Quotation #: 09272024-05 F.O.B: Wayland, MA, U.S.A.
 Terms: Net 30 Days Transportation: Prepaid & Added
 Credit Card Payments: Credit card payments are subject to a 3.6% fee

Pricing is valid for 30 days. Please reference the above quote and address your order to *Ocean Data Systems* at:

orders@dreamreport.com
 Ocean Data Systems, Inc.
 173 Plain Road
 Wayland, MA 01778
 U.S.A.

Kind regards,

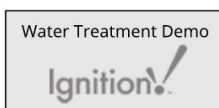


Richard Kaye
 V.P. Business Development - Americas
 Ocean Data Systems
 Tel (610) 202-3940
richard.kaye@dreamreport.com

Figure 6 DreamReport Quote



6.3 Ignition Sample Reports



Backwash Report

Filter 1 - All Backwashes	
Start Date	2024-08-30 13:47:24
End Date	2024-09-27 13:47:24

Filter	Start Date	End Date	Dur.	Type	Status	Before Backwash				After Backwash			
						Level	Flow	Loss of Head	Turb.	Level	Flow	Loss of Head	Turb.
1	2024-09-27 07:04:55	2024-09-27 07:09:12	6.9	Manual	Complete	94.32	0	2.44	0	95.38	0	0	0.1
1	2024-09-26 20:53:27	2024-09-26 20:57:44	7.0	Manual	Complete	94.53	0	7.21	0	94.32	0	0	0.1
1	2024-09-26 10:03:06	2024-09-26 10:07:23	6.9	Manual	Complete	94.66	1004.74	7.18	0.11	91.46	974.35	0.03	0.1
1	2024-09-25 12:52:30	2024-09-25 12:56:49	7.0	Manual	Complete	96.5	0	24.92	0	94.59	0	0	0.1
1	2024-09-20 08:51:13	2024-09-21 14:43:06	4,919.2	Manual	Complete	96.76	0	0	0	86.58	1967.52	0.03	0.1
1	2024-09-20 08:44:01	2024-09-20 08:48:19	7.0	Manual	Complete	90.54	1110.39	0	0	96.76	0	0	0.1
1	2024-09-20 08:44:01	2024-09-20 08:48:19	7.0	Manual	Complete	90.54	1110.39	0	0	96.76	0	0	0.1
1	2024-09-20 08:44:00	2024-09-20 08:48:19	7.0	Manual	Complete	93.64	0	0	0	96.76	0	0	0.1
1	2024-09-20 08:03:27	2024-09-20 08:07:44	6.9	Manual	Complete	90.45	0	5.69	0	93.64	0	0	0.1

Figure 7 Ignition Sample Report



Water Treatment Demo



Backwash Report

Filter Train 1 - Filter #1, 2, 3

All Backwashes for each filter

Start Date

2024-08-30 13:47:24

End Date

2024-09-27 13:47:24

Filter	Start	End	Dur.	Type	Status	Before Backwash				After Backwash			
						Level	Flow	Loss of Head	Turb.	Level	Flow	Loss of Head	Turb.
1	2024-09-01 06:08:08	2024-09-01 06:12:25	6.95	Auto	Complete	94.78	0	0	0	92.83	0	0	0.1
1	2024-09-02 10:32:22	2024-09-02 10:36:39	6.95	Manual	Complete	94.28	0	0	0	95.27	0	0	0.1
1	2024-09-02 09:50:39	2024-09-02 09:50:39	0	Auto	Complete	35.96	0	0	0	22.96	0	0	0
1	2024-09-02 09:50:33	2024-09-02 09:50:37	0.07	Auto	Complete	94.46	0	0	0	48.96	0	0	0
1	2024-09-02 09:21:40	2024-09-02 09:50:11	47.18	Manual	Complete	93.73	0	0	0	94.46	0	0	0.1
1	2024-09-02 06:01:44	2024-09-02 06:06:01	6.94	Manual	Complete	94.96	0	0	0	93.73	0	0	0.1
1	2024-09-02 03:33:09	2024-09-02 03:37:26	6.95	Manual	Complete	97.77	0	0	0	94.96	0	0	0.1
1	2024-09-02 02:13:50	2024-09-02 02:18:07	6.94	Manual	Complete	93.52	0	0	0	97.77	0	0	0.1
1	2024-09-01 09:01:14	2024-09-01 09:05:31	6.95	Auto	Complete	94.33	0	0	0	93.52	0	0	0.1
1	2024-09-01 08:55:12	2024-09-01 08:59:29	6.95	Auto	Complete	92.83	0	0	0	94.33	0	0	0.03

Figure 8 Ignition Sample Report



	Water Treatment
Form Title:	Monthly Operating Report
Effective Date:	Sep 27, 2024
Date Range:	Mar 1, 2024 - Apr 1, 2024

Water and Chemicals

Total Water In	Total Water Out	Total Chlorine Used	Total Fluoride Used
22,953,728.80 Gal	22,295,435.19 Gal	3.20 kg	7.65 kg

Pump Runtime

Pump	Part Number	Run Time	Maintenance Due	Progress	Last Maintenance
Chem Pump1	CHP-001	136.83 hrs	400 hrs	34%	2024-09-27 00:00:00
Chem Pump2	CHP-001	436.04 hrs	400 hrs	>100%	2024-09-20 00:00:00
Chem Pump3	CHP-001	118.83 hrs	400 hrs	30%	2024-09-27 00:00:00
Chem Pump4	CHP-001	388.83 hrs	400 hrs	97%	2024-09-27 00:00:00
ChemTransfer	CT-234	514.83 hrs	500 hrs	>100%	2024-09-27 00:00:00
FinishedWater Pump1	FW-025	1178.2 hrs	1000 hrs	>100%	2024-08-07 15:44:57
FinishedWater Pump2	FW-025	951.73 hrs	1000 hrs	95%	2024-09-25 00:00:00
FinishedWater Pump3	FW-025	995.73 hrs	1000 hrs	100%	2024-09-24 00:00:00
FinishedWater Pump4	FW-025	665.39 hrs	1000 hrs	67%	2024-08-30 16:50:30
FinishedWater Pump5	FW-025	995.4 hrs	1000 hrs	100%	2024-08-15 16:07:45
HighService Pump1	HS-940	881.79 hrs	750 hrs	>100%	2024-09-20 00:00:00
HighService Pump2	HS-940	528.37 hrs	750 hrs	70%	2024-08-30 16:50:30
HighService Pump3	HS-940	786.82 hrs	750 hrs	>100%	2024-09-26 00:00:00
HighService Pump4	HS-940	837.79 hrs	750 hrs	>100%	2024-09-21 00:00:00
RawWater Pump1	RW-104	1427.6 hrs	1200 hrs	>100%	2024-07-21 14:56:30
RawWater Pump2	RW-104	1208.26 hrs	1200 hrs	>100%	2024-08-05 15:39:15
RawWater Pump3	RW-104	683.9 hrs	1200 hrs	57%	2024-08-25 16:36:15
RawWater Pump4	RW-104	1302.69 hrs	1200 hrs	>100%	2024-07-31 15:25:00
RawWater Pump5	RW-104	1388.13 hrs	1200 hrs	>100%	2024-07-26 15:10:45

Sep 27, 2024

1 of 1

Figure 9 Ignition Sample Report

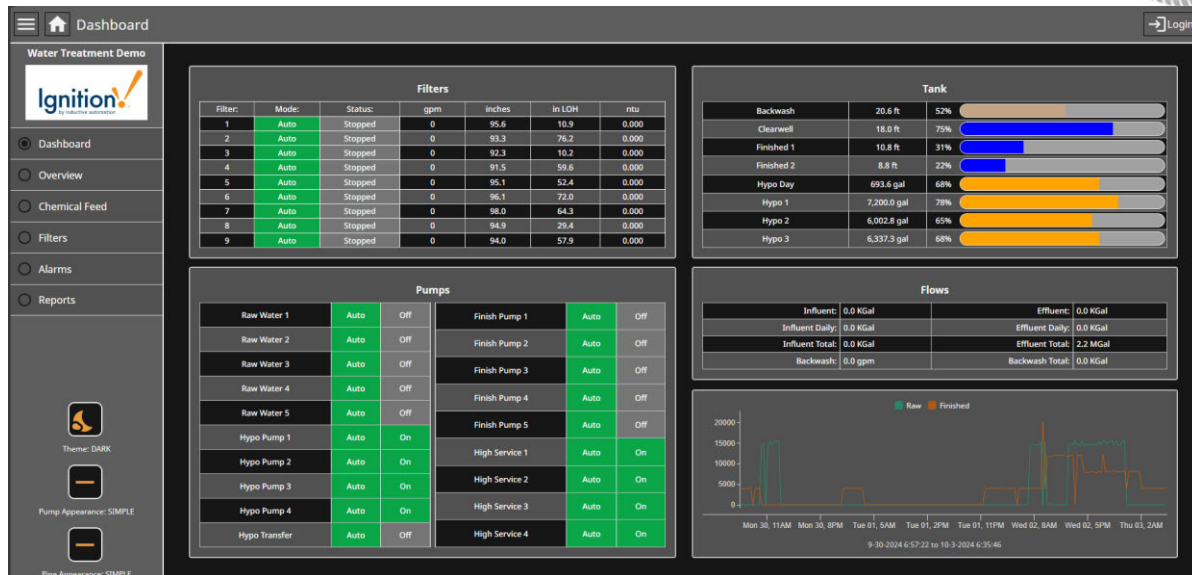


Figure 10 Ignition Sample Dashboard



6.4 Ignition Quote



Quote
Hazen and Sawyer

Quote #1343550

Quote valid: September 27, 2024 - November 26, 2024
Payment Terms: Net 30

Bill To:

Hazen and Sawyer
Alan Madrid
2420 LAKEMONT AVE
ORLANDO, FL 32814-6164
US

Ship To:

Hazen and Sawyer
Alan Madrid
2420 LAKEMONT AVE
ORLANDO, FL 32814-6164
US

Product	Price	Qty	Total
Ignition Custom Package 8.1- Main	\$16,225.00	1	\$16,225.00
- Ignition Platform			
- OPC UA Server Module			
- Core Drivers			
- Perspective Module			
- Symbol Factory			
- Reporting Module			
Ignition Custom Package 8.1- Backup	\$8,112.50	1	\$8,112.50
- Ignition Platform			
- OPC UA Server Module			
- Core Drivers			
- Perspective Module			
- Symbol Factory			
- Reporting Module			
TotalCare Support Plan: ORLANDO, FL	\$4,867.50	1	\$4,867.50
Term: Sep 27, 2024 - Dec 26, 2025			
Includes 90 days of free Post-Sales Support			
Get peace of mind for the entire year with phone, email, and web access to our technical support reps, free software upgrades, and 10% discounts on training courses.			
Price			\$29,205.00
Subtotal			\$29,205.00
Sales Tax			\$0.00
Total			\$29,205.00 USD

THIS QUOTE, AND ANY RELATED SALE, IS NULL AND VOID IF ALTERED IN ANY MANNER BY ANYONE OTHER THAN AUTHORIZED INDUCTIVE AUTOMATION PERSONNEL.
THIS QUOTE IS VALID ONLY TO THE PARTY TO WHOM IT IS ISSUED AND IS NOT VALID AND MAY NOT BE TRANSFERRED TO ANY OTHER PARTY.

Inductive Automation
90 Blue Ravine Road Folsom, CA 95630 USA

Ph (800) 266-7798
Int'l (916) 456-1045

Fax (916) 932-1194
inductiveautomation.com

Page
1 of 2

Figure 11 Ignition Quote

6.5 PIVision Reports

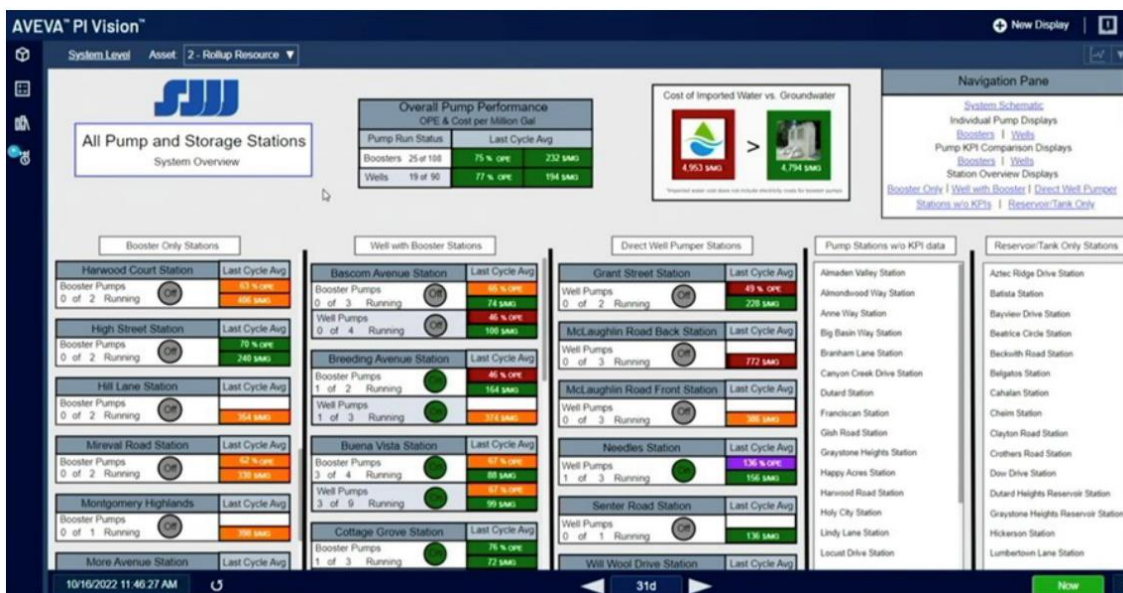


Figure 12 PIVision Layout



Figure 13 PIVision Data Visualization

OSISOFT

OSISOFT is now part of AVEVA

OSISOFT LLC | 1600 Alvarado Street | San Leandro, California 94577 United States

QUOTATION

QUOTE# Q-211265 | October 21, 2024

Quote Valid Thru December 31, 2024

SELLER

OSISOFT, LLC

1600 Alvarado Street
San Leandro, California 94577
United States

Account Manager:

Andrew Primeaux
andrew.primeaux@aveva.com

PURCHASER

CARAHSOFT Technology Corp

0005050800
11493 Sunset Hills Road, Suite 100
Reston, Virginia 20190
United States

Contact:

Paul Battaglia
+1 703-230-7422
paul.battaglia@carahsoft.com

INTRODUCTION

OSISOFT, LLC ("Seller") is submitting the present Quote to Carahsoft Technology Corp ("Purchaser").

Payment Terms: Net due in 30 days

In accordance with the terms of your agreement with us - timely payment of annual fees for our Software Reliance Program ("SRP") is required to continue receiving the benefits of our SRP program, including but not limited to accessing product downloads, submitting service requests and creating technical support cases. Avoiding lapses and late payments of SRP also serves to eliminate possible restrictions with regard to additional software license purchases.

SUMMARY

*Final Invoiced price is subject to following conditions:

Taxes may apply.

Software provided by download.If physical media shipment is requested, additional charges will apply.

Total Software Reliance Program (SRP) price is estimate based on the dates indicated.

Final SRP price will be prorated according to the date the order is processed.

Total Software License Fees: 195,890.00

*Projected Prorated SRP: 0.00

Software Discount: 21,763.38

*Total Price (USD): 174,126.62

1 of 4

HFC AWTP Master Plan
Howard F. Curren AWTP - SCADA System
Report Creator Software Evaluation



6.7 XLReport Sample Reports

Year Month		2022 October				
PROCESS						
		Form _F limits 0.3 1.0				Form G 0.2
	Date	Max	Count	Count<	Count>	Cl ₂ mg/L
	10/1/2022	0.07	6	6	0	2.27
	10/2/2022	0.07	6	6	0	2.24
	10/3/2022	0.07	6	6	0	2.25
	10/4/2022	0.15	6	6	0	1.64
	10/5/2022	0.15	6	6	0	2.30
	10/6/2022	0.15	6	6	0	1.45
	10/7/2022	0.17	6	6	0	2.16
	10/8/2022	0.17	6	6	0	1.77
	10/9/2022	0.17	6	6	0	2.30
	10/10/2022	0.17	6	6	0	2.24
	10/11/2022	0.15	6	6	0	1.53
	10/12/2022	1.09	6	5	1	1.53
	10/13/2022	0.17	6	6	0	2.27
	10/14/2022	0.15	6	6	0	2.28
	10/15/2022	0.15	6	6	0	2.30
	10/16/2022	0.11	6	6	0	1.66
	10/17/2022	0.11	6	6	0	1.59
	10/18/2022	0.11	6	6	0	2.21
	10/19/2022	0.11	6	6	0	1.51
	10/20/2022	0.11	6	6	0	1.59
	10/21/2022	0.11	6	6	0	2.21
	10/22/2022	0.07	6	6	0	1.73
	10/23/2022	0.07	6	6	0	1.49
	10/24/2022	0.15	6	6	0	2.22
	10/25/2022	0.15	6	6	0	1.73
	10/26/2022	0.17	6	6	0	1.94
	10/27/2022	0.17	6	6	0	2.25
	10/28/2022	0.17	6	6	0	1.77
	10/29/2022	0.17	6	6	0	2.30
	10/30/2022	0.17	6	6	0	2.24
	10/31/2022	0.17	6	6	0	1.53

FILTERS						
		Form J_2				
		Filter 1		Filter 2		Filter 3
	Date	Max	Max 4hr	Max	Max 4hr	Max
	10/1/2022	0.04	0.04	0.04	0.04	0.04
	10/2/2022	0.04	0.04	0.04	0.04	0.04
	10/3/2022	0.05	0.05	0.05	0.05	0.05
	10/4/2022	0.05	0.05	0.05	0.05	0.05
	10/5/2022	0.04	0.04	0.04	0.04	0.04
	10/6/2022	0.04	0.04	0.04	0.04	0.04
	10/7/2022	0.04	0.04	0.04	0.04	0.04

Figure 15 XLReport Sample Report



10/8/2022	0.05	0.05	0.05	0.05	0.05
10/9/2022	0.04	0.04	0.04	0.04	0.04
10/10/2022	0.04	0.04	0.04	0.04	0.04
10/11/2022	0.04	0.04	0.04	0.04	0.04
10/12/2022	0.05	0.05	0.05	0.05	0.05
10/13/2022	0.04	0.04	0.04	0.04	0.04
10/14/2022	0.04	0.04	0.04	0.04	0.04
10/15/2022	0.04	0.04	0.04	0.04	0.04
10/16/2022	0.04	0.04	0.04	0.04	0.04
10/17/2022	0.05	0.05	0.05	0.05	0.05
10/18/2022	0.04	0.04	0.04	0.04	0.04
10/19/2022	0.04	0.04	0.04	0.04	0.04
10/20/2022	0.04	0.04	0.04	0.04	0.04
10/21/2022	0.05	0.05	0.05	0.05	0.05
10/22/2022	0.04	0.04	0.04	0.04	0.04
10/23/2022	0.04	0.04	0.04	0.04	0.04
10/24/2022	0.04	0.04	0.04	0.04	0.04
10/25/2022	0.06	0.06	0.06	0.06	0.06
10/26/2022	0.04	0.04	0.04	0.04	0.04
10/27/2022	0.04	0.04	0.04	0.04	0.04
10/28/2022	0.04	0.04	0.04	0.04	0.04
10/29/2022	0.04	0.04	0.04	0.04	0.04
10/30/2022	0.05	0.05	0.05	0.05	0.05
10/31/2022	0.04	0.04	0.04	0.04	0.04

CHEMICALS							
		Chemicals					
	Date	Chlorine NaOCL	Manual Addition	Pomt. Hydro	Manual Addition	Poly Phosp.	
	10/1/2022	5.00		0	51.61	0	5.00
	10/2/2022	8.00		0	52.91	0	8.00
	10/3/2022	8.00		0	93.15	0	8.00
	10/4/2022	4.00		0	61.82	0	4.00
	10/5/2022	6.00		0	67.78	0	6.00
	10/6/2022	5.00		0	73.04	0	5.00
	10/7/2022	6.00		0	99.15	0	6.00
	10/8/2022	5.00		0	0.98	0	5.00
	10/9/2022	5.00		0	82.55	0	5.00
	10/10/2022	4.00		0	24.46	0	4.00
	10/11/2022	8.00		0	60.38	0	8.00
	10/12/2022	4.00		0	60.36	0	4.00
	10/13/2022	9.00		0	10.12	0	9.00
	10/14/2022	4.00		0	80.84	0	4.00
	10/15/2022	3.00		0	88.77	0	3.00
	10/16/2022	2.00		0	99.83	0	2.00
	10/17/2022	3.00		0	7.18	0	3.00
	10/18/2022	4.00		0	60.30	0	4.00
	10/19/2022	3.00		0	69.92	0	3.00
	10/20/2022	3.00		0	31.01	0	3.00
	10/21/2022	4.00		0	55.53	0	4.00

Figure 16 XLReport Sample Report



10/22/2022	4.00	0	0.74	0	4.00
10/23/2022	3.00	0	83.17	0	3.00
10/24/2022	3.00	0	51.61	0	3.00
10/25/2022	3.00	0	14.41	0	3.00
10/26/2022	4.00	0	77.36	0	4.00
10/27/2022	4.00	0	36.50	0	4.00
10/28/2022	4.00	0	43.82	0	4.00
10/29/2022	4.00	0	27.90	0	4.00
10/30/2022	3.00	0	54.76	0	3.00
10/31/2022	4.00	0	39.94	0	4.00

VIOLATIONS

Form G		Form J_1
Combined Filter > G6		Q4 : NTU > 1.0 fo
Date	NTU	Date
10/12/2022 0:45	1.1	10/5/2022 12:00
		10/5/2022 12:15
		10/17/2022 4:30
		10/17/2022 4:45

Figure 17 XLReport Sample Report



PO Box 19229 Austin, TX 78760
Phone: 512.326.1011 Email: sales@smartsights.com

Quote Name 2492585995 subscription
Expiration Date 12/24/2024
Prepared By Dylan Schmidt
Contact Name Allan Madrid-Huitron
Email amadridhuitron@hazenandsawyer.com
Please reference the quote name on your purchase order.

2101 NW Corporate Blvd, Suite 301
Boca Raton, FL 33458
US

Standard Terms:
Net 30 with approved credit, or Credit Card Shipment by UPS
Ground, PP&A
Prices and payment in U.S. dollars

Standard Delivery from receipt of approved order:
Two days after receipt of order
An Expedite Fee can accommodate earlier shipments

Product	Description	Discount (Percentage)	Quantity	Sales Price	Total Price
XLR-Ultimate	XLReporter Ultimate Subscription License (3-year term). Includes Connect, Design, Report from Real-Time, Historical, and Database data sources Distribute reports as Excel & PDF files Automatic report creation based on time/event and on-demand Five concurrent desktop or web client licenses to generate and view reports Generate reports using the REST API Analytic data logging Manual data entry Email and SMS Basic Customer Care with new product upgrades.		1.00	\$3,900.00	\$3,900.00
XLR-Ultimate	XLReporter Ultimate Subscription License (3-year term). Includes Connect, Design, Report from Real-Time, Historical, and Database data sources Distribute reports as Excel & PDF files Automatic report creation based on time/event and on-demand Five concurrent desktop or web client licenses to generate and view reports Generate reports using the REST API Analytic data logging Manual data entry Email and SMS Basic Customer Care with new product upgrades.	50.00%	1.00	\$3,900.00	\$1,950.00
XLR-Install	Includes initial scoping meeting, software installation services, validation and customized training.		2.00	\$1,000.00	\$2,000.00
Subtotal					\$9,800.00
Total Price					\$7,850.00
Grand Total					\$7,850.00

XLReporter Ultimate with redundant license (discounted at 50%)
Three-year term subscription comes with customer care support and complimentary upgrades.

OPTIONAL Installation and training included to ensure proper set up and install.

Thank you for the opportunity to provide a quote! Purchase orders and/or sales tax/resale exemption certificates may be emailed to orders@smartsights.com.

Figure 18 XLReport Quote



Howard F. Curren AWTP SCADA Standards - Policies Volume 1 of 3

SCADA Standards

City Project NO. 20-C-00001

Reliable Tampa Partners Project No. 23-502

Hazen and Sawyer Project No. 41077-013 Task 263, 264, 265

January 2025



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Revision History

REV	DATE	ENGINEER	NOTES
1	2/17/2025	Hazen and Sawyer	Final Submittal



List of Acronyms and Abbreviations

AWTP: Advanced Water Treatment Plant

CIP: Capital Improvement Projects

COT: City of Tampa

CPU: Central Processing Unit

HMI: Human Machine Interface

OITs: Operator Interface Terminals

OT: Operations Technology

PCS: Process Control System

PLCs: Programmable Logic Controllers

SCADA: Supervisory Control and Data Acquisition



1 Introduction

This is Volume 1 of the City of Tampa's standards for Supervisory Control and Data Acquisition (SCADA) and Process Control System (PCS) programming, configuration and design standards for The City of Tampa referred to as "The City" or abbreviated as "COT" throughout this document

Volume 1 is a compilation of policies and procedures and provides both guidance and specific requirements for control system work.

The City SCADA & PCS Standards and Conventions Manual is intended to be applied by the City's contractors, consultants, and in-house personnel when developing or modifying any portion of the City's control system. The control system is a utility-wide system built upon a common human machine interface (HMI) system and is comprised of the following:

Process Control System (PCS): The industrial control system for processes within the boundaries of the plant (Howard F. Curren AWTP). The primary function of the system is control and monitoring of plant operations. The PCS is comprised of the local HMI subsystem and various programmable logic controllers (PLCs) and operator interface terminals (OITs).

Supervisory Control and Data Acquisition (SCADA) System: The industrial control system for processes outside the boundaries of the process areas, ability to monitor and/or control the process from the control room from outside the plant. The primary function of this system is data acquisition; processes or remote sites are designed to run autonomously without supervisory control function. The SCADA system serves both remote sites such as lift stations and wastewater treatment plant facility in an integrated environment and is comprised of telemetry equipment with a supervisory HMI.

This manual is divided into three main volumes plus two appendices:

Volume 1 contains the control system policies and procedures that apply to the management, maintenance and modification of the control system. Volume 1 includes policies for:

- Programming laptop use
- Management of change (MOC)
- Software and application revision control
- Cybersecurity
- Other related topics.



Volume 2 addresses practices for development and programming of control processors such as:

- Programmable logic controllers (PLCs) of various types

Including requirements for programming software

- Alarm processing
- Control loops
- Control logic structure
- Input/output (I/O) layout and signal processing
- Programming comments
- Tagging and naming conventions.

Volume 3 contains practices for development and programming of human-machine interface (HMI) and operator interface terminals (OITs). Standards for programming and display development, historian data exchange, and security are included in this volume.

Appendix A Contains definitions and general references that provide clarity and detail to volumes 1 to 3 of the City of Tampa's SCADA standards manuals.

Appendix B Contains forms and documents needed for deviations and documentation of changes to the City's PCS or SCADA systems.

Compliance with the standards and conventions outlined in the manual is required for all projects that add to or modify the control system. If a contractor or staff member identifies a need for an addition or modification to the standards for a specific project, or if in the course of the work it is found that some part of the standards cannot be adhered to, a standards deviation request may be submitted in accordance with the requirements provided in Section 3 of this volume and in Appendix B.



2 Responsibilities Matrix

The policies and procedures contained in this manual must be periodically reviewed and updated to ensure accuracy based on changes to the City's systems and for changes to technology. This section describes the roles and responsibilities for maintenance and update of these policies.

Policy	City operations technology (OT) contact		Engineering/individuals supervising contractors
Controller Firmware Revision	• Overall implementation of this policy for COT • Coordinate the review/update of this policy as needed: at transition to new firmware release, due to SCADA or PCS changes, or at least every three years • Coordinate with COT engineering, construction and subcontractors for firmware requirements during capital improvement projects (CIP)	• Coordinate and/or perform training sessions for personnel and contractors • Assist with review/update of this policy as needed due to SCADA or PCS changes or at least every three years	• Ensure the requirements of this policy are implemented when contractors work on the SCADA or PCS
Applications Management of Change	• Overall implementation of this policy for COT • Coordinate the review/update of this policy as needed due to SCADA or PCS changes or at least every three years • Assignment of approver for engineering, construction, and CIP project modification requests • Approval of change requests submitted by COT OT contact	• Coordinate and/or perform training sessions for personnel and contractors • Assist with review/update of this policy as needed due to SCADA or PCS changes or at least every three years	• Ensure the requirements of this policy are implemented when contractors work on the SCADA or PCS



3 SCADA & PCS Standards Deviation Request

3.1 General

The City's SCADA & PCS Standards and Convention Manual is intended to provide consistent, reliable controls within all plants. However, it is recognized there may be specific instances in which a contractor or supplier may not be able to fully comply with the standards for software, equipment, cabling and other control system components supplied or developed under a contract or other procurement method or may not be able to program or configure the system in conformance with these standards. When these cases arise, the contractor or supplier shall submit a request for deviation from the City's standards using the Standards Deviation Request Form included in Appendix B. The City will review the issues documented on the form and any supplemental documentation that is supplied with the request, and if compelling reasons are presented, the City may grant the deviation. The standards deviation request shall meet the following criteria:

- 1) It shall clearly indicate those sections of the standards relevant to the proposed deviation(s).
- 2) It shall verify that compliance with the standards form which the deviation(s) is requested is, under the circumstances, not feasible.
- 3) It shall include a specific description of the proposed alternative to the requirements in the City's standards and include supporting documentation. Documentation may include references demonstrating successful use by other public utilities.

3.2 Procedure

The process to request a deviation from the City's SCADA & PCS Standards and Conventions is as follows:

- 1) Fill out and submit the Standards Deviation Request Form. The form shall be filled out electronically and submitted via e-mail to the City's designated project manager or other designated contact. The city will supply the blank electronic form on request. A copy of the form is included in Appendix B.
- 2) Transmit supporting documentation securely through City approved transmittal methods if file contents are sensitive such as VTS changesets, PLC programs, etc. Drawings, mark-ups, photographs, sketches, or vendor-supplied product information with the deviation request e-mail. If attachments exceed mailbox



limits, submission shall occur via secure USB flash drive, approved file sharing site, or other agreed means of sharing large files.

- 3) Additional information may be requested by the City and/or an alternative solution(s) presented by the requester. A meeting may be requested by the deviation requester to explain the issues to the City's project manager and project team members.
- 4) The City's staff reviews of the standards deviation request will result in the City assigning one of the following statuses:
 - a. Accepted: If the requested deviation is acceptable, the City will notify the requester in writing and note any limitations placed on the allowable deviation.
 - b. Rejected: If the requested deviation is rejected, the City will notify the requester in writing and the work shall proceed without delay in accordance with the contract or other pertinent procurement requirements.

The City will return a written decision within ten (10) working days under normal circumstances. Complex issues may require additional time for analysis and preparation of a response. The City will work with the requester if further explanation or discussion is needed to reach a timely decision.

Appeals of the City's decision shall be submitted within ten (10) calendar days of the date of the decision and shall be submitted in writing to the City's project manager.



4 SCADA & PCS Programming Laptop Request

4.1 General

Any on-site control system changes to be implemented shall require prior approval from the City, usage of any equipment to make control system changes shall require the City's T&I (IT department) authorization and requires portable media to be scanned for malware or request the City's laptop. Use of the City's laptop is encouraged to provide consistent software versioning, ensure use of the SCADA & PCS Change Management Server, and promote SCADA & PCS security.

4.2 Procedure

The process to request a laptop from the City is as follows:

- 1) Fill out and submit the Programming Laptop Request Form. The form shall be filled out electronically and submitted via e-mail to the City's designated project manager or other designated contact. The City will supply the blank electronic form upon request. A copy of the form is included in Appendix B
- 2) Transmit supporting documentation, such as assigned programmer name, project number/description, expected duration, and required software.
- 3) The City staff will review the programming laptop request the City will assign one of the following statuses:
 - a. **Accepted:** If the request is acceptable, the City will notify the requester in writing, note any limitations placed, and provide an anticipated laptop transfer date.
 - b. **Rejected:** If the request is rejected, the City will notify the requester in writing

The City will return a written decision within ten (10) working days under normal circumstances. Laptops will generally be available for transfer ten (10) working days after approval. The City will work with the requester if further explanation or discussion is needed to reach a timely decision.



5 Controller Firmware Revision

5.1 Overview

The City's Controller Firmware Policy applies to all of the City's plants and locations where controllers exist. For the purposes of this policy, controller is defined as any PLC, or CPU module.

5.2 Responsibilities

To ensure that the firmware policy is implemented and maintained in accordance with the procedures listed in the policy, the City's identified employees and contractors have the responsibility identified in Section 2 of this Volume.

5.3 Firmware version requirements

Controller firmware versions must be consistent throughout the City. It is required that the firmware of all new or replacement controllers installed match the most current version installed by the city. Current versions are available via email request to the City's OT contact.

5.4 Firmware Updates

Firmware version updates will be performed on an annual basis or as required by manufacturer to address vulnerabilities or other critical flaws. The City's OT contact is responsible for approval and notification of adopting new firmware versions.

The first application of any new firmware version on each controller type shall undergo testing on the City's Test Environment requirements defined in Section 6.4, First Version Testing Requirements.

The City's test environment has a limited number of concurrent seats available for use. Person(s) responsible for update shall submit an emailed schedule request to the City's OT contact or assigned contact a minimum of two weeks in advance of the required testing date to confirm availability. The City will confirm the schedule via email or coordinate alternate dates with requesting person(s) if required. Confirmation will be at least one week prior to the requested date.

If the firmware update requires any process interruption affecting operations, the person(s) responsible for update shall submit a shutdown request at least two weeks in



advance of required update. Refer to the City's Request for Shutdown Form (See Appendix B).

Person(s) responsible for update of firmware version are required to document the following prior to beginning the update process:

- 1) Verification of compatibility with the City's current controller programming software.
 - a. Any firmware version updates that require software update shall have the City's OT contact approval in writing.
- 2) Verification of hardware compatibility for all cards in local and remote racks with the controller manufacturer's compatibility matrix.
 - a. Any component identified as non-compatible shall have a written plan for migration to compatibility during update process.

5.5 First Version Testing Requirements

The City's Test Environment shall be utilized to validate compatibility of firmware with the various I/O and communications modules that exist in the City's SCADA & PCS. A test plan shall be developed and submitted to the City's OT contact detailing equipment arrangements (rack layouts) that will be tested to ensure all types of I/O modules and communications modules are tested with the newly updated controller firmware.

All tests are required to run hands-off without error for a minimum of 100 hours. PLC fault tables, and HMI error logs shall be validated throughout the test; any controller fault or HMI fault related to loss of communications will result in test failure. All standard object blocks shall be tested and confirmed to operate as defined after firmware upgrade.

5.6 Deployment

This section contains the requirements and procedures for deploying fully tested and accepted changes into the live production environment.

An implementation plan shall be submitted for the City's approval prior to modification of the live production environment.

Person(s) completing the update of firmware version are required to perform the following steps in addition to following the controller original equipment manufacturer's (OEM) detailed migration documentation.

1. Follow the City's MOC requirements (See Section 6).



2. Create online (SCADA & PCS Change Management Server) and offline copies of controller program application files.
3. Remote network connections are forbidden. All firmware version updates are required to be completed utilizing a City provided programming laptop locally at the controller. After the panel has been removed from service, connect directly to the controller from the laptop to perform version update.
4. Upon restoration of service;
 - a. Controller fault tables shall be checked and documented to show no compatibility or other faults generated.
 - b. Connectivity shall be verified between controller and HMI, and controller and OIT (where applicable).

All changes shall be implemented from the City provided programming laptop, see Section 4 and Programming Laptop Request Form in Appendix B for details.

5.7 Recordkeeping

Controller firmware updates shall be documented by the persons(s) performing the updates following the procedures defined in the Section 6.



6 Management of Change

6.1 Overview

The City's Management of Change Policy is intended to establish requirements for SCADA & PCS change management policies and procedures. The MOC policy and procedure addresses requirements for change management including review/approval process, documentation and usage of the SCADA & PCS Change Management Server.

This policy applies to all modifications of City SCADA & PCS assets including but not limited to HMIs, OITs, historians, network equipment, PLC, and radios.

6.2 Responsibilities

To ensure the MOC policy is implemented and maintained in accordance with the procedures listed in this policy, the identified City Employees and contractors have the responsibilities identified in Section 2.

6.3 Management of Change Approval Requirements

All modifications to the control system shall be reviewed and approved prior to deployment on the live production system. A change request is also referred to as an MOC request throughout this document.

A change request shall be submitted to the City for approval utilizing the SCADA & PCS Change Request Form provided in Appendix B. Change requests shall include the following:

- 1) Description of change
- 2) Location of change (e.g., PLC name, subroutine and rungs, HMI screen name, etc.)
- 3) Name, company name, and contact phone number for person implementing change
- 4) Copy of completed test plan from the City's Test Environment
- 5) Copy of proposed field test verification plan
- 6) Back-out plan including details on how to revert to a previous known good installation.

No change shall be implemented without written approval from the City. The City's OT contact is responsible for assigning appropriate approval authority and coordinating with City operations.



Exceptions: Emergency work may be completed under direction of operations supervisor or OT department manager. Upon completion of emergency work, a retroactive change request form shall be submitted for record purposes.

Change request forms are to be stored on the designated document management site. Coordinate with the City's OT contact for current document control protocols and for access to the document management site and City standards.

6.4 The City's Test Environment Requirements

The City requires all software version and patches and application programs (PLC, HMI, OIT, and others) to be validated in the City's Test Environment prior to deployment on a live production system.

The City's Test Environment has a limited number of concurrent seats available for use. Person(s) responsible for the update shall submit an emailed schedule request to the City's OT contact, or assigned contact, a minimum of two weeks in advance of the required testing date to confirm availability. The City will confirm the schedule via email or coordinate alternate dates with the requesting person(s) if required. Confirmation will be provided at least one week prior to the request. Person(s) responsible for modifications are required to document the testing and facilitate the City's witness and approval. A test plan shall be submitted to the City and approved prior to scheduling testing.

All application programs shall be loaded into the City's SCADA & PCS Change Management Server at the time of deployment into the city's test environment.

6.5 PLC Logic Modifications

All PLC programs are saved in the City's SCADA & PCS Change Management Server. Modifications shall be made utilizing the City provided programming laptop (Refer to Section 4 of this document). The SCADA & PCS Change Management Server shall be utilized to maintain versions via a check-in/check-out process. The SCADA & PCS Change Management Server transaction comments are required to be completed and shall contain initials of the person making the change, company name, and approved change request form file name.

Changes to logic (whether ladder logic, function block, or other programming language) shall be commented and include:

- Date of change



- Initials of person making the change
- Company that employs the person making the change
- Reason and description of the change
- Example: 12/02/16 – ABC – CompanyName – Logic changes associated with VFD (TAG) upgrade. New VFD ramp time 60 seconds at VFD instead of only PLC controlled ramp.

All changes made following system commissioning shall be documented in a similar manner. Information including the date of programming change; initials and company of author; work order number or change requestor as appropriate; and description of the change shall be appended to the documentation on the first rung.

- Example: 02/03/24 – ABC – CompanyName – PCD update to document VFD upgrade for (TAG). VFD ramp time modified to 60 seconds. Rate of change alarms modified to reflect VFD controlled ramp.

6.6 OIT Modifications

ALL OIT programs are saved in the City's SCADA & PCS Change Management Server. OIT modifications shall be made utilizing the City provided programming laptop. All programmers assigned a City programming laptop will be given access privileges for the SCADA & PCS Change Management Server. The SCADA & PCS Change Management Server transaction comments are required to be completed and shall contain initials of person making the change, company name and approved change request form file name.

The SCADA & PCS Change Management Server shall be utilized to maintain versions via a check-in/check-out process.

6.7 HMI Configuration Modifications

HMI templates are backed up in the City's SCADA & PCS Change Management Server. Additionally, a backup is created every morning on the HMI Enterprise Server. The backups can be used to control change management.

HMI modifications shall be made utilizing a City provided programming laptop or directly on the HMI Enterprise Server using the configuration application. Only programmers who request a City programming laptop with an HMI development license can access the HMI development environment.



Changes made that modify an entire process area shall be validated in the City's Test Environment. HMI modifications are subject to the MOC Policy.

6.8 Alarm and Event Modifications

All alarm and event modifications, including setpoint changes, are subject to both MOC Policy and Alarm Management Policy (Reference Volume 2, Section 5).

6.9 Contractor Check-out

Contractors may request to check-out a program file for modification off-site during capital improvement projects (CIP) projects. During this time, programming modifications may be required to maintain the operating facility, every effort will be made to copy contractors on MOC paperwork; however, it is the contractor's responsibility to verify the transmitted check-out version versus the current version in the City's Test Environment for changes prior to deployment of contractor developed code.

6.10 Deployment Requirements

This section contains the requirements and procedures for deploying fully tested and accepted changes into the live production environment.

An implementation plan shall be submitted for the City's approval prior to modification of the live production environment. At a minimum, the plan shall include the following:

- Copy of approved SCADA & PCS Change Request Form (See Appendix B)
- Written back-out plan for approval. The back-out plan shall include details on how to revert to a previous known good installation (See Appendix B)
- City Request for Shutdown Form (See Appendix B)

All forms are available by request from the City's project manager or the OT contact. The form shall be submitted to the City's assigned engineer who will facilitate operations sign-off.

All changes shall be implemented from the City's programming laptop, see Section 4 and Programming Laptop Request Form in Appendix B for details.



6.11 Recordkeeping

In addition to the MOC requirements stated in the above sections, it is the implementer's responsibility to update all City SCADA & PCS documentation affected by the change including but not limited to:

- Process control description (PCD)
- Alarm and historian databases
- P&IDs
- Loop diagrams
- Panel Drawings
- Standard object libraries (if creating new objects)
- Reports
- Historian change log (add/change/delete)
- Network Diagrams



7 Recovery and Restore Policy

7.1 General

The City's SCADA & PCS Recovery and Restore Policy is intended to establish requirements to promote efficient and accurate system restoration after a failure has occurred. The City's SCADA & PCS consist of numerous highly integrated software packages, which undergo continual change for plant maintenance, operational improvements, and projects. This policy and procedure addresses requirements to promote known good system backups; and procedures to identify and utilize the backups and asset management systems during recovery.

This policy applies to all City SCADA & PCS software assets.

7.2 Backup Storage Requirements

The City has deployed a SCADA & PCS Change Management server for version control and file storage for SCADA & PCS Software applications including PLC, and OIT network application files as well as HMI standard object templates.

If the programmer does not have access to the City's SCADA & PCS Change Management Server, then the programmer shall request a data transfer for the following:

- HMI backup
- HMI standard object templates
- OIT standard object templates

The following applications shall be stored in the SCADA & PCS change management server at initial installation and after any modification has been deployed in the production environment:

- PLC program files including network configuration files
- OIT application files
- Network switch configuration files
- Radio configuration files

All contractors completing on-site startup/commissioning modifications to operating equipment are required to complete change documentation and upload files to SCADA & PCS Change Management Server at the end of each shift. If the contractor or



application programmer does not have access to the SCADA & PCS Change Management Server, they shall submit all files to City PM to upload to the SCADA & PCS Change Management Server at the end of each shift.

Backups shall be stored on a separate physical server in-plant and at the City's operations center.

7.3 Recovery procedures

The City's OT contact should be immediately notified upon identification of a SCADA or PCS component failure and the City's OT contact, or designated contract support resources, shall be responsible for following recommended recovery procedures and verifying restoration of system stability.

7.3.1 SCADA & PCS Change Management Server Recoveries

In the event of a component failure where backup files are stored within the SCADA & PCS Change Management Server and the SCADA & PCS Change Management Server has not failed; the assigned resource shall replace the failed hardware and utilize the SCADA & PCS Change Management Server to obtain the last known application backup to the end device.

If the component's backup file is stored on the SCADA & PCS Change Management Server and a SCADA & PCS Change Management Server failure has occurred, follow the steps in Section 7.3.2 to restore the SCADA & PCS Change Management Server and then follow normal recovery procedure listed above.

7.3.2 SCADA & PCS Change Management Server Failure Recovery

In the event of a SCADA & PCS Change Management server failure, the SCADA & PCS Change Management Server must be restored from most current image file stored on designated backup server. Since backups are only taken on a weekly basis, changes implemented since last backup will not be in the backup file. The resource responsible for failure recovery will need to review approved change request form and supporting documents to determine any mutual changes that must occur to validate backup files. The SCADA & PCS change management server should be utilized to pull files from any asset which has had documented changed since the last server image.

7.4 Recovery Testing Requirements

The City's OT resources shall complete recovery tests for each of the recover methods stated in Section 7.3 no less than quarterly. Each test shall follow the stated recovery



method to restore associated equipment and applications within the City's Test Environment.

Failure of any backup during recovery process shall result in a manually initiated and immediate backup for the identified associated live production environment equipment. The manually initiated backup shall also be tested to guarantee a known good and known valid backup. Backup policies and procedures shall be reviewed to determine and resolve issues creating backup recovery failure.

7.5 Documentation requirements

Change request forms and supporting documentation shall be completed retroactively to document the recovery procedures followed including exact file names and dates for application backups used for the restoration.



8 Cybersecurity Policy

This section contains cybersecurity requirements for all network components recommended by Hazen at a minimum, however the City shall employ the best practices to promote SCADA & PCS security. This is in addition to specific configuration requirements for integration into PCS/SCADA system networks covered in other sections. All persons are required to review and acknowledge the City's policies before accessing the PCS/SCADA system.

8.1 General

- 1) All servers, workstations laptops and other devices shall be managed by City policy.
- 2) The use of unencrypted communication (e.g. email, etc.) for PCS/SCADA system related correspondence which includes information related to cybersecurity and networking is prohibited. All electronically transmitted documents shall be password protected; the password shall be shared with the intended participants via alternate out of band communications channels (e.g. voice, text, etc.).

8.2 Asset management

- 1) Work Management – PCS/SCADA system assets shall be entered into and maintained using the City's asset management system. Additions, changes, and deletions shall be performed in the system **within one week.**
- 2) Device Inventory – Maintain an inventory of all physical devices throughout the PCS/SCADA system networks. Include all network nodes and communication-capable devices (e.g., servers, workstations, laptops, OIT, PLCs, PACs, switches, routers, firewalls, etc.). This inventory shall include all devices, whether connected to the PCS/SCADA system networks or not. Maintain the inventory in a spreadsheet. Include the supplier, manufacturer, model number, serial number, subnet, network address, hardware address, machine name, and installation location.
- 3) Software Inventory – Maintain an inventory of all software platforms and applications (e.g., operating systems, HMI applications, historians, OPC servers, programming software, IDE software, drivers, office productivity software, utilities, etc.). Maintain the inventory in a spreadsheet. Include supplier, product vendor, product name, product version, patching level, firmware version, licensing methods, and licensing keys. Maintain additional information as required to allow reinstallation of software after final acceptance.



- 4) Network Design – Maintain drawings depicting PCS/SCADA system interconnections. Maintain the drawings in electronic and hardcopy formats. Electronic copies shall be maintained using the latest version of Microsoft Visio and PDF file formats
- 5) Physical Drawing – Maintain a Layer 2 drawing that depicts the physical interconnection of network hardware and hosts. Include location, cable type, cable standard, interface speed, host name, description, vendor, model number, MAC address, IP address, and subnet mask. The drawing shall include all components and subcomponents with a MAC address.
- 6) Logical Drawing – Maintain a Layer 3 drawing consistent with the zones & conduits model used in ISA/IEC 62443. The drawing shall depict the various zones (e.g., networks, subnets, VLANs, etc.) and conduits (e.g., Layer 3 switches, routers, firewalls, etc.) used to connect the zones together. The drawing shall include hosts grouped according to the zone in which they reside and the default gateway for each zone. The drawing shall include WAN links and supporting hardware. Include location, host name, description, vendor, model number, MAC address, IP address, subnet mask, and interface speed. The drawing shall include all components and subcomponents with an IP address.
- 7) IP Addressing Scheme – Maintain a spreadsheet that documents the IP addresses and related TCP/IP settings (e.g., default gateway, DNS servers, etc.) for all nodes with an IP address. Group the listing by subnet/VLAN. Maintain the addressing scheme for consistency with the City's existing overall scheme to prevent conflicts with IP addresses used elsewhere in the City's networks.
- 8) Ports/Applications/Services – Maintain a listing of services and applications required for each computer system in the PCS/SCADA system. The listing shall include all ports, applications, and services required for normal operation as well as any others required for emergency operation. Ensure an explanation exists to justify why each is necessary.
- 9) Firewall Rule Sets – Maintain documentation on firewalls and firewall rule sets required for normal and emergency operations.
- 10) Data Flow Diagram – Maintain a diagram depicting communications between software components. Maintain the diagram in MS Visio format. The diagram shall show communications related to all products listed in the device inventory and software inventory. Include ports, protocols, and components that initiate communication. Use typical depictions for similar communication links.
- 11) Network Boundary Inventory – Maintain an inventory of all network boundaries where communications is possible with other networks external to the



PCS/SCADA system networks (e.g., PIN, business network, remote access, dial-up modems, alarm notification systems, vendors, other municipalities, etc.).

- 12) Authentication System Inventory – Maintain an inventory of all authentication systems in use by the PCS/SCADA system (e.g., Active Directory, LDAP, RADIUS, TACACS+, etc.). Indicate where local authentication is used exclusively.

8.3 Access control

- 1) Identities and credentials shall be centrally managed through domain level services for authorized devices and users. The authentication solution shall be dedicated to the PCS/SCADA system using a different set of identities and credentials than the business network. Authentication shall not be based on trusts or any other link with the business network.
- 2) A backup domain controller shall be maintained in a separate building from the primary domain controller. Both domain controllers shall be fed from separate power sources and back by separate UPSs.
- 3) All network devices shall use IEEE 802.1x for authentication to the network.
- 4) A role-based access control system shall be used throughout the PCS/SCADA System and shall be configured to operate using the principle of least privilege. This includes operating system permissions, file access, user accounts, service accounts, application-to-application communications, and component system services. Access permissions shall be centrally managed and limited to only the functionality needed to perform job functions associated with the account.
- 5) Default host accounts (e.g., guest, administrator, etc.) shall be removed. If the accounts are required for normal or emergency operation, they shall be recreated under a different name than the default account. Coordinate with the PCS/SCADA system software vendors.
- 6) Unique user IDs shall be used for authentication. The use of shared accounts is prohibited.
- 7) The PCS/SCADA system shall require identification and authentication before allowing any actions by a user.
- 8) Wherever it is possible to do so, PCS/SCADA system equipment (e.g., servers, workstations, laptops, etc.) shall, as part of the boot process, display to users a system use notification message or banner before granting access to the system that provides privacy and security notices which states that:
 - a. Users are accessing a critical infrastructure information system



- b. Information system usage may be monitored, recorded, and subject to audit
 - c. Unauthorized use of the information system is prohibited and subject to criminal and civil penalties
 - d. Use of the information system indicates consent to monitoring and recording
 - e. Retains the notification message or banner on the screen until users acknowledge the usage conditions and take explicit actions to log on to or further access the information system.
- 9) The PCS/SCADA system shall limit the number of concurrent user sessions to three sessions for privileged access (administrator) and to two sessions for non–privileged access.
- 10) All computers supporting password–based authentication must enforce the following requirements:
- a. Minimum password length of 14 characters
 - b. Password must contain at least one uppercase character.
 - c. Password must contain at least one lowercase character.
 - d. Password must contain at least one numeric character.
 - e. Password must contain at least one special character.
 - f. Password must have a minimum lifetime of 24 hours.
 - g. Password must have a maximum lifetime of 60 days. When passwords expire, prompt users to change passwords. Do not lock accounts due to expired passwords.
 - h. Password must differ from previous five passwords, where differ is defined as changing at least 50 percent of the characters.
 - i. Passwords must be cryptographically protected during storage and transmission.
- 11) For all devices with a default password, change the password from the default password. Coordinate selection of passwords with the password requirements above. Do not use the same password for more than one device unless specifically instructed to do so.
- 12) The PCS/SCADA system shall obscure feedback of authentication information during the authentication process to protect the information from possible exploitation/use by unauthorized individuals.
- 13) For administrators, two accounts shall be maintained: one for normal activity and one for activity requiring elevated privileges. The elevated privileges account shall only be used for work requiring elevated privileges.
- 14) The use of scripting tools (e.g., Microsoft PowerShell) shall be disabled.



- 15) Physical access to control panels, wiring closets, server rooms, data centers, and control rooms shall be controlled, at a minimum, through a keyed lock.
- 16) Unused router and switch ports shall be normally turned off and turned on for configuration and testing purposes.
- 17) Remote access using the remote desktop protocol (RDP) without domain authentication, authorization, accounting, and encryption is prohibited. The use of remote control software (e.g., Dameware, VNC, RealVNC, TeamViewer, etc.) which does not support domain authentication, authorization, accounting, and strong encryption is prohibited.
- 18) Remote access shall be performed using laptops owned and configured by the City. Remote access shall utilize a VPN to first connect and authenticate the user to the business network. A second VPN shall be used to connect and authenticate the user to the process information network (PIN). Once the VPN connections are established, RDP shall be used to connect to a jump host (workstation) in the PIN. Then, a second RDP connection shall be made to an engineering workstation on the PCS. All RDP connections shall use strong authentication against an authentication, authorization, accounting (AAA) server and strong encryption.
- 19) Session controls shall monitor and automatically logout after 10 minutes of inactivity.
- 20) All software components that are not required for the operation and/or maintenance of the PCS/SCADA system shall be removed. If removal is not technically feasible, software not required for operation and/or maintenance shall be disabled. This removal shall not impede the function of the PCS/SCADA system. If software that is not required cannot be removed or disabled, document a specific explanation.
- 21) Disable all network ports, protocols, and services not required by the PCS/SCADA system.
- 22) The PCS/SCADA system networks shall be protected through network segmentation as follows:
 - a. The PCS/SCADA system networks shall be isolated from external connections including the internet. This includes remote SCADA site communications.
 - b. The business network and PCS/SCADA system networks shall be separate and direct communications between the two networks shall be denied. All traffic shall terminate in the PIN described below.



- c. An industrial DMZ shall act as a buffer network (i.e., DMZ) between the business network and the PCS/SCADA system networks.
 - i. The industrial DMZ shall be the only means of communications beyond the PCS/SCADA system domain. Other architectures (including the use of dual or multi-homed hosts) are prohibited. The use of dial-up modems is prohibited. The use of cellular routers is prohibited.
 - ii. The PCS/SCADA system shall operate autonomously (industrial DMZ, other plant PCS, etc.) except for remote SCADA sites associated with the SCADA system. Remote SCADA sites shall operate autonomously with no dependency on SCADA communications; the only exception would be a site that must receive a monitoring signal from another site for control purposes (e.g., an elevated tank sends a level signal to pump station to control the level in the elevated tank).
- d. The industrial DMZ may, based on project scope, contain physical or virtual workstations and servers needed to facilitate data exchange with business network applications. Firewall rules shall be configured to only allow ports and protocols required for the following functions that could be provided.
 - i. Antivirus definition updates
 - ii. Operating system patches
 - iii. IDS/IPS definition updates
 - iv. Syslog servers
 - v. Web portal
 - vi. Process control historian (Tier 2)
 - vii. FTPS Server
 - viii. Security information and event management (SIEM)
 - ix. Email relay
 - x. Backup repository
- e. The industrial DMZ shall be configured to prevent host-to-host communications unless specifically required to meet operational requirements. In such cases, ports, protocols, and initiating direction shall be configured to minimize connectivity in accordance with least functionality and least privilege principles.
- f. The PCS/SCADA system Tier-1 historian shall push data into a Tier-2 historian in the PIN. Business network users and enterprise



applications shall access PCS/SCADA system historical data in the Tier-2 historian in the PIN.

- 23) Access to network hosts and hardware shall require login through an authenticated and encrypted connection.
- 24) Remote sites shall be polled from a central location. Report by exception methods are prohibited. However, protocols which poll for exceptions from a central location (e.g., DNP3) are acceptable.
- 25) During commissioning, a test port may be configured for temporary use. This port shall be configured with MAC authentication for a specific programming laptop. See Volume 1 for details regarding programming laptop restrictions and requirements.
- 26) The use of port-scanning software is prohibited.
- 27) Users shall be prohibited from installing software. Only administrators shall have the ability to install software.

8.4 Awareness and Training

Operations and maintenance staff shall periodically receive position-appropriate cybersecurity training and awareness. This includes specialized training for those involved in the design, development, testing, installation, operation, and maintenance of products related to the City's PCS/SCADA system.

8.5 Data security

- 1) Communication links to remote sites shall use encrypted site to site IPsec VPN for authentication, confidentiality, and integrity.
- 2) Existing devices removed from operation shall be sanitized to permanently remove internally stored information.
- 3) The authenticity of software installed on devices shall be confirmed by comparing the hash of the installation file(s) to the hash provided by the software vendor. This applies to all software (e.g., operating systems, hot fixes, service packs, application software, utilities, device firmware, etc.).
- 4) Ensure that all account usernames and authentication credentials are transmitted across networks using encryption.
- 5) Where encryption is required (SCADA communications and site to site communications), use approved cryptographic methods.



8.6 Information Protection Processes and Procedures

Maintain a patch management system to ensure that PCS/SCADA system production operating systems and third-party software are running the most recent security updates provided by the software vendors. Maintain a patch management server in the PIN. Work with the City's information technology department to maintain a secure method of automatically updating the patch management server in the industrial DMZ using the City's business network and internet connection.

Maintain an anti-virus definition update system to ensure that PCS/SCADA system production operating systems are using the latest anti-virus definitions. Maintain an anti-virus update server in the PIN. Work with the City's information technology department to implement a secure method of automatically updating the anti-virus server in the industrial DMZ using the City's business network and internet connection.

8.7 Maintenance

Maintain three laptops dedicated to onsite PCS/SCADA system development. Ensure the laptops are secured in accordance with relevant host requirements elsewhere in policies, standards, guidelines, and procedures. The use of any other laptops on the SCADA and PCS is prohibited. Configure the laptops with fixed IP addresses, subnet masks, default gateways, and DNS servers to eliminate the need for DHCP.

On a monthly basis, run vulnerability scans on servers, workstation, thin clients, and laptops. The scans shall be performed without an internet connection. Ensure the approach compares the devices to the newest available patches. Install important and critical patches on the systems in accordance with all PCS/SCADA system software vendor recommendations. In a test environment, verify patches will not have an undesirable effect on the PCS/SCADA system production environment prior to deployment. Use operating system restore points to provide the ability to restore systems to pre-patch levels.

Subscribe to vulnerability alert systems including ICS-CERT, US-CERT, and WaterISAC. Monitor correspondence from these sources for alerts related to hardware and software provided under this project. Patch affected hardware/software as soon as possible and in accordance with other parts of policies, standards, guidelines, and procedures.

8.8 Protective Technology

- 1) The use of open source software is prohibited.
- 2) Uninstall all browser and email client software on hosts.



- 3) Removable media shall be scanned with anti-malware software on a dedicated kiosk with up to-date anti-malware definitions prior to use in any of the PCS/SCADA system environments (e.g., development, test, production).
- 4) Devices shall be configured so they automatically conduct an anti-malware scan of removable media when inserted or connected.
- 5) Maintain disconnection points between network security zones (e.g., PIN, VLANs, subnets, etc.) and provide methods to isolate the zones while preserving the ability to continue limited operations.
- 6) Power and communication cable shall be run through conduit for physical protection.

8.9 Anomalies and Events

- 1) Maintain a centralized log collection/analysis service and a security information and event management (SIEM) tool.
- 2) Ensure that system and networking device logs are being aggregated to a central log management system for analysis and review.



Howard F. Curren AWTP SCADA Standards – PLC Volume 2 of 3

City Project NO. 20-C-00001

Reliable Tampa Partners Project No. 23-502

Hazen and Sawyer Project No. 41077-013 Task 263, 264, 265

January 2025



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Revision History

REV	DATE	ENGINEER	NOTES
1	2/17/2025	Hazen and Sawyer	Final Submittal



List of Acronyms and Abbreviations

COT: City of Tampa

FBD: Function Block Diagram

HMI: Human Machine Interface

I/O: Input/Output

IDE: Integrated Development Environment

LD: Ladder Logic

MOC: Management of Change

OIT: Operator Interface Terminal

P&IDs: Process and Instrumentation Diagrams

PCN: Process Control Network

PCS: Process Control System

PLC: Programmable Logic Controller

SCADA: Supervisory Control and Data Acquisition

ST: Structured Text

UDTs: User Defined Types



1 Introduction

This is Volume 2 of the City of Tampa's standards for Supervisory Control and Data Acquisition (SCADA) and Process Control System (PCS) programming, configuration and design standards for the City of Tampa referred to as "the City" or abbreviated as "COT" throughout this document

Volume 2 is a compilation of procedures for development and programming of control processors and provides both guidance and specific examples to complete these tasks.

The City SCADA & PCS Standards and Conventions Manual is intended to be applied by the City's contractors, consultants, and in-house personnel when developing or modifying any portion of the City's control system. The control system is a utility-wide system built upon a common human machine interface (HMI) system and is comprised of the following:

Process Control System (PCS): The industrial control system for processes within the boundaries of the plant (Howard F. Curren AWTP). The primary function of the system is control and monitoring of plant operations. The PCS is comprised of the local HMI subsystem and various programmable logic controllers (PLCs) and operator interface terminals (OITs).

Supervisory Control and Data Acquisition (SCADA) System: The industrial control system for processes outside the boundaries of the process areas, ability to monitor and/or control the process from the control room from outside the plant. The primary function of this system is data acquisition; processes or remote sites are designed to run autonomously without supervisory control function. The SCADA system serves both remote sites such as lift stations and wastewater treatment plant facility in an integrated environment and is comprised of telemetry equipment with a supervisory HMI.

This manual is divided into three main volumes plus two appendices:

Volume 1 contains the control system policies and procedures that apply to the management, maintenance and modification of the control system. Volume 1 includes policies for:

- Programming laptop use
- Management of change (MOC)
- Software and application revision control
- Cybersecurity



- Other related topics.

Volume 2 addresses practices for development and programming of control processors such as:

- Programmable logic controllers (PLCs) of various types

Including requirements for programming software

- Alarm processing
- Control loops
- Control logic structure
- Input/output (I/O) layout and signal processing
- Programming comments
- Tagging and naming conventions.

Volume 3 contains practices for development and programming of human-machine interface (HMI) and operator interface terminals (OITs). Standards for programming and display development, historian data exchange, and security are included in this volume.

Appendix A Contains definitions and general references that provide clarity and detail to volumes 1 to 3 of the City of Tampa's SCADA standards manuals.

Appendix B Contains forms and documents needed for deviations and documentation of changes to the City's PCS or SCADA systems.

Compliance with the standards and conventions outlined in the manual is required for all projects that add to or modify the control system. If a contractor or staff member identifies a need for an addition or modification to the standards for a specific project, or if in the course of the work it is found that some part of the standards cannot be adhered to, a standards deviation request may be submitted in accordance with the requirements provided in Section 3 of this volume and in Appendix B.



2 Programming Software

2.1 Development Platform

The specific software to be used is Studio 5000 Logix Designer, Version 36

In the case of a new product being introduced to the facility the version will be the most recent available. The software must support all of the capabilities that the hardware offers.

The Integrated Development Environment (IDE) shall provide a complete set of tools for platform configuration, application program development, online troubleshooting / debugging, tag management, security, and safety. The PLC software is not to be password protected as requested by the City. Secondary tools, such as firmware update management, are acceptable as stand-alone applications due to their limited use.

In all cases, lite, demo, or self-developed versions of development/configuration software are not allowed.

All software furnished to the City on a project is to be properly licensed with all licensing transferred to City management no later than initiation of site acceptance testing.

It is the responsibility of the developer/systems integrator to provide their own development software and licensing for off-site development. City licensing or systems will not be loaned for offsite use.

2.2 Security

The City's facility is critical infrastructure and as such, per the US Department of Homeland Security, requires heightened security. It is expected that software development and preliminary testing of software will take place on vendor computers and equipment. However, implementation and debugging while on site will only be accomplished utilizing City computers and laptops. No vendor equipment will be allowed to be directly connected to the process control network (PCN).

The City's computers and laptops will have the development software suite installed from manufacturers' media or website. All configuration files and applications will be loaded to the City's computer equipment after proper virus and malware scanning.

New software requirements must be submitted to the City with suitable lead time, a minimum of four weeks, for a security evaluation and loading. It is the developer's responsibility to ensure all of the required tools are in place prior to beginning a start-up.

3 General Programming Practices

3.1 Languages

The IEC 61131-3 standard includes for five languages: Ladder Logic (LD), Function Block Diagram (FBD), Instruction List, and Sequential Function Flowchart. The only allowable languages for all City projects and implementations are LD, and FBD.

3.1.1 Ladder Logic

LD is a graphical, symbol-based language with a foundation in circuit diagrams and relay logic hardware. The logic is organized in a series of rungs composed of Boolean elements whose logical result is then applied to outputs or action elements. This can simplistically be considered to be a series of IF/THEN statements. The ladder rungs are scanned in a top-down, left to right manner enforcing strict order of execution.

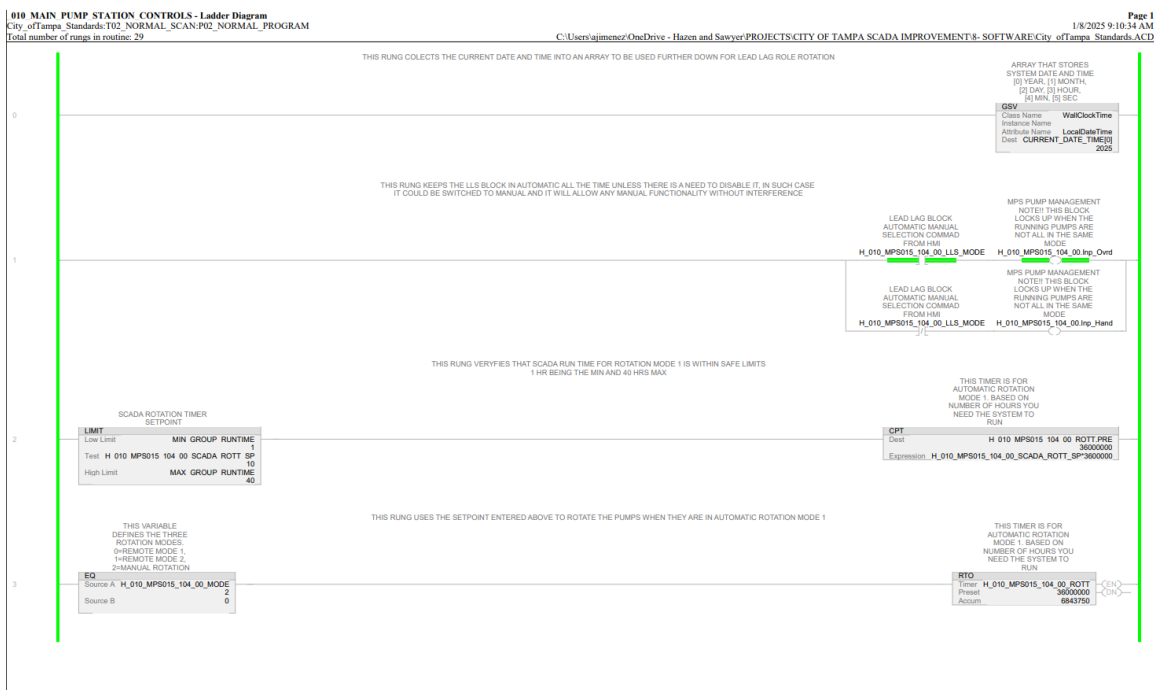


Figure 1 Ladder Logic

LD is the preferred language for Boolean equations. This is also an acceptable language for the development of functions and functional blocks.

3.1.2 Function Block Diagram

FBD is a graphical, symbolic language based on the assembly of interconnected functional elements. The logic is similar to ladder logic, with left to right, top to bottom order. The individual functional elements (blocks) can be, and often are, complex with numerous input and output points, as well as configuration points. Program constructs are organized into “sheets”, akin to a page, on which the blocks are rendered.

FBD offers the opportunity to implement consistent, repetitive programming in a compact, regular manner. As such, this approach allows for the simplified representation of complex operations.

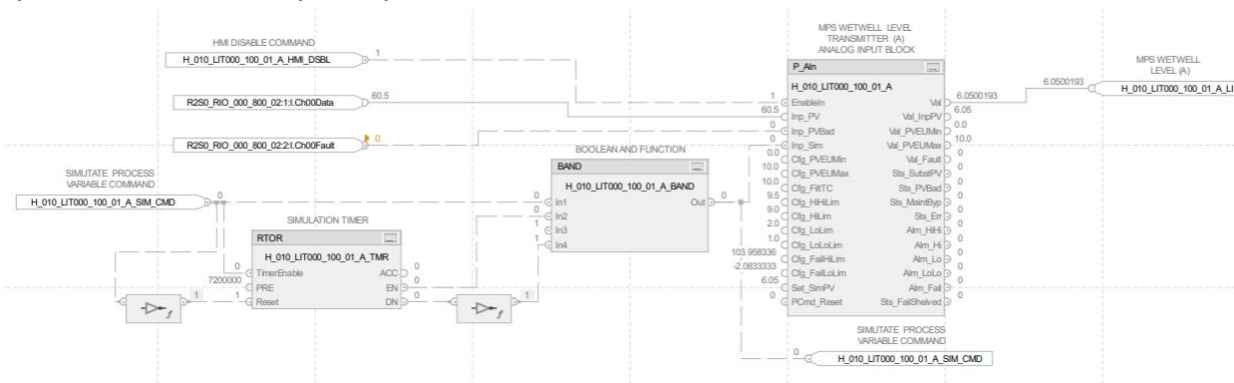


Figure 2 Function Block Diagram

FBD is the preferred language for process values as well as utilization of complex functional elements.

3.2 Object Library Usage

The library of function blocks, and functions remove large blocks of repetitive code as well as aggregate data into one cohesive unit. Any communication between the controller and the HMI or OIT(s) must utilize City approved objects. Refer to Section 6.6 for a listing of supplied function blocks.

During development the programmer shall review and, where possible, populate all relevant parameter fields for each object instance. For example, this may include setting engineering unit scaling for analog instructions, programming limit switch and position



feedback for valve instructions, or programming speed feedback, motor current, motor RPM scaling, and drive fault status for variable speed drive instructions. This will be application-dependent, based on the availability of information and field I/O in the controller.

3.3 Source Protection

Source protection is a feature implemented in many development environments which provides the ability to lock proprietary code so that it cannot be viewed or modified by anyone who does not have the key.

Source protection of code is prohibited. This includes all code created or used by systems integrators, programmers, vendors and OEM suppliers.

Unless contractually stipulated to the contrary, all source code, images, databases, and supporting documentation are the property of the City. As such, all of this information is to be supplied to the City no later than initiation of site acceptance testing.

3.4 Documentation

It is the programmer's responsibility to provide an annotated program compliant with the minimum documentation requirements defined in this section for all program files.

As a general guideline, the level of documentation provided should allow for a technician with no familiarity of the functions of the specific unit process to read the comments and fully understand the inputs, outputs, and logic implemented in the program.

3.4.1 Object Parameters, UDT and Tag Comments

It is required that all tags including object parameters and UDT elements be provided with completed description fields. Object parameters, UDT elements, and tags are subject to tag name and description requirements defined in Section 4.1 of this volume.

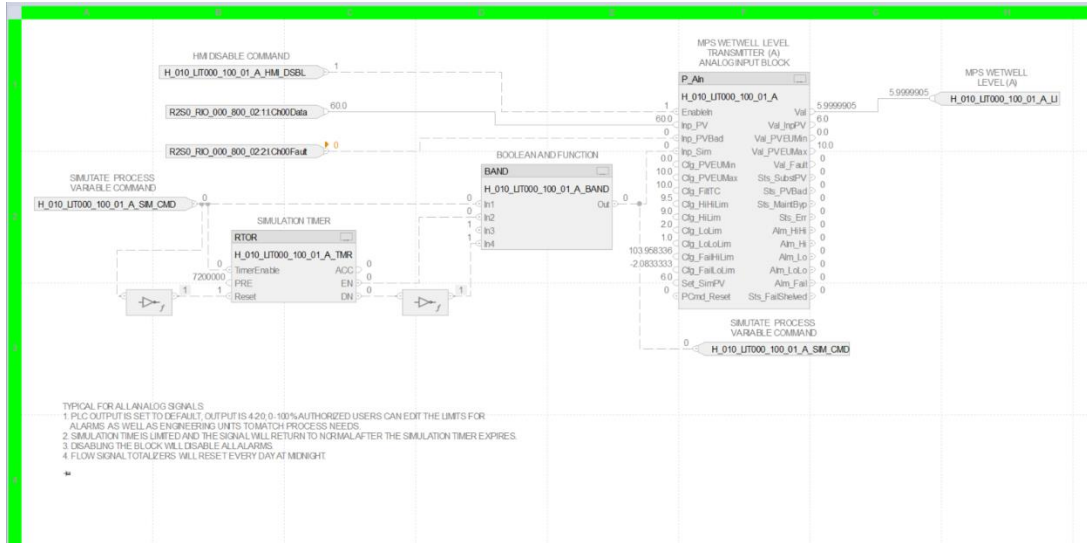


Figure 3 Object Attribute Comments

3.4.2 Ladder Logic Comments

Each LD rung must include a comment clearly describing its purpose and function. The first rung of each routine or section of rungs should summarize the overall function of the routine/section as well as the logic found on the rung.

All rungs regardless of how simple or complex must include comments sufficient for someone who did not write the program to understand the function(s) of the rung. This includes all sub-rungs and subroutines. See example in **Figure 4** Ladder rung comments.

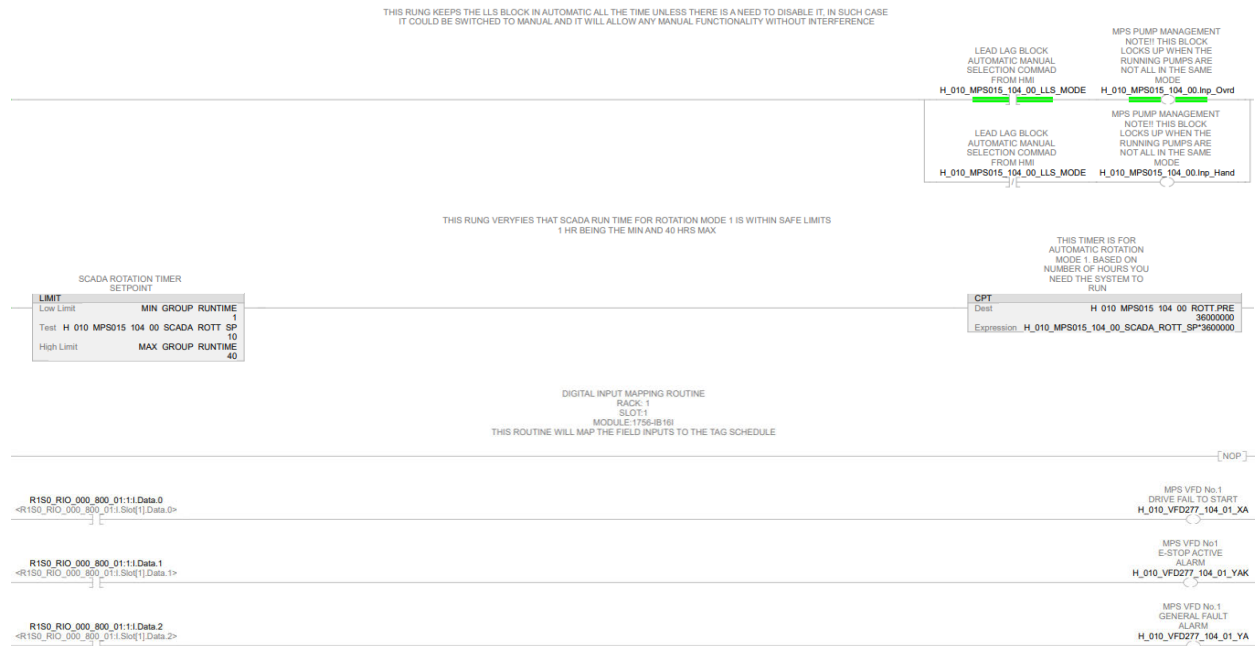


Figure 4 Ladder Rung Comments

3.4.3 Function Block Diagram Comments

FBD programming increases the readability of complex operations such as those with multiple paths based on Boolean functions (AND/OR/NOT) or selection blocks as well as intermediate calculations (sums and limiting functions).

It is required that the programmer provide comments describing the overall function for each connected group of function blocks. Additionally, the programmer shall provide comments for each distinct intermediate calculation (Boolean function, selection, sum, limit, etc.). See example in **Figure 5** Function block comments.



Each subroutine of any type will be documented. A single “No Output” [NOP] instruction or unique coil designated as “Comment Coil” on the first rung of routine (see example in **Figure 6** First rung NOP rung comments) shall be utilized to provide a location for required subroutine documentation. The following information shall be included in the rung description:

- Original programming date
- Initials and company of author
- Descriptive summary of the routine functions

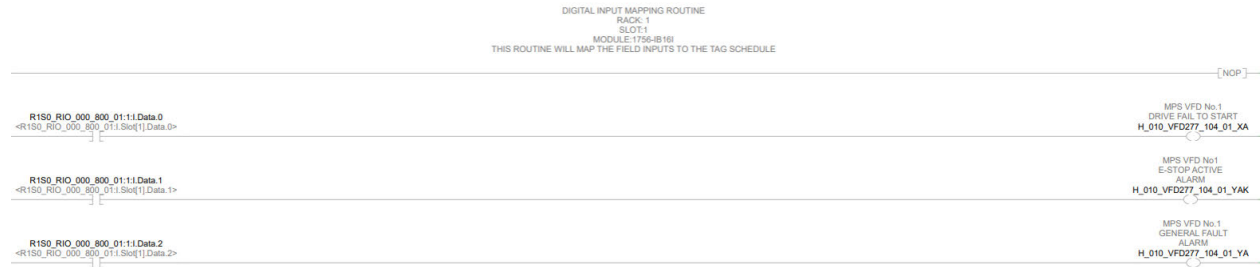


Figure 6 First Rung NOP Rung Comments

3.4.5 Documentation for Change Management

It is required that all changes to logic in the live production environment contain descriptions of the change. Specific documentation requirements and format are contained in the City's Management of Change Policy (Refer to Volume 1). At a minimum, this will contain the date code, the initials of the programmer, and a summary of the change and its motivating reasons.

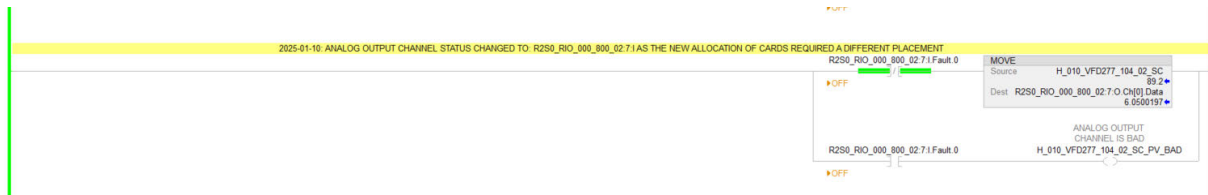


Figure 7 Rung Change Comments



4 Naming Conventions

Consistent naming across systems and controllers facilitates the City's technicians' efforts during troubleshooting. As such, a series of standards has been developed to address these needs.

4.1 Tag Naming Conventions

As data is generated by the various elements of the process, the easiest way to track things is through human decipherable tag names. The tags stand in the place of the somewhat arcane addressing and naming conventions that manufacturers use to address their points. This also results in a language construct that is regular and non-repetitive. It is extremely important that the naming system yield unique names with a consistent format throughout the entire system.

As such, the following naming convention is to be utilized throughout the entire City system. These mnemonics are to be applied to any and all elements that might be transferred from a controller to another system, i.e., SCADA, HMI, OIT, gateway, or controller. This system shall be utilized, but in a paired down manner, for internal registers and flags within a controller.

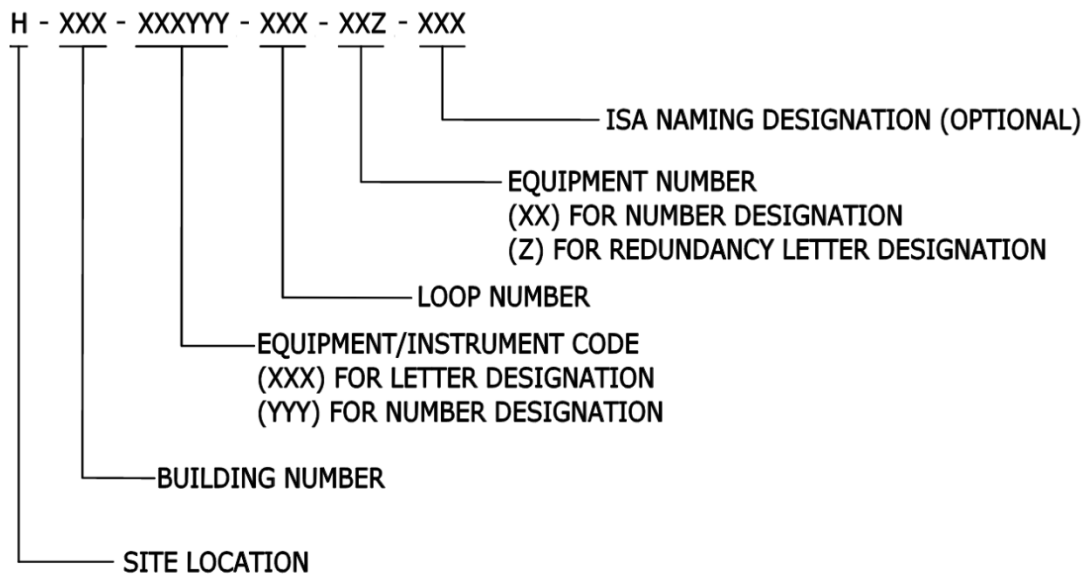


Figure 8 Tag Naming Convention

PLC programming does not accept hyphens, so PLC tags must use underscores to be compatible with the program. The tagging standards shall remain the same in the PLC with the only difference being the use of underscores instead of hyphens. The figure below shows the tagging as it will be used inside the PLC program.

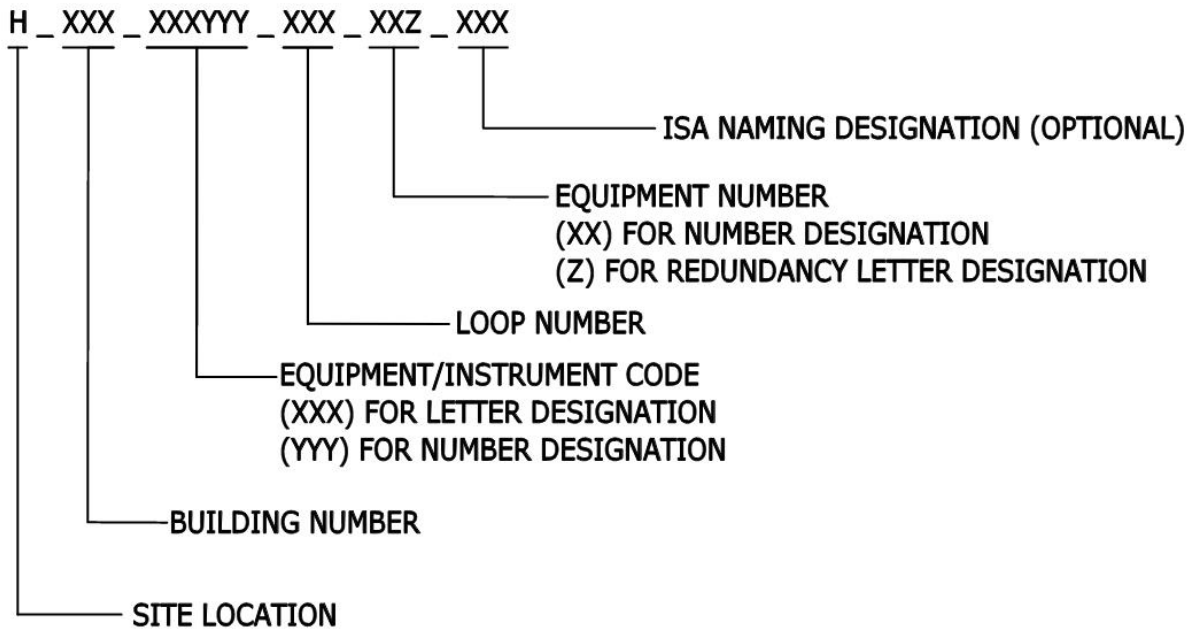


Figure 9 PLC Tag Naming

The following sections outline the meaning of the various codes and reference appropriate appendices for specifics. While the listings try to address all needs, there will be times when a specific need is not addressed, such as a new area or instrument. In those cases, suitable suggested additions should be submitted to the City prior to use for consideration and approval. Once approved they will be added to the approved list.

4.1.1 Site Location

This is a designation for a particular site throughout the City. For the HFW AWTP the designation will be “H”. All tags will begin with this designation for the HFC AWTP.

4.1.2 Building Number

This refers to the building the equipment is located in. The City has used both numerical and letter designations for buildings but letter designations don’t address all buildings. Tagging in the design criteria used numerical designation for equipment and letter designation for instruments as that was consistent with past practice. It was agreed to use the numerical designation in all tags for building codes. Building numbers to utilize are as listed in Appendix A. There are gaps in sequential numbering (highlighted in grey and underlined). If new buildings are added, unused numbers can be assigned.



4.1.3 Equipment and Instrument Tags

The City has been using an alphanumeric designation for process equipment identification. This was to be used for equipment tags. The alphanumeric designations to use for equipment are outlined in Appendix A. Additional designations are to follow the ISA standards as presented on instrument legends followed by “000” to be the same alphanumeric format as equipment tags.

4.1.4 Loop number

This refers to the specific loop number as illustrated on the P&IDs. This is required to maintain a direct relationship between the P&IDs and generated information. Loop numbers will be assigned on the P&IDs following the process flow for each line. Loop numbers will increment starting at the top left most process line and follow that process line until it ends or joins with another, sheet to sheet, for all process equipment within a particular building.

Loops are defined by each separate function in a process (manual valve, pump with related integral instruments, control valves, etc.) as assigned by the instrument engineer.

Process equipment that works as a system, such as centrifuge sludge feed pump 1, 2, and 3, shall share the same loop number and increment the equipment number. For example, if pump 1 has [loop]-[equipment] 101-01 pump two would be 101-02, and pump 3 would be 101-03. This also applies to dedicated equipment for that pump; an upstream and downstream pump isolation valve could be 100-01 and 102-01 respectively. Pumps 2 and 3 upstream would be 100-02, 102-02, and 100-03, 102-03. Instrumentation associated with a pump (pressure switch, temperature transmitter, etc.) installed upstream or downstream of the pump, without a process control equipment separating the pump from the instrumentation shall, shall use the same loop number as the pump. There will be more than 100 loops within a building so three digits will be used.

The City will also use loop numbers separately numbered for equipment that normally is not shown on P&IDs (switchgear, network equipment, etc.) as well as all assets that don't have control signals associated with them (manual valves, check valves, air release valves, etc.). Each P&ID will indicate the first and last tag used on the drawing along with 10 loop numbers for future use. The sequential loop numbers are outlined in Appendix A



4.1.5 Equipment Number

Distinct equipment numbers shall be incremented sequentially based on multiple equipment working as part of a system in parallel or series operation. Wherever possible, the equipment number shall match the equipment descriptor or start with 01 and increment based on the number of matching loop number and type items in that system.

For example:

- Sludge feed pump 1 shall have an equipment number of 01, pump 2 shall have an equipment number of 02, and so on.
- Three discharge pumps from one tank, pumping to a common header, would share the same loop number and iterate the equipment number to make the tag unique.
- Three tanks, each with one discharge pump will have the same equipment number, but the loop numbers will be different to make the tag unique.

4.1.6 Redundancy letter

If two or more instruments serve the same purpose at an identical location in a loop, they shall be labeled with an identical loop and equipment number with a letter appended, starting at A, to identify the instrument as redundant. For example if there are two PIT instruments that share a header one should be labeled H-065-PIT-110-01-A and the other labeled H-065-PIT-110-01-B

4.1.7 ISA Naming Convention

The ISA naming are used to standardize the identification of instruments and equipment in process control systems. Each instrument or equipment is assigned a unique tag consisting of the loop number followed by up to three uppercase letters that describe the function.

For example

- "FIT" stands for Flow Indicating Transmitter
- "YA" stands for State Alarm

These conventions ensure consistency and clarity in documentation and communication across different disciplines. Please refer to Appendix A for the ISA naming conventions.



4.2 Controller and Remote Rack Naming

Each controller shall be given a unique name using the format and abbreviations outlined in the City's asset tag standards.

Appendix A, Definitions and General Reference, of the City's SCADA & PCS Standards and Conventions Manual provides a complete listing of the sites, building code, loop number, and equipment number. Any area or location new to the facility must have a location designation approved by the facility staff.

For example controllers based on a PLC, the nomenclature follows the Tag Naming Conventions outlined in section 4.1

[SITE LOCATION] _ [BUILDING NUMBER] _ PLC000 _ [LOOP NUMBERS 800-819] _ EQUIPMENT NUMBER]

- H_075_PLC000_800_01 = Howard F. Curren AWTP, anaerobic digester electrical room, programmable logic controller, on loop 800, PLC number 1.

The controller tag shall be consistently used within the controller documentation, controller programming software, and other locations as appropriate. This may include, but is not limited, to the following:

- Controller tag configured with development software
- Development software file name

For another example the naming convention for a module that links to remote I/O racks is detailed below

[SITE LOCATION] _ [BUILDING NUMBER] _ RIO000 _ [LOOP NUMBERS 800-819] _ [EQUIPMENT NUMBER]

- H_074_RIO000_800_01 = Howard F. Curren AWTP, Digester control building C, Remote I/O rack, on loop 800, rack number 1

4.3 Program Files

The naming of the files for a controller must be based on the name of the controller. There must be one-to-one traceability between the controller and the file. Additional to the controller name, a version number will be assigned. The version number will be



appended to the controller name utilizing the structure `_r##` where the hash marks reflect the specific version number. The specifics of the version as well as the reasoning for incrementing will be contained in the internal program documentation. An example of this is:

`H_075_PLC000_800_01_r04.ext`

The file name above indicates this is version 4 of the controller `H_075_PLC000_800_01`. The 'ext' indicates the manufacturer's assigned extension for the file.

When periodic backups are taken, the files will have a date code added to the file name. This will be in the form of `yymmdd`. This reflects the year, month, and day, in two (2) digit format upon which the file was saved. If further granularity is required then `hhmm`, representing hour in 24 hour time and the minute, may be added to the date code. A full example of the backup file naming convention is:

`H-075_PLC000_800_01_r04_2410041603.ext`

This indicates that the backup was captured on October 4, 2024 at 4:03 pm.

In this manner, multiple versions and backups may exist in the same subdirectory without interfering with each other. The data coding also leverages the native lexicographic sort order of Microsoft file systems.

4.4 Module Naming

Each module must be assigned a unique description in the controller to aid in identifying the hardware. The naming convention for modules is defined as:

`R#S#_[Module Type]`

Where:

`R#` = Physical Rack number

`S#` = Physical Slot number

`[Module Type]` = the common acronym taken from the manufacturers part number

Examples:

- `1756_IA16I_R2S4_ACDI_MOD_04`
 - `1756_IA16I` = This indicates the model ref.
 - `R2S4` = Reference to location, rack 2 slot 4.



- AC = Reference to the type of card, AC indicates voltage type.
- DI = Reference to type of input, DI indicates discrete input.
- MOD-04 = Indicates the module number.

4.5 Tasks

This section describes the various objects available for the organization of program logic within the controller and their associated parameters. The section provides guidelines for selection and organization of logic into these objects and configuration of their properties.

Three tasks are used, fast, normal, and slow. The tasks are typically reserved for message communications with other devices. The fast scan task has the highest priority of 1, the normal scan task has a priority of 3, being used for all regular monitoring and control operations. The slow scan task has a priority of 5, being reserved for processor monitoring.

Each task shall contain a single program within itself and program name shall follow a similar naming as the task.

4.5.1 Task Structure

Tasks are the highest organizational unit in the controller and dictate the order of execution. The nomenclature applied to tasks must represent the broadest definition of the contents.

4.5.2 Program Structure

Programs represent the middle tier of the organizational structure. At this layer there is more additional granularity added to the overall structure and the naming conventions must reflect that. Naming at this layer must not overlap with the layer above.

For example:

- P01_Fast Program
- P02_Normal Program
- P03_Slow Program

Individual names at this tier may be duplicated in other tasks but must be unique per task.



4.5.3 Routine Structure

This is the lowest tier of programming structure. As such the name must provide clarity into the exact programming construct. Each routine is linked to a process area for fast identification and each process area has 3 subroutines associated, except for IO subroutines that are 4.

For Example,

- _000_ is associated with IO Mapping.
 - _000_ANALOG_INPUT_MAPPING
 - _000_ANALOG_OUTPUT_MAPPING
 - _000_DIGITAL_IO_MAPPING
 - _000_DISCRETE_IO_MAPPING
- _010_Main_PUMP_STATION_ALM
- _010_Main_PUMP_STATION_ASSETS
- _010_Main_PUMP_STATION_CONTROLS



5 Alarms

The basic definition of an alarm (per ISA-18.2, Alarm Management) is an audible and/or visual indication to the operator that an equipment malfunction, process deviation or other abnormal condition requires a response. This standard contains definitions that help to define the various elements that must be addressed for IO derived and Setpoint derived alarms and what functionality must be applied.

5.1 General Requirements

The following section contains requirements and best practices that are to be applied to City alarms.

5.1.1 Generation Location

All alarms will be generated and managed as close to the source as possible. This implies that all alarms will be generated in the controller, if at all possible. Utilizing alarming at the HMI/SCADA layer is the least desirable and is only to be utilized if controller based is not possible.

Alarm generation will be consistent throughout the system. The alarms must mean the same thing in all cases and must be generated utilizing consistent logic. All capabilities must be implemented consistently. An example of this would be:

Current value > Alarm setpoint vs Current Value $\geq$ Alarm setpoint (the former case of '>' is preferred) for setpoint derived alarms.

Alarm generation capabilities that might be contained in the analog I/O modules themselves are to be used. These embedded alarming capabilities are not available in all modules and thus represent a mixed system.

Alarming will be generated by the first or primary utilizing element. This would mean that analog values would be alarmed at the block that was performing the conversion from raw input value to scaled engineering units. In the case of discrete inputs this would be in the block that is performing the primary use or monitoring.

5.1.2 Basic configuration

The following outlines the various basic elements for alarms.

5.1.2.1 Setpoints

Setpoints for each alarm condition will be provided. This will be appropriate to



the signal being monitored, analog or digital. **All setpoints will be supplied in engineering units.**

5.1.2.2 *Toggle Alarms*

Alarms cannot be individually enabled/disabled. Equipment must be disabled in order to disable the alarms associated to that piece of equipment. Otherwise, all the equipment's associated alarms will remain enabled.

5.1.2.3 *Debounce Times*

Debounce times are the period (in mSec) for which the signal must be in excess of the indicated setpoint limit before the alarm is generated. Setting a value to zero eliminates the debounce function completely. Alarms are currently all set to have debounce times at zero

5.1.2.4 *Dead-Band Amount*

The dead-band amount is used to eliminate the chattering of alarms around the setpoint by requiring the process variable to retreat from the setpoint by a set amount before the alarm resets. A dead-band setting is applied to all limit alarms monitoring a process value. The configuration parameter is applicable to analog alarms only. The amount is supplied in engineering units with a value of zero deactivating the feature. Alarms are currently all set to have debounce times at zero.

5.1.2.5 *Shelving or Bypassing*

The ability to bypass, or shelf, an alarm for a specified period will not be provided. Alarms cannot be bypassed or shelved; alarms can only be disabled. Disabling alarms is done through disabling the associated equipment.

5.1.3 Alarm conditions

All alarm conditions are expected to apply positive logic. When the alarm value is a Boolean 1/true/on then the alarm is to be considered present/active. When the alarm value is a Boolean 0/false/off then the alarm is considered to be not present/inactive.

5.2 Definition and Rationalization

5.2.1 Analog Alarms

The following are available alarm conditions for analog values. These will support the basic typical requirements.

Condition	Description
Low-Low (LL)	The current scaled value is below the configured Low-Low setpoint (value < Low-Low SP)
Low (L)	The current scaled value is below the configured

	Low setpoint (value < Low SP)
High (H)	The current scaled value is Above the configured High setpoint (value > High SP)
High High (HH)	The current scaled value is Above the configured High-High setpoint (value > High-High SP)

5.2.2 Discrete Alarms

The following are the available alarm conditions for digital values

Condition	Description
Alarm (Alm)	The current value is in the configured alarm state.

5.2.3 Alarm Rationalization

Alarm rationalization is the process of reviewing, validating, and justifying the alarms that meet the criteria of a critical alarm. In other words, the rationalization specifies only those points in the process system that require alarming. The ultimate goal of alarm rationalization is to determine the most efficient number of alarms to ensure that the process system is safe and remains within normal operating range.

Alarm rationalization must be accomplished in conjunction with the City at the pre-programming workshop. The basic process can be outlined as:

- Check Alarm Validity
- Determine the consequence of inaction
- Document Cause, confirmation, and corrective action
- Document operator response time
- Assign alarm priority
- Alarm classification
- Determine alarm attributes
- Address need for special handling

All unused or deprecated alarms are to be removed from the system. Alarms that are no longer needed are not to be abandoned in place

5.2.4 Alarm Generation Guidelines

The generation of alarms is to be consistent with the ISA-18.2 alarm management guidelines. The overgeneration of alarms is indicative of ill-considered alarm policies. As such the alarming frequency should be considered against the following matrix.

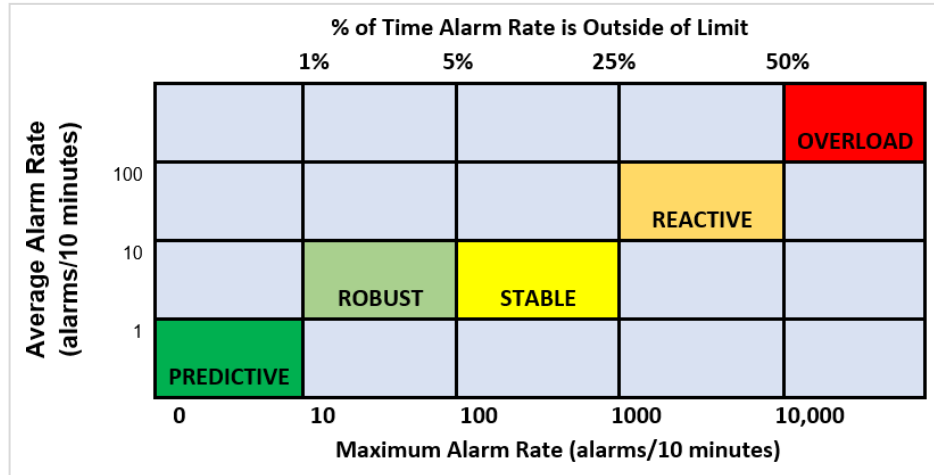


Figure 10 Recommended Alarm Rate per Operator Guidelines

It is critical that alarms be generated at a rate at which the operator can recognize the alarm and address the cause. Control system acceptance requires the average alarm rate per operator to fall within the predictive classification, number of operators for a particular system will be confirmed at pre-programming workshop.

5.2.5 Cascaded Alarms

Cascaded alarms are those in which one precipitating alarm also results in multiple others. The subsequent alarms are considered to be false alarms and are to be eliminated from the system. The generation of alarms should be considered, as much as possible, in a first-in-first-out manner.

Additionally, an event should only generate one unique alarm. An example of this is a motor stopping while running. The precipitating event is the Uncommanded Stop. Subsequent, related alarms such as Fail to Start are not to be generated.

Alarms, such as a process generating a Low and subsequently a Low-Low alarm are not considered to be cascaded events since each condition has a separate setpoint and the duration between events provides additional troubleshooting information to the operator.



6 Program Structure

The City's programs will be written utilizing LD, and FBD languages only. Any exceptions must be submitted for approval following the procedures contained in the City's Standards Deviation Request Policy (Reference Volume 1, SCADA & PCS Standards Deviation Request).

6.1 Ladder Logic

LD is the preferred language when performing complex Boolean logic. This would include actions such as top-down Boolean logic, interlock development, sequencing equipment operations, or control of I/O elements.

Function blocks (AOIs, FBs, FCs) may be utilized as part of the rung logic; however, this approach should be minimized. Block programming requirements often require support branches whose sole purpose is to port data into and out of the block. This approach results in rungs that are large and less comprehensible. The preferred approach in this case is to only use blocks that all of the parameters are supplied and visible; typical of internal instructions.

Rungs shall be organized in a one concept per rung manner. Stringing logic across rungs through the use of intermediary bits is to be avoided as much as possible. Logic that becomes excessively large will require being broken into multiple rungs. In cases where logic is split, it is incumbent on the developer to provide clarity and explain logic flow.

LD shall be limited in size to that which can be printed on an 11" x 17" sheet of paper, either portrait or landscape.

LD is a suitable language for the construction of custom function blocks. The same programming constraints are to be applied in this case as well.

6.2 Function Block Diagram

FBD is preferred when working with blocks and process values and control. Operations such as analog/digital input mapping, PID control elements, stand-alone alarm handling, and totalization should be handled in this manner. It is possible to perform Boolean logic in FBD; however, this should be kept to a minimum. The density of information contained on the sheet should be as concise and legible as possible.



FBD sheets should be limited in size to that which can be printed on an 11" x 17" sheet of paper.

6.3 Task and Program Files

Tasks provide the broadest level of organization. They also provide a level of execution control, that being continuous, periodic, event amongst others. Only two types of tasks are to be employed at the City: continuous and periodic. All other types of task types will not be employed.

6.3.1 Periodic tasks

Periodic tasks are designed to execute on a fixed period of time, typically in milliseconds. These tasks are conducive when working with a process or system that is slow, or requires the processing on a regular basis. Creation of periodic tasks should be kept to a minimum (six or less) as required by the controlled process or area.

The periodic task execution rate should be set to allow ample time for program execution without burdening the processor. Programmers shall frequently monitor and adjust the execution rate based on the task time. All programs shall be commissioned with task settings tuned such that no overlaps exist in the program. During commissioning, the main program overlap counter shall be confirmed at zero and FAULTLOG object shall not have any minor faults for overlap.

Each periodic task must be set with a priority from 1 to 15, with 1 representing the highest priority. It is recommended that each task be set with a unique priority.

Fast Scan Task

Parameter	Setting
Default rate	10ms
Priority	1

Normal Scan Task

Parameter	Setting
Default rate	250ms
Priority	3



Slow Scan Task

Parameter	Setting
Default rate	500ms
Priority	5

6.4 Main or “0”

Each program folder must contain a routine to be named “Main” or “0”; the language type specified for this routine should be LD. The purpose of the main routine is to govern the flow of the program. The jump subroutine (JSR) instructions shall be used to reference all other logical routines in the PLC program. No other logic is permitted in the main routine.

The first JSR of the main routine shall be to the initialization subroutine conditioned on first scan flag from PLC. This will allow initialization logic to run each time the PLC returns to run after power cycle or other interruption.

6.5 Subroutines

Routines are the lowest level of program structure; routines are subsets of programs. Subroutines are routines that are not designated as the main routine. Subroutines should contain the code for control modules, equipment modules, or other compartmentalized pieces of code or equipment. Subroutines are beneficial for encapsulating a specific function that is a subset of the larger program scope. For traceability, all routines are called from the program main routine. This allows for a single location where the program flow can be quickly identified. The following are exceptions:

- Routines that capture event data such as hourly data or report data

Routine names shall be named after the process areas the routine interacts with. The naming shall be _XXX_AREA_NAME, where XXX indicates the loop number and AREA_NAME is the description of the loop number area

6.6 Functions and Function Blocks

There are a set of predefined blocks supplied by the City to be used for specific functions. These blocks provide a common, known functionality in the PLC whose interface connects to OITs, HMIs and SCADA system.



Function blocks contain a listing of the supplied function blocks for use in programming. There is a corresponding graphical component discussed in Volume 3, HMI Standards. These function blocks are not to be modified without first submitting the suggested changes to the City for review and approval.

Block Name	Description
P_AIN	Provides a standard representation of an analog process reading (flow, pressure, temperature, etc.)
P_INTLK	Provides a standard methodology towards the accumulation of various process signals into a single digital output representing the operational permissibility of a device within the control systems
P_MOTOR	Provides a standard representation of a remotely controlled discrete (2-state) motor, fan, blower, pump, etc.
P_ALARM	Provides the ability for the control system to generate a variable level alarm for a system of related devices or a single device that is unrelated directly to a single tag element.
RAP_DVC_LGXCPU_5X80_5_10_00_AOI	Provides a standard representation of the health of the PLC and provides status information to the HMI/OIT
RAP_DVC_LGXREDUN_5_10_00_AOI	Provides a standard representation of the health of the redundant PLC and provides status information to the HMI/OIT
P_RESINH	Provides a standard representation of the restart inhibition of large motors or other equipment, where repeated start/stop or failures might cause damage.
P_RUNTIME	Provides a standard representation of the total runtime in multiple timeframes and number of starts.
TOT	Provides a standard representation of the integration of a process value over time for multiple periods
P_VAVLEMO	Provides a standard representation for control, operation, indication, and alarming of actuated (open/close/stop)
P_VALVEC	Provides a standard representation for control, operation, indication, and alarming of valves and gates that have position feedback (%)



RAC_OPRNETMODBUSTCPMASTER	Provides a representation for communication between modbus devices where the master block enables the sending of data to other devices.
RAC_OPRNETMODBUSTCPCLIENT	Provides a representation for communication between modbus devices where the client requests data from other devices.

Refer to Appendix A, Definitions and General Reference, for detailed information on the function blocks.

Additional function blocks may be developed for the application. This is also extensible to complex functions, such as calculations or complex selection. However, should functionality be needed that would be viewed as an extension of the pre-existing blocks, refer to the procedures specified in City Standards Deviation Request (Reference Volume 1, SCADA & PCS Standards Deviation Request).

Any and all function blocks developed in the execution of a project that are not part of the City standard functions must be fully documented and the block submitted to the City for possible inclusion into the City accepted function block toolkit.

6.7 Process Control Programs

A single program called P0X (where X is the program number) shall be created under the normal task, within the normal program. The program name is standardized with the same number as the task and process area loop number. The process area number and loop number is reserved for subroutines which is explained upon in the following figure.

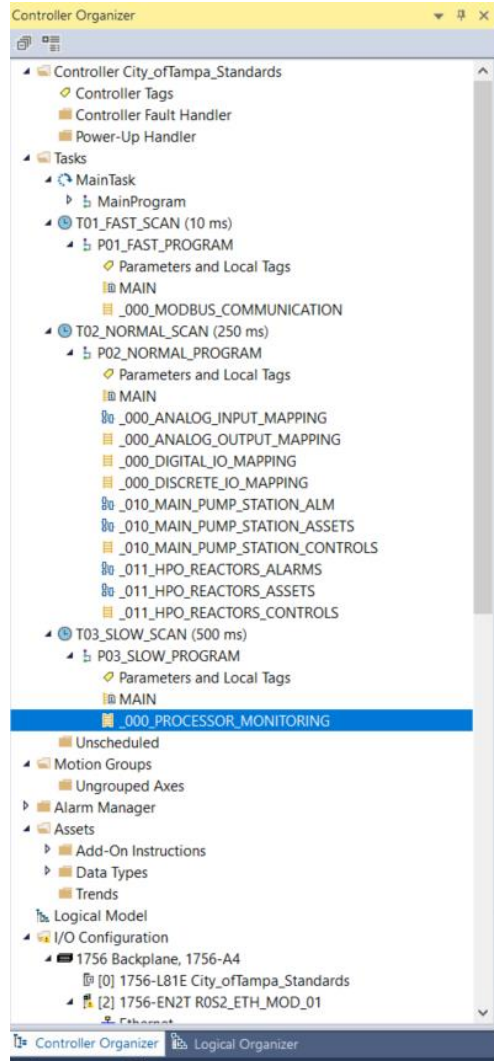


Figure 11 Subroutine Structures

6.8 I/O Handling

Most modern controllers process I/O through complex interface modules that provide a significant amount of additional information. In the case of analog values this can be channel fault, over-range, under-range, and wire-break. Digital inputs can also provide similar information such as point fault, broken wire, electronic fusing, etc. It is best practice to consider all of this information when utilizing the values from field instruments and devices.



The physical data is required to be aggregated with the quality information into one cohesive unit with a new unique name. This point or tag name is what will be used in lieu of the physical I/O address and any/all of its quality

Programmers shall organize all I/O, (local, networked and messaged) into four subroutines, _000_ANALOG_INPUT_MAPPING, _000_ANALOG_OUTPUT_MAPPING, _000_DIGITAL_IO_MAPPING, _000_DISCRETE_IO_MAPPING

To clarify the above:

- All Inputs must be mapped into variable objects with unique, symbolic tag names
- In all cases input points must be used with quality information supplied.
- All outputs will be directly controlled by unique, symbolic tag names.

I/O mapping programs shall be organized within the normal scan periodic task. Program nomenclature shall follow the guideline provided below. The number and types shall be limited to those required for the project but will likely include at least some of these:

- Analog_IO
- Digital_IO
- Message_IO
- Network_IO
- Modbus_IO

Some controllers support the use of tag aliasing, which allows for the abstraction of complex input or output addressing into a single symbolic name. This feature is not to be employed in place of the mapping requirements outlined above. This methodology does not include the quality of the data in question.

6.8.1 Analog IO

The configuration of the individual point type is to be performed in the module. Modules that support multiple types of input, such as 4-20mA and 0-10VDC must be set to the appropriate selection at the module.

Any input module specific configurations, such as scaling and alarming are not to be utilized at the module level. All signal diagnostic capabilities are to be employed.



Module configurations are to be kept as close to manufacturer default (out of the box) as possible. This is to facilitate the replacement of modules on failure at some point in the future. In all cases 'Hot Swappable' modules are preferred.

Modules that support advanced features, such as the HART protocol, should adhere to the spirit of the specification as much as possible. The ability to employ these additional features, such as multiple data points on a signal channel, offer cost savings and convenience. However, beyond returning the value and any indication of the quality of that data, extended features should not be utilized.

Diagnostic points such as broken wire detect, under range, and over range are to be enabled, if selectable, and the signals utilized as faults to the analog input blocks. Module fault information is to be aggregated into a common signal and utilized as fault inputs to the analog blocks.

In the case of inputs and outputs, either fault status information should be supplied to the primary controlling element. This allows the blockware to be cognizant that the element(s) that are being controlled will be non-responsive. This is applicable to equipment position control/feedback and speed control/feedback.

6.8.2 Digital IO

Each point is assigned a variable. Typically, there are few configuration elements; however, in the case that such configuration elements are available, those elements are to be used sparingly or not at all. All signal diagnostic capabilities are to be employed. Filters on the input signals are not to be utilized and in all cases turned off.

In the case of outputs, fault status information should be supplied to the primary controlling element. This allows the blockware to be cognizant that the element(s) that are being controlled will be non-responsive.

6.8.3 Message IO

All peer-to-peer tag values passed through message arrays shall be read through the fast scan. Message routines shall be named by applying the prefix "MSG_" to the paired controller's name, followed by "_IO". An example would be "MSG_ H-010-PLC000-800-01_IO" (Howard F. Curren AWTP, MPS Electrical room, PLC number 1).

Messaged data will be handled in a similar manner as module supplied data, through analog blocks. In the case of messaged data, the success or failure of communications will be used as the data quality. As the receiving controller is not the owner of the data



no alarming information will be generated. Scaling, beyond the conversion of integers to reals, is not to be employed. All failure states will be discussed with the City at pre-programming workshop to determine the proper course of action.

Messages array bits are each mapped to a variable where variables 0XXX (where XXX is the unique variable number) are reserved for digital outputs, 1XXX (where XXX is the unique variable number) are reserved for digital inputs, and 4XXX (where XXX is the unique variable name) are reserved for analog inputs/outputs which are read/write blocks.

6.8.4 SCADA IO

This is data and information that is being specifically marshalled for use by the SCADA system. These SCADA IO points shall be kept minimal, the basic ones that are provided and used are the simulation and disable IO points, some may be added if needed and should be documented accordingly.

6.9 Data Structures

Internal to most modern controllers is the concept of structured data. This is typically represented employing two methods, add-on instructions/function blocks and user data types. Each of these concepts offers opportunities to add clarity and reusability to the overall control program. User data types shall not be used for the development of new code. Only predefined add on instructions shall be used.

6.9.1 Function Blocks/Add-on Instructions

For the purpose of this discussion these will be referred to as add-on instructions (AOIs)

AOIs represent a unique collection of data and logic. The logic is customarily developed using the controller's standard programming languages. The AOI also presents a usable interface to the logic through a series of parameters, both inputs and outputs. The AOI also can contain internal data registers that maintain the unique state of the instance of the AOI. The AOI in short is a complete, unique encapsulation of control data and logic.

The primary benefit of the AOI is in its reusability. The advantage to the developer is that logic only has to be developed and tested once. Once proven, this logic can be reused countless times with the assurance that it will always function the same across all instances. This aids in the rapid development of entire systems.



The AOI interface contains a duality in its nature. From the programmer's perspective, this allows them to interact with the code-block in a regular manner. From the graphical developer's perspective, this presents a reliable interface to contained data that simplifies their data management requirements.

This interface is a strictly enforced contract with all parties into what the contained data is and to which the inner workings of the blocks code can respond.

The parameters are constructed of the controller's basic data types. Examples are Booleans, integers, and real numbers. The parameters are also capable of handling complex data elements like arrays and user defined types (UDTs). This allows the developer the opportunity to source whatever data is required for the contained logic process.

There are more subtle advantages to the use of AOIs from the controller's perspective. Typically, the controller only maintains one copy of the executable code without regard to the total number of actual used instances. The only requirement on the controller is to have enough memory to contain the interface and internal variable data. The end result is a much smaller controller footprint.

AOIs shall be used for any function that will be repetitive. An example of this is a valve. There is a high probability that a system will contain multiple valves. As such the generation of one block of code that addresses the needs for all similar acting valves can be a significant time saver.

AOIs should not be used for one time code or code that has the potential to be modified (such as during start-up). AOIs are typically compiled and subsequently downloaded to the controller for optimization purposes. Modifying them typically requires the entire controller to be taken out of active state while a completely new download takes place. This can have a significant impact on the process.

A secondary function of AOIs is the development and encapsulation of calculations or custom control requirements. Calculations are generally fixed in nature; an example being the solution to the quadratic equation. There is little value or clarity to be gained by exposing the details of the equation to the general codebase. The only thing that realistically matters are the results. There is also the case of supplementing or extending the functionality of native programming elements. There will often be cases where special requirements need to be applied to a native function that is not supplied or supported. In these cases, an AOI provides the opportunity for a simplified solution.



6.9.2 User Defined Data Types

Data is the foundation of what the controllers are utilizing. All controllers support and supply atomic data types; examples are Booleans, integers, and real numbers. These are the fundamental elements upon which control programs are built. Controllers also natively support arrays of these basic types, providing a primitive complex type.

The user defined data type (UDT) is the logical extension of the primitive complex type into a structure that is constructed of multiple data types. In this case a UDT is a container for Boolean elements, integers, reals, arrays, and even other UDTs.

UDTs are not to be used for programming



7 Standard Logic Descriptions

7.1 Initialization and Non-Volatile Memory

The controller maintains its program, data, and configuration through non-volatile memory (NVM). This is memory that can exist in several forms, battery backed up RAM, EEPROM, or compact flash device (SD card). This technology allows the processor to return to its previous state after being powered up.

The controller must provide some type of non-volatile memory. At no time is it acceptable to rely on continuous power. The NVM must be capable of withstanding the same environmental conditions as the controller. The particular form-factor of the NVM is dependent on the manufacturer. The preferred types of NVM are those that do not rely on batteries, or other mechanical devices (such as hard disk drives). This memory shall also not be read-only but support re-writing using the native development tools.

The process of loading the program after power loss must be inherent in the controller natively. At a minimum the non-volatile memory must return the control program to active RAM. The ability of returning retained variable data to its previous state is a function that is desirable. However, when the ability to return retained data values is not supported, the control code itself must account for this and suitable initialization and start-up logic.

7.2 Peer-to-peer Communications

Within the plant all messaging shall be performed over Ethernet. If Ethernet is not available to the device, alternatives may be employed with City approval.

For remote locations the preferred platform is Cellular modems however, if cellular modems are not appropriate, with City approval, acceptable alternative platforms are serial radio modems, and satellite for extremely remote locations.

In all cases, alternative peer-to-peer communications are to be submitted to the City for review and approval prior to implementation. All inter-processor communications will be performed utilizing native communication control elements. An example of this is to utilize the "MSG" instruction in a ControlLogix controller.

All communications will be performed in a read-only manner. At no time is a data write, or push, allowed. This leaves the receiving end in a non-deterministic condition in which the receiving controller is unsure of all of the factors affecting communications.



Communications to remote controllers will utilize comprehensive fault monitoring of the status. The message execution complete and error results will be monitored and be utilized as data quality status. Additionally, the data being transferred will contain a watchdog register with each message packet.

This value will be used to drive a timer which indicates the information being read from the foreign controller is valid.

At the time of development, the failure modes for the communicated signals and the local process. Each signal must be evaluated for Fail-Last, Fail-to-Zero, etc. This will be performed in conjunction with the City. All failure mode determination and conditioning is to take place in the communications handler.

Data that is being supplied as status inputs to remote controllers will be marshalled in routines following naming conventions outlined above. The data will be passed in arrays of Integers (INT) or double integers (DINT), whichever is the native integer format of the controllers. Structures of data utilizing UDTs are not permitted. Structures do not accommodate last minute changes without requiring both controllers to be re-downloaded. Additionally, some devices might not support structured data beyond arrays.

The first element in the transmission array will always be the clock time in seconds and milliseconds. This value is the watchdog timing element for the receiving end. A seconds-based number is suitable as communications polling periods should not exceed five seconds (0.2 Hz). Subsequent elements of the array are to contain the data values.

It is understood that not all data exists as integers. In the case of Boolean data that may be transferred in a one bit per word or may be packed with multiple bits into one word. In the case of reals (floating point) these are to be multiplied by a suitable factor of 10 to fit within the integer value space. The multiplicative factor needs to consider the significant digits of the value in question. In example, a value of 43.56 would be transmitted as 4356.

In all cases with packed array of data documentation is critical. All of the data that is being transmitted must be clearly defined and detailed.



7.3 DNP3 Exception Configuration

The communication protocol between remote controllers and the supervisory (SCADA) system will be based on the DNP3 protocol as specified by DNP.ORG. This protocol shall be only used on remote sites. The transport layer for communications is to be appropriate for the application, e.g., LAN, serial modems, etc.

No proprietary protocols are to be implemented.

The master will be configured to perform its polling utilizing events (exceptions). Only periodically will static values be requested to insure validity and quality. The definition of what constitutes an event are dependent on the nature of the data point and acceptable excursion limits. All events will include a timestamp to facilitate sequence of event generation.

The data is to be formatted and marshalled to facilitate optimal polling. Data being read from LAN based sources will by nature support a larger number of points being read than those from serial based devices. As such the data being sent must have the event thresholds and organization considered prior to implementation.

Due to the potential communications loss events that can occur to some remote stations the concept of store & forward will be fully implemented. Therefore, all controllers must support this method of operation. This functionality may be supplied either natively or by the use of in-chassis interface modules. Each device is to be configured to maintain the data as long as possible, this is heavily dependent on the device design.

Standard polling of remote locations by the SCADA system is to be configured such that the entire store & forward buffer may be read. This is much more critical when communicating to devices utilizing serial or cellular modems where outstations are typically read in a round-robin approach. In these cases, acquiring the data and storing the data into the historian in chronological order is critical.

Stations that have a higher probability of continuous connection may be configured for unsolicited messaging. This feature is to be used sparingly and only for critical events. This feature will not be supportable in systems employing round-robin polling.



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Reliable Tampa Partners Project No. 23-502
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January 2025

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Howard F. Curren AWTP
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Revision History

REV	DATE	ENGINEER	NOTES
1	2/17/2025	Hazen and Sawyer	Final submittal



List of Acronyms and Abbreviations

AWTP: Advanced Water Treatment Plant

COT: City of Tampa

HMI: Human Machine Interface

OIT: Operator Interface Terminal

PCS: Process Control System

PLCs: Programmable Logic Controllers

SCADA: Supervisory Control and Data Acquisition



1 Introduction

This is Volume 3 of the City of Tampa's standards for Supervisory Control and Data Acquisition (SCADA) and Process Control System (PCS) programming, configuration and design standards for the City of Tampa referred to as "The City" or abbreviated as "COT" throughout this document

Volume 3 is a compilation of procedures for development and programming of the HMI and OIT. This volume provides both guidance and specific examples to set up these interfaces

The City SCADA & PCS Standards and Conventions Manual is intended to be applied by the City's contractors, consultants, and in-house personnel when developing or modifying any portion of the City's control system. The control system is a utility-wide system built upon a common human machine interface (HMI) system and is comprised of the following:

Process Control System (PCS): The industrial control system for processes within the boundaries of the plant (Howard F. Curren AWTP). The primary function of the system is control and monitoring of plant operations. The PCS is comprised of the local HMI subsystem and various programmable logic controllers (PLCs) and operator interface terminals (OITs).

Supervisory Control and Data Acquisition (SCADA) System: The industrial control system for processes outside the boundaries of the process areas, ability to monitor and/or control the process from the control room from outside the plant. The primary function of this system is data acquisition; processes or remote sites are designed to run autonomously without supervisory control function. The SCADA system serves both remote sites such as lift stations and wastewater treatment plant facility in an integrated environment and is comprised of telemetry equipment with a supervisory HMI.

This manual is divided into three main volumes plus two appendices:

Volume 1 contains the control system policies and procedures that apply to the management, maintenance and modification of the control system. Volume 1 includes policies for:

- Programming laptop use



- Management of change (MOC)
- Software and application revision control
- Other related topics.

Volume 2 addresses practices for development and programming of control processors such as:

- Programmable logic controllers (PLCs) of various types

Including requirements for programming software

- Alarm processing
- Control loops
- Control logic structure
- Input/output (I/O) layout and signal processing
- Programming comments
- Tagging and naming conventions.

Volume 3 contains practices for development and programming of human-machine interface (HMI) and operator interface terminals (OITs). Standards for programming and display development, historian data exchange, and security are included in this volume.

Appendix A Contains definitions and general references that provide clarity and detail to volumes 1 to 3 of the City of Tampa's SCADA standards manuals.

Appendix B Contains forms and documents needed for deviations and documentation of changes to the City's PCS or SCADA systems.

Compliance with the standards and conventions outlined in the manual is required for all projects that add to or modify the control system. If a contractor or staff member identifies a need for an addition or modification to the standards for a specific project, or if in the course of the work it is found that some part of the standards cannot be adhered to, a standards deviation request may be submitted in accordance with the requirements provided in Section 3 of Volume 1 and in Appendix B.



2 HMI Software

The SCADA software currently utilized by the City is VTScada 12.1.58, development environment from Trihedral Engineering, contact the City for version being used. This software suite forms the basis of the system, as well as providing the majority of the data acquisition drivers. All development of HMI screens and system wide visualization will utilize this software.

All new HMI screens and graphical elements are required to be developed using the latest available City provided ChangeSet file. A ChangeSet file contains the instructions required to re-create an application. This is not an exact backup but a compendium of changes and the base information to reproduce a functional application. In general, ChangeSets are used to distribute new applications, distribute updates to an existing application, or add extra features to OEM layers. This ChangeSet file will contain all of the latest container tags, display definitions, and library widgets needed to support development activities.

Each project shall request, via email to the City's project manager (or assigned City Operational Technology (OT) contact), a copy of the current ChangeSet application immediately prior to initiating programming activities. Although updates to the standard may occasionally occur, the files provided on request date shall be utilized throughout the project. Only those updates which are determined mission critical (have severe consequences to operations, life or equipment safety) will be handled on a case by case basis through direct notice to programmers by the City's project manager or assigned OT contact.

The distribution ChangeSet file will be re-created periodically as functional elements are added and/or enhanced. Additionally, other exports will be created as required in order to maintain an appropriate level of application consistency between the City's templates and any standalone in development.

The City's SCADA system is a managed VTScada application which has been developed using custom City developed library widgets. Refer to the City Standard Object Library Programming Guideline for details on the currently available object template library or submit an email request to the City's project manager.



Note: All operator screens shall be constructed using the City's library widgets and graphic symbols.

All new SCADA development projects must be executed utilizing development tools that match the revisions currently being employed at the City. Software may not be executed in a version newer than the version implemented within the City's systems. While VTScada provides extensive software cross-version controls this functionality is not to be relied on for new development deployment.

All applications developed for OITs must be executed utilizing development tools and environments that use matching application software revisions, service packs, patches etc. to those at the City. Software developed using outdated revisions will not be accepted for import into the City's master application. A current supported version list is available upon request from the City's project manager or assigned OT.



3 Key Concepts

3.1 VTScada Development platform

The VTScada development platform contains key concepts that need to be understood in order to plan, design, and implement an application. Key concepts for tag based configuration, tag widgets data acquisition, historian, configuration nodes, HMI clients, and development nodes are described below.

3.1.1 Tag Based Configuration

Tags are software elements representing physical objects or concepts. Tags represent communications ports, device drivers, I/O elements for a device, historical logging of data, and alarms. The combination of various functional tags into larger units will create orderly, consistent structures that may then be directly utilized or combined together further with other functional elements.

The underlying concept to the system is that everything is a tag. Whether a single atomic element or a collection of complex elements the end result is simply considered to be a tag. This in turn allows the tags to be referenced as a single item with all of the inherited properties immediately available.

3.1.2 Tag Widgets

Tag information is visualized to the operators utilizing widgets. These widgets may be indicators, push buttons, numeric values, numeric entries, gauges, variable fill, and more. The crucial point to this is that the visualization elements are very tightly coupled with the data elements.

3.1.3 Data Acquisition

Data acquisition (DA) is to be configured as appropriate to the controller(s) being monitored. The preferred communications pathways are as follows:

- For PCS or process: Ethernet/IP or Modbus TCP
- For remote telemetry: DNP3 protocol over Ethernet



Communications are to be configured in VTScada using the appropriate driver and port tag constructs. The driver tag, specifically, must be appropriate to the communications protocol.

Separate, stand-alone servers will be dedicated to data acquisition. There will be at least two servers configured for the system in the roles of primary and backup. This will provide redundancy for the purposes of monitoring the information from field devices and controllers. There are expected to be pairs of data acquisition servers for collections/distributions, waste water operations, and water operations.

The data acquisition servers (referred to as default servers) will be added to the system configuration default server list as one, uniquely named device. Under this named configuration the server machines that will act as the primary and backup systems will be listed. The primary data acquisition machine being that system listed first and subsequent backups following in order. In this way the system allows for the growth and expansion of data acquisition clusters servicing the data needs for logical areas of operations as a whole.

3.1.4 Configuration Systems

Configuration systems are workstations specifically designed for system configuration and contain the currently running configuration with the system property “Automatically Deploy Local Changes” disabled. These systems have been added to the system server lists under the “Configuration” category. All development and testing will utilize these stations at the City’s Operations Center. Upon successful testing and acceptance, the ChangeSet file will be transferred to deployment nodes.

HMI clients are the portals through which the process is monitored and controlled by the operator. These stations may be based on workstations, laptops, or mobile devices. As such additional consideration must be given to the functionality of the screens as the platform changes.

All workstation based HMI clients will be added to the configuration of the system. This allows for remote administration of the machines as well as the ability to push updates to the systems.

Mobile clients, either portable or vehicle mounted, will be based on Windows 10 with cellular communications for data access. As with all systems these stations will be



added to the system configuration for centralized management and application synchronization.

3.1.5 HMI Clients

HMI clients are the portals through which the process is monitored and controlled by the operator. These stations may be based on workstations, laptops, or mobile devices. As such additional consideration must be given to the functionality of the screens as the platform changes.

All workstation-based HMI clients will be added to the configuration of the system. This allows for remote administration of the machines as well as the ability to push updates to the systems.

Mobile clients, either portable or vehicle mounted, will be based on Windows 10 with cellular communications for data access. As with all systems these stations will be added to the system configuration for centralized management and application synchronization.

3.1.6 Deployment Nodes

Deployment nodes are workstations on which new applications will be methodically deployed. These stations will have the system property "Automatically Deploy Local Changes" disabled. These stations accept newly developed/tested and approved ChangeSet files and provide a platform to methodically deploy the edits. Once loaded these changes will be "Accepted for Distribution" and the native application synchronization service will distribute the application to the configured nodes.

3.1.7 Historian

The process value historian function will be conversely aligned with the primary and backup function of the data acquisition servers. In this manner the primary data acquisition server system will function as the backup historian server. All process value data storage files will be specified to reside in a subdirectory on a non-operating system drive partition under the name ".\Historian".

The alarm databases will also be located on the data acquisition servers in separate, native alarm database files. The alarm database historian server files will be specified to



reside in a subdirectory on a non-operating system drive partition under the name ".\AlarmDBHistorian".

The historian aspect used for historization will be a structured query language (SQL) based server located in the PIN (DMZ) network. This server(s) will receive critical and compliance information pulled from the applications on the data acquisition servers. This database will use the table configurations specified by VTScada.

City does not have any standards for frequency and deadband of logging analog values, these parameters shall be reviewed on each project and approved by the City. All PLC I/O, process control setpoints, and other key settings and status shall be logged to the historian. Higher resolution logging may be required during testing and startup of a project to demonstrate performance of the process controls.

Graphics display hierarchy includes multiple levels. The graphics hierarchy shall be maintained such that no more than two clicks are required to navigate to any process screen within a plant. The graphics provide progressive layers of system details ranging from system wide and process overviews to specific equipment details; each of these layers are described in subsequent sections of this volume.

```

graph TD
    SWO[SYSTEM-WIDE OVERVIEW] --> PH1[ALARM HEADER  
PLANT OVERVIEW]
    SWO --> AS[ALARM SUMMARY]
    PH1 --> PH2[ALARM HEADER  
PROCESS UNIT OVERVIEW]
    PH2 --> PH3[ALARM HEADER  
SUB PROCESS OVERVIEW]
    PH3 --> CS[ALARM HEADER  
CONTROLS STATIONS]
    PH3 --> ED[ALARM HEADER  
EQUIPMENT DETAILS]
    CS --> EC[Equipment Control / Configure (Faceplate)]
    ED --> AS
    ED --> EC
    AS --> EC
  
```

The diagram illustrates the alarm hierarchy, starting with a **SYSTEM-WIDE OVERVIEW** box at the top. A black arrow points down to an **ALARM HEADER** box containing **PLANT OVERVIEW**. From this box, a red arrow points down to another **ALARM HEADER** box containing **PROCESS UNIT OVERVIEW**, and a black arrow points down to a third **ALARM HEADER** box containing **SUB PROCESS OVERVIEW**. From the **SUB PROCESS OVERVIEW** box, a black arrow points down to a fourth **ALARM HEADER** box containing **CONTROLS STATIONS**, and a black arrow points down to a fifth **ALARM HEADER** box containing **EQUIPMENT DETAILS**. From the **CONTROLS STATIONS** box, a black arrow points down to the **EQUIPMENT CONTROL / CONFIGURE (FACEPLATE)** box at the bottom. From the **EQUIPMENT DETAILS** box, a black arrow points down to the **ALARM SUMMARY** box, and a red arrow points down to the **EQUIPMENT CONTROL / CONFIGURE (FACEPLATE)** box. From the **ALARM SUMMARY** box, a black arrow points down to the **EQUIPMENT CONTROL / CONFIGURE (FACEPLATE)** box. Additionally, a black arrow points from the **SYSTEM-WIDE OVERVIEW** box down to the **ALARM SUMMARY** box, and a red arrow points from the **SYSTEM-WIDE OVERVIEW** box down to the **ALARM SUMMARY** box.

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4.1 Plant Overview

The overview provides a bird's eye view of the entire plant/facility and all sub-areas (unit processes) are accessible from this level. The overview screen has graphic pushbuttons which the user can navigate to a specific sub-area or process unit. The user cannot monitor or control any equipment belonging to the sub-areas from the overview screen. The overview is a means to display a static descriptive image of the plant/facility and a means to navigate down to any specific sub-area. Area alarms will be indicated utilizing standard alarm symbology along with a general area boundary highlight.

Figure 2 is an example of an overview graphic screen for the Howard F. Curren AWTP which is the first graphic displayed when accessing an individual plant overview.

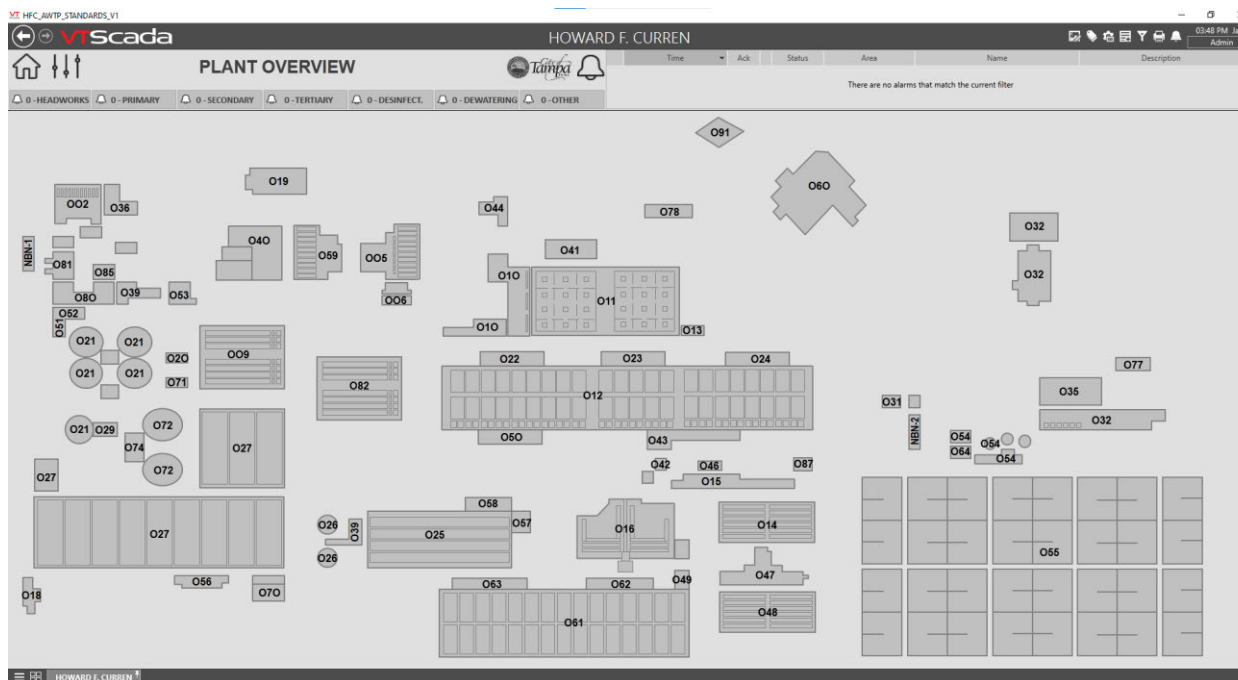


Figure 2 Plant Overview Screen Example

4.2 Process Unit Overview

This view displays the process unit screen. The plant/facility will be subdivided into various process units and components of these process units will be displayed on the

process unit screen. All the imagery on this page is based on the ISA 101 compliant graphics standard as applied to this facility. Depending on the equipment in each process unit more than one graphic screen may be required for a single process unit.

These displays are to be primary alpha-numeric status screens. Some elements, such as meters, gauges and radar plots may be used where they allow a quick comparison between systems or elements. This display will not contain 3D representations of P&ID interrelationships.

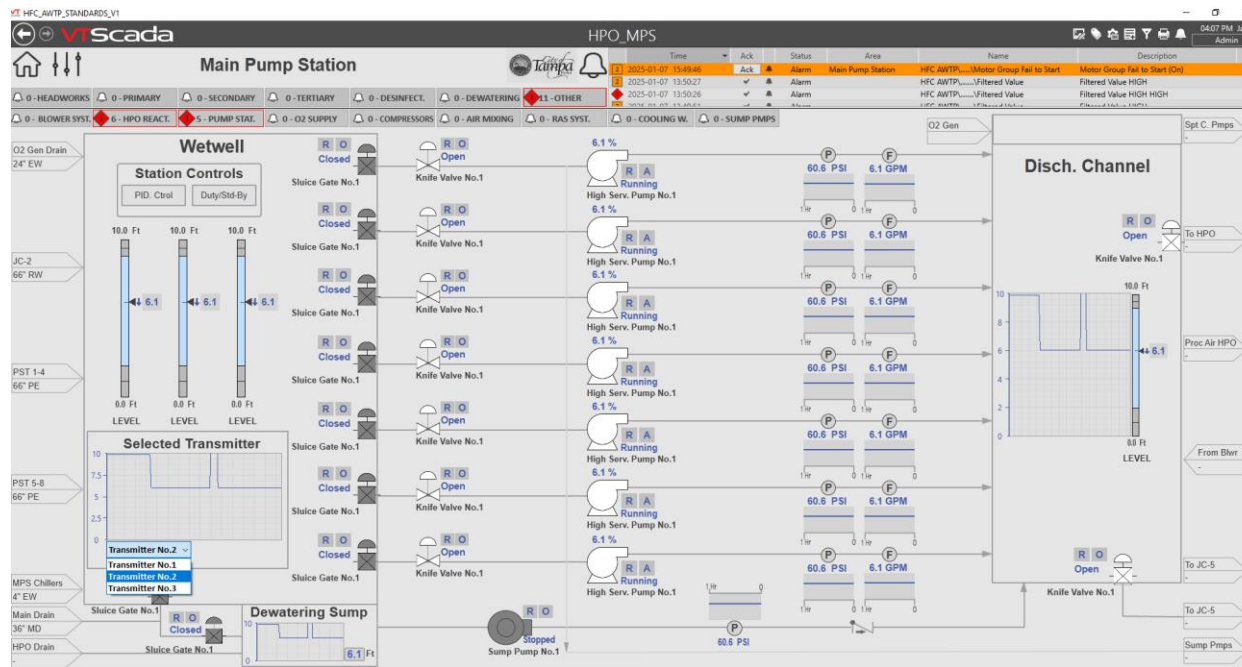


Figure 3 Process Unit Screen Example

The unit process screens will indicate all PCS controlled process equipment. The information will be organized in such a manner as to give a broad perspective of the area. The general flow of the screens will be of influent on the left to effluent on the right. However, the display will not be representing the P&ID. The City Standard Object Library shall be used for all animated display components.

4.3 Equipment Detail

Detail screens are to be provided for those cases where providing additional information from the process graphic is warranted. All of the imagery on this page is based on the high performance graphics standard as applied to this facility. These are the graphics that would contain information into the interrelationships between devices and elements. Information from the P&ID would be represented on these displays.

This layer of graphic is also well suited to simple multi-device control routines or sequence of operation. While that functionality is intended to be contained on control station displays, there are cases where less complicated relationships can be implemented.

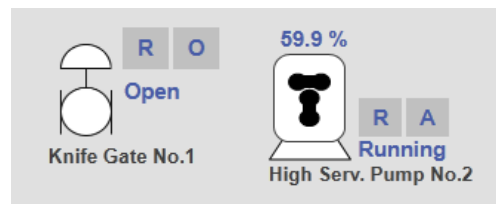


Figure 4 Equipment Detail Example

4.4 Faceplate Display

Faceplate displays provide access to and information about all elements of the equipment or device. From the graphic screen for a particular process unit the operator can click on the equipment object to bring up its associated window. Interaction with faceplate control elements is restricted by security group as described in Section 11 of this volume. The general sections of the faceplates are listed in the following table.

Section	Description of contents
Home	The current condition of the device, along with basic operation and mode control.
Alarms	The current status and setpoints for the alarms.
Settings	Access to functions such as simulated values, scaling, ranges, etc.
Configuration	Similar to settings these are elements that impact the overall performance of the device. Often these will be forced values in the controller due to their impact.

Trend	This will provide a short term trend for the primary values or conditions.
Notes	This provides a quick interface for the operator to make entries regarding the instrument or specific events regarding the point.

All imagery on these pages is based on the ISA 101 compliant graphics standard as applied to this facility. This view enables the operator to take control action on the associated equipment.

The following are a series of graphics that represent one faceplate for an analog value. In practice these will only be visible one at a time by selecting the tab button.

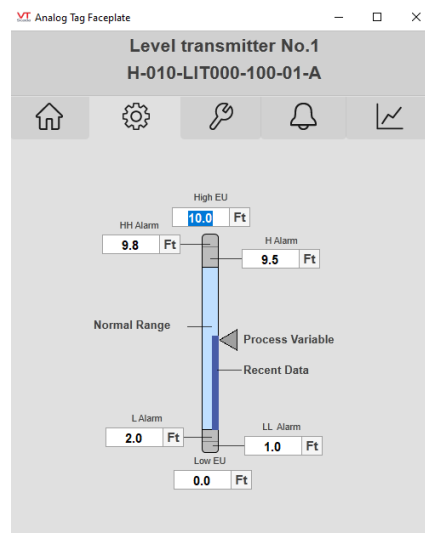


Figure 5 Analog Face Value Faceplate Example PT. 1

4.5 System Title Bar

Located at the top of every page will be the VTScada title bar. This display element will contain the following items:

- Page title
- Logon button
- Date and time

- Alarm indication
- Print button

The elements that relate to editing or system elements will be visible/enabled based on login. The forward/back buttons will be deactivated. The title bar will not be enabled for any element on popup pages.

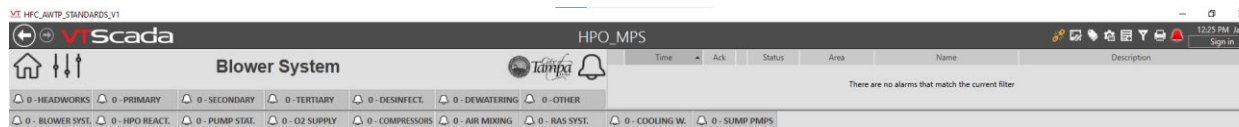


Figure 6 Title Menu Bar

4.6 System Task Bar

Located at the bottom of every page will be the VTScada system task bar. The task bar will provide access to the system wide display page menu; this is located in the lower left. This will be organized utilizing the standard VTScada menuing organizational system in the same logical order as the pages are structured for use. This offers operators familiar with the system, to directly access pages with minimal system navigation. Operators will also be able to pin graphics pages to the task bar for quick access. These pinned pages are solely at the operator discretion and are workstation specific.

This display element will contain the following items:

- List menu button and menu
- Page buttons
- Addition/removal of shortcuts



Figure 7 System Task Bar

4.7 Main Menu/Navigation

Located at the top of each overview, process graphic, and equipment screen will be the main menu. This menu will be comprised of critical plant information and the base, or main, navigation menu. This base navigation menu will be comprised of the major areas of the plant whose name is displayed on touch points. Selecting the individual plant

areas from this menu will open drop-down lists that will contain access to the specific graphics in the area.

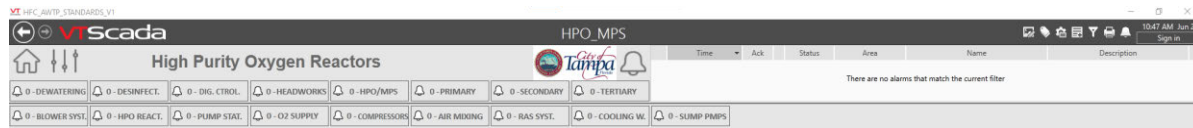


Figure 8 Main Navigation Menu

4.8 Alarm Header

Located at the top of each process or display screen will be the alarm header. This is not to be displayed on system side, total plant overviews, pop-up or non-full screen displays. This screen element will provide information about the most recent five alarms. This is designed to alert the operator about the immediate alarming conditions only. Further information into the state of the alarms is to be provided on the alarm summary.

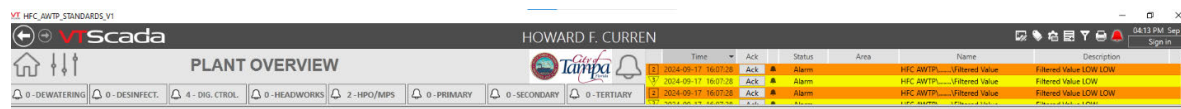


Figure 9 Alarm header

4.9 Alarm Summary

The alarm summary allows the user to see current alarms as well as historical alarms and events. The user may acknowledge an individual alarm, a group of alarms, or all alarms and add an alarm comment. Filtering is also available to allow the user to sort by state or priority. Figure 10 Alarm Summary an example of the alarm summary with a description of each of the functions.

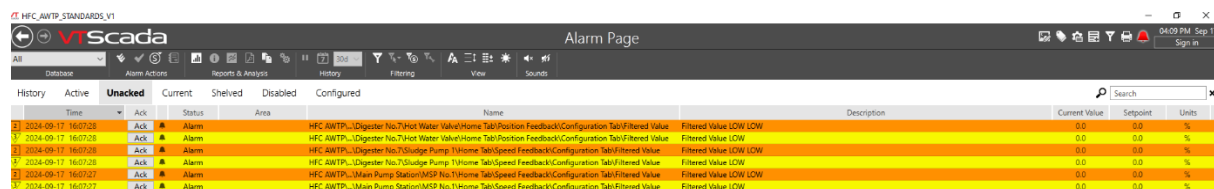


Figure 10 Alarm Summary



4.10 Troubleshooting

Troubleshooting displays provide overview and detailed status into the health of the system. These displays are organized in a hierarchical manner utilizing the drill-down approach. At their maximum depth the displays will provide detailed information into the selected component. This methodology applies to field equipment as well as system hardware and components such as PLCs, and communications drivers. All of the displays, by nature, are to be customized to address the specifics of the equipment. At a minimum the controller and fault status along with its diagnostic information is to be provided. As much information as possible is to be provided.

4.11 Flow Totals

Flow totalization displays provide a quick overview of the complete facility flow values. These displays are considered to be in the process unit overview family; however, often reach into more areas than a process unit. Flow total displays should span no more than the plant to which they are attached.

Totals associated with wet wells or towers will be clustered in zones/regions similar to the Remote Site summaries. These displays will represent a basic overview of the facility with the flows and totals through the critical sections. The individual totalizer faceplates will provide additional depth of information into current day totals, previous day totals, monthly totals, and annual totals.

4.12 Runtime and Starts Totals

Runtime and starts totals displays provide a quick overview of the complete facility motor and pump usage. These displays are considered to be in the process unit overview family. These displays will provide detailed information into the operation of electromechanical devices. The individual motor and pump faceplates will provide additional depth of information into the current day usage, previous day, monthly, and annual totals.



5 Graphic Symbols and Object Library

The ISA 101 HMI standard is an industry standard developed by the ISA 101 HMI committee which establishes standards, recommended best practices and guidelines pertaining to HMI interfaces in process automation applications. The ISA 101 HMI standard serves as a guideline to help organizations design, build and operate effective HMI applications. The City's Standard Object Library incorporates recommendations from ISA 101. All new objects and displays shall follow the current ISA 101 recommendations at time of development to maintain system with latest industry standards.

The City's Standard Object Library provides a set of ready to use HMI objects for use in the development of HMI graphics. The object library makes it easy to create an interface that is more consistent in both appearance and function. Some standard HMI objects include:

- Tanks
- Pumps
- Motors
- Valves
- Generator

These preconfigured objects are animated to the City's color standards, refer to Appendix A for the colors standards table.

- Dark Gray
 - Pumps, Generator, Driven Equipment: Inactive
 - Valves: At closed limit
- White
 - Pump, Generator, Generic Driven Equipment: Active
 - Valves: At open limit
- Light Blue
 - Pump, Generic Driven Equipment: Ramping Up/Ramping down
 - Valves: in 'Travel' neither at open or closed limit

In conjunction with the standard objects are a series of faceplates and detailed information displays. These will be accessible by selecting the base object on the

display. These displays will ‘popup’ proximally to the screen display element and remain open until dismissed. While they will open adjacent to the calling element they will be movable on the display. Multiple faceplates are allowed to be open simultaneously, however, must be closed, or forced closed, upon leaving the calling display. The individual element faceplates will support the requisite security and include a detailed perspective on all aspects of the object. An example of a faceplate is provided on Figure 11.

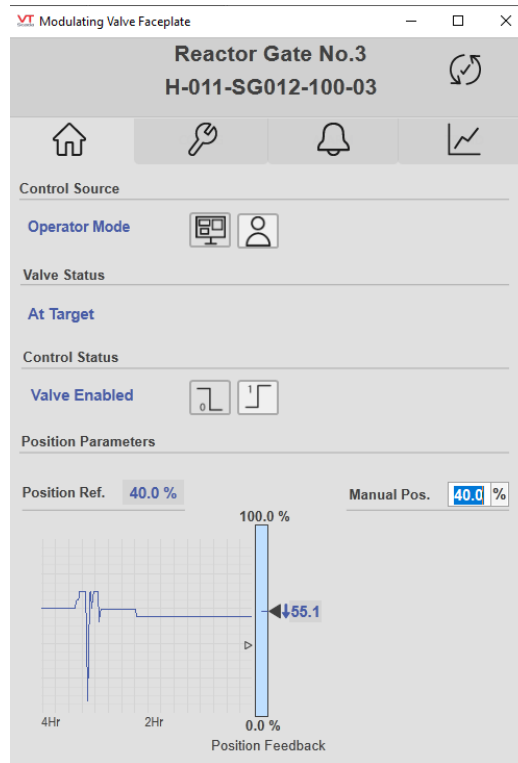


Figure 11 Reactor Gate Valve Example

Graphical user interface (GUI) elements such as tooltips shall be used to display mouse-over text. When the mouse is hovered over an object, the associated tooltip shall be visible with a text describing the objects function. All equipment objects shall be configured to display device tag name on mouse-over event



The graphical elements are in Appendix A, Definitions and General Reference. These pre-constructed objects are to be used wherever possible. This will discuss what the different elements are and how those elements are to be used. In the event that a function or indication is not available in the library, the developer is expected to follow all other standards and style of the supplied objects to construct the required screen elements.



6 HMI Graphics Naming Convention

This section contains the requirements for HMI tags and is intended to provide consistent usage throughout the City

6.1 Display Naming Standards

The City's naming convention is to be followed for all program development using VTScada screens.

Refer to Appendix A, Definitions and General Reference, for a detailed listing of the site locations, building numbers, and equipment/instrument codes.

The screen type designations are as follows.

Overview	Alarm	Menu
Process	Popup	
Detail	Trend	
Faceplate	Status	

Some example screen names would be:

Overview – Howard F. Curren MPS overview screen.

Alarm – Howard F. Curren MPS alarm screen.

The screen description presented on the display must be consistent with this naming convention and also in full, non-abbreviated English words. In the case of faceplates or pop-ups, the description will refer to the underlying object name and/or description.

6.2 Tag Name Standard

6.2.1 Controller Object References

The controller will contain the majority of the elements that are required to be visualized on the HMI. For any and all tags whose data is originating or terminating in a controller, the name utilized in the HMI will be identical to that which is in the device. A one to one relationship shall be maintained. Refer to the City's SCADA & PCS Standards and Conventions Manual Volume 2 for proper naming conventions.



HMI tags for controller referenced data will maintain the same encapsulated methodology as is employed in the controllers. These tags will be constructed from context type tags designed to mimic the structure of the controller data. A one to one relationship shall be maintained.

In places where data is not contained in encapsulating structures, the HMI tag will still be constructed in a structured manner. The individual addresses will be handled internally to the object itself. The structure will be developed in such a way as to allow passing of data en masse to display elements and widgets. The individual tag thus representing the complete definition of data and information for the device or concept.

6.2.2 HMI Exclusive Tag References

For those instances when data is to be managed exclusively in the HMI, those tags will follow the same naming conventions as outlined in the City's SCADA & PCS Standards and Conventions Manual Volume 2 PLC, This applies to the following types of tags:

- Alarm Tags
- Logging and Reporting Tags
- Calculation and Inquiry Tags
- Station Tags
- Configuration Tags

The data that is exclusive to the HMI will be managed in a structured manner employing context tags as the container. Tag construction will be approached such that as needs change elements inside of a context tag can be added or deprecated without having to edit all graphical elements utilizing the tag.

6.3 Controller Tag Naming Standard

Reference the City's SCADA & PCS Standards and Conventions Manual, Volume 2, PLC, for tag naming requirements. In the event that the naming standards does not have the desired abbreviations the developer is to submit a list of abbreviations to the City for review and approval.

All tags created within the HMI and SCADA system must be distinctive.



6.4 Tag Naming Best Practices

The following are a series of best practices and limitations for tags. The differences in tagging are in part based on the differences between PLC programming and the limitations of VTScada. For example, PLC programming is restricted to using underscores as dashes are not able to be used. In comparison dashes are able to be used in HMI programming.

These practices do not supersede the tag naming convention specified in Volume 2. Reference the tag naming conventions in Volume 2 for details. This is provided for consideration of locally created tags. These rules particularly apply to context tags used in the construction of complex object tags.

- Tag names must be no longer than 64 characters in length (This rule refers only to the tag's immediate name, not its full name, which may include a lengthy list of parent tags.)
- Full tag names must be no longer than 253 characters in length (This rule refers to the tag's full name, which may include many parent tags.)
- Tag names must not duplicate other named Items. (tags cannot be named "TagBrowser" or "Test", since those names are used elsewhere in VTScada.)
- A tag may not be named "Value" or "Area" since those are the names of tag properties. Tags, pages, and widgets may not share a name. Tag names may not duplicate type names – a tag cannot be named "Calculation" or "Analog Status".
- Avoid using common English words unless appended with a prefix or suffix.
- Valid tag name characters include:
 - Any combination of alphanumeric characters (A through Z and 0 through 9)
 - Spaces, except at the beginning or end of the name.
 - Period (.)
 - Symbols other than those listed below (e.g., use of the number hatch (#), and underscore (_) characters in tag names is acceptable)
- Invalid tag name characters consist of:
 - Backslash (\ used to separate parent names)
 - Forward slash (/)
 - Colon (:)
 - Asterisk (*)

- Question mark (?)
- Double quotes (")
- Less than (<)
- Greater than (>)
- Vertical bar (|)
- Leading spaces
- Trailing spaces
- Tag names cannot be purely numeric.
 - "57" is not a valid tag name but "Station57" is.
 - An interesting side effect of this rule is that a tag cannot be named "E1" or similar, since this is a valid numeric expression: ("E1" == "0E1" == "zero exponent one").

6.5 Tag Areas

VTScada supports the concept of tag areas through the use of a property of the same name. The use of well-defined areas, conforming to standard naming conventions is required. The tag area is a property that can also be visualized, this adds to the information presented to the operator. Most importantly tags may be filtered by area.

Tag areas will be clearly defined. The area names will be defined utilizing the following structure.

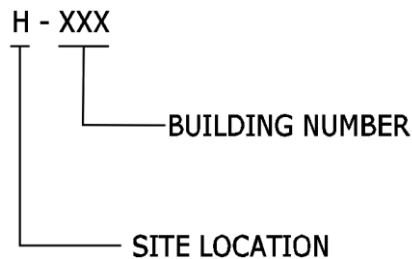


Figure 12 Area Naming Convention

Utilizing the same naming conventions throughout the system allows for the intelligent construction of filters.



All tags will inherit the area of the parent or may be individually declared. The area structure specified ensures that as areas are created, that are sub-areas of a larger element, the use of wild-card characters will allow for adequate filtering.



7 HMI Graphics General Requirements

Graphic screens will be composed of many individual types of data elements, a significant portion of which are alpha-numeric. To maintain consistency across the application, the following requirements are to be adhered to.

7.1 Color

The use of color throughout the application is limited. The nature of high performance graphics restricts colors to those elements that require attention. In order to provide a consistent color pallet throughout the application colors have been defined for use. Refer to Appendix A, Definitions and General Reference, for a listing of those colors approved for use.

The colors have been defined using the standard RGB color system. The color name is as defined by Microsoft along with the color values in red, green, and blue and hex code. Throughout this document, where specific colors are required, these color names will be used.

The only times the full color spectrum is allowed is on map based screens and those places where photographs are utilized.

7.2 Process Values

Displaying live process values will be handled differently than static text. Values depicted from the controller will be in bold, blue. This is in contrast to the units of measure that will be indicated in non- bold, black either near the process value or not at all in the case of bar graphs or other animated elements. Leading zero's (0) will not be utilized except to indicate a fraction (e.g., 0.12). When dynamic values are being used in a column generally align the values on the decimal point. In mixed cases, floating point values and integers, the values are to be aligned to the implied decimal point. In integer only cases the values are to be right aligned.

Where applicable and feasible, the process value will indicate its quality. This will be accomplished by including a small indication adjacent to the value indicating "BAD". This shall be highlighted with a white background to improve legibility. In the event that the value is currently under simulation, that is a manual value being driven by the operator, the indication "SIM" will be used in place of "BAD".

Digital values are also to be shown in bold, blue using easily understood words. In these cases the values are to have a simple description included within a surrounding rectangle. In the case where multiple digital values are to be indicated in a table the surrounding rectangle may encompass all of the values.

In addition to the process values or conditions the alarm status is to be clearly indicated. The iconography utilized throughout the application is to be consistent with that outlined in Section 8.0 HMI Graphics Alarming.

The following provides some illustration of the depiction of process values.

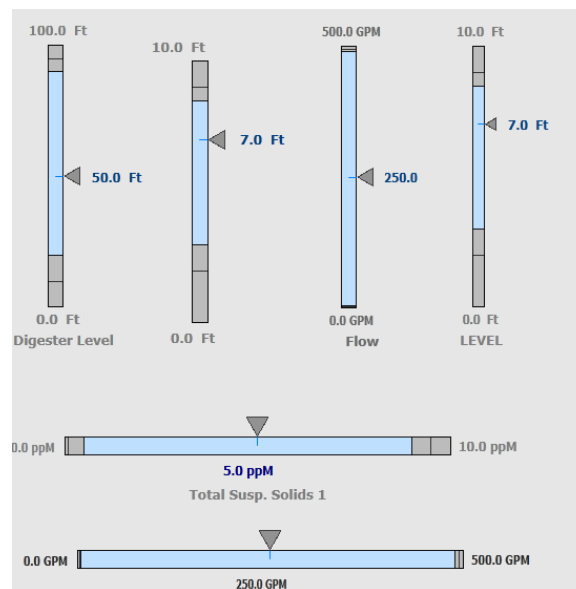


Figure 13 Process Values Examples

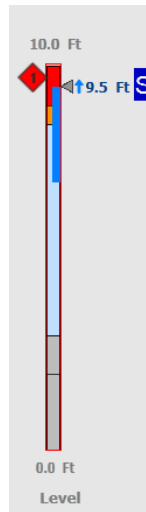


Figure 14 Process Values With Alarming

7.3 Operator Editable Values

Operator editable values are similar to normal process values with the exception that they are intended to be written to the controller in addition to being read. As such, these values require security rights to enable interaction. When the operator has suitable rights to edit the value, this will be visually distinguishable without the exclusive use of color. In the case where the operator does not have suitable rights, the value looks and functions similarly to a normal process variable.

The style of text for these values will be green, bold font. When the operator has sufficient rights to edit the value, a bounding box and slightly darker background will be the distinction. When the rights are not sufficient, the bounding box will not be visible and the value will not be selectable.

Typically operator editable values pertain to values such as setpoints or parameters. The following provides some illustration of the depiction of operator editable values.

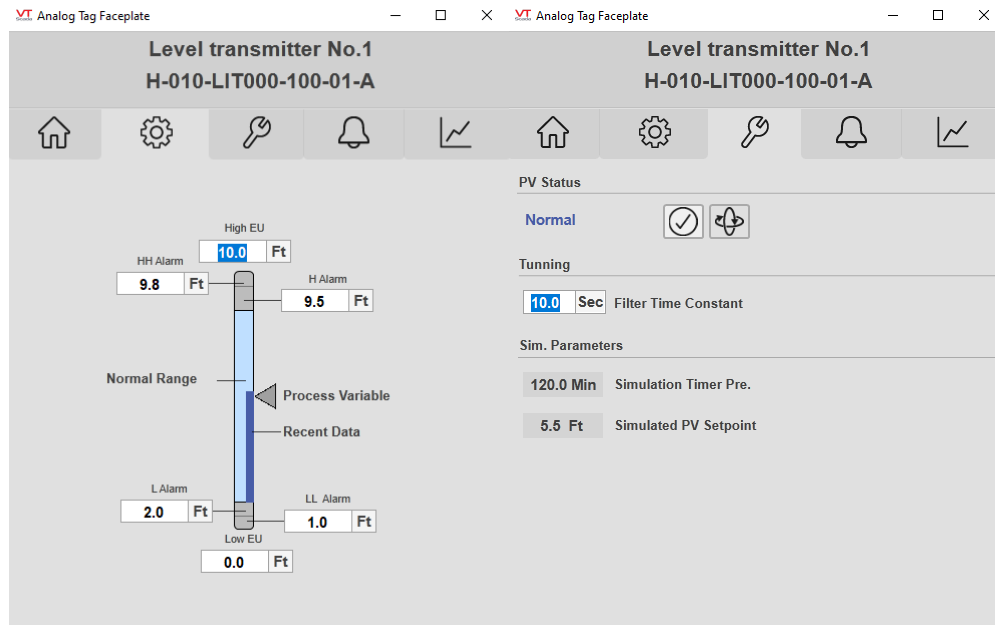


Figure 15 Operator Editable Values

7.4 Scaling and Precision

7.4.1 Integers

This includes 8-bit, 16-bit, 32-bit and 64-bit integers. These values will be depicted with enough numbers to display the actual numerical range. For example: a 32-bit integer that will only include the values from 0-100, will only allow for three places ("###"). In the case where the values may be negative, then space is to be allowed for the sign (-) character.

7.4.2 Real/Floating Points

This refers to all decimal, IEEE floating-point, real, single precision, and double precision numbers. These values will be depicted to display the actual numerical range and the sign character. The number of decimal places to represent is dependent on the precision of the value. In example: "100.0"



has four significant digits and is presumed to be accurate to the tenths place. This is highly dependent on the instrument or calculation. Digitals shall not be indicated past their determined significance.

Numbers that might be referenced using scientific notation will allow enough space for the sign and exponential portion. In example: “1.246E-8” has four significant digits and an exponent portion indicating its magnitude.

7.5 Text

Static text and static objects are elements that do not change in response to change in input or output statuses. They retain their text color irrespective of their associated equipment run-time, alarm or maintenance status. Static text identifies the graphic screen title and static objects. All text must be in US English and all units must be in US Imperial system.

For equipment and asset tags, all text must be uppercase. For all other text, each word in a text string must begin with an uppercase letter and the subsequent letters must be lowercase. All new words must begin in uppercase letters. All equipment must carry the same tag name as shown on the P&IDs.

All static text shall adhere to the settings shown in the following table. The font, style, and size will be defined in style tags.

FONT NAME	FONT	STYLE	SIZE
AREA DESCRIPTION	Arial	Bold	20
Bar Graph PV	Arial	Bold	10
Building Numbering	Arial	Bold	12
Buttons Font	Calibri	Bold	11
Column Headings	Arial	Bold	10
Control Label	Arial	Regular	10
D_Board Header	Arial	Bold	14
Data Labels	Arial	Regular	8
Display Live Data	Arial	Bold	11
Display Support Data	Arial	Bold	10
Equipment Description Style	Arial	Bold	10
Faceplate Headings	Arial	Bold	16
Group Labels	Arial	Bold	10



Live Data Primary	Arial	Bold	11
Live Data Secondary	Arial	Bold	8
Motor Status	Arial	Bold	10
Off Page Connector	Arial	Regular	10
Process Symbol	Arial	Bold	12
Simulation Status	Arial	Bold	16
Text in Button	Arial	Regular	10
Trend Labels	Arial	Narrow	10
Units	Arial	Regular	8
Widget Headings	Arial	Bold	16

Animated or dynamic objects are associated with a specific equipment status such as running, stopped, out of service (offline), etc., or with analog values such as flow, level, pressure, temperature, etc. Dynamic objects can also be a graphic pushbutton, touch area (applicable for touchscreens only), or static text highlighted against a dynamic object (to indicate alarms or statuses). City approved dynamic objects are contained in the City Standard Object Library; any exceptions shall be submitted with a PCS Deviation Request Form (Reference Volume 1, and Appendix B) for City review and approval prior to use. It is the developer's responsibility to insure that all submissions are made with enough time, a minimum of two weeks is required, to respond appropriately to acceptance or rejection of the deviation.

7.6 Analog Indication Bars

Process values that are analog in nature may be indicated in two ways. The first being a dynamic value as addressed in Section 7.2 Process Values. The second is through the use of analog indication bars. This allows for a very compact, dynamic illustration of the value within the context of its ranges and alarm points. This is to be applied to values that are non-static in nature and not setpoints or other sub-elements.

The following properties will be utilized, if available, for analog values.

- Process value
- Nominal range
- Desired range
- Hi and Hi-Hi alarm points

- Lo and Lo-Lo alarm points
- Two hour average or similar, if relevant

Selecting the analog bar will provide access to the elements detailed faceplate.

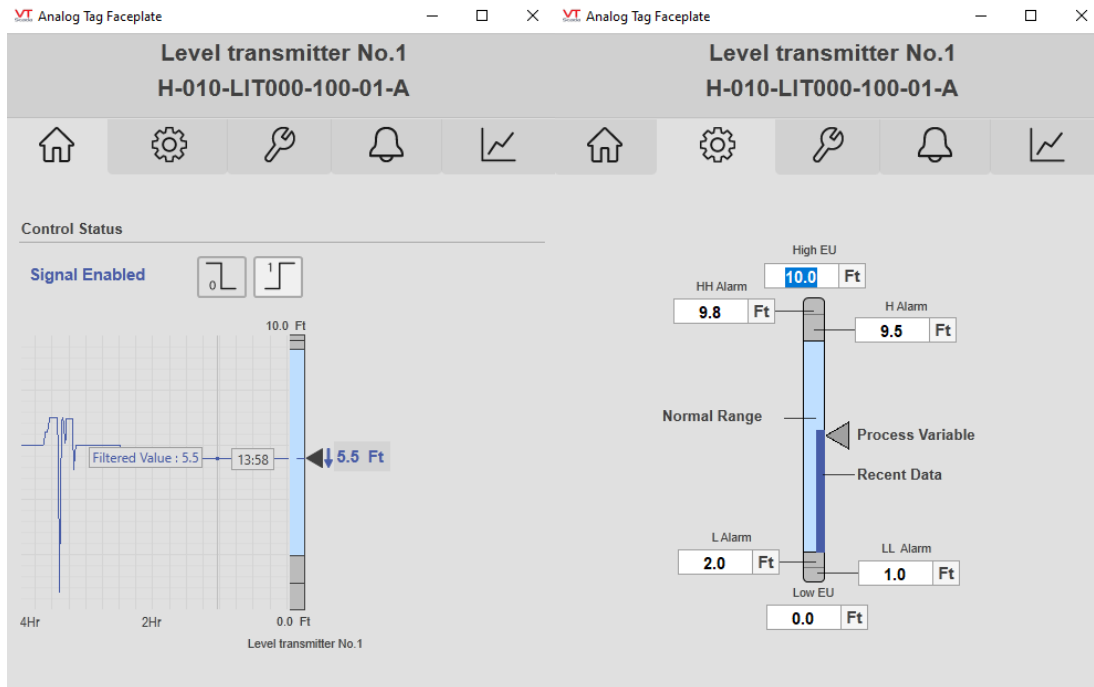


Figure 16 Analog Indication Bars

These display elements may be clustered such that a consistent profile of the process or area is visible. Placement at that point is dictated by the process.

7.7 Analog indication

The analog indication element is related to the analog Indication bar. However, this also contains additional information regarding setpoint, controller output, mode, and device feedback. All these elements are to be combined with the analog bar.

Selecting the analog bar will provide access to the elements detailed faceplate.

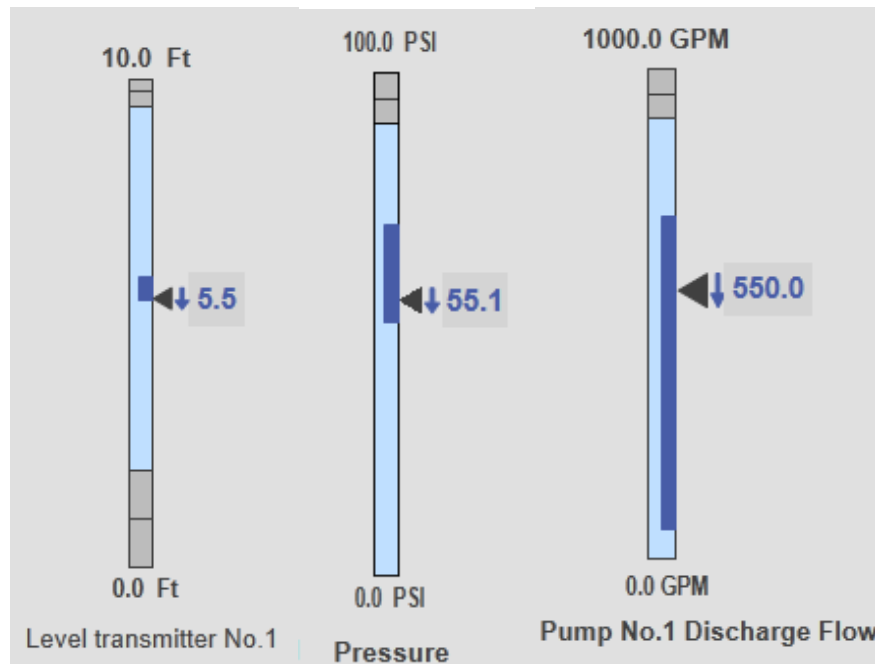


Figure 17 Bar Graph Indicator

Wherever possible all the values are to be represented. Controllers may be segregated through the use of a bounding box to ensure that clarity is maintained.

7.8 Analog Indication

7.8.1 Level Indication

These values are generally constrained by a vessel or tank and as such have critical end points. In cases where the previous state of a level provides additional context into the state of the level a trend graph is to be included. The trend requires no direct scale of grid lines. The analog bar indication located on the right-hand side of the trend will provide limits. The trend will be configured to indicate a fixed duration value. This range may be from 1 to 24 hours. The range should only be long enough to represent the reasonable movement of the process value.

Excessively long periods are to be avoided as they tax the system and delay screen display.

Selecting the analog bar will provide access to the elements detailed faceplate.

Vessels with extremely slow responses, value changes less than 5 percent per day, should only utilize an analog bar indication with PV Trending¹ applied.

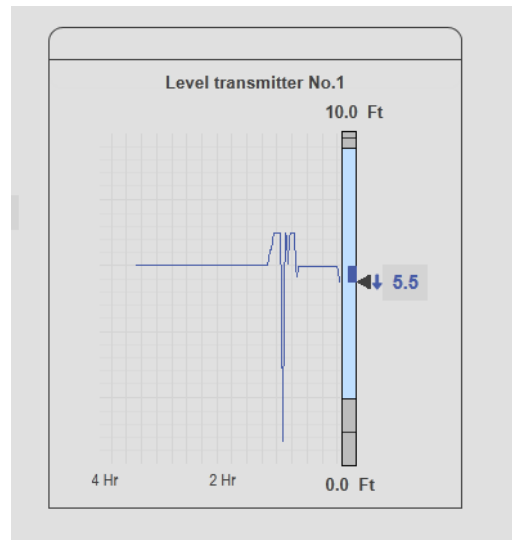


Figure 18 Analog Indication Bar With PV Trendline

The configuration of the tank or vessel may be applied to other configurations however the vessel shape is for reference purposes only and should be minimized. 3D tanks as well as tank shapes with cutout fill are not to be utilized.

7.8.2 Flow Indication

The flow indication element is a special type of analog signal as it is the only one that provides totalization values. Totalization values are shown on the faceplate under the utility tab.

¹ Controller PV Trending is a mathematical regression analysis over time occurring in the controller. This allows for the indication of general value movement direction and magnitude. Refer to Volume 2, PLC, and Process Object standards for further discussion.

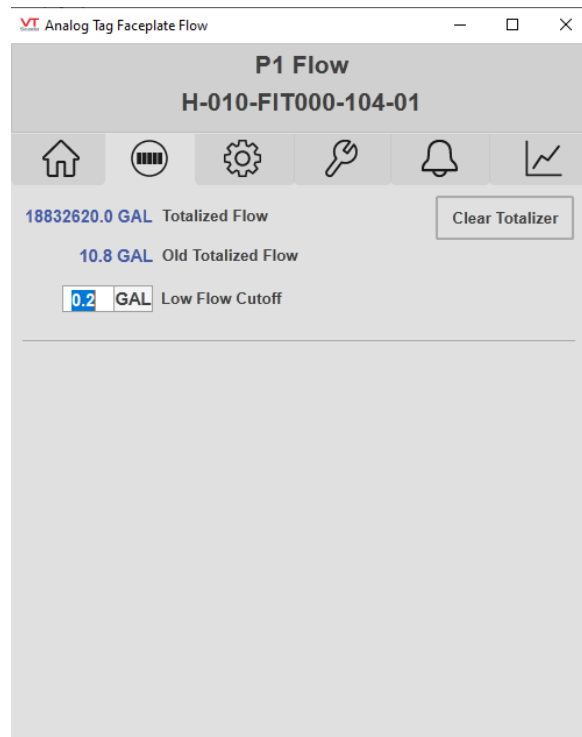


Figure 19 Flow Totalization

7.9 Control and Shutoff Valves

Control and shutoff valves are based off their native P&ID depiction. In this case the bodies will indicate the state of the valve and any other conditional information will be depicted around the perimeter of the icon. Selecting the icon will provide access to the elements detailed faceplate.

Control valves shall include information on state, open/closed/traveling, position feedback, and controlled output. This information is to be depicted as illustrated below. Shutoff valves are to include as much information as is available from the underlying data source.

The following are examples of control and shutoff valves. These examples are not illustrative of all orientations and configurations.

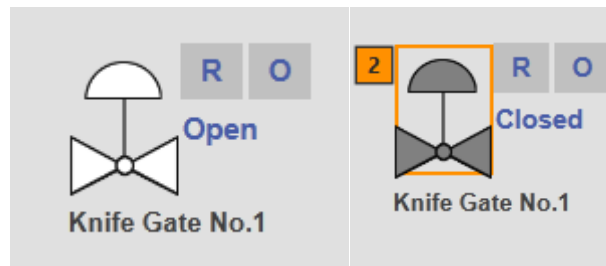


Figure 20 Valve Example

7.10 Pumps and Motors

Pumps and motors may include the following information on state, stopped/running, speed feedback, controlled output, and interlock conditions. These are to be indicated as depicted.

Note: The specific icon utilized for a device may vary greatly based on the specifics. In all cases a minimalistic approach towards the icon is to be maintained, the icon artistry is not the critical element of indication.

In cases where the motor or pump has monitored analog values, such as temperature or vibration, then analog bars are to be used in conjunction with the icon. The same condition holds true if the

If motor is the dependent device in a control loop, that graphical element is to be depicted adjacent to the controller.

Selecting the icon will provide access to the elements detailed faceplate.

Support elements, such as interlock graphics may be included as a table on the primary screen or called as a popup from the Interlock icon. Alarms and other fault conditions will be indicated consistent with the application alarming icons.

Pumps and motors often have information regarding starts and total time running. Only critical portions of this are to be immediately displayed. Comprehensive value indication is to be provided by accessing that faceplate through the use of a button. All indicated values are considered to be dynamic and subject to the same display style.

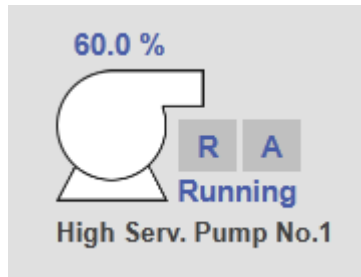


Figure 21 Centrifugal Pump

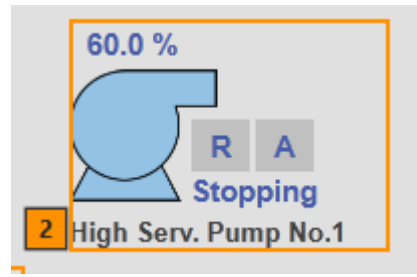


Figure 22 Centrifugal Pump- Faulted



8 HMI Graphics Alarming

8.1 Overview

Alarm configuration requirements are contained in the City's Alarm Management Strategy (Reference the City's SCADA & PCS Standards and Conventions Manual, Volume 2). Any alarm modification, addition or deletion must follow alarm definition and rationalization procedures discussed in the alarm management strategy prior to implementation.

It is important to note that although OIT and HMI system functions can be used to monitor and generate alarms, in the City's PCS process alarms shall be generated in the PLCs which will be logged and displayed on the HMIs and OITs. HMI application shall not be configured to perform alarm calculations. HMI generated alarms will be utilized only for alarms and events initiated from within the HMI software such as software status alarms, loss of communications with a PLC and other system level alarming.

Alarm limits must be adjustable through the HMI graphics screens; however, those alarm limits will be used by the PLC in determining if there is an alarm condition. The nature of the distributed PCS is such that the PLC-based process control logic can and will continue to operate, even if one or more HMIs become unavailable. As a result, the PLC must be able to determine alarm conditions and act accordingly without the need for continuous communication with the HMI system.

The City's Standard Object Library and add-on instruction (AOI) standard library objects shall be utilized for configuration of PLC and HMI.

8.2 Nuisance Alarm Suppression Techniques

All nuisance alarm suppression shall be by approved methods documented in the City's Alarm Management Strategy (Reference the City's SCADA & PCS Standards and Conventions Manual, Volume 2 for more details on alarm suppression techniques). Disabling equipment will disable the alarms associated with the equipment.



8.3 Commissioning Requirements

Commissioning activities create abnormal alarm situations; this section contains requirements for alarm and event system during commissioning activities.

8.3.1 Operational Readiness Review Meetings

Alarms and events risk review shall be reviewed at operational readiness meetings to determine alarm owner (contractor or operations) based on risk to process and processing equipment.

8.3.2 Alarms in Active Commissioning State

Alarms and events which are not turned over to operations at operational readiness review are required to be suppressed by means of PLC logic suppression outside of testing hours to avoid presenting operators with nuisance and/or unknown alarms.

8.3.3 Alarm and Event Acceptance Matrices

The City utilizes the defined average alarm rate of less than six alarms per hour period as defined in alarm management strategy in Volume 2 as maximum allowable alarm rate for acceptance of modifications to alarm system. After commissioning activities have been completed, system shall run for 30 days in hands-off mode to document alarm rates for modified alarms.

9 Alarm Graphics

9.1 Colors

Alarms of different priorities are displayed on the alarm footer and alarm summary using different colors and animations to aid in their identification. Alarm color configuration is shown in the table below.

Unacknowledged Alarms					Acknowledged Alarms		Unacknowledged alarms that have cleared	
Alarm priority	Alarm level	Text/foreground	Back-ground	Symbol	Text/foreground	Back-ground	Text/foreground	Back-ground
1	Critical	Black	Red		Red	White smoke	Black	Lime
2	High	Black	Orange		Orange	White smoke	Black	Lime
3	Warning	Black	Yellow		Yellow	White smoke	Black	Lime
4	Notice	Black	Aqua		Aqua	White smoke	Black	Lime
0	Event	Black	White smoke					

Alarm priorities 0, Event, are not shown on the alarm footer and by default are not shown on the alarm summary window. These alarms are viewable on the alarm summary window by selecting the appropriate filter.

9.2 Graphics

This section discusses how the alarm graphic displays are configured. These screens shall not be modified without City approval.

9.2.1 Alarm Indications

- Active alarms that are unacknowledged will blink with the alarm priority color (Flash Unpack Alarms)
- Active alarms that are acknowledged will stop blinking when acknowledged
- Inactive alarms that are unacknowledged remain in the alarm summary queue until cleared by acknowledgement

9.2.2 Alarm Priority Boxes

Located around the perimeter of the graphics icon for a device on a display will be an alarm priority box with an alarm priority indication icon. This will indicate the alarming systems status for the device. The iconography will be consistent with that outlined in Section 7.1 Colors. Figure 23 displays an example of a priority box.

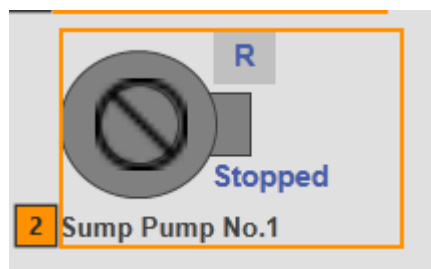


Figure 23 Alarm Priority box

9.2.3 Alarm header

The alarm header is a critical informational communications element. This header will be included on every full display page. As the name implies, the header will be located at the top of the page.

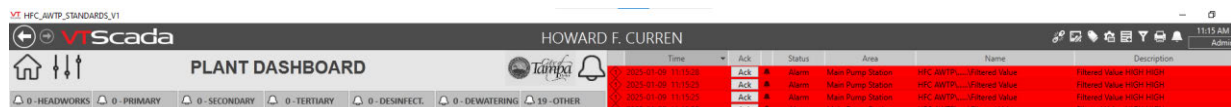


Figure 24 Alarm Header Example

9.2.4 Alarm Summary

The alarm summary allows the user to see current alarms as well as historical alarms and events. The user may acknowledge an individual alarm, a group of alarms, or all alarms and add an alarm comment. Filtering is also available to allow the user to sort by state or priority. Figure 25 is a screenshot of the alarm summary with a description of each of the functions.

HFC_AWTP_STANDARDS_V1

Alarm Page

04:09 PM Sep 17
Sign in

DatabaseAlarm ActionsReports & AnalysisHistoryFilteringViewSounds

HistoryActiveUnackedCurrentShelvedDisabledConfigured

Search

	Time	Ack	Status	Area	Name	Description	Current Value	Setpoint	Units
1	2024-09-17 16:07:28	ACK	Alarm		HFC_AWTP...Digester No.7/Hot Water Valve/Home Tab/Position Feedback/Configuration Tab/Filtered Value	Filtered Value LOW LOW	0.0	0.0	%
2	2024-09-17 16:07:28	ACK	Alarm		HFC_AWTP...Digester No.7/Hot Water Valve/Home Tab/Position Feedback/Configuration Tab/Filtered Value	Filtered Value LOW	0.0	0.0	%
3	2024-09-17 16:07:28	ACK	Alarm		HFC_AWTP...Digester No.7/Sludge Pump 1/Home Tab/Speed Feedback/Configuration Tab/Filtered Value	Filtered Value LOW LOW	0.0	0.0	%
4	2024-09-17 16:07:28	ACK	Alarm		HFC_AWTP...Digester No.7/Sludge Pump 1/Home Tab/Speed Feedback/Configuration Tab/Filtered Value	Filtered Value LOW	0.0	0.0	%
5	2024-09-17 16:07:27	ACK	Alarm		HFC_AWTP...Main Pump Station/MSP No.1/Home Tab/Speed Feedback/Configuration Tab/Filtered Value	Filtered Value LOW LOW	0.0	0.0	%
6	2024-09-17 16:07:27	ACK	Alarm		HFC_AWTP...Main Pump Station/MSP No.1/Home Tab/Speed Feedback/Configuration Tab/Filtered Value	Filtered Value LOW	0.0	0.0	%

Unacked: 6 records

Alarm Page

Figure 25 Alarm Summary page

This graphic is callable from every screen in the system that presents the system title bar. This page will be based on the native system alarm display.

9.3 Alarm Groups

The grouping of alarms is dependent on the area definitions for the base element. As such this is an inherited quality. For this reason it is important that the areas be configured in a clear, well ordered tiered structure. All alarms for all datatypes in the standards can be located within the alarm tab of each custom data type.

10 Trending

Trending shall be supplied to facilitate the operator comprehension of the system performance. Trending will be provided in three manners: equipment faceplates, custom trends, and native value trending. Each data tab within the standards has a trend tab that logs the main process variable associated with the type. There is an expanded version of these logged values that can be accessed by selecting the “more” button.

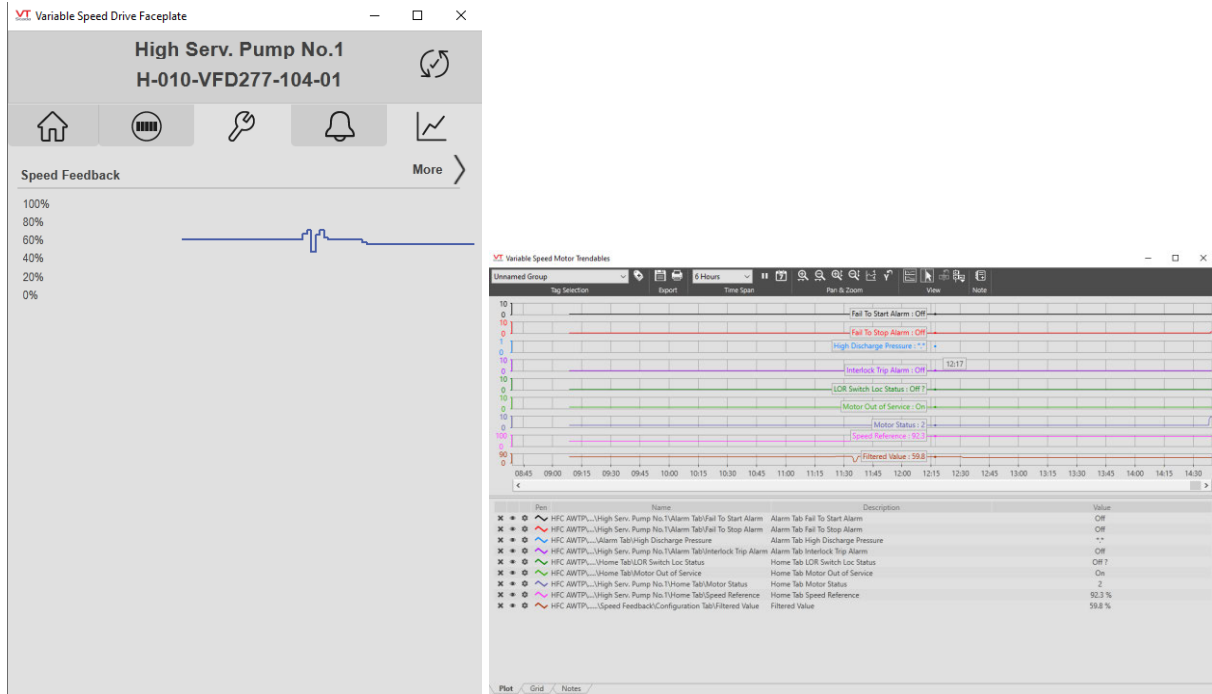


Figure 26 Faceplate With Trend

Trending capabilities will be provided for the following items:

- Analog values
- Setpoints
- Discrete alarm signals
- Controllers (PID)
- Analog control valves
- Motors with VFDs



10.1 Native Value Trending

This trending function is available by clicking on a value or object. The native historical trend viewer will be displayed and populated with data for the individual element selected. The user will be able to view the trend of the data with the ability of leaving a quick note.

10.2 Faceplate Trends

Faceplate trends will be developed using the sparkline trend view with the individual elements being displayed being preset. Faceplate trends to be limited to a single pen. The values will only be displayed for the piece of equipment being displayed. The following settings will be applied.

Property	Setting
Timespan	8 hours
Background Color	Light Gray 224
Text color	Dark Gray 63
Process Value	Blue

10.3 Trend pages

Trend pages, accessible from operator pick buttons on display pages or the menu structure, will be developed for areas and systems using the historical trend view object. These controls will be sized for full screen, or as near as feasible should other controls be required. Multiple trend controls may be utilized on a trend page with a maximum of four trend controls displayed. For displays with three or more trends on them, the same restrictions as the faceplate trends are to be adhered to.

Trend objects whose total height is at least 90 percent of the page height, may display up to six pens. Half height (approx. 50 percent of page height) trend objects may display no more than four pens.

The following settings may be applied to trend page trend controls.

Property	Setting
Toolbar	Enabled
Timespan	8 hours
Notes	Enabled
Background Color	Light Gray 224
Text color	Dark Gray 63
Grid	Silver 192
Process Variables	Automatic Assignment by VTScada

A full screen trend screen example is illustrated by Figure 27 below.

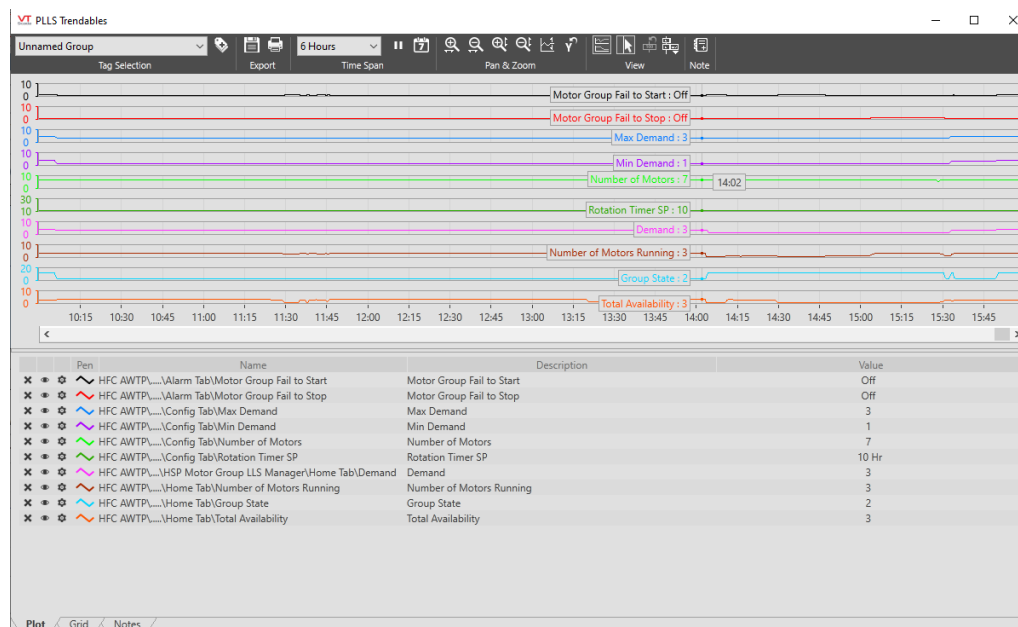


Figure 27 Full page trend

10.4 Trend Groups

Trend groups will be supplied by the developer for all referenced, predefined trends. These will contain the definitions of which tags are to be displayed on specific pens. Pages with specified intent must have all tags and qualities predefined for the operators. Free-form trend pages shall be provided for operator use.



11 Security

Security will be enabled for the application. Security will be configured using two complementary methods; accounts and custom privileges as indicated by the City. This approach allows for targeted and appropriate security.

Note: Modifications to the security role titled SuperUser will only be made in conjunction with the City’s project manager or assigned OT security roles

Note: Security roles are a managed set of privileges that can be applied to elements and functions throughout the system. One of more security roles can be applied to a user account in order to grant common privileges to people with similar job descriptions or duties.

The roles will be established or provided based on the City’s needs. The roles available are off the shelf provided by VTScada. A custom list shall be developed later by the City.

Role Name	Description
Logged off	This is the specific role that defines the functions and access to the system when no user is logged on. This role provides view only accessibility
Operator	The user is allowed to operate the basic functions of the equipment as well as acknowledge alarms
Configurer	The user is allowed to operate the equipment and also able to make changes to critical setpoints and configuration elements that might impact compliance including system functions such as security, backup, shutdown, etc.
SuperUser	The user will have full access to all elements of the system including the development tools.

The following figure outlines the privileges that are to be applied to the various security roles as requested by the City.

Custom Privileges

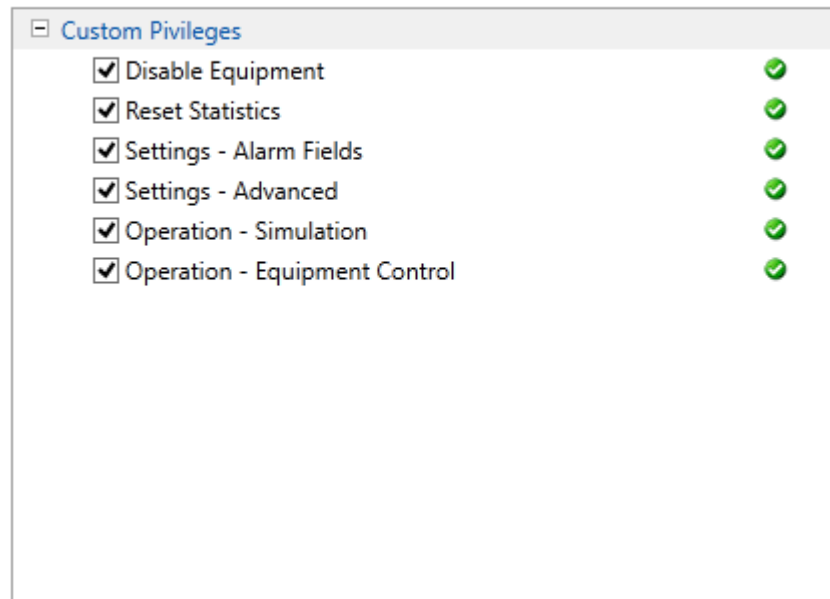


Figure 28 Custom Privileges

11.1 Default security role

Implied in the security system is the concept of the view only mode. This is the basic access provided to all users of the system. This mode provides no ability to interact with the equipment or alarm management.

During development it is expected that the basic security role will be applied to the base screen. From this base screen control elements will be interacted with popup displays. In the cases where some tags do appear on the base screen the appropriate role must be applied to insure that no ability is provided to change the value/setting.

The view only mode does allow a user to navigate through the base process screens only. No access shall be provided to system configuration, troubleshooting, or maintenance areas.

11.2 User Accounts

The default logoff for inactivity will be 15 minutes. Individual user accounts have the following inactivity automatic logout periods.



Account Role	Auto logout period
Operator	30 minutes
Configurer	15 minutes
Super User	10 minutes



12 OIT Graphics

The OITs are field mounted devices adjacent to the equipment or process they are related to. These devices are designed to provide a sub-set of the total functionality provided in the system as a whole. They will provide the following characteristics:

- 15" color display
- Touch capable
- Ruggedized for the environment
- Panel mounted
- Ethernet cable to interface to the controller

The display will be limited to resolutions that are less than an HMI monitor and the pixel density will be specified by the manufacturer. This is an accepted quality of the units. This is a consideration that must be planned for during development to ensure that screens are legible and functional to the operator.



13 OIT Graphics Symbol Library

The OIT graphic symbol library will conform to the same standards and requirements as the full HMI application. The City's OIT symbol library incorporates recommendations from ISA 101, Human Machine Interfaces; however, is less stringent in its adherence. The limited display sizes place a priority on visibility and operator usability. The styling and colors will be retained as close as possible to the HMI standards. All new or updated OIT units shall utilize and follow the styling as specified for the supplied objects.

- Analog inputs
 - Inline process variables
 - Tanks
- Single speed motors
 - Centrifugal pump
 - Grinder
 - Mixer
 - Sump pump
- Variable speed motors
 - Blower
 - Rotary lobe pump
 - Sewage pump
 - Vertical pump
- Open close actuators
 - Ball valve
 - Knife valve
 - Plug valve
 - Gate
- Modulating actuators
 - Butterfly valve
 - 3 position valve
- Engine generators

These preconfigured objects are animated to the City's color standards. Refer to Appendix A.



- Gray
 - Pumps, Generators, Generic Driven equipment: Off/De-energized, Idle, Disabled/Out of service.
 - Vales: at closed limit.
- Off White
 - Pumps, Generators, Generic Driven equipment: On/Energized, Running status.
 - Valves: at open limit.
- Light Blue
 - Pumps, Generators, Generic Driven equipment, valves: Transition (Starting, Stopping, Accelerating, Decelerating, Opening, Closing).
- Gray 160
 - Equipment border
 - Objects: operational mode indication background.
- Dark Gray 63
 - Label foreground
- Blue
 - Dynamic data foreground

See Figure 29 Knife Valve Opened through Figure 35 Generator *faceplate* stopped for example graphics symbols.

The specific equipment symbols used by the OIT will match those used by the SCADA/HMI. Simulated motion and 3D symbols are not to be utilized. Imagery and iconography that clearly illustrates a state or condition are allowed, like a symbol of a flame in a burner, are allowed but are to be utilized sparingly.

The use of faceplates is encouraged for displays suitable of displaying then. The information density must always be considered when creating popups or faceplates. The displays must present usable information while maintaining legibility.



Figure 29 Knife Valve Opened



Figure 30 Knife Valve Closed



Figure 31 Knife valve in Transition



Figure 32 Knife valve alarm

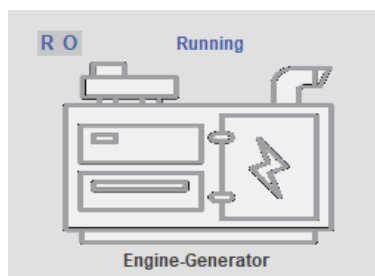


Figure 33 Generator running

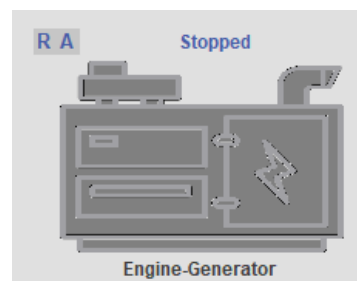


Figure 34 Generator Stopped

Faceplates shall be based on the faceplates for the SCADA/HMI as much as possible. The degree of consistency between SCADA/HMI and OIT is dependent on the capabilities of the OIT system and the immediate needs. In all cases the tag elements depicted on faceplates at the OIT must connect to blocks in the controller that are being utilized by the SCADA/HMI.

Faceplates will be used to facilitate the security model. The main control elements for a device or screen element will be contained on a faceplate so as to allow security system to prevent/allow access. Editable elements are not allowed on main displays. See Figure 35 Generator faceplate for example faceplates.

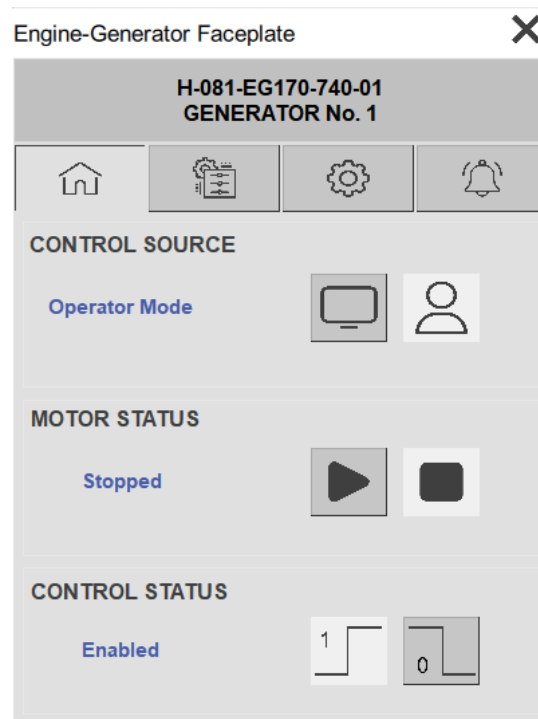


Figure 35 Generator faceplate

14 OIT Software Description

14.1 Overview

The standard was created using EasyBuilder Pro V6, leveraging its advanced features to implement a modular and template-based structure, enabling flexibility and scalability for integration with PLC variables.

The process overview screen for the main pump station was developed as shown in Figure 36 Main Pump Station Process overview screen, and all variables were linked with the corresponding PLC variables.

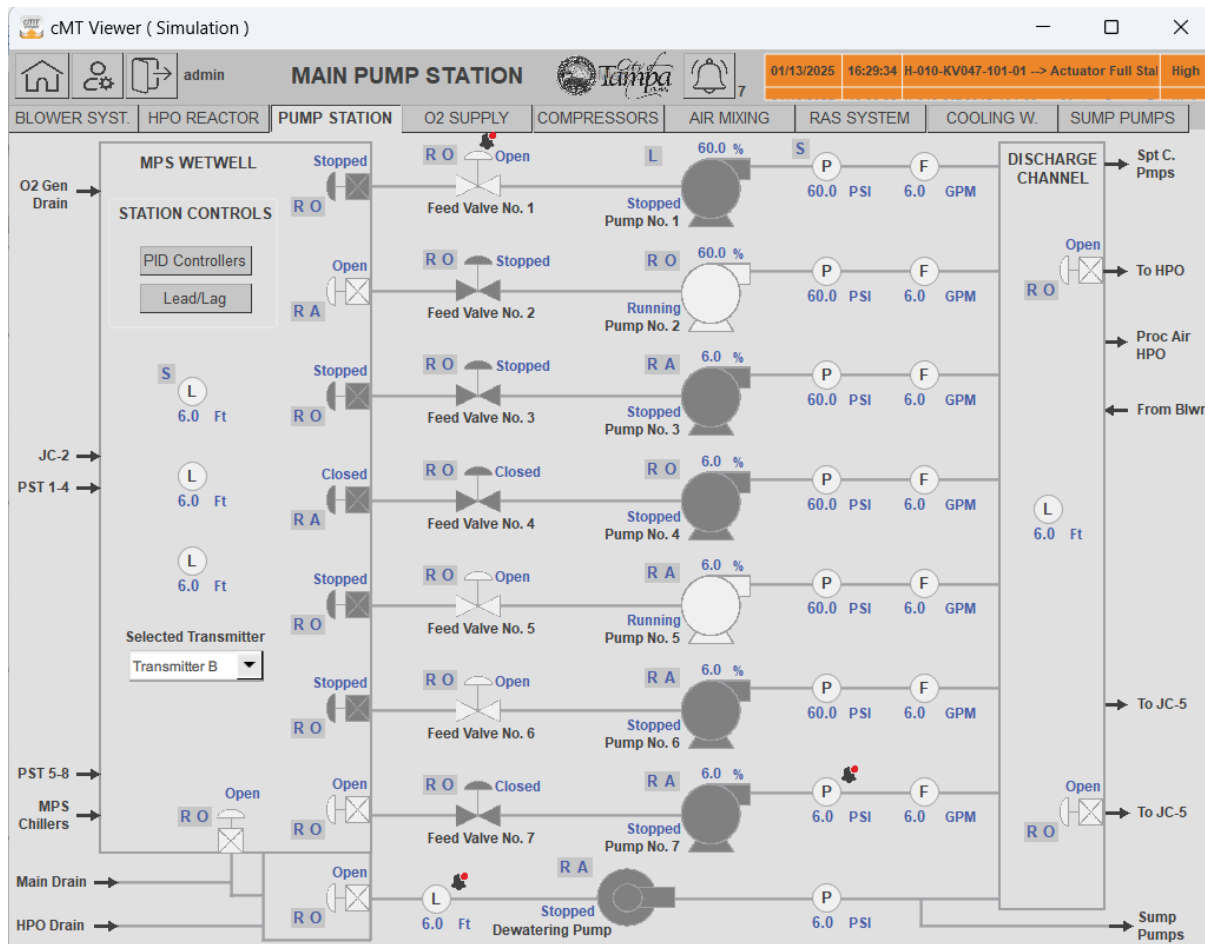


Figure 36 Main Pump Station Process overview screen

14.2 Objects and Templates

The system includes the objects shown in Figure 37 Standard Objects, each based on a pre-defined template in Maple System. These templates are linked to specific variables in the PLC. The linked variable can be replaced with a new one as long as the data type matches the original template. The objects have been named using the following structure: OBJECT_DATATYPE_EQUIPMENT.



- ☐ 20: OBJECT_OPEN-CLOSE-ACTUATOR_KNIFE VALVE HORIZONTAL
- ☐ 21: OBJECT_OPEN-CLOSE-ACTUATOR_KNIFE VALVE VERTICAL
- ☐ 22: OBJECT_OPEN-CLOSE-ACTUATOR_PLUG VALVE HORIZONTAL
- ☐ 23: OBJECT_OPEN-CLOSE-ACTUATOR_PLUG VALVE VERTICAL
- ☐ 24: OBJECT_OPEN-CLOSE-ACTUATOR_BALL VALVE HORIZONTAL
- ☐ 25: OBJECT_OPEN-CLOSE-ACTUATOR_BALL VALVE VERTICAL
- ☐ 26: OBJECT_OPEN-CLOSE-ACTUATOR_GATE VERTICAL
- ☐ 27: OBJECT_OPEN-CLOSE-ACTUATOR_GATE HORIZONTAL
- ☐ 28: OBJECT_MODULATING-VALVE_3-POS VALVE
- ☐ 29: OBJECT_MODULATING-VALVE_BUTTERFLY VALVE
- ☐ 30: OBJECT_AI_INLINE
- ☐ 31: OBJECT_AI-FLOW_INLINE
- ☐ 32: OBJECT_AI_TANK
- ☐ 33: OBJECT_SINGLE-SPEED-MOTOR_CENTRIFUGAL PUMP
- ☐ 34: OBJECT_SINGLE-SPEED-MOTOR_SUMP PUMP
- ☐ 35: OBJECT_SINGLE-SPEED-MOTOR_GRINDER
- ☐ 36: OBJECT_SINGLE-SPEED-MOTOR_MIXER
- ☐ 37: OBJECT_VARIABLE-SPEED-MOTOR_SEWAGE PUMP
- ☐ 38: OBJECT_VARIABLE-SPEED-MOTOR_ROTARY LOBE PUMP
- ☐ 39: OBJECT_VARIABLE-SPEED-MOTOR_VERTICAL PUMP
- ☐ 40: OBJECT_VARIABLE-SPEED-MOTOR_BLOWER
- ☐ 41: OBJECT_MCC
- ☒ 42: OBJECT_GENERATOR

Figure 37 Standard Objects

Once an object is created, it can be reused by replacing its default linked variable with a new variable associated with a different device. For example, the Knife Valve object was initially created with a default link to the variable H_010_KV047_101_01, as shown in Figure 38. This default configuration serves as a template for the object. When reusing the object, the default variable can be replaced with a new variable, such as H_010_KV047_102_02, to associate it with a different Open-Close Actuator as shown in Figure 39.

It is important to emphasize that this object can only be reused for data types that are compatible, such as Open-Close Actuator. Ensuring data type compatibility is critical to maintaining the integrity and functionality of the system. This procedure is not limited to the Knife Valve object; it is extensible to all other objects in the system.

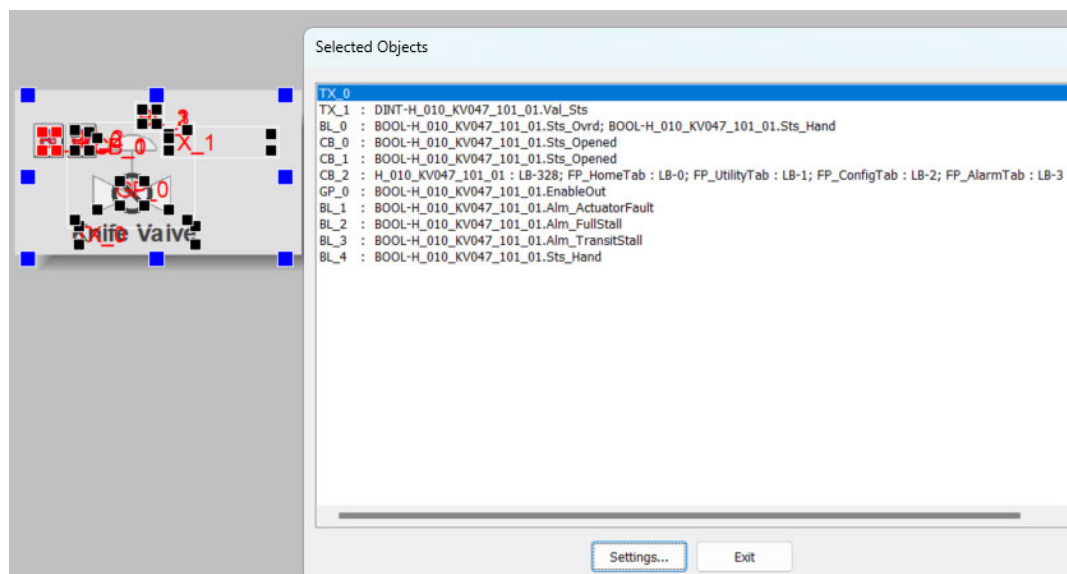


Figure 38 Knife valve object linked to a default PLC tag

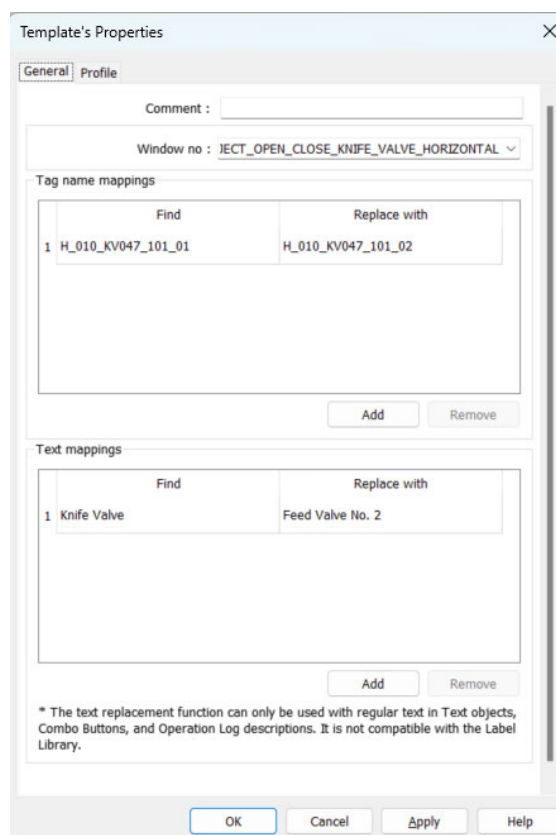


Figure 39 Adding a new valve

14.3 Faceplates and Datatypes

The system utilizes different faceplates, each corresponding to a specific data type in the PLC. Refer to Section 5 for more information. For every PLC data type created, there is an associated faceplate in the system as shown in Figure 40. The objects have been named using the following structure: FP_DATATYPE.

Example: A "Knife Valve" object corresponds to the "Open-Close Actuator" data type. When a user interacts with an object of this data type, the associated faceplate is displayed on the screen.

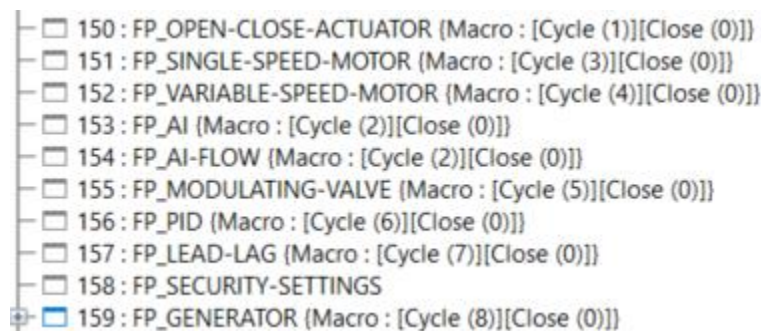


Figure 40 Standard Faceplates

A special case is the Security Settings faceplate. Unlike other faceplates, it is not associated with any data type in the PLC or with any macro. Instead, it functions independently to allow users to manage security settings within the system such as: adding new users, editing existing users or removing existing users.

14.4 Faceplate Display and Macros

To ensure that the correct information is displayed when a faceplate is activated, macros have been created for each faceplate as shown in Figure 41. When a user interacts with an object, the corresponding macro is executed, and the related faceplate pops up.

Example: If the user clicks on "Knife Valve No. 1," which is of type "Open-Close Actuator," the "Open-Close Actuator Macro" is triggered. This displays the "Open-Close Actuator Faceplate" with information specific to "Knife Valve No. 1."

Each macro is structured with conditional "if-else" statements to identify the selected object and execute the appropriate code segment as shown in Figure 42.

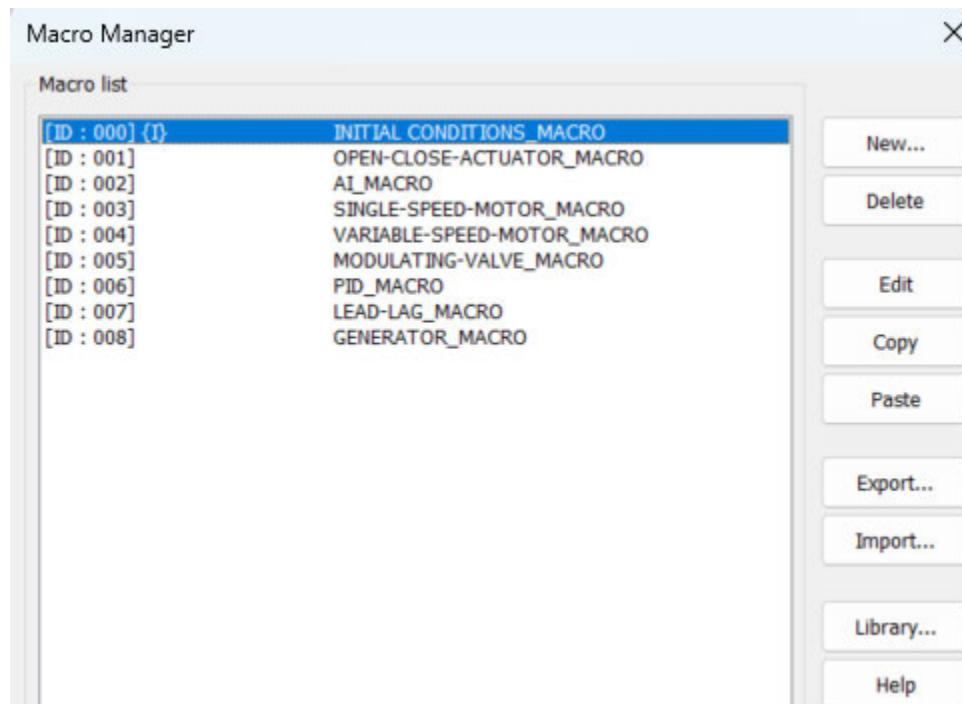


Figure 41 Macros

```
// Open Close Actuator No. 1: Sludge Feed Valve No. 1 -----
GetData(fp, "Local HMI", "H_010_KV047_101_01", 1)
if fp == true then
    fp = false
    id = 1

    // ***Writing PLC variables from OIT***
    // Auto Mode/Operator Mode selection
    if inpOvrd_pressed == true then
        SetData(init_f, "Local HMI", "FP_Inp_Ovrd_btn_pressed", 1)
        GetData(Inp_Ovrd, "Local HMI", "OIT_Inp_Ovrd", 1)
        SetData(Inp_Ovrd, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Inp_Ovrd", 1)
    end if
    // Enable/Disable signal
    if enableIn_pressed == true then
        SetData(init_f, "Local HMI", "FP_EnableIn_btn_pressed", 1)
        GetData(EnableIn, "Local HMI", "OIT_DSBL", 1)
        SetData(EnableIn, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.HMI_DSBL", 1)
    else
        GetData(EnableIn, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.HMI_DSBL", 1)
        SetData(EnableIn, "Local HMI", "OIT_DSBL", 1)
    end if
    // Open command
    if openCmd_pressed == true then
        SetData(init_f, "Local HMI", "FP_Cmd_Open_btn_pressed", 1)
        GetData(PCmd_Open, "Local HMI", "OIT_PCmd_Open", 1)
        SetData(PCmd_Open, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.PCmd_Open", 1)
    end if
    // Close command
    if closedCmd_pressed == true then
        SetData(init_f, "Local HMI", "FP_Cmd_Close_btn_pressed", 1)
        GetData(PCmd_Close, "Local HMI", "OIT_PCmd_Close", 1)
        SetData(PCmd_Close, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.PCmd_Close", 1)
    end if
    // Resetting alarms
    if almReset_pressed == true then
        SetData(init_f, "Local HMI", "FP_Alm_InpReset_btn_pressed", 1)
        GetData(Alm_InpReset, "Local HMI", "OIT_Alm_Inp_Reset", 1)
        SetData(Alm_InpReset, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Inp_Reset", 1)
    else
        GetData(Alm_InpReset, "Local HMI", "OIT_Alm_Inp_Reset", 1)
        if Alm_InpReset == true then
            Alm_InpReset = false
            SetData(Alm_InpReset, "Local HMI", "OIT_Alm_Inp_Reset", 1)
            SetData(Alm_InpReset, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Inp_Reset", 1)
        end if
    end if

    // ***Reading PLC variables***
    GetData(Sta_Hand, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Sts_Hand", 1)
    GetData(Sta_Ovrd, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Sts_Ovrd", 1)
    GetData(EnableOut, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.EnableOut", 1)
    GetData(Sta_Opened, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Sts_Opened", 1)
    GetData(Sta_Closed, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Sts_Closed", 1)
    GetData(Use_ClosedLS, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Cfg_UseClosedLS", 1)
    GetData(Use_OpenLS, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Cfg_UseOpenLS", 1)
    GetData(HasClosedLS, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Cfg_HasClosedLS", 1)
    GetData(HasOpenLS, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Cfg_HasOpenLS", 1)
    GetData(Val_Sts, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Val_Sts", 1)
    GetData(OutPulseIT, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Cfg_OutPulseIT", 1)
    GetData(FullStallIT, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Cfg_FullStallIT", 1)
    GetData(TransitStallIT, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Cfg_TransitStallIT", 1)
    GetData(CpltCloseC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.STATS.Val_CpltCloseC", 1)
    GetData(CpltOpenC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.STATS.Val_CpltOpenC", 1)
    GetData(IncpItCloseC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.STATS.Val_IncpItCloseC", 1)
    GetData(IncpItOpenC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.STATS.Val_IncpItOpenC", 1)
    GetData(SlowCloseC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.STATS.Val_SlowCloseC", 1)
    GetData(SlowOpenC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.STATS.Val_SlowOpenC", 1)

    // Alarms
    GetData(Alm_Fault, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Alm_ActuatorFault", 1)
    GetData(Alm_FullStall, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Alm_FullStall", 1)
    GetData(Alm_TransitStall, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_01.Alm_TransitStall", 1)
end if
```

Figure 42 Macro code segment for Open-Close Actuator No. 1

14.5 Boolean Variables for Object Selection

Every object in the OIT is linked to a Boolean variable. This variable determines whether the object has been selected by the user, allowing the system to update the faceplate with the relevant information. For example, in Figure 42 Macro code segment for Open-

Close Actuator No. 1, the code within the if-else statement will execute only if the tag H_010_KV047_101_01 is set to "ON". This tag is turned "ON" when the valve is selected by the operator, as shown in Figure 43. These variables shall be previously created in the OIT. Refer to Appendix A OIT mapping

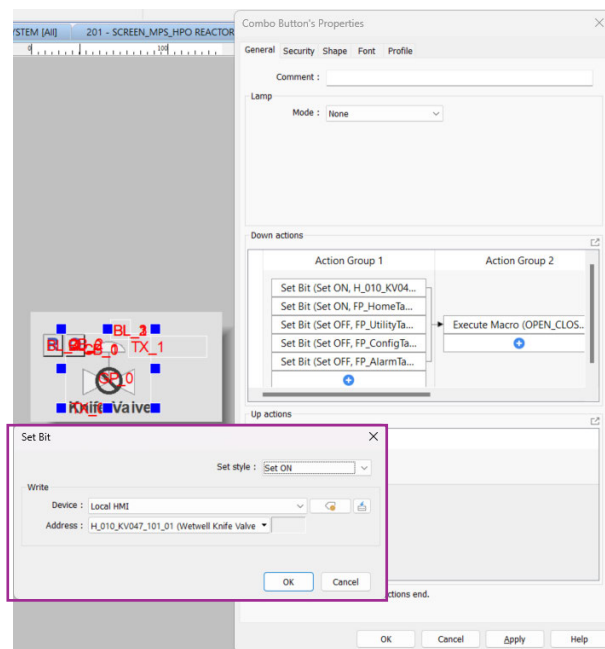


Figure 43 Button actions triggered

14.6 String Table usage

The software leverages the String Table feature in EasyBuilder Pro to dynamically manage and display information on the OIT as shown in Figure 44 String Table.

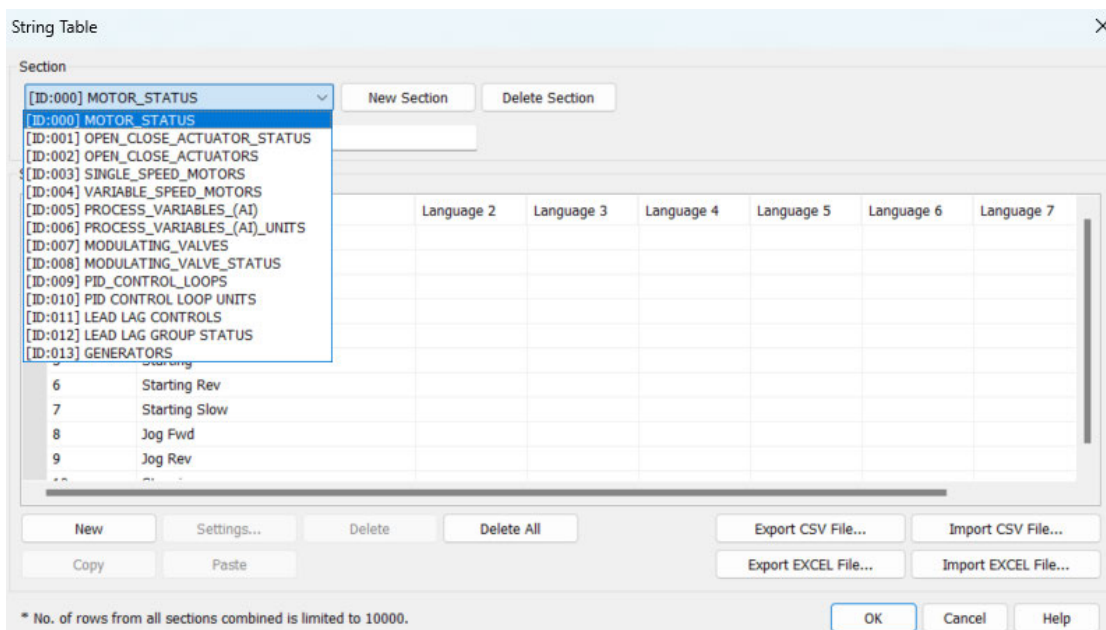


Figure 44 String Table

Specific tables have been pre-configured with the statuses of valves, motors, and other objects (Tables ID:000, ID:001, ID:008, ID:012). These tables, which relate to the statuses of objects, will remain constant across all systems. However, string tables related to specific system equipment, such as "SINGLE_SPEED_MOTORS," must be filled in accordance with the equipment and configuration of the system.

For example, Table ID:002 contains all objects of the "Open-Close Actuator" data type. Each object in the table is associated with a String ID (e.g., 1, 2, 3) as shown in Figure 45. The order of these objects in the table shall match the order of objects in the

associated macro. The macro also includes an ID variable whose value must correspond to the ID in the string Table to ensure accurate information display and operation.

String Table

Section:

Description:

String Table

String ID	Language 1	Language 2
0		
1	H-010-KV047-101-01 SLUDGE FEED VALVE NO. 1	
2	H-010-KV047-101-02 SLUDGE FEED VALVE NO. 2	
3	H-010-KV047-101-03 SLUDGE FEED VALVE NO. 3	
4	H-010-KV047-101-04 SLUDGE FEED VALVE NO. 4	
5	H-010-KV047-101-05 SLUDGE FEED VALVE NO. 5	
6	H-010-KV047-101-06 SLUDGE FEED VALVE NO. 6	
7	H-010-KV047-101-07 SLUDGE FEED VALVE NO. 7	
8	H-010-SG012-100-01 WETWELL SLUICE GATE NO. 1	
9	H-010-SG012-100-02 WETWELL SLUICE GATE NO. 2	

* No. of rows from all sections combined is limited to 10000.

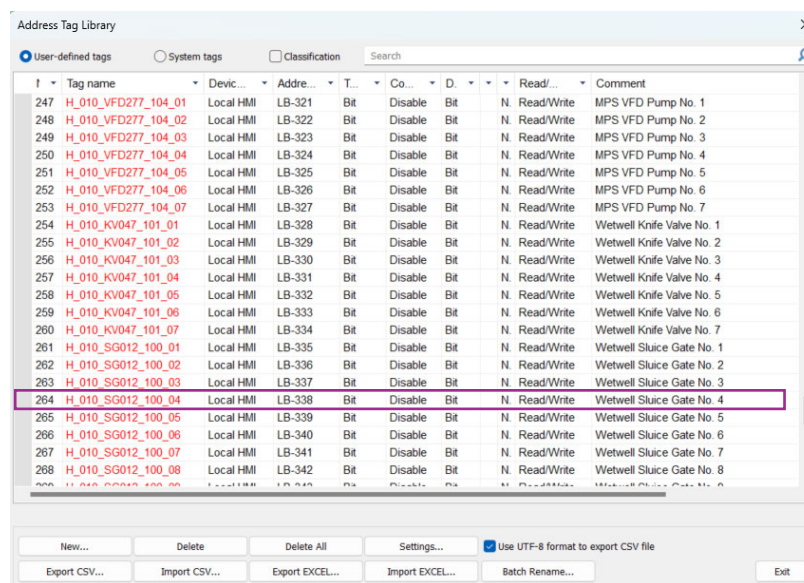
Figure 45 String Table - Open Close Actuators

14.7 Step-by-Step Guide: creating new objects with corresponding Faceplates

This guide explains how to create new objects and link them to their respective PLC tags. For this example, we will create an Open-Close Actuator (ball valve) linked to the PLC tag H-010-SG012-100-04.

Note: It is required that the tag already exists in the PLC before proceeding.

Step 1: Create Boolean Variable in the Local OIT Address as shown in Figure 46



I	Tag name	Devic...	Addre...	T...	Co...	D...	Read/...	Comment
247	H_010_VFD277_104_01	Local HMI	LB-321	Bit	Disable	Bit	N. Read/Write	MPS VFD Pump No. 1
248	H_010_VFD277_104_02	Local HMI	LB-322	Bit	Disable	Bit	N. Read/Write	MPS VFD Pump No. 2
249	H_010_VFD277_104_03	Local HMI	LB-323	Bit	Disable	Bit	N. Read/Write	MPS VFD Pump No. 3
250	H_010_VFD277_104_04	Local HMI	LB-324	Bit	Disable	Bit	N. Read/Write	MPS VFD Pump No. 4
251	H_010_VFD277_104_05	Local HMI	LB-325	Bit	Disable	Bit	N. Read/Write	MPS VFD Pump No. 5
252	H_010_VFD277_104_06	Local HMI	LB-326	Bit	Disable	Bit	N. Read/Write	MPS VFD Pump No. 6
253	H_010_VFD277_104_07	Local HMI	LB-327	Bit	Disable	Bit	N. Read/Write	MPS VFD Pump No. 7
254	H_010_KV047_101_01	Local HMI	LB-328	Bit	Disable	Bit	N. Read/Write	Wetwell Knife Valve No. 1
255	H_010_KV047_101_02	Local HMI	LB-329	Bit	Disable	Bit	N. Read/Write	Wetwell Knife Valve No. 2
256	H_010_KV047_101_03	Local HMI	LB-330	Bit	Disable	Bit	N. Read/Write	Wetwell Knife Valve No. 3
257	H_010_KV047_101_04	Local HMI	LB-331	Bit	Disable	Bit	N. Read/Write	Wetwell Knife Valve No. 4
258	H_010_KV047_101_05	Local HMI	LB-332	Bit	Disable	Bit	N. Read/Write	Wetwell Knife Valve No. 5
259	H_010_KV047_101_06	Local HMI	LB-333	Bit	Disable	Bit	N. Read/Write	Wetwell Knife Valve No. 6
260	H_010_KV047_101_07	Local HMI	LB-334	Bit	Disable	Bit	N. Read/Write	Wetwell Knife Valve No. 7
261	H_010_SG012_100_01	Local HMI	LB-335	Bit	Disable	Bit	N. Read/Write	Wetwell Sluice Gate No. 1
262	H_010_SG012_100_02	Local HMI	LB-336	Bit	Disable	Bit	N. Read/Write	Wetwell Sluice Gate No. 2
263	H_010_SG012_100_03	Local HMI	LB-337	Bit	Disable	Bit	N. Read/Write	Wetwell Sluice Gate No. 3
264	H_010_SG012_100_04	Local HMI	LB-338	Bit	Disable	Bit	N. Read/Write	Wetwell Sluice Gate No. 4
265	H_010_SG012_100_05	Local HMI	LB-339	Bit	Disable	Bit	N. Read/Write	Wetwell Sluice Gate No. 5
266	H_010_SG012_100_06	Local HMI	LB-340	Bit	Disable	Bit	N. Read/Write	Wetwell Sluice Gate No. 6
267	H_010_SG012_100_07	Local HMI	LB-341	Bit	Disable	Bit	N. Read/Write	Wetwell Sluice Gate No. 7
268	H_010_SG012_100_08	Local HMI	LB-342	Bit	Disable	Bit	N. Read/Write	Wetwell Sluice Gate No. 8

Figure 46 Creating Boolean Variable

Step 2: Add the new valve to the String Table as shown in Figure 47. Locate the appropriate string table for the equipment types.

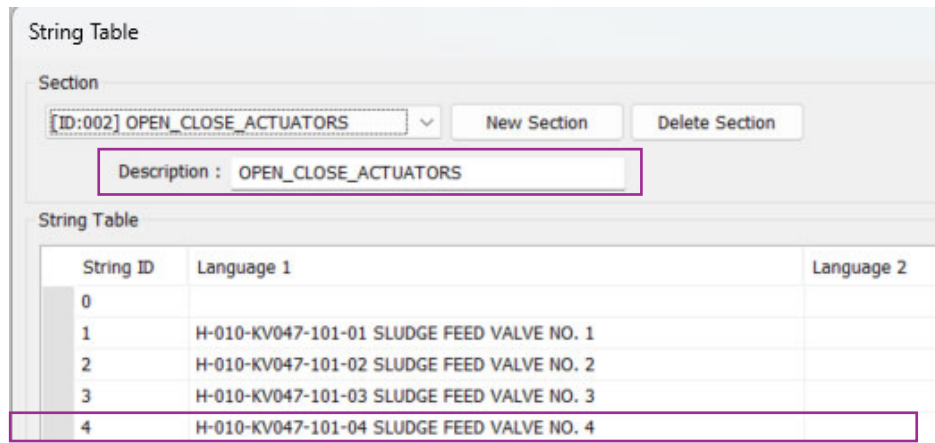


Figure 47 Creating Boolean Variable

Step 3: Configure the objects in the OIT. Open the “Object” menu and select “Template” as shown in Figure 48. Find the Ball Valve object in the list and click Add to configure it. Under the Find column, double-click to locate the default Boolean tag linked to the object. Under the Replace column, double-click and select the new Boolean tag created in the Local OIT address. In the Text Mappings subsection, double-click under the Find column to locate the default text linked to the object. Replace it with the desired text or leave it blank if not needed. The result of these steps should look as shown in Figure 49.

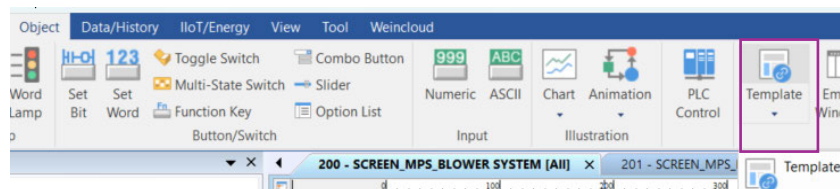
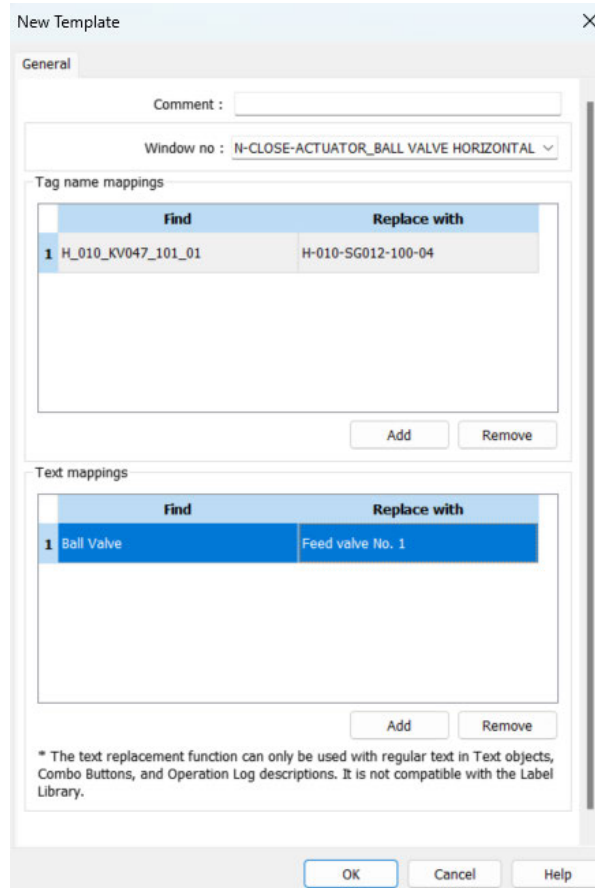


Figure 48 Selecting a template object



New Template

General

Comment :

Window no : N-CLOSE-ACTUATOR_BALL VALVE HORIZONTAL

Tag name mappings

	Find	Replace with
1	H_010_KV047_101_01	H-010-SG012-100-04

Add Remove

Text mappings

	Find	Replace with
1	Ball Valve	Feed valve No. 1

Add Remove

* The text replacement function can only be used with regular text in Text objects, Combo Buttons, and Operation Log descriptions. It is not compatible with the Label Library.

OK Cancel Help

Figure 49 Selecting the ball valve object template

Step 4: After adding the valve to the screen, the corresponding macro shall be edited to ensure the faceplate displays the correct information when the valve is selected by the operator as shown in Figure 50. Open the macro associated with the data type of the new equipment (in this case, an Open-Close Actuator). Copy the code segment for an existing Open-Close Actuator and replace all instances of the tag with the tag of the new equipment (H-010-SG012-100-04). Ensure the variable “id” in the macro matches the String ID of the new equipment in the string table. For this specific example, the String ID=4.

```
// Open Close Actuator No. 4: Sludge Feed Valve No. 4 -----
GetData(fp, "Local HMI", "H_010_KV047_101_04", 1)
if fp == true then
    fp = false
    id = 4

    // ***Writing PLC variables from OIT***
    // Auto Mode/Operator Mode selection
    if inpOvrd_pressed == true then
        SetData(init_f, "Local HMI", "FP_Inp_Ovrd_btn_pressed", 1)
        GetData(inp_Ovrd, "Local HMI", "OIT_Inp_Ovrd", 1)
        SetData(inp_Ovrd, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Inp_Ovrd", 1)
    end if
    // Enable/Disable signal
    if enableIn_pressed == true then...
        // Open command
        if openCmd_pressed == true then...
            // Resetting alarms
            if almReset_pressed == true then...
                end if

                // ***Reading PLC variables***
                GetData(Sts_Hand, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Sts_Hand", 1)
                GetData(Sts_Ovrd, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Sts_Ovrd", 1)
                GetData(EnableOut, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.EnableOut", 1)
                GetData(Sts_Opened, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Sts_Opened", 1)
                GetData(Sts_Closed, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Sts_Closed", 1)
                GetData(Use_ClosedLS, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Cfg_UseClosedLS", 1)
                GetData(Use_OpenLS, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Cfg_UseOpenLS", 1)
                GetData(HasClosedLS, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Cfg_HasClosedLS", 1)
                GetData(HasOpenLS, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Cfg_HasOpenLS", 1)
                GetData(Val_Sts, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Val_Sts", 1)
                GetData(OutPulseT, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Cfg_OutPulseT", 1)
                GetData(FullStallIT, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Cfg_FullStallIT", 1)
                GetData(TransitStallIT, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Cfg_TransitStallIT", 1)
                GetData(CpltCloseC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.STATS.Val_CpltCloseC", 1)
                GetData(CpltOpenC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.STATS.Val_CpltOpenC", 1)
                GetData(IncptCloseC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.STATS.Val_IncptCloseC", 1)
                GetData(IncptOpenC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.STATS.Val_IncptOpenC", 1)
                GetData(SlowCloseC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.STATS.Val_SlowCloseC", 1)
                GetData(SlowOpenC, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.STATS.Val_SlowOpenC", 1)
                // Alarms
                GetData(Alm_Fault, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Alm_ActuatorFault", 1)
                GetData(Alm_FullStall, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Alm_FullStall", 1)
                GetData(Alm_TransitStall, "Rockwell EtherNet/IP (ControlLogix)", "H_010_KV047_101_04.Alm_TransitStall", 1)
            end if
        end if
    end if
end if
```

Figure 50 Open-Close Actuator Macro

Step 5: The alarms to be shown in the general alarm screen shall be created. In this case, all the alarms associated with the new valve shall be added to the Event Alarm Log as shown in Figure 51.

Note: All alarms related to the faceplates have already been created and do not require any further edits. However, alarms associated with the various systems, which will be displayed on the general alarm screen, must be created independently to ensure proper functionality and monitoring.

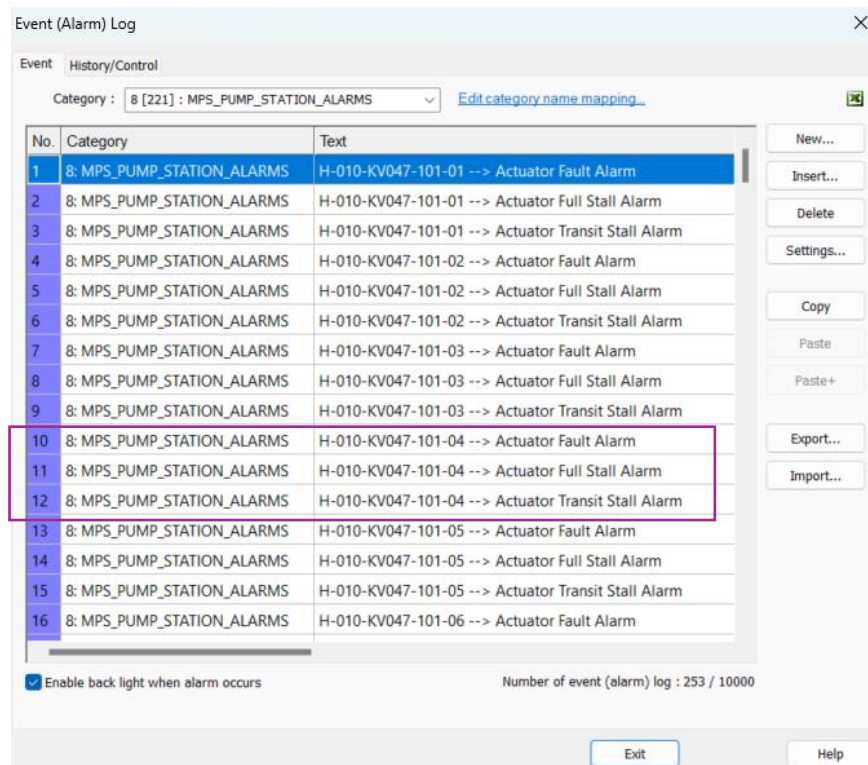


Figure 51 Adding New Alarms

14.8 Alarm System Overview

The alarm system is configured within the Event (Alarm) Log object, which allows the creation of different alarm categories as shown in Figure 52. For this project, alarm categories have been created for each data type (and consequently for each faceplate). These alarms do not require further editing, as the bits that trigger the corresponding alarms are updated within the macros associated with each data type. These alarm categories follow the naming structure FP_Datatype.



Event (Alarm) Log

Event History/Control

Category : All [269]

No.	Category	
0	3	FP_OPEN_CLOSE_ACTUATOR_ALARMS
1	5	FP_PROCESS_VARIABLES_ALARMS
2	8	FP_SINGLE_SPEED_MOTOR_ALARMS
3	8	FP_VARIABLE_SPEED_MOTOR_ALARMS
4	6	FP_MODULATING_VALVE_ALARMS
5	2	FP_LEAD-LAG_ALARMS
6	0	MPS_BLOWERS_SYSTEM_ALARMS
7	0	MPS_HPO_REACTOR_ALARMS
8	229	MPS_PUMP_STATION_ALARMS
9	0	MPS_O2_SUPPLY_ALARMS
10	0	MPS_COMPRESSORS_ALARMS
11	0	MPS_AIR_MIXING_ALARMS
12	0	MPS_RAS_SYSTEM_ALARMS
13	0	MPS_COOLING_WATER_ALARMS
14	0	MPS_SUMP_PUMPS_ALARMS
15	8	FP_GENERATOR_ALARMS
16	0	Category 16
17	0	Category 17
18	0	Category 18
19	0	Category 19
20	0	Category 20
21	0	Category 21
22	0	Category 22
23	0	Category 23
24	0	Category 24
25	0	Category 25
26	0	Category 26
27	0	Category 27
28	0	Category 28

Figure 52 Alarm Categories

Additionally, alarm categories have been created for each subsystem within the Main Pump Station. These categories must be edited based on the alarms associated with each specific subsystem. As part of this standard, all alarms associated with the Pump Station Subsystem have been pre-configured as shown in Figure 53. Alarms for other subsystems should be edited in a similar manner to ensure comprehensive system coverage. These alarm categories follow the naming structure MPS_SubsystemName.

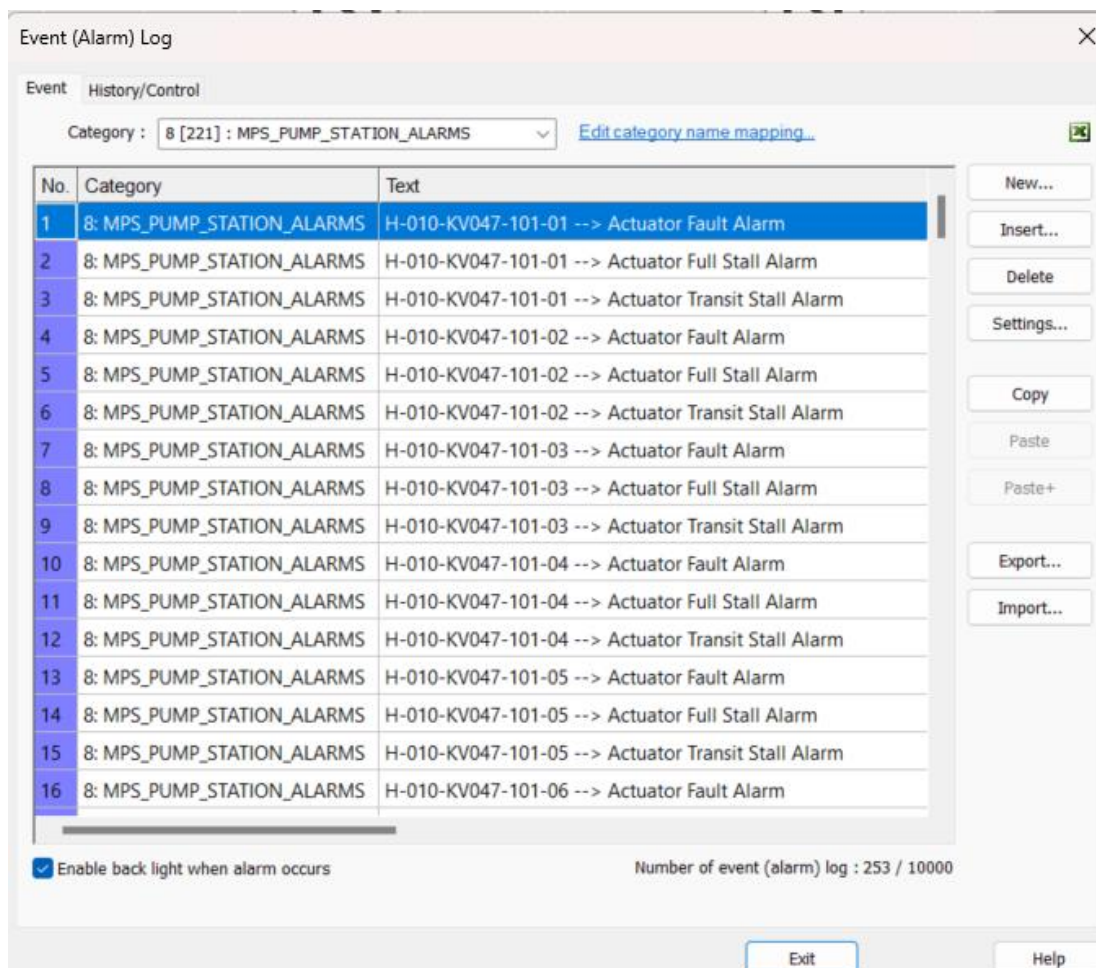


Figure 53 MPS Pump Station Alarms

The Alarm Tabs within the faceplates are linked to their corresponding faceplate alarm categories. Additionally, the alarm displays located in the upper-right corner of each Subsystem Process Overview Screen are linked to the alarm category of their respective subsystem.

The General Alarm Screen contains an alarm display that is linked to all alarms in the system, including those associated with faceplates. Although faceplate alarms are shown within their respective faceplates, these alarms have been duplicated to ensure they are also included in the General Alarm Display. This is achieved by creating two versions of each faceplate alarm: one version is updated automatically through the macros and displayed in the faceplate, while the other is configured separately within the subsystem category to be included in the general alarm display. This setup ensures that all alarms,



regardless of their association with faceplates, are properly represented in the General Alarm Screen.

15 OIT Graphics Security

Security is to be utilized at the OIT. The native systems security model is to be utilized; custom developed systems are not to be developed for a system.

15.1 User accounts

The OITs support individual user accounts. All user accounts will require a password. All accounts will have an automatic log out after 30 minutes as shown in Figure 54.

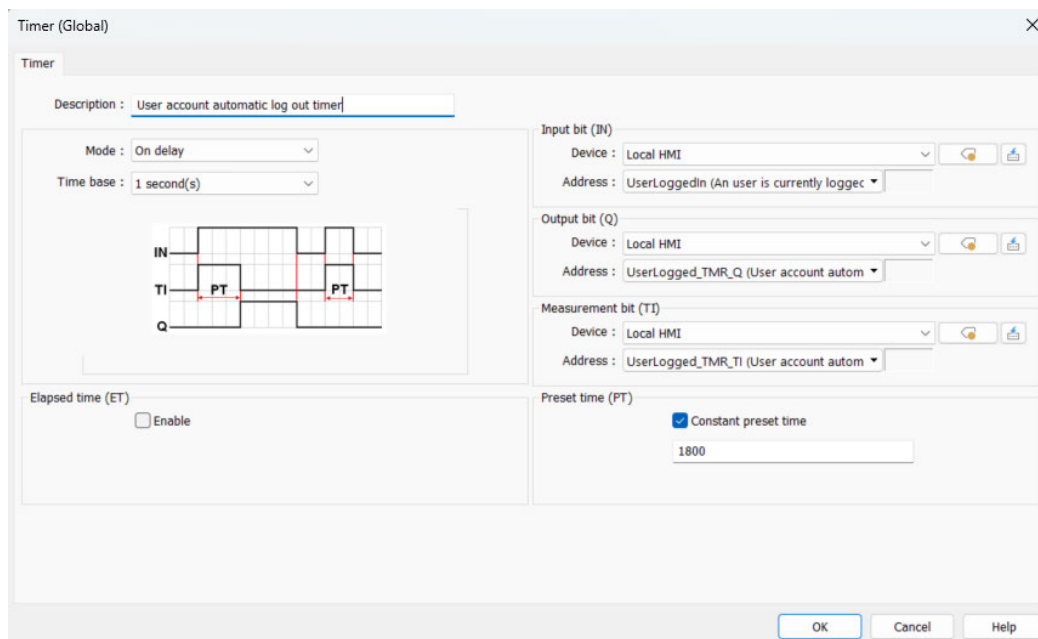


Figure 54 Automatic Logout Timer Configuration

The default state of the non-logged in station will be considered to a view only mode and no control over the equipment will be allowed. The user will be required to login to perform any actions as shown in Figure 55. The login of users will be logged to the OIT's native event log for reference if required.

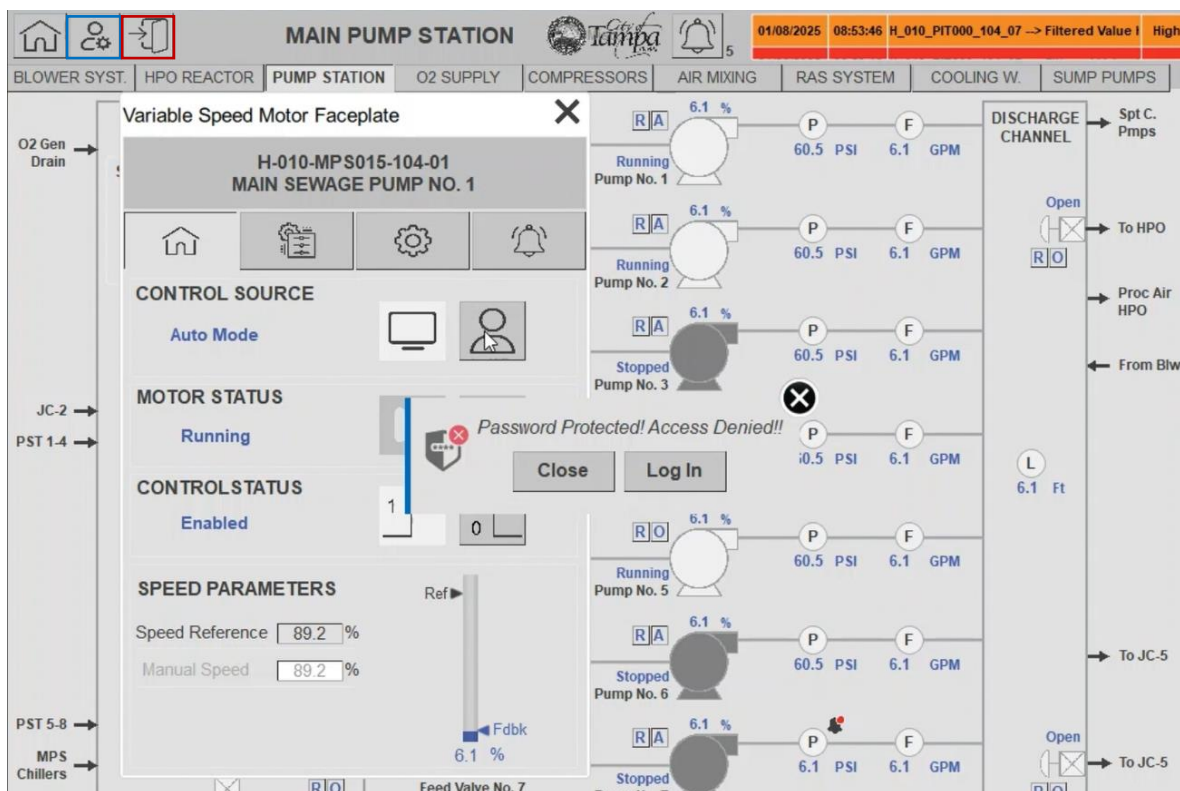


Figure 55 OIT Faceplate Edit Login Required

Using the button shown in the red box on the upper left section of Figure 55, users can log in or log out of the OIT by entering their username and password, regardless of whether they intend to execute any specific action. The Log in/Log Out action is done via the pop-up window shown in Figure 56.

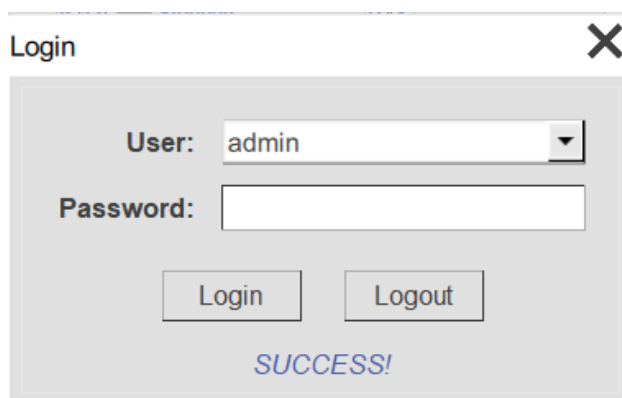


Figure 56 Log In/Log Out Window



Each user in the system is assigned specific privileges. These privileges are listed in the Table below. Depending on the privileges granted, users will have access to perform various actions within the OIT.

User Privilege	ID number
Disable Equipment	22
Settings – Alarm Field	23
Settings - Advanced	24
Operation – Signal Simulation	25
Operation – Equipment Control	26
Reset Statistics	27

For actions related to the creation, editing, and deletion of users, the OIT provides a button in the upper left blue box shown in Figure 55. Only users with the required privileges can modify security settings.

The security configuration options allow for the creation of a new user by defining a username and password, as shown in Figure 54. Once the user is created (by clicking the "Add User" button), the user must be selected from the list below, the desired privileges assigned by marking the corresponding checkboxes, and finally clicking "Assign." This process completes the creation of a new user.

Security Settings

USER SECURITY SETTINGS





ADDING NEW USER

Username:

Password:

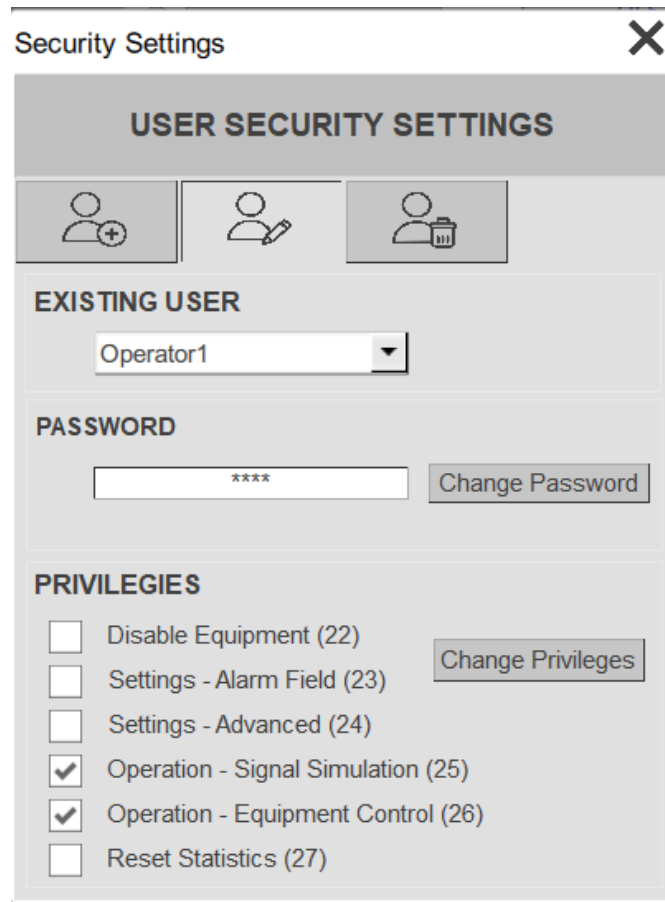
ASSIGNING PRIVILEGES

User:

☐ Disable Equipment (22)
 ☐ Settings - Alarm Field (23)
 ☐ Settings - Advanced (24)
 ☒ Operation - Signal Simulation (25)
 ☒ Operation - Equipment Control (26)
 ☐ Reset Statistics (27)

Figure 57 New User Creation

Additionally, the OIT enables editing an existing user, as shown in Figure 58. To edit a user, select the desired user from the list and update the password and/or privileges as necessary.



Security Settings [X]

USER SECURITY SETTINGS

[User Icon] [Edit Icon] [Delete Icon]

EXISTING USER

Operator1 [v]

PASSWORD

**** [Change Password]

PRIVILEGES

☐ Disable Equipment (22)

☐ Settings - Alarm Field (23)

☐ Settings - Advanced (24)

☒ Operation - Signal Simulation (25)

☒ Operation - Equipment Control (26)

☐ Reset Statistics (27)

[Change Privileges]

Figure 58 Existing User Edition

Finally, the OIT also allows the deletion of an existing user, as illustrated in Figure 59.

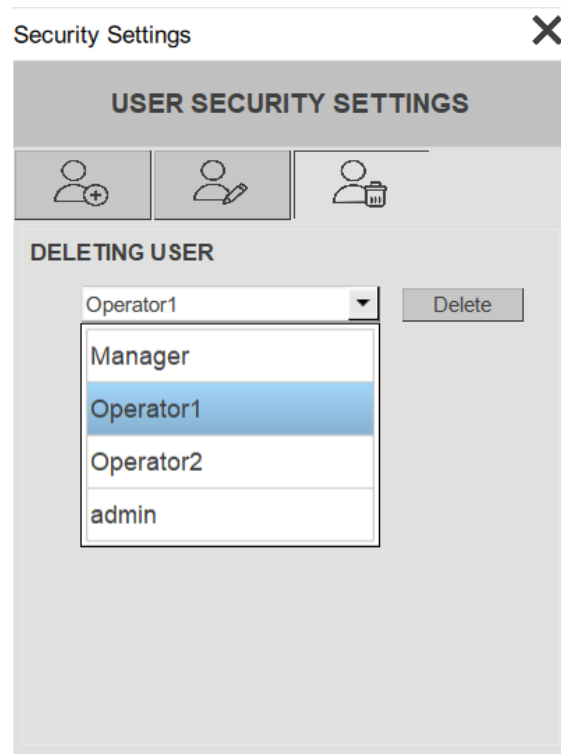


Figure 59 Removing an Existing User

16 OIT Alarming

The alarms in the OIT have been created using the Event (Alarm) feature in EBPro. This system organizes alarms into categories, with each category containing its respective alarms.

16.1 Trigger Type

Each alarm is triggered based on a bit value:

- 0 indicates no alarm condition.
- 1 indicates an alarm condition.

Alarms displayed in the faceplates are connected to local variables in the OIT as shown in Figure 60. These variables are dynamically updated by the macros.

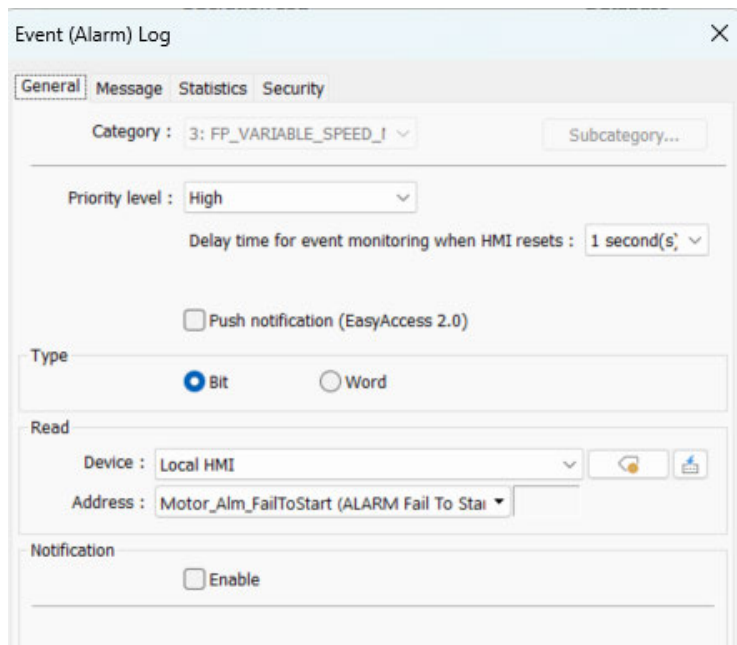


Figure 60 Faceplates alarms

Alarms shown on the General Alarm Screen and in the alarm, display located in the top-right corner of each subsystem process view are linked directly to the corresponding bit in the PLC, as illustrated in Figure 61.

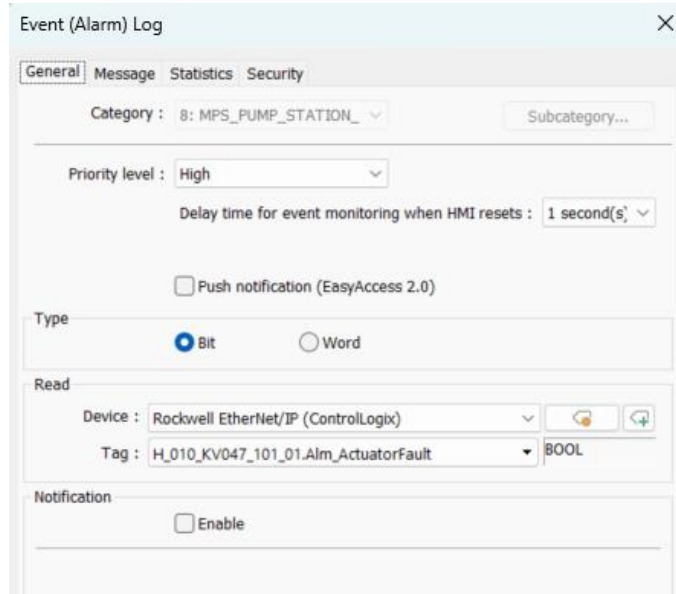


Figure 61 Subsystems Process Overview Alarms

When configuring each alarm, it is necessary to define the text that will be displayed when the alarm is active (Message Tab in Figure 61). This ensures that the alarm message clearly communicates the nature of the issue.



cMT Viewer (Simulation)

MAIN PUMP STATION

BLOWER SYST. HPO REACTOR PUMP STATION O2 SUPPLY COMPRESSORS AIR MIXING RAS SYSTEM COOLING W. SUMP PUMPS

Trigger date	Trigger time	Message	Priority level	Acknowledge time
01/07/2025	14:16:35	H-010-VFD277-104-01 --> Motor Fail to Start	High	
01/07/2025	14:14:57	H-010-VFD277-104-01 --> Motor Fail to Stop	High	
01/07/2025	14:04:30	H_010_LIT000_111_01 --> Filtered Value High	High	14:09:35
01/07/2025	14:04:30	H_010_PIT000_114_01 --> Filtered Value High	High	14:09:35
01/07/2025	14:04:29	H-010-DC400-114-01 --> Motor Seal Leak Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-01 --> Motor Fail to Stop	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-01 --> Motor Interlock Trip Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-01 --> Motor Seal Leak Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-01 --> Motor High Temperature Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-02 --> Motor Fail to Stop	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-02 --> Motor Interlock Trip Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-02 --> Motor Seal Leak Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-02 --> Motor High Temperature Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-03 --> Motor Seal Leak Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-03 --> Motor High Temperature Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-04 --> Motor Seal Leak Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-04 --> Motor High Temperature Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-05 --> Motor Fail to Stop	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-05 --> Motor Interlock Trip Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-05 --> Motor Seal Leak Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-05 --> Motor High Temperature Alarm	High	14:09:35
01/07/2025	14:04:29	H-010-VFD277-104-06 --> Motor Seal Leak Alarm	High	14:09:35

Acknowledge

Figure 62 OIT General Alarms Screen

16.2 Message guidelines

Each alarm trigger shall generate a unique message that is concise yet descriptive. Process area and equipment naming shall remain consistent across OIT, PLC, and HMI platforms. For OIT applications with similar alarm sets for more than one set of equipment or process train, the alarm message shall be prefixed with the equipment or train number to be followed by the alarm in the message as shown in Figure 62.

Note: Use of embedded variables in the alarm message shall not be used.

Alarm messages must fully match across both the HMI and OIT displays as well as the comments provided in the tag description in the PLC. In general, the PLC programmers

shall decide the alarm message, place the message as part of the bit field comment of the alarm tag, and provide the same alarm message for OIT and HMI developers to configure.

Trigger date	Trigger time	Message	Priority level	Acknowledge time
01/07/2025	14:16:35	H-010-VFD277-104-01 --> Motor Fail to Start	High	
01/07/2025	14:14:57	H-010-VFD277-104-01 --> Motor Fail to Stop	High	

Figure 63 OIT Alarm Message Example

17 OIT configuration requirements

The specific configuration details of the OIT are device dependent; however, the following items will be configured as closely as the specific system allows.

17.1 Communications

The systems communication interface will be connected only to the required controllers. The primary pathway will utilize Ethernet. The pathway will be named with the same designation as the controller is named. In places where the identical OIT configuration will be used for multiple stations that generic name of PLC will be utilized.

The communications protocol for data access will be based either on the controllers native, such as DNP3 over Ethernet. Third party interfaces, such as BACnet, are not to be utilized.

The refresh rate of tags data will be set for one second.

17.2 Power On Display

The display will be configured to display the equipment overview display upon power up.

17.3 Event/Data Logger

The event and/or data logger functions are to be enabled and utilized. At a minimum the following events will be logged

- Operator login/logout



- System events; Starting up, shutting down, etc.
- Communications; loss/resumption
- Alarms



Howard F. Curren AWTP SCADA Standards Appendix A - Definitions and General Reference

SCADA Standards

City Project NO. 20-C-00001

Reliable Tampa Partners Project No. 23-502

Hazen and Sawyer Project No. 41077-013 Task 263, 264, 265

January 2025

HFC AWTP Master Plan
Howard F. Curren AWTP
SCADA Standards Appendix A -
Definitions and General Reference

January 2025

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1 Introduction

This is Appendix A of the City of Tampa's standards for Supervisory Control and Data Acquisition (SCADA) and Process Control System (PCS) programming, configuration and design standards for The City of Tampa referred to as "The City" or abbreviated as "COT" throughout this document

Appendix A contains a compilation of definitions and general reference to provide greater details to the SCADA standards manuals volumes 1-3.

The City SCADA & PCS Standards and Conventions Manual is intended to be applied by The City's contractors, consultants, and in-house personnel when developing or modifying any portion of The City's control system. The control system is a utility-wide system built upon a common human machine interface (HMI) system and is comprised of the following:

Process Control System (PCS): The industrial control system for processes within the boundaries of the plant (Howard F. Curren AWTP). The primary function of the system is control and monitoring of plant operations. The PCS is comprised of the local HMI subsystem and various programmable logic controllers (PLCs) and operator interface terminals (OITs).

Supervisory Control and Data Acquisition (SCADA) System: The industrial control system for processes outside the boundaries of the plants. The primary function of this system is data acquisition; remote sites are designed to run autonomously without supervisory control function. The SCADA system serves both Water SCADA and Sewer SCADA in an integrated environment and is comprised of telemetry equipment with a supervisory HMI.

This manual is divided into three main volumes plus two appendices:

Volume 1 contains the control system policies and procedures that apply to the management, maintenance and modification of the control system. Volume 1 includes policies for:

- Programming laptop use
- Management of change (MOC)
- Software and application revision control
- Other related topics.

Volume 2 addresses practices for development and programming of control processors such as:

- Programmable logic controllers (PLCs) of various types

Including requirements for programming software

- Alarm processing
- Control loops
- Control logic structure
- Input/output (I/O) layout and signal processing
- Tagging and naming conventions.

Volume 3 contains practices for development and programming of human-machine interface (HMI) and operator interface terminals (OITs). Standards for programming and display development, historian data exchange, and security are included in this volume.

Appendix A Contains definitions and general references that provide clarity and detail to volumes 1 to 3 of the City of Tampa's SCADA standards manuals.

Appendix B Contains forms and documents needed for deviations and documentation of changes to the City's PCS or SCADA systems.

Compliance with the standards and conventions outlined in the manual is required for all projects that add to or modify the control system. If a contractor or staff member identifies a need for an addition or modification to the standards for a specific project, or if in the course of the work it is found that some part of the standards cannot be adhered to, a standards deviation request may be submitted in accordance with the requirements provided in Section 3 of Volume 1 and in Appendix B.

2 Glossary of terms

AWTP: Advanced Water Treatment Plant

CIP: Capital Improvement Projects

COT: City of Tampa

CPU: Central Processing Unit

FBD: Function Block Diagram

HMI: Human Machine Interface

I/O: Input/Output

IDE: Integrated Development Environment

LD: Ladder Logic

MOC: Management of Change

OIT: Operator Interface Terminal

OITs: Operator Interface Terminals

OT: Operations Technology

P&IDs: Process and Instrumentation Diagrams

PCN: Process Control Network

PCS: Process Control System

PLC: Programmable Logic Controller

PLCs: Programmable Logic Controllers

SCADA: Supervisory Control and Data Acquisition

ST: Structured Text

UDTs: User Defined Types

3 Equipment Codes

CODE	EQUIPMENT
AB018	AIR BLOWER
ABEF302	AFTERBURNER EXH FAN
ABF301	AFTERBURNACE FURNACE
ABS220	ATOMIC ABSORPTION UNIT
ABV012	AIR OPERATED BLOCK VALVE
ABX000	AFTERBURNER EXHAUST FAN
AC020	AIR COMPRESSOR
ACD300	DAMPER
ACP000	ANALYZER CONTROL PANEL
ACP100	PANEL, AERATION CONTROL
ACS102	ACTIVATED CARBON SYST
ACT000	ACTUATOR
AD021	AIR DRYER
ADS341	AIR DIFFUSER SYSTEM
AE000	ANALYZER ELEMENT/PROBE
AEP000	AERATION CONTROL PANEL
AFC000	AIR FAN COOLER
AFS193	AIR FILTRATION UNIT
AHF000	ACTIVE HARMONIC FILTER
AHU051	AIR CONDITIONING UNIT
AIT000	ANALYZER INDICATING TRANS
ALG500	AIR LEAKS GENERAL
AOV124	AIR OPERATED VALVE
APF000	ACTIVE POLYMER FEED TANK
APFP068	ACTIV POLYMER FEED PUMP
APFT101	TANK, ACT POLYMER FEED
APST101	ACT POLYMER STORAGE TNK
APT000	ACTIVATED POLYMER STORAGE TANK
AR147	AIR RECEIVER
ARF057	AUTO ROLL FILTER UNIT
ARPV330	AIR REGULATOR PILOT VAL
ARV266	AIR RELEASE VALVE
AS139	AIR SEPERATOR
AS342	ASPIRATOR SILO
ATO000	AUTOMATIC TRANSFER OPER
ATS000	AUTOMATIC TRANSFER SWITCH
AUTO214	AUTO ANALYZER
AVV240	AIR/VACUUM VALVE
AW011	ADJUSTABLE WEIR
BAT000	BATTERIES
BAV144	BACKWASH AIR VALVE
BC279	BATCH COUNTER
BCN000	NEUTRALIZATION TREATMENT
BCR000	BATTERY CHARGER/CONTROLLER
BDV143	BACKWASH DRAIN VALVE
BE340	BUCKET ELEVATOR

BFV01	BUTTERFLY VALVE
BHC000	BOOSTER HEATING COIL
BI222	BACTERIAL INCUBATOR
BIN000	BINS
BIO200	BIO-FILTER
BLD000	BUILDING
BLN000	BLEND UNIT
BLR000	BOILER, WATER HEATER
BLW000	BLOWERS
BP263	BACKFLOW PREVENTERS
BRD000	DC DISTRIBUTION BOARDS
BRN000	BURNER – WASTE GAS
BS001	BAR SCREEN
BST099	BREWERY WASTE STOR TK
BTD000	BUTTERFLY DAMPER
BTM104	BRINE TANK MIXER
BTP111	BRINE TRANSFER PUMP
BUS000	BUS DUCTS, BARS AND ACCESS
BWS062	STRAINER BACKWASH PUMP
BWV131	BACKWASH WATER VALVE
CA073	CHLORINE ANALYZER
CA149	ANAEROBIC DIGEST COVER ASSY
CA209	ANALYZER
CAB000	HIGH RESISTANCE GROUND CABINET, TERMINAL CABINET - 5 KV
CAM000	CAMERA
CB052	CIRCUIT BREAKER
CB236	OXYGEN PLANT COLD BOX
CBT000	CABLE TRAY
CC202	CONTROL CONSOLE
CCD000	COILING COUNTER DOOR
CCU063	COMPRESS CONDENSOR UNIT
CDR000	COLLECTOR DRIVE
CDU219	CHLORINE DISINFECTION UNIT
CEF319	CIRCULATING EXHAUST FAN
CF037	SED TANKS CHAINS / FLIGHTS
CFP146	CHEMICAL FEED PUMP
CH070	CHLORINATOR
CH235	COMPUTER HARD / SOFTWARE
CL205	CONTROL LOOPS
CLC000	COLLECTOR
CLR000	CLARIFIER
CLS000	COALESCERS
CLUP265	CHLORINE UNLOAD PLATFORM
CMH000	CONTROL MANHOLE
CMP112	CAUSTIC METERING PUMP
CND000	CONDENSER (WATER-COOLED) UNIT
CNV000	CONVEYOR
CO000	CLEANOUT
CPL000	CONTROL PANEL (MISCELLANEOUS)
CRC103	CHEMICAL REACTION CHAMBER
CRD000	CARD

CRN000	CRANE, HOIST, TROLLEY, WINCH
CRP106	CELL RECYCLE PUMP
CRT000	CART
CS294	CYCLONE SEPERATOR
CS298	CYCLONIC SEPERATOR
CS444	COURIER SERVICES
CSN267	CHEMICAL SPRAY NOZZLES
CSP024	CHEMICAL CIRCULATING PUMP
CST098	CHEMICAL STORAGE TANK
CSV000	CROSSOVER VALVE (MANUAL)
CT287	COOLING TOWER
CTR000	CONCENTRATOR UNIT
CUS000	CHEMICAL UNLOADING STATION
CV122	CHECK VALVES
CWP053	CHILLED WATER PUMP
CWP083	CONDENSOR WATER PUMP
CWP218	CLEAR WELL PUMP
CXL000	ELECTRIC DUCT HEATER, HEATING COIL, COOLING COIL
CYC000	CYCLONES, HYDRO CYCLONES
DAS000	DISTRIBUTED ANTENNA SYSTEM
DBP	DIESEL BYPASS PUMP
DBS194	DEEP BED SCRUBBER
DC304	DUST COLLECTOR
DC400	DEWATERING CENTRIFUGE
DCE000	DRY CHEMICAL EQUIPMENT
DCN000	DATA COMM NETWORK
DCP254	DECHLOR CONTROL PANEL
DCR332	DIESEL COOLANT RADIATOR
DCS000	DISTRIBUTED CONTROL SYSTEM
DCU000	DISTRIBUTED CONTROL UNIT
DCV000	DATA CONVERTER (EX. SUTRON)
DEF997	DEF STORAGE TANK
DF247	FLOW DEFLECTORS / BAFFLES
DHU000	DEHUMIDIFIER
DI206	DEIONIZED UNIT
DL000	DATA LOGGER
DLG000	SPRINKLER/DELUGE SYSTEMS
DO076	DISSOLVED OXYGEN METER
DO223	DRYING OVEN
DOR000	OVERHEAD DOOR
DP017	DEWATERING PUMP
DR228	DISTILLATION RACK
DRG000	DIFFUSER (HVAC)
DRM000	DRUM
DRN000	DRAIN, FLOOR SINK
DRV000	DRIVE UNIT
DRY000	DRYER, INCLUDING AIR DRYER
DS000	DIVERSION STRUCTURE
DSC090	DRIED SLUDGE CONVEYOR
DSC296	DRIED SLUDGE CRUSHER
DSG092	DRIED SLUDGE GRINDER

DSN000	DOWNSPOUT NOZZLE
DSP085	DIGESTED SLUDGE PUMP
DSP245	DUCT SCRUBBER PUMP
DST256	DRIED SLUDGE PRODUCT STORAGE TANK (PELLETS)
DSW	DISCONNECT SWITCH
DT133	DRIP TRAPS
DTR000	DEAERATOR
DU323	DEMISTER UNIT
DWH000	DOMESTIC WATER HEATER, TANKLESS WATER HEATER
EBB191	EMERGENCY BATTERY BANKS
ECP000	ELECTRICAL CATHODIC PROTECTION
ECV000	ENVIRONMENTAL CONTROL PANEL
EEWS322	EMERGENCY EYE WASH
EF056	EXHAUST FAN
EG170	ENGINE GENERATOR
EHD000	EXHAUST HOOD (LAB, WELDING, KITCHEN)
EJ071	CHLORINE EJECTORS
ELEV172	ELEVATOR
ELP240	PANEL, ELECTRICAL LIGHTING
ELV000	ELECTRICAL DUCT BANK - LOW VOLTAGE
ELW000	ELECTRICAL WIRING AND CABLING
EM280	ELECTRICAL MANHOLES
EMS000	ENVIRONMENT MONITORING SYSTEM (H2S MONITORING)
EMV000	ELECTRICAL DUCT BANK - MEDIUM VOLTAGE
EP244	EQUIPMENT REPAIRS
EQP000	EQUIPMENT (ELECTRICAL SHOP, LABORATORY, MECHANICAL SHOP, VEHICLE MAINTENANCE SHOP, WAREHOUSE, ETC.)
ER238	EQUIPMENT ROUNDS
ERS152	EXHAUST RECOVERY SILENCER
ERV328	EXPLOSION RELIEF VALVE
ESC000	ESCAPE/RETRIEVAL DEVICES/LIFE SAVING/WINCH
ESS000	EMERGENCY SHUT-DOWN SYSTEM
ET138	EXPANSION TANK
ETV999	EFFLUENT WATER TAP VALVE
EUS	EMISSION UNITS TITLE V AIR PERMIT
EV069	CHLORINE EVAPORATOR
EV250	SULPHUR DIOXIDE EVAPORATOR
EWP062	EFFLUENT WATER PUMP
EWS060	EFFLUENT WATER STRAINER
EXP000	EXPANDERS
FAC127	FACILITY
FAE000	FIRST-AID EQUIPMENT
FAN000	FAN (CIRCULATION, EXHAUST, RETURN, PORTABLE, SUPPLY, ETC.)
FBM200	FILTER BASIN MEDIA
FBP217	FILTER BACKWASH PUMP
FC109	FLOW CONVERTOR
FCG000	FLOW CONTROL GATE
FCP000	FIRE CONTROL PANEL, FIRE ALARM CONTROL PANEL
FCS000	FIRE & GAS - SHUT DOWN CONTROL SYSTEM
FCU314	FAN COIL COOLING UNIT
FCV101	FLOW CONTROL VALVE/ACTUATOR

FDR000	VOLUMETRIC CHEMICAL FEEDER
FE000	FLOW ELEMENT
FE242	FIRE EXTINGUISHERS
FED000	FEEDERS
FEP216	FILTER EFFLUENT PUMP
FET000	FLOW ELEMENT ATTACHED TO TRANSMITTER, NON-INDICATING
FG185	FENCES AND GATES
FGD000	FLARES GROUND
FGST167	FUEL GAS SURGE TANK
FH312	FIRE HYDRANTS
FHR000	FIRE HOSE REEL
FIT000	FLOW INDICATING TRANSMITTER
FLT000	FILTER/FAN UNIT
FM000	FORCE MAIN
FMD000	FLOW METERING DEVICE (ANY KIND)
FMR000	FLOW METER
FOP046	FUEL OIL PUMP
FOT282	FUEL OIL STORAGE TANK
FPAT334	FAN POWERED AIR TERMINAL
FPP000	FIBER PATCH/SPLICE PANEL
FPS329	FIRE PROTECTION SYSTEM
FR208	FLOW RECORDERS
FRK000	FORK LIFT
FRT000	FLOW, TRANSMITTER RECORDING
FSA000	FIRE ALARM SYSTEM ANNUNCIATOR
FSC000	FINE SCREEN COMPACTOR
FSH000	FLOW SWITCH, HIGH
FSL000	FLOW SWITCH, LOW
FTA128	FLAME ARRESTOR & TRAP ASSEMBLY
GAS288	GENERATOR AIR STARTER
GBX	GEARBOX
GC003	GRIT COLLECTOR
GC006	GRIT CONVEYER
GC009	GRIT SNAIL ESCALATOR
GC225	GAS CHROMATICGRAPH
GCC150	SLUDGE GAS CONDENSATE COLLECTOR
GCP188	PANEL, GENERATOR CONTROL
GCT151	SLUDGE GAS CONDENSATE TANK
GD044	GAS DETECTOR SENSOR
GD072	CHLORINE GAS LEAK DETECTOR
GDT311	GAS DRAIN TRAPS
GDU000	GRIT DRIVE UNIT
GMC019	GAS MIXING COMPRESSOR
GMP189	PANEL, GENERATOR MONITORING
GND000	GROUNDING AND BONDING
GP007	GRIT PUMP
GRD000	GRINDER (ANY)
GRL000	WATER SUPPLY GRILLE
GRN000	GRANULATORS
GS004	GRIT SEPARATOR
GSV325	GAS SYSTEM VALVES

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SCADA Standards Appendix A

GTE000	GATE EXCEPT FLOW CONTROL GATE (FCG)
GV120	GATE VALVE
GW005	GRIT WASHER
HC054	ELECTRIC HEATER COIL
HCP000	HVAC CONTROL PANEL
HCS000	HVAC CONTROL SYSTEM
HD000	HEAT DETECTOR
HDU000	HYDRAULIC UNITS
HE136	SLUDGE HEAT EXCHANGER
HH000	HANDHOLE
HMP000	HEAT PUMP, WATER SOURCE HEAT PUMP
HOP000	HOPPERS
HPP313	HOT WATER FEED PUMP
HPW000	HIGH PRESSURE WASHER
HRE000	EXHAUST HOSE REEL
HRG000	HIGH RESISTANCE GROUND SYSTEM
HRU000	HEAT RECOVERY UNIT
HSB000	HOSE BIB
HTR000	HEATER (CABINET UNIT, ELECTRIC, GAS FIRED, INFRARED, HOT WATER, UNIT ETC.)
HTT000	HEAT TRACE SYSTEM
HWP315	HOT WATER CIRCULATING PUMP
HYD000	HYDRANT (ROOF OR WALL)
IC195	ICE MACHINES
ICAC142	INNERCOOLER AND AFTERCOOLER
ICP000	INSTRUMENT CONTROL PANEL
IDF299	INDUCED DRAFT FAN
IGE000	INERT GAS EQUIPMENT
IH197	INTERCEPT HOPPER
IJB000	INSTRUMENT JUNCTION BOX
INC000	INCINERATORS
IRP020	INTERNAL RECYCLE PUMP
IS029	DISTRIBUTION & CONTROL ISOLATING SWITCH
IWP072	INDUSTRIAL PERMITTED WASTE DISCHARGE
JBX000	JUNCTION BOX
JIT000	POWER INDICATING TRANSMITTER (POWER METERING)
JWP023	JACKET WATER PUMP
KV047	KNIFE VALVE
LC030	LONGITUDINAL COLLECTOR DRIVE
LCC031	LONGITUDINAL AND CROSS COLLECTOR DRIVE
AB018	AIR BLOWER
ABEF302	AFTERBURNER EXHAUST FAN
ABF301	AFTERBURNACE FURNACE
ABS220	ATOMIC ABSORPTION UNIT
ABV012	AIR OPERATED BLOCK VALVE
ABX000	AFTERBURNER EXHAUSE FAN
AC020	AIR COMPRESSOR
ACD300	DAMPER
ACP000	ANALYZER CONTROL PANEL
ACP100	PANEL, AERATION CONTROL
ACS102	ACTIVATED CARBON SYSTEM

ACT000	ACTUATOR
AD021	AIR DRYER
ADS341	AIR DIFFUSER SYSTEM
AE000	ANALYZER ELEMENT/PROBE
AEP000	AERATION CONTROL PANEL
AFC000	AIR FAN COOLER
AFS193	AIR FILTRATION UNIT
AHF000	ACTIVE HARMONIC FILTER
AHU051	AIR CONDITIONING UNIT
AIT000	ANALYZER INDICATING TRANSMITTER
ALG500	AIR LEAKS GENERAL
AOV124	AIR OPERATED VALVE
APF000	ACTIVATED POLYMER FEED TANK
LCP000	LOCAL CONTROL PANEL
LCS000	LOCAL CONTROL STATION
LCS249	PNEUMATIC LEVEL CONTROL SYST
LCS250	ULTRANSONIC LVL CONTROL SYST
LDC000	LOAD CENTER
LDR000	LOADER
LE000	LEVEL ELEMENT, SENSOR
LET000	LEVEL ELEMENT, NON-INDICATING
LIS180	LAWN IRRIGATION SYSTEM
LIT000	LEVEL INDICATING TRANSMITTER
LOG000	CHANNEL STOP LOG
LPL000	LIGHTING PANEL
LPS000	LIGHTING PROTECTION SYSTEM
LRG000	LOW RESISTANCE GROUNDING
LRP000	LIGHTING RELAY PANEL
LSH000	LEVEL SWITCH, HIGH
LSL000	LEVEL SWITCH, LOW
LSO100	LIFT STATION OPERATION FACILTY
LST117	LOX STORAGE TANK
LTA000	LIGHTNING ARRESTORS
LTC000	LIGHTING CONTACTOR PANEL
LVL000	LEVELER, STORAGE BIN LEVELER
LVR000	LOUVER
MA029	MECHANICAL AERATOR
MAU000	MAKEUP AIR UNIT
MB229	METTLER BALANCER
MBS096	METHANOL BASKET STRAINER
MCC190	MOTOR CONTROL CENTERS
MCP159	PANEL, MAIN CONTROL
MDR000	MAN DOORS
MDU420	PERMISSIBLE METHANE MONITOR
MEL000	MIST ELIMINATOR
MEV145	MODULATING EFFLUENT VALVE
MF224	MUFFLE FURNACE
MFA000	METERING FACILITY (ANNUAL CHARGE)
MFO000	METERING FACILITY (FLOW MONITOR)
MFP096	METHONAL FEED PUMP
MH009	HOIST

MIX028	MIXER
MIX029	MIXER--WET WELL MIXER
MKP000	GLYCOL MAKE-UP UNIT
MLSS077	ML SUSPENDED SOLIDS METER
MNT000	MONITOR
MOV125	MOTOR OPERATED VALVE
MP025	METERING PUMP
MPM075	MULTIPARAMETER METER
MS132	MOISTURE SEPERATOR
MSP015	MAIN SEWAGE PUMP
MSP153	MIXED SLUDGE PUMP
MST100	METHONAL STORAGE TANK
MTP095	METHONAL TRANSFER PUMP
MTR056	MOTORS
MV118	MANUAL VALVES
NA059	NITRITE-NITRATE ANALYZER
NGP321	NATURAL GAS PIPING
NGR000	NEUTRAL GROUNDING RESISTORS
NIP000	NETWORK INTERFACE PANEL
NJB000	NETWORK JUNCTION BOX
NP331	NITRIFICATION PUMP
NPS286	NITROGEN PURGE SYSTEM
NSW000	NETWORK SWITCH
OBS097	FUEL OIL BASKET STRAINER
OC211	OIL COOLER
OCFM335	OPEN CHANNEL FLOW METER
OFH079	OIL FIRED HEATING UNIT
OP253	OIL PUMP
OPA043	OXYGEN PURITY ANALYZER
OS276	OIL SEPERATOR
OSM555	OUTSIDE SEWER MAINTENANCE
OZ027	OZONE GENERATOR
PA045	PHOSPHATE ANALYZER
PAM199	PORTABLE GAS MONITOR
PAS000	PUBLIC ADDRESS AND ALARM SYSTEM
PAT155	PNEUMATIC AIR TANK
PAU066	POLYMER ACTIVATION MIXER
PAV111	PURGE AIR VALVE
PBU087	POLYMER BLENDING UNIT
PBX000	PULL BOX
PBX345	TELEPHONE SYSTEM
PC338	PELLET COOLER
PCU113	PEPCON CELL UNIT
PDP480	PANEL, POWER DISTRIBUTION
PDT000	PRESSURE DIFFERENTIAL TRANSMITTER
PE000	PRESSURE ELEMENT, SENSOR
PE121	POTS & EJECTORS
PE307	PORTABLE EQUIPMENT
PET000	PRESSURE ELEMENT, NON-INDICATING
PF041	PARSHELL FLUME
PFP075	POLYMER FEED PUMPS

PFS308	PRODUCT FLOW SCALE
PG000	PRESSURE GAUGE
PH074	PH ANALYZER
PIT000	PRESSURE INDICATING TRANSMITTER
PJB000	POWER JUNCTION BOX
PLC000	PROGRAMMABLE LOGIC CONTROLLER
PLM000	PLUMBING
PM261	PUG MILL
PMP000	PUMP (GENERAL)
PPL000	POWER PANEL
PRN000	PRINTER
PRS000	SCREEN PRESS
PRV126	PRESSURE RELIEF VALVES
PRV130	GAS PRESSURE REGULATING VALVE
PRV264	PRESSURE REDUCING VALVE
PRV333	PRESSURE REGULATING VALVE
PSH000	PRESSURE SWITCH, HIGH
PSL000	PRESSURE SWITCH, LOW
PST000	PRESSURE SWITCH AND TRANSMITTER
PST065	POLYMER STORAGE TANK
PSU000	POWER SUPPLY UNIT
PSV000	PRESSURE SAFETY VALVE
PT137	PIPING AND TUBING
PTE244	PORTABLE TEST EQUIPMENT
PTP067	POLYMER TRANSFER PUMP
PU026	PEAKING UNIT 1 SOUTH WAUKESHA
PV119	PLUG VALVES
PVM000	PHOTOVOLTAIC MODULE
PW093	PARTS WASHER
PWBT210	PLANT WATER BREAK TANK
PWJP154	PLANT WATER JOCKEY PUMP
PWP022	PLANT WATER PUMP
RAD000	RADIO
RB293	RECYCLE BIN
RC014	RATE CONTROLLER
RC207	RATIO CONTROLLER
RCT000	REACTORS
RCU114	PEPCON REMOTE UNIT
RDD260	ROTATING DRYER
RDT000	ROTARY DRUM THICKENER
REF050	ROOF EXHAUST FAN
REF231	REFRIGERATOR UNIT
RF049	RETURN FAN
RFS309	RECYCLE FLOW SCALE
RH271	REACTIVATION HEATER
RIO000	REMOTE I/O CABINET
RLR000	RAILROAD AND ROAD LOADING EQUIP
ROAD186	ROADS
ROD080	OVER HEAD ROLLING DOOR
ROF000	ROOFING
RP327	RETENTION POND

RSCS285	RETURN SLUDGE CONTROL SYST
RSP033	RETURN SLUDGE PUMP
RSP034	RAW SEWAGE PUMP
RTDT317	RECEIVER TANK DRAIN TIMERS
RTS337	FIRE TEMPERATURE SENSOR
RTU201	REMOTE TERMINAL UNIT
RU233	RADIO UNITS
RV292	ROTARY VALVE
SAS262	SECURITY ALARM SYSTEM
SAS343	STATION ALARM SYSTEM
SC002	SCREENING CONVEYER
SC258	SCREW CONVEYER
SC291	SETTLING CHAMBER
SCB000	SCRUBBERS
SCBA241	SELF CONTAINED BREATHING APPARATUS
SCL000	SCALE
SCMPIT-01	SCUM PIT FOR ANY PIT CONTAINING SCUM
SCN	SCREEN SEWAGE
SCP000	SECURITY CONTROL PANEL
SCR000	SCREEN
SCU246	SHOP CLEAN UP
SCWP326	SPENT COOLING WATER PUMP
SD000	SMOKE DETECTOR
SDAS289	SULPHUR DIOXIDE ADDER/SUBTRACTOR
SDB000	SECONDARY DRYING BEDS
SDF259	SLUDGE DRYING FURNACE
SDLD252	SULPHUR DIOXIDE LEAK DETECTOR
SEG000	SEGMENT (INTERCEPTOR)
SEP320	SCUM EQUALIZATION PUMP
SET000	SPEED/FREQUENCY ELEMENT ATTACHED TO TRANSMITTER, NON-INDICATING
SF048	SUPPLY FAN
SFP084	SLUDGE FILTER PRESS
SFP156	SLUDGE FEED PUMP
SFU115	SILENCER FILTER UNIT
SG000	SPEED/FREQUENCY GAUGE, TACHOMETER
SG012	SLUICE GATE
SG013	SLIDE GATE
SG026	STANDBY GENERATOR
SG039	SWITCHGEAR
SG162	SLUDGE GRINDER
SGF168	SLUDGE GAS FILTER
SGFC089	GAS BOOSTER COMPRESSOR
SGST278	SCUM GATE SEQUENTIAL TIMER
SH000	STROBE HORN
SH055	ELECTRIC STEAM HUMIDIFIER
SHP105	SODIUM HYPOCHLORIDE PUMP
SI000	SIPHON INLET
SIT000	SPEED/FREQUENCY INDICATING TRANS
SL248	STREET LIGHTING
SLG270	STOP LOG GATES

SLM078	SLUDGE BLANKET LEVEL METER
SMP000	SUMP PIT
SO000	SIPHON OUTLET
SP008	SUMP PUMP
SP032	SAMPLE PUMP
SP255	SLUDGE PLOW
SP402	SAMPLING PUMP
SPR000	SEPARATOR (AIR, FOAM, MECHANICAL, OIL/WATER)
SRP035	SLUDGE RECIRCULATION PUMP
SS042	SAMPLER STATION
SS276	SOFTSTART
SSB256	SLUDGE STORAGE BIN
SSH000	SPEED/FREQUENCY SWITCH, HIGH
SSL000	SPEED/FREQUENCY SWITCH, LOW
SSP010	SAMPLE SUMP PUMP
ST171	SEDIMENT TRAP
STP016	SCUM TRANSFER PUMP
STP088	SLUDGE TRANSFER PUMP
STW174	SCUM TILTING WEIRS
STY000	SITE SECURITY ACCESS GATES & FENCING
SU251	SULFONATOR
SV086	SOLENOID VALVE EFFLUENT WATER PUMPS STAR
SV237	SWITCH VALVES
SV306	SLUDGE VIBRATOR
SVP000	SOLENOID VALVE PANEL
SVR000	SERVER
SWBP086	SEAL WATER BOOSTER PUMP
SWD000	SOLID WASTE DISPOSAL UNITS
T038	TRANSFORMERS
TCD081	THICKENER TANK COLLECTOR DRIVE
TCU000	TERMINAL CONTROL UNIT
TD091	TRIP OFF DEVICE
TE116	TURBINE EXPANDER
TEF107	TOWER EXHAUST FAN
TET000	TEMPERATURE ELEMENT ATTACHED TO TRANSMITTER, NON-INDICATING
TG094	TIDE GATE
TI166	TEMPERATURE INDICATOR
TIT000	TEMPERATURE INDICATING TRANSMITTER
TJB000	TERMINAL JUNCTION BOX
TLC318	TRUCK LOADING CHUTE
TMX019	INDUSTRIAL SCIENTIFIC TMX CHARGERS
TNK000	BASIN (CIRCULAR, RECTANGULAR, ETC)
TOC058	TOTAL ORGANIC CARBON ANALYZER
TOX213	TOX ANALYZER
TP303	THERMOPILE
TRAN273	TRAINING
TRB000	TURBINE
TRP281	TOWER RECYCLE PUMP
TRV283	THERMAL RELIEF VALVE
TS040	TRANSFER SWITCH

TS183	TREES AND SHRUBS
TSH000	TEMPERATURE SWITCH, HIGH
TSL000	TEMPERATURE SWITCH, LOW
TSM161	TANK SKIMMER MECHANISM
TSP082	THICKENED SLUDGE PUMP
TSS011	TOTAL SUSPENDED SOLIDS ANALYZER
TWV123	THREE WAY VALVES
UH064	UNIT HEATER
UNS000	RECTIFIERS, INVERTERS, FREQUENCY CONVERTERS
UPS310	UNINTERRUPTIBLE POWER SUPPLY
UU215	ULTRAFILTRATION UNIT
UV059	UV MONITOR
UVD000	ULTRAVIOLET DISINFECTION
VAP	VACUUM PUMP
VBA239	VACUUM BREAKING ASSEMBLY
VE000	VIBRATION ELEMENT/PROBE
VFD277	VARIABLE FREQUENCY DRIVES
VIT000	VIBRATION INDICATING TRANSMITTER
VLV000	VALVE (MANUAL, GATE, BALL, BUTTERFLY, NRV, THERMAL, MIXING, THREE-WAY, ETC)
VPR000	VAPORIZER
VS295	VIBRATORY SCREEN
VS297	VENTURI SCRUBBER
VS339	VIBRATING SCREEN
VSH000	VIBRATION SWITCH, HIGH
VST000	VIBRATION SWITCH AND TRANSMITTER
VT000	VIBRATION TRANSMITTER
WAP000	WIRELESS ACCESS POINT
WAS316	WASTE SLUDGE PUMP
WBP163	WATER BOOSTER PUMP
WBT101	WATER BREAK TANK
WC230	WATER COOLER
WCR	WASHING COMPACTOR
WCU052	WATER CHILLER UNIT
WEC284	WAUKESHA ENGINE CARBERATOR
WEL000	WELDING RECEPTICLE (480V)
WET000	WETTING DEVICE/UNIT/SYSTEM
WGB169	WASTE GAS BURNER
WH134	WATER HEATER/BOILER
WH232	WATER HEATER
WHFP135	WATER HEATER FEED PUMP
WI257	WEIGHT INDICATOR
WIN000	WINDOWS
WKS000	WORKSTATION
WLC110	WATER LEVEL CONTROLLER
WOPP290	WASTE OIL PIT PUMP
WS227	WATER SOFTENER
WS305	WEIGHT SCALE
WS336	WEATHER STATION
XCH000	HEAT EXCHANGER (CIRCULAR, HVAC, PLATE, PROCESS, SHELL AND TUBE)

XHT000	ENGINE EXHAUST
ZG000	POSITION GAUGE
ZIT000	POSITION INDICATING TRANSMITTER
ZSC000	POSITION SWITCH, CLOSED LIMIT SWITCH
ZSH000	POSITION SWITCH, HIGH
ZSL000	POSITION SWITCH, LOW
ZSO000	POSITION SWITCH, OPEN LIMIT SWITCH
LCP000	LOCAL CONTROL PANEL (GO-NO GO PANELS)
LCS000	LOCAL CONTROL STATION
LCS249	PNEUMATIC LEVEL CONTROL SYSTEM
LCS250	ULTRANSONIC LIQUID LEVEL CONTROL SYSTEM
LDC000	LOAD CENTER
LDR000	LOADER
LE000	LEVEL ELEMENT, SENSOR
LET000	LEVEL ELEMENT ATTACHED TO TRANSMITTER, NON-INDICATING
LIS180	LAWN IRRIGATION SYSTEM
LIT000	LEVEL INDICATING TRANSMITTER
LOG000	CHANNEL STOP LOG
LPL000	LIGHTING PANEL
LPS000	LIGHTING PROTECTION SYSTEM
LRG000	LOW RESISTANCE GROUNDING
LRP000	LIGHTING RELAY PANEL
LSH000	LEVEL SWITCH, HIGH
LSL000	LEVEL SWITCH, LOW

4 Building numbers

Bldg No.	Building
1	RAW SEWAGE PUMP STATION
2	JUNCTION CHAMBER NO. 1
3	METER VAULT NO. 1
4	LUBE STORAGE BUILDING
5	SCREEN & GRIT NO. 2 (EAST)
6	JUNCTION CHAMBER NO. 2
7	METER VAULT NO. 2
8	JUNCTION CHAMBER NO. 3
9	PRIMARY SEDIMENTATION TANKS 1-4
10	MAIN PUMPING STATION
11	HPO REACTORS
12	FINAL SEDIMENTATION TANKS 1-12
13	INTERMEDIATE PUMP STATION
14	DENITRIFICATION FILTERS 1-20
15	FILTER BUILDING NO. 1
16	POST AERATION CHLORINATION TANKS
17	JUNCTION CHAMBER NO. 4
18	OUTFALL STRUCTURE
19	WAREHOUSE
20	PRIMARY SLUDGE PUMP STATION NO. 1
21	ANAEROBIC DIGESTER TANKS
22	RETURN SLUDGE STATION NO. 1
23	RETURN SLUDGE STATION NO. 2
24	RETURN SLUDGE STATION NO. 3
25	DIFFUSED AIR REACTORS
26	SLUDGE THICKENER TANKS
27	SLUDGE DRYING BEDS (OLD)
28	DIGESTER CONTROL BUILDING A
29	DIGESTER CONTROL BUILDING B
30	SLUDGE TREATMENT BUILDING
31	FILTRATE PUMP STATION
32	SLUDGE DEWATERING BUILDING
33	WASTE GAS BURNERS (DIG 1 – 5)
35	SLUDGE HEAT DRYING
36	JC-1 ODOR CONTROL NO. 1
37	JC-1 ODOR CONTROL NO. 2
39	TECH SERVICES BUILDING
40	OPERATION & MAINTENANCE BUILDING
41	OXYGEN PLANTS AREA GENERATION
42	CHEMICAL HANDLING PLATFORM
43	CHEMICAL STORAGE TANKS
44	PLANT SWITCHGEAR BUILDING
45	FILTER ACCESS TUNNEL
46	DECHLORINATION FACILITY
47	FILTER BUILDING NO. 2
48	DENITRIFICATION FILTERS 21-26, 31-36
49	JUNCTION CHAMBER NO. 6

50	JUNCTION CHAMBER NO. 5
51	CARPENTER SHOP
52	WELDING SHOP
53	CAR PORT AND REPAIR SHOP
54	SLUDGE STORAGE TANKS / BUILDING
55	SLUDGE DRYING BEDS
56	BELT THICKENER BUILDING
57	NITRIFICATION PUMP STATION
58	BLOWER BUILDING
59	SCREEN & GRIT NO. 1
60	ADMINISTRATION BUILDING
61	FINAL SEDIMENTATION TANKS 13-20
62	RETURN SLUDGE STATION NO. 4
63	RETURN SLUDGE STATION NO. 5
64	VEHICLE MAINTENANCE FACILITY
65	SLUDGE DEWATERING BUILDING
66	DEWATERING FEED PUMP STATION
67	ANAEROBIC DIGESTER8 (FUTURE)
68	ANAEROBIC DIGESTER 9 (FUTURE)
69	DIGESTER 8 & 9 CONTROL BUILDING (FUT)
70	SCUM THICKENER FACILITY
71	MIXED SLUDGE PUMP STATION
72	ANAEROBIC DIGESTERS 6 AND 7
73	ANAEROBIC DIGESTERS 7 (FUTURE)
74	DIGESTER CONTROL BUILDING C
75	ANAEROBIC DIGESTER ELECT ROOM (FUT)
76	ANAEROBIC DIGESTER BOILER RM (FUT)
77	TECO PARTNERSHIP STATION
78	STAND-BY POWER FACILITY
79	WASTE GAS BURNERS (DIG 6 AND 7)
80	GENERATOR BUILDING AND FILTER ROOM
81	OLD GENERATORS BUILDING
82	PRIMARY SEDIMENTATION TANKS 5-8
83	PRIMARY SLUDGE PUMP STATION 2
84	DIGESTED GAS FLARE STRUCTURE (FUT)
85	SWITCHGEAR NO. 60
86	RECLAIMED WATER STATION
<u>87</u>	<u>WATER REUSE PILOT PLANT</u>
<u>89</u>	<u>FUEL STATION GAS & DIESEL</u>
91	COLLECTIONS ADMIN BUILDING
NBN-1	SEPTAGE RECEIVING STATION
NBN-2	LEACHATE DISCHARGE STATION
	METHANOL STATION

**Dark gray underlined cells indicate gap in building numbering*

5 Loop numbering

LOOP RANGES	DESCRIPTION
100-699	PROCESS RELATED CONTROL LOOPS
700-719	15Kv GEAR
720-739	5Kv GEAR
740-759	LOAD CENTERS & TRANSFORMERS
760-779	MCC, SWITCHBOARD, ATS
780-799	PANELBOARDS
800-819	PLCs / RIO
820-849	NETWORK EQUIPMENT
850-889	NETWORK / POWER / INSTRUMENT JB'S
890-899	FIBER PATCH PANELS
900-909	SAFETY SHOWER / EYEWASH
910-959	FIRE ALARM / SECURITY ALARM
960-999	HVAC EQUIPMENT

6 ISA Naming Conventions

FIRST LETTERS			SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	VARIABLE MODIFIER	READOUT/ PASSIVE FUNCTION	OUTPUT/ ACTIVE FUNCTION	FUNCTION MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY			CONTROL	CLOSE
D	DENSITY (MASS) OR SPECIFIC	DIFFERENCE, DIFFERENTIAL			DEVIATION
E	GRAVITY VOLTAGE (EMF)		SENSOR, PRIMARY ELEMENT		
F	FLOW, FLOW RATE	RATIO			
G	USER'S CHOICE		GLASS, GAUGE, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT		INDICATE		
J	POWER		SCAN		
K	TIME, SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE, INTERMEDIATE
N	TORQUE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE, RESTRICTION		OPEN
P	PRESSURE		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE, TOTALIZE	INTEGRATE, TOTALIZE		
R	RADIATION		RECORD		RUN
S	SPEED, FREQUENCY	SAFETY		SWITCH	STOP
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL PROBE		
X	UNCLASSIFIED	X-AXIS	ACCESSORY DEVICES, UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, PRESENCE	Y-AXIS		AUXILIARY DEVICES	
Z	POSITION, DIMENSION	Z-AXIS, SAFETY INSTRUMENTED SYSTEM		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

7 Color Definitions

Name	Red	Green	Blue	Hex code	Sample
Light Gray 224	224	224	224	E0E0E0	
Silver 192	192	192	192	C0C0C0	
Dark Gray 63	63	63	63	3F3F3F	
Light Gray 216	216	216	216	D8D8D8	
Gray 160	160	160	160	A0A0A4	
Light Gray 232	232	232	232	E8E8E8	
Magenta	145	106	173	916AAD	
White	255	255	255	FFFFFF	
Yellow	245	225	27	F5E11B	
Orange	236	134	41	EC8629	
Red	266	32	40	E22028	
Black	0	0	0	000000	
Gray	128	128	128	808080	
Off White	240	240	240	F0F0F0	
Light blue	147	194	228	93C2E4	
Light gray 91	145	145	145	919191	
Blue	71	92	167	475CA7	
Light Gray 198	198	198	198	C6C6C6	
Gray 170	170	170	170	AAAAAA	



8 Modulating Valve FB Definition

NAME	USAGE	TYPE	ALIAS FOR	DEFAULT	STYLE	REQ	VIS	DESCRIPTION	EXTERNAL ACCESS
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_PosFdbk	Input	REAL		0	Float	0	1	Position Feedback from Valve (in Raw Input units)	Read/Write
Inp_OpenLS	Input	BOOL		0	Decimal	0	1	Valve Open Limit Switch 1=confirmed fully open	Read/Write
Inp_ClosedLS	Input	BOOL		0	Decimal	0	1	Valve Closed Limit Switch 1=confirmed fully closed	Read/Write
Inp_ActuatorFault	Input	BOOL		0	Decimal	0	1	Valve Actuator Fault (overload, etc.), 0=OK, 1=Fault)	Read/Write
Inp_IntlkOK	Input	BOOL		1	Decimal	0	1	1=Interlocks OK, Pulse Output Valve can be moved	Read/Write
Inp_NBIntlkOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Interlocks OK, Pulse Output Valve can be moved	Read/Write
Inp_IntlkAvail	Input	BOOL		0	Decimal	0	0	1 = Interlock Availability OK	Read/Write
Inp_IOFault	Input	BOOL		0	Decimal	0	0	Input / Output Communication Status 0=OK, 1=fail	Read/Write
Inp_Sim	Input	BOOL		0	Decimal	0	0	1=I/O are being simulated, set output CV to 0.0, ignore I/O Fault	Read/Write
Inp_Hand	Input	BOOL	CmdSrc.Inp_Hand	0	Decimal	0	0	1=Acquire Hand (typ. hardwired local), 0=Release Hand	Read/Write
Inp_Ovrd	Input	BOOL	CmdSrc.Inp_Ovrd	0	Decimal	0	0	1=Acquire Override (higher priority program logic), 0=Release Override	Read/Write
Inp_OvrdCV	Input	REAL		0	Float	0	0	CV target in Override Mode (CV EU)	Read/Write



Inp_ExtInh	Input	BOOL	CmdSrc.Inp_ExtInh	0	Decimal	0	0	1=Inhibit External Acquisition, 0=Allow External Acquisition	Read/Write
Inp_Reset	Input	BOOL		0	Decimal	0	0	1=Reset shed latches and cleared alarms	Read/Write
Cfg_ShedHold	Input	BOOL		0	Decimal	0	0	1=Hold Output on Interlock or bad PV, 0=Go to Cfg_IntlkCV	Read/Write
Cfg_ShedOnIOFault	Input	BOOL		1	Decimal	0	0	1=Take shed action (hold or interlock CV) on I/O Fault	Read/Write
Cfg_SkipRoCLim	Input	BOOL		0	Decimal	0	0	1=Skip RoC Limiting in Intlk, Maint, Ovr modes	Read/Write
Cfg_SetTrack	Input	BOOL		1	Decimal	0	0	1=PSets track OSets in Oper, OSets track PSets in Prog, 0=no tracking	Read/Write
Cfg_SetTrackOvrHand	Input	BOOL		0	Decimal	0	0	1=Prog/Oper Settings track Override/Hand CV	Read/Write
Cfg_HasPosFdbk	Input	BOOL		1	Decimal	0	0	1=Valve provides an analog position feedback, 0=simulate feedback	Read/Write
Cfg_HasOpenLS	Input	BOOL		0	Decimal	0	0	1=Valve provides an Open Limit Switch signal	Read/Write
Cfg_HasClosedLS	Input	BOOL		0	Decimal	0	0	1=Valve provides a Closed Limit Switch signal	Read/Write
Cfg_UseOpenLS	Input	BOOL		0	Decimal	0	0	1=Valve Open LS should be used for open/closed status	Read/Write
Cfg_UseClosedLS	Input	BOOL		0	Decimal	0	0	1=Valve Closed LS should be used for open/closed status	Read/Write
Cfg_LSFail	Input	BOOL		1	Decimal	0	0	1=both switches ON=fail, 0=both switches OFF=fail	Read/Write
Cfg_ClampPosToLS	Input	BOOL		0	Decimal	0	0	1=Clamps Val_Pos to EUMin/Max when on a Limit Switch	Read/Write
Cfg_HasIntlkObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_Intlk is connected to Inp_Intlk	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write



Cfg_HasCVNav	Input	BOOL		0	Decimal	0	0	1=Tells HMI to enable navigation to a connected CV object	Read/Write
Cfg_OvrDIntlk	Input	BOOL		0	Decimal	0	0	1=Override ignores Bypassable Intlk; 0=always use Intlk	Read/Write
Cfg_DecPlcs	Input	DINT		0	Decimal	0	0	Number of decimal places for CV display (0..6)	Read/Write
Cfg_HasIntlkTripAlm	Input	BOOL	IntlkTrip.Cfg_Exists	0	Decimal	0	0	1=Interlock Trip Alarm exists and will be checked	Read/Write
Cfg_HasActuatorFaultAlm	Input	BOOL	ActuatorFault.Cfg_Exists	0	Decimal	0	0	1=Actuator Fault Alarm exists and will be checked	Read/Write
Cfg_HasIOFaultAlm	Input	BOOL	IOFault.Cfg_Exists	0	Decimal	0	0	1=I/O Fault Alarm exists and will be checked	Read/Write
Cfg_IntlkTripResetReqd	Input	BOOL	IntlkTrip.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Interlock Trip Alarm	Read/Write
Cfg_ActuatorFaultResetReqd	Input	BOOL	ActuatorFault.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Actuator Fault Alarm	Read/Write
Cfg_IOFaultResetReqd	Input	BOOL	IOFault.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear I/O Fault Alarm	Read/Write
Cfg_IntlkTripAckReqd	Input	BOOL	IntlkTrip.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Interlock Trip Alarm	Read/Write
Cfg_ActuatorFaultAckReqd	Input	BOOL	ActuatorFault.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Actuator Fault Alarm	Read/Write
Cfg_IOFaultAckReqd	Input	BOOL	IOFault.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for I/O Fault Alarm	Read/Write
Cfg_IntlkTripSeverity	Input	DINT	IntlkTrip.Cfg_Severity	500	Decimal	0	0	Interlock Trip Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_ActuatorFaultSeverity	Input	DINT	ActuatorFault.Cfg_Severity	1000	Decimal	0	0	Actuator Fault Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_IOFaultSeverity	Input	DINT	IOFault.Cfg_Severity	1000	Decimal	0	0	I/O Fault Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_MinCV	Input	REAL		0	Float	0	0	Minimum CV (in CV EU, for limiting)	Read/Write



Cfg_MaxCV	Input	REAL		100	Float	0	0	Maximum CV (in CV EU, for limiting)	Read/Write
Cfg_CVRoCLimInc	Input	REAL		0	Float	0	0	CV Rate of Change Limit, Increasing, (EU/sec, 0=unlimited)	Read/Write
Cfg_CVRoCLimDec	Input	REAL		0	Float	0	0	CV Rate of Change Limit, Decreasing, (EU/sec, 0=unlimited)	Read/Write
Cfg_IntlkCV	Input	REAL		0	Float	0	0	CV (target in EU) when interlocked (if not Cfg_ShedHold)	Read/Write
Cfg_CVEUMin	Input	REAL		0	Float	0	0	CV Minimum in Engineering Units (for scaling)	Read/Write
Cfg_CVEUMax	Input	REAL		100	Float	0	0	CV Maximum in Engineering Units (for scaling)	Read/Write
Cfg_CVRawMin	Input	REAL		0	Float	0	0	CV Minimum in I/O (raw) Units (for scaling)	Read/Write
Cfg_CVRawMax	Input	REAL		100	Float	0	0	CV Maximum in I/O (raw) Units (for scaling)	Read/Write
Cfg_FdbkRawMin	Input	REAL		0	Float	0	0	Position Feedback Minimum in raw input units (for scaling)	Read/Write
Cfg_FdbkRawMax	Input	REAL		100	Float	0	0	Position Feedback Maximum in raw input units (for scaling)	Read/Write
Cfg_CycleT	Input	REAL		10	Float	0	0	Open and Close Pulse Output overall period (s)	Read/Write
Cfg_OpenRate	Input	REAL		1	Float	0	0	Rate at which valve moves when opening (CV EU/sec)	Read/Write
Cfg_CloseRate	Input	REAL		1	Float	0	0	Rate at which valve moves when closing (CV EU/sec)	Read/Write
Cfg_MaxOnT	Input	REAL		5	Float	0	0	Open and Close Pulse Output maximum ON time (s)	Read/Write
Cfg_MinOnT	Input	REAL		1	Float	0	0	Open and Close Pulse Output minimum ON time (s)	Read/Write
Cfg_BumpT	Input	REAL		0	Float	0	0	Time to bump valve open or closed (by Oper) when Fdbk Bad (sec)	Read/Write



Cfg_Deadtime	Input	REAL		0	Float	0	0	Additional time on first pulse after stop or direction change	Read/Write
Cfg_MaxClosedPos	Input	REAL		0	Float	0	0	Position above which valve is assumed open if limit switches not used	Read/Write
PSet_CV	Input	REAL		0	Float	0	0	Program Setting of Controlled Variable (output) (CV EU)	Read/Write
PSet_Owner	Input	DINT		0	Decimal	0	0	Program Owner Request ID (non-zero) or Release (zero)	Read/Write
XSet_CV	Input	REAL		0	Float	0	0	External Setting of Controlled Variable (output) (CV EU)	Read/Write
PCmd_Prog	Input	BOOL	CmdSrc.PCmd_Prog	0	Decimal	0	0	Program Command to select Program (Oper to Prog)	Read/Write
PCmd_Oper	Input	BOOL	CmdSrc.PCmd_Oper	??	Decimal	0	0	Program Command to select Operator (Prog to Oper)	Read/Write
PCmd_Lock	Input	BOOL	CmdSrc.PCmd_Lock	??	Decimal	0	0	Program Command to Lock Program (disallow Operator)	Read/Write
PCmd_Unlock	Input	BOOL	CmdSrc.PCmd_Unlock	??	Decimal	0	0	Program Command to Unlock Program (allow Oper to acquire)	Read/Write
PCmd_Normal	Input	BOOL	CmdSrc.PCmd_Normal	??	Decimal	0	0	Program Command to select Normal (Oper or Prog)	Read/Write
PCmd_Reset	Input	BOOL		??	Decimal	0	0	Program Command to reset shed latches and cleared alarms	Read/Write
PCmd_IntlkTripAck	Input	BOOL	IntlkTrip.PCmd_Ack	??	Decimal	0	0	Program Command to Acknowledge Interlock Trip Alarm	Read/Write
PCmd_IntlkTripSuppress	Input	BOOL	IntlkTrip.PCmd_Suppress	??	Decimal	0	0	Program Command to Suppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnsuppress	Input	BOOL	IntlkTrip.PCmd_Unsuppress	??	Decimal	0	0	Program Command to Unsuppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnshelve	Input	BOOL	IntlkTrip.PCmd_Unshelve	??	Decimal	0	0	Program Command to Unshelve Interlock Trip Alarm	Read/Write
PCmd_ActuatorFaultAck	Input	BOOL	ActuatorFault.PCmd_Ack	??	Decimal	0	0	Program Command to Acknowledge Actuator Fault Alarm	Read/Write



PCmd_ActuatorFaultSuppress	Input	BOOL	ActuatorFault.PCmd_Suppress	??	Decimal	0	0	Program Command to Suppress Actuator Fault Alarm	Read/Write
PCmd_ActuatorFaultUnsuppress	Input	BOOL	ActuatorFault.PCmd_Unsuppress	??	Decimal	0	0	Program Command to Unsuppress Actuator Fault Alarm	Read/Write
PCmd_ActuatorFaultUnshelve	Input	BOOL	ActuatorFault.PCmd_Unshelve	??	Decimal	0	0	Program Command to Unshelve Actuator Fault Alarm	Read/Write
PCmd_IOFaultAck	Input	BOOL	IOFault.PCmd_Ack	??	Decimal	0	0	Program Command to Acknowledge I/O Fault Alarm	Read/Write
PCmd_IOFaultSuppress	Input	BOOL	IOFault.PCmd_Suppress	??	Decimal	0	0	Program Command to Suppress I/O Fault Alarm	Read/Write
PCmd_IOFaultUnsuppress	Input	BOOL	IOFault.PCmd_Unsuppress	??	Decimal	0	0	Program Command to Unsuppress I/O Fault Alarm	Read/Write
PCmd_IOFaultUnshelve	Input	BOOL	IOFault.PCmd_Unshelve	??	Decimal	0	0	Program Command to Unshelve I/O Fault Alarm	Read/Write
MCmd_Rel	Input	BOOL	CmdSrc.MCmd_Rel	??	Decimal	0	0	Maintenance Command to Release (Maint to Oper/Prog/Ovrd)	Read/Write
OCmd_Unlock	Input	BOOL	CmdSrc.OCmd_Unlock	??	Decimal	0	0	Operator Command to Unlock Operator (allow Prog to acquire)	Read/Write
XCmd_Acq	Input	BOOL	CmdSrc.XCmd_Acq	??	Decimal	0	0	External Command to Acquire	Read/Write
XCmd_Rel	Input	BOOL	CmdSrc.XCmd_Rel	??	Decimal	0	0	External Command to Release	Read/Write
XCmd_Reset	Input	BOOL		0	Decimal	0	0	External Command to reset shed latches and cleared alarms	Read/Write
Out_CV	Output	REAL		0	Float	0	1	CV Output in Raw (I/O Card) Units	Read Only
Out_Open	Output	BOOL		0	Decimal	0	1	Pulse Output to drive valve Open	Read Only
Out_Close	Output	BOOL		0	Decimal	0	1	Pulse Output to drive valve closed	Read Only
Val_Pos	Output	REAL		0	Float	0	1	Valve actual position from feedback (CV EU)	Read Only



Val_CVSet	Output	REAL		0	Float	0	1	Value of selected CV Setting (before rate limiting, CV EU)	Read Only
Val_CVOut	Output	REAL		0	Float	0	1	Value of CV output (after clamping and ramping) (CV EU)	Read Only
Val_CVEUMin	Output	REAL		0	Float	0	0	Minimum of scaled range = MIN (Cfg_CVEUMin, Cfg_CVEUMax)	Read Only
Val_CVEUMax	Output	REAL		100	Float	0	0	Maximum of scaled range = MAX (Cfg_CVEUMin, Cfg_CVEUMax)	Read Only
SrcQ_IO	Output	DINT		0	Decimal	0	0	Source and Quality of primary I/O (enumeration)	Read Only
SrcQ	Output	DINT		0	Decimal	0	0	Source and Quality of primary Val/Sts (enumeration)	Read Only
Val_Fdbk	Output	DINT		0	Decimal	0	0	Device Feedback 0=Moving, 1=Closed, 2=Opened, 3=Limit Switch Failure	Read Only
Val_Sts	Output	DINT		0	Decimal	0	0	0=AtTarget, 1=RampClose, 2=RampOpen, 3=Clamp@Min, 4=Clamp@Max, 5=BumpClose, 6=BumpOpen	Read Only
Val_Fault	Output	DINT		0	Decimal	0	0	Device Fault Status 0=none, 32=I/OFault, 34=CfgErr	Read Only
Val_NotifyAll	Output	DINT		0	Decimal	0	0	Highest Alarm prio and ack status this object + channel (enum)	Read Only
Val_UnackAlmC	Output	DINT		0	Decimal	0	0	Count of Unacknowledged Alarms	Read Only
Val_Owner	Output	DINT		0	Decimal	0	0	Current Object Owner ID (0=not owned)	Read Only
Sts_CVInfNaN	Output	BOOL		0	Decimal	0	0	1=Selected CV is Infinite or Not A Number (1.\$, 1.#NaN)	Read Only
Sts_PosInfNaN	Output	BOOL		0	Decimal	0	0	1=Inp_PosFdbk is Infinite or Not A Number (1.\$, 1.#NaN)	Read Only
Sts_BumpOpen	Output	BOOL		0	Decimal	0	0	1=Bump Open Requested or Active	Read Only
Sts_BumpClose	Output	BOOL		0	Decimal	0	0	1=Bump Close Requested or Active	Read Only



Sts_Ramping	Output	BOOL		0	Decimal	0	0	1=CV is ramping to target	Read Only
Sts_Clamped	Output	BOOL		0	Decimal	0	0	1=CV Set is clamped at CVMin or CVMax	Read Only
Sts_SkipRoCLim	Output	BOOL		0	Decimal	0	0	1=Rate of Change Limiting was skipped this scan (Maint, Ovrd, Intlk, Hand)	Read Only
Sts_Active	Output	BOOL		0	Decimal	0	0	1=CV is greater than Cfg_MaxClosedPos, show valve symbol as "opened"	Read Only
Sts_Available	Output	BOOL		0	Decimal	0	0	1=Pulse Output Valve available for control by automation (Prog)	Read Only
Sts_Bypass	Output	BOOL		0	Decimal	0	0	1=Bypassable Interlocks are Bypassed	Read Only
Sts_BypActive	Output	BOOL		0	Decimal	0	0	1=Bypassing Active (Bypassed or Maintenance)	Read Only
Sts_LSFail	Output	BOOL		0	Decimal	0	0	1=Limit Switch Overlap Failure	Read Only
Sts_NotRdy	Output	BOOL		0	Decimal	0	0	1=Device Not Ready, see detail bits for reason	Read Only
Nrdy_CfgErr	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Configuration Error	Read Only
Nrdy_Intlk	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Interlock Not OK	Read Only
Nrdy_IOFault	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: I/O Fault (Shed Requires Reset)	Read Only
Nrdy_OoS	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device is Out of Service	Read Only
Sts_MaintByp	Output	BOOL		0	Decimal	0	0	1=Device has a Maintenance Bypass function active	Read Only
Sts_Almlnh	Output	BOOL		0	Decimal	0	0	1=An Alarm is Disabled or Shelved, display icon	Read Only
Sts_Err	Output	BOOL		0	Decimal	0	1	1=Error in Config: see detail bits for reason	Read Only



Err_Limit	Output	BOOL		0	Decimal	0	0	1=Error in Config: CV Limits swapped	Read Only
Err_EU	Output	BOOL		0	Decimal	0	0	1=Error in Config: Scaled CV EU Min = Max	Read Only
Err_Raw	Output	BOOL		0	Decimal	0	0	1=Error in Config: Raw Output Scaling Min = Max	Read Only
Err_Fdbk	Output	BOOL		0	Decimal	0	0	1=Error in Config: Raw Feedback Scaling Min = Max	Read Only
Err_Timer	Output	BOOL		0	Decimal	0	0	1=Error in Config: Invalid Timer Preset (use 0 to 2147483)	Read Only
Err_Alarm	Output	BOOL		0	Decimal	0	0	1=Error in Config: Alarm Min On Time, Shelf Time, Severity	Read Only
Sts_Hand	Output	BOOL	CmdSrc.Sts_Hand	0	Decimal	0	1	1=Hand is selected (supersedes OoS, Maint, Ovr, Ext, Prog, Oper)	Read Only
Sts_OoS	Output	BOOL	CmdSrc.Sts_OoS	0	Decimal	0	1	1=Out of Service is selected (supersedes Maint, Ovr, Ext, Prog, Oper)	Read Only
Sts_Maint	Output	BOOL	CmdSrc.Sts_Maint	0	Decimal	0	1	1=Maintenance is selected (supersedes Ovr, Ext, Prog, Oper)	Read Only
Sts_Ovr	Output	BOOL	CmdSrc.Sts_Ovr	0	Decimal	0	1	1=Override is selected (supersedes Ext, Prog, Oper)	Read Only
Sts_Ext	Output	BOOL	CmdSrc.Sts_Ext	0	Decimal	0	1	1=External is selected (supersedes Prog, Oper)	Read Only
Sts_Prog	Output	BOOL	CmdSrc.Sts_Prog	0	Decimal	0	1	1=Program is selected	Read Only
Sts_ProgLocked	Output	BOOL	CmdSrc.Sts_ProgLocked	0	Decimal	0	0	1=Program is selected and Locked	Read Only
Sts_Oper	Output	BOOL	CmdSrc.Sts_Oper	0	Decimal	0	1	1=Operator is selected	Read Only
Sts_OperLocked	Output	BOOL	CmdSrc.Sts_OperLocked	0	Decimal	0	0	1=Operator is selected and Locked	Read Only
Sts_Normal	Output	BOOL	CmdSrc.Sts_Normal	0	Decimal	0	0	1=Selection equals the Normal (Prog or Oper)	Read Only



Sts_ExtReqInh	Output	BOOL	CmdSrc.Sts_ExtReqInh	0	Decimal	0	0	1=External request inhibited	Read Only
Sts_ProgReqInh	Output	BOOL	CmdSrc.Sts_ProgReqInh	0	Decimal	0	0	1=Program request inhibited, cannot Get to Program from Current State	Read Only
Sts_MAcqRcvd	Output	BOOL	CmdSrc.Sts_MAcqRcvd	0	Decimal	0	0	1=Maintenance Acquire command received this scan	Read Only
Sts_RdyReset	Output	BOOL	ORdy_Reset	0	Decimal	0	0	1=A latched alarm or shed condition is ready to be reset	Read Only
Sts_RdyAck	Output	BOOL		0	Decimal	0	0	1=An alarm is ready to be acknowledged	Read Only
Sts_IntlkTrip	Output	BOOL	IntlkTrip.Inp	0	Decimal	0	0	1=Status: CV held or forced by interlock NOT OK (1-shot)	Read/Write
Alm_IntlkTrip	Output	BOOL	IntlkTrip.Alm	0	Decimal	0	0	1=Alarm: CV held or forced by interlock NOT OK	Read/Write
Ack_IntlkTrip	Output	BOOL	IntlkTrip.Ack	1	Decimal	0	0	1=Interlock Trip Alarm has been acknowledged	Read/Write
Sts_IntlkTripDisabled	Output	BOOL	IntlkTrip.Disabled	0	Decimal	0	0	1=Interlock Trip Alarm has been Disabled by Maintenance	Read/Write
Sts_IntlkTripShelved	Output	BOOL	IntlkTrip.Shelved	0	Decimal	0	0	1=Interlock Trip Alarm has been Shelved by Operator	Read/Write
Sts_IntlkTripSuppressed	Output	BOOL	IntlkTrip.Suppressed	0	Decimal	0	0	1=Interlock Trip Alarm has been Suppressed by Program	Read/Write
Sts_ActuatorFault	Output	BOOL	ActuatorFault.Inp	0	Decimal	0	0	1=Actuator Fault detected (input)	Read/Write
Alm_ActuatorFault	Output	BOOL	ActuatorFault.Alm	0	Decimal	0	0	1=Alarm: Actuator Fault Detected	Read/Write
Ack_ActuatorFault	Output	BOOL	ActuatorFault.Ack	1	Decimal	0	0	1=Actuator Fault Alarm has been acknowledged	Read/Write
Sts_ActuatorFaultDisabled	Output	BOOL	ActuatorFault.Disabled	0	Decimal	0	0	1=Actuator Fault Alarm has been Disabled by Maintenance	Read/Write
Sts_ActuatorFaultShelved	Output	BOOL	ActuatorFault.Shelved	0	Decimal	0	0	1=Actuator Fault Alarm has been Shelved by Operator	Read/Write



Sts_ActuatorFaultSuppressed	Output	BOOL	ActuatorFault.Suppressed	0	Decimal	0	0	1=Actuator Fault Alarm has been Suppressed by Program	Read/Write
Sts_IOFault	Output	BOOL	IOFault.Inp	0	Decimal	0	0	1=I/O Fault Status (0=OK, 1=Bad)	Read/Write
Alm_IOFault	Output	BOOL	IOFault.Alm	0	Decimal	0	0	1=I/O Fault Alarm	Read/Write
Ack_IOFault	Output	BOOL	IOFault.Ack	1	Decimal	0	0	1=I/O Fault Alarm has been acknowledged	Read/Write
Sts_IOFaultDisabled	Output	BOOL	IOFault.Disabled	0	Decimal	0	0	1=I/O Fault Alarm has been Disabled by Maintenance	Read/Write
Sts_IOFaultShelved	Output	BOOL	IOFault.Shelved	0	Decimal	0	0	1=I/O Fault Alarm has been Shelved by Operator	Read/Write
Sts_IOFaultSuppressed	Output	BOOL	IOFault.Suppressed	0	Decimal	0	0	1=I/O Fault Alarm has been Suppressed by Program	Read/Write
MRdy_Rel	Output	BOOL	CmdSrc.MRdy_Rel	0	Decimal	0	0	1=Ready for MCmd_Rel (enables HMI button)	Read Only
ORdy_Unlock	Output	BOOL	CmdSrc.ORdy_Unlock	0	Decimal	0	0	1=Ready for OCmd_Unlock (enables HMI button)	Read Only
P_ValveC	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



9 Inhibit FB Definition

NAME	USAGE	TYPE	ALIAS FOR	DEFAULT	STYLE	REQ	VIS	DESCRIPTION	EXTERNAL ACCESS
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_Stopped	Input	BOOL		0	Decimal	0	1	Equipment is confirmed Stopped	Read/Write
Inp_Starting	Input	BOOL		0	Decimal	0	1	Equipment is Starting, indicating a start attempt	Read/Write
Inp_Running	Input	BOOL		1	Decimal	0	1	Equipment is confirmed Running	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
Cfg_ThreeColdStarts	Input	REAL		0.5	Float	0	0	Time within which three starts are allowed if cold (hr)	Read/Write
Cfg_FirstFailCold	Input	REAL		0.5	Float	0	0	Time for cold motor to wait after 1st start failure before ready to start (hr)	Read/Write
Cfg_SubseqFailCold	Input	REAL		4	Float	0	0	Time for cold motor to wait after 2nd and subsequent start failure before ready (hr)	Read/Write
Cfg_FirstFailHot	Input	REAL		0.5	Float	0	0	Time for hot motor to wait after 1st start failure before ready to start (hr)	Read/Write
Cfg_SubseqFailHot	Input	REAL		4	Float	0	0	Time for hot motor to wait after 2nd and subsequent start failure before ready (hr)	Read/Write
Cfg_HotRestartOK	Input	REAL		1	Float	0	0	Time for hot motor to run so it can immediately restart after stop (hr)	Read/Write
Cfg_RestartHot	Input	REAL		1	Float	0	0	Time for hot motor to wait after stop if stopped before Hot Restart OK time (hr)	Read/Write
Cfg_HotToCold	Input	REAL		16	Float	0	0	Time for a stopped hot motor to become cold (hr)	Read/Write



Val_MinToReady	Output	DINT		0	Decimal	0	1	Minutes yet inhibited before ready to start (mmm:ss)	Read Only
Val_SecToReady	Output	DINT		0	Decimal	0	1	Seconds yet inhibited before ready to start (mmm:ss)	Read Only
Val_Fdbk	Output	DINT		0	Decimal	0	0	Device Feedback 0=None/Multiple, 1=Stopped, 2=Starting, 3=Running	Read Only
Val_State	Output	DINT		0	Decimal	0	0	State Number (see State Diagram in docs) for HMI	Read Only
Sts_Ready	Output	BOOL		0	Decimal	0	1	Permissive for unit to start 1=ready, 0=not ready	Read Only
Sts_Err	Output	BOOL		0	Decimal	0	1	1=Error in Config: Invalid Time (use 0.0 to 2147483)	Read Only
P_ResInh	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



10 Interlocks FB Definition

NAME	USAGE	TYPE	ALIAS FOR	DEFAULT	STYLE	REQ	VIS	DESCRIPTION	EXTERNAL ACCESS
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_Intlk00	Input	BOOL	Wrk_Inp.0	0	Decimal	0	1	Interlock Cond. 00, Stop if not in configured OK state	Read/Write
Inp_Intlk01	Input	BOOL	Wrk_Inp.1	0	Decimal	0	1	Interlock Cond. 01, Stop if not in configured OK state	Read/Write
Inp_Intlk02	Input	BOOL	Wrk_Inp.2	0	Decimal	0	1	Interlock Cond. 02, Stop if not in configured OK state	Read/Write
Inp_Intlk03	Input	BOOL	Wrk_Inp.3	0	Decimal	0	1	Interlock Cond. 03, Stop if not in configured OK state	Read/Write
Inp_Intlk04	Input	BOOL	Wrk_Inp.4	0	Decimal	0	1	Interlock Cond. 04, Stop if not in configured OK state	Read/Write
Inp_Intlk05	Input	BOOL	Wrk_Inp.5	0	Decimal	0	1	Interlock Cond. 05, Stop if not in configured OK state	Read/Write
Inp_Intlk06	Input	BOOL	Wrk_Inp.6	0	Decimal	0	1	Interlock Cond. 06, Stop if not in configured OK state	Read/Write
Inp_Intlk07	Input	BOOL	Wrk_Inp.7	0	Decimal	0	1	Interlock Cond. 07, Stop if not in configured OK state	Read/Write
Inp_Intlk08	Input	BOOL	Wrk_Inp.8	0	Decimal	0	0	Interlock Cond. 08, Stop if not in configured OK state	Read/Write
Inp_Intlk09	Input	BOOL	Wrk_Inp.9	0	Decimal	0	0	Interlock Cond. 09, Stop if not in configured OK state	Read/Write
Inp_Intlk10	Input	BOOL	Wrk_Inp.10	0	Decimal	0	0	Interlock Cond. 10, Stop if not in configured OK state	Read/Write
Inp_Intlk11	Input	BOOL	Wrk_Inp.11	0	Decimal	0	0	Interlock Cond. 11, Stop if not in configured OK state	Read/Write

Inp_Intlk12	Input	BOOL	Wrk_Inp.12	0	Decimal	0	0	Interlock Cond. 12, Stop if not in configured OK state	Read/Write
Inp_Intlk13	Input	BOOL	Wrk_Inp.13	0	Decimal	0	0	Interlock Cond. 13, Stop if not in configured OK state	Read/Write
Inp_Intlk14	Input	BOOL	Wrk_Inp.14	0	Decimal	0	0	Interlock Cond. 14, Stop if not in configured OK state	Read/Write
Inp_Intlk15	Input	BOOL	Wrk_Inp.15	0	Decimal	0	0	Interlock Cond. 15, Stop if not in configured OK state	Read/Write
Inp_BypActive	Input	BOOL		0	Decimal	0	1	1=Interlock Bypassing is currently active	Read/Write
Inp_LatchDefeat	Input	BOOL		0	Decimal	0	1	Latch Defeat 1=Do not latch inputs even if configured for latching	Read/Write
Inp_Reset	Input	BOOL		0	Decimal	0	1	1=Reset Latched Interlocks that are now OK	Read/Write
Cfg_OKState	Input	INT		2#0000_0000_0000_0000	Binary	0	0	Bits indicate which state (0 or 1) of each input is OK to run	Read/Write
Cfg_Latched	Input	INT		2#0000_0000_0000_0000	Binary	0	0	Set bits indicate which conditions are latched (sealed in)	Read/Write
Cfg_Bypassable	Input	INT		2#0000_0000_0000_0000	Binary	0	0	Set bits indicate which conditions can be bypassed	Read/Write
Cfg_HasNav	Input	INT		2#0000_0000_0000_0000	Binary	0	0	Set bits indicate which Navigation buttons are enabled	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
PCmd_Reset	Input	BOOL		0	Decimal	0	0	Program Command to Reset Latched Interlocks	Read/Write
Sts_IntlkOK	Output	BOOL		1	Decimal	0	1	Overall Interlock Status (1=OK to run, 0=Stop)	Read Only
Sts_NBIntlkOK	Output	BOOL		1	Decimal	0	1	Non-Bypassable Interlock Status (1=All NB Interlocks OK to run)	Read Only
Sts_BypActive	Output	BOOL		0	Decimal	0	0	1=Interlock Bypassing is Active (ignore bypassable interlocks)	Read Only



Sts_RdyReset	Output	BOOL	ORdy_Reset	0	Decimal	0	0	1=A latched interlock (returned to OK) is ready to be reset	Read Only
Sts_Intlk	Output	INT		2#0000_0000_0000_0000	Binary	0	1	Individual Interlock Status (1=Stop, 0=OK)	Read Only
Sts_FirstOut	Output	INT		2#0000_0000_0000_0000	Binary	0	1	Interlock First Out Status (bit 1 is First Not-OK condition)	Read Only
P_Intlk	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



11 P_Ain FB Definition

NAME	USAGE	TYPE	ALIAS FOR	DEFAULT	STYLE	REQ	VIS	DESCRIPTION	EXTERNAL ACCESS
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_RunFdbk	Input	BOOL		0	Decimal	0	1	Input Signal: RUN feedback from motor	Read/Write
Inp_PermOK	Input	BOOL		1	Decimal	0	1	1=Permissives OK, motor can start	Read/Write
Inp_NBPermOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Permissives OK, motor can start	Read/Write
Inp_IntlkOK	Input	BOOL		1	Decimal	0	1	1=Interlocks OK, motor can start/run	Read/Write
Inp_NBIntlkOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Interlocks OK, motor can start/run	Read/Write
Inp_IntlkAvail	Input	BOOL		0	Decimal	0	0	1 = Interlock Availability OK	Read/Write
Inp_OvldNotify	Input	DINT		0	Decimal	0	0	Related Overload object alarm prio and ack status (enum)	Read/Write
Inp_IOFault	Input	BOOL		0	Decimal	0	0	Input Communication Status 0=OK, 1=fail	Read/Write
Inp_Sim	Input	BOOL		0	Decimal	0	0	1=Simulate working motor; 0=Start/Stop/ Monitor actual motor	Read/Write
Inp_Hand	Input	BOOL	CmdSrc.Inp_Hand	0	Decimal	0	0	1=Acquire Hand (typ. hardwired local), 0=Release Hand	Read/Write
Inp_Ovrd	Input	BOOL	CmdSrc.Inp_Ovrd	0	Decimal	0	0	1=Acquire Override (higher priority program logic), 0=Release Override	Read/Write
Inp_OvrdCmd	Input	DINT		0	Decimal	0	0	Override Mode Command: 0=None, 1=Stop, 2=Start	Read/Write



Inp_ExtInh	Input	BOOL	CmdSrc.Inp_ExtInh	0	Decimal	0	0	1=Inhibit External Acquisition, 0=Allow External Acquisition	Read/Write
Inp_HornInh	Input	BOOL		0	Decimal	0	0	1 = Inhibit audible alert, 0 = Allow audible alert	Read/Write
Inp_Reset	Input	BOOL		0	Decimal	0	0	1=Reset Shed Latches and Cleared Alarms	Read/Write
Cfg_HasJog	Input	BOOL		0	Decimal	0	0	1=Motor Jog Command enabled/visible, 0=Motor Jog Command not allowed	Read/Write
Cfg_HasRunFdbk	Input	BOOL		0	Decimal	0	0	1=Motor provides run feedback	Read/Write
Cfg_UseRunFdbk	Input	BOOL		0	Decimal	0	0	1=Motor run feedback should be used for failure checking	Read/Write
Cfg_AllowLocal	Input	BOOL		0	Decimal	0	0	1=Allow Local Start/Stop without alarm, 0=Start/Stop from HMI/prog only	Read/Write
Cfg_HasPermObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to permissive object	Read/Write
Cfg_HasIntlkObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to interlock object	Read/Write
Cfg_HasResInhObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to restart inhibit object	Read/Write
Cfg_HasRunTimeObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to run time object	Read/Write
Cfg_HasOvldObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to overload object	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
Cfg_OperStopPrio	Input	BOOL		0	Decimal	0	0	1=OCmd_Stop any time, 0=OCmd_Stop only when Oper selected	Read/Write
Cfg_ExtStopPrio	Input	BOOL		0	Decimal	0	0	1=XCmd_Stop any time, 0=XCmd_Stop only when Ext selected	Read/Write
Cfg_OCcmdResets	Input	BOOL		0	Decimal	0	0	1=New motor OCcmd resets shed latches and cleared alarms, 0=OCcmdReset req'd.	Read/Write



Cfg_XCmdResets	Input	BOOL		0	Decimal	0	0	1=New motor XCmd resets shed latches and cleared alarms, 0=XCmdReset req'd.	Read/Write
Cfg_OvrdrPermlntlk	Input	BOOL		0	Decimal	0	0	1=Override ignores Bypassable Perm/ Intlk; 0=always use Perm/Intlk	Read/Write
Cfg_ShedOnFailToStart	Input	BOOL		1	Decimal	0	0	1=Stop Motor and Alarm on Fail to Start; 0=Alarm only on Fail to Start	Read/Write
Cfg_ShedOnIOFault	Input	BOOL		1	Decimal	0	0	1=Stop Motor and Alarm on I/O Fault; 0=Alarm only on I/O Fault	Read/Write
Cfg_HasFailToStartAlm	Input	BOOL	FailToStart.Cfg_Exists	0	Decimal	0	0	1=Fail to Start Alarm exists and will be checked	Read/Write
Cfg_HasFailToStopAlm	Input	BOOL	FailToStop.Cfg_Exists	0	Decimal	0	0	1=Fail to Stop Alarm exists and will be checked	Read/Write
Cfg_HasIntlkTripAlm	Input	BOOL	IntlkTrip.Cfg_Exists	0	Decimal	0	0	1=Interlock Trip Alarm exists and will be checked	Read/Write
Cfg_HasIOFaultAlm	Input	BOOL	IOFault.Cfg_Exists	0	Decimal	0	0	1=I/O Fault Alarm exists and will be checked	Read/Write
Cfg_FailToStartResetReqd	Input	BOOL	FailToStart.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Fail to Start Alarm	Read/Write
Cfg_FailToStopResetReqd	Input	BOOL	FailToStop.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Fail to Stop Alarm	Read/Write
Cfg_IntlkTripResetReqd	Input	BOOL	IntlkTrip.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Interlock Trip Alarm	Read/Write
Cfg_IOFaultResetReqd	Input	BOOL	IOFault.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear I/O Fault Alarm	Read/Write
Cfg_FailToStartAckReqd	Input	BOOL	FailToStart.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Fail to Start Alarm	Read/Write
Cfg_FailToStopAckReqd	Input	BOOL	FailToStop.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Fail to Stop Alarm	Read/Write
Cfg_IntlkTripAckReqd	Input	BOOL	IntlkTrip.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Interlock Trip Alarm	Read/Write
Cfg_IOFaultAckReqd	Input	BOOL	IOFault.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for I/O Fault Alarm	Read/Write



Cfg_FailToStartSeverity	Input	DINT	FailToStart.Cfg_Severity	1000	Decimal	0	0	Fail To Start Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_FailToStopSeverity	Input	DINT	FailToStop.Cfg_Severity	1000	Decimal	0	0	Fail To Stop Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_IntlkTripSeverity	Input	DINT	IntlkTrip.Cfg_Severity	500	Decimal	0	0	Interlock Trip Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_IOFaultSeverity	Input	DINT	IOFault.Cfg_Severity	1000	Decimal	0	0	I/O Fault Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_StartHornT	Input	REAL		0	Float	0	0	Time to sound audible on commanded start (sec) (0=disabled)	Read/Write
Cfg_SimFdbkT	Input	REAL		2	Float	0	0	Feedback delay in Simulation (sec)	Read/Write
Cfg_FailToStartT	Input	REAL		10	Float	0	0	Time after Start for running feedback before Fault (sec)	Read/Write
Cfg_FailToStopT	Input	REAL		10	Float	0	0	Time after Stop for stopped feedback (=0) before Fault (sec)	Read/Write
Cfg_MaxJogT	Input	REAL		0	Float	0	0	Maximum jog time (sec, 0=unlimited)	Read/Write
PSet_Owner	Input	DINT		0	Decimal	0	0	Program Owner Request ID (non-zero) or Release (zero)	Read/Write
PCmd_Start	Input	BOOL		0	Decimal	0	0	Program Command to Start Motor	Read/Write
PCmd_Stop	Input	BOOL		0	Decimal	0	0	Program Command to Stop Motor	Read/Write
PCmd_Prog	Input	BOOL	CmdSrc.PCmd_Prog	0	Decimal	0	0	Program Command to select Program (Oper to Prog)	Read/Write
PCmd_Oper	Input	BOOL	CmdSrc.PCmd_Oper	0	Decimal	0	0	Program Command to select Operator (Prog to Oper)	Read/Write



PCmd_Lock	Input	BOOL	CmdSrc.PCmd_Lock	0	Decimal	0	0	Program Command to Lock Program (disallow Operator)	Read/Write
PCmd_Unlock	Input	BOOL	CmdSrc.PCmd_Unlock	0	Decimal	0	0	Program Command to Unlock Program (allow Oper to acquire)	Read/Write
PCmd_Normal	Input	BOOL	CmdSrc.PCmd_Normal	0	Decimal	0	0	Program Command to select Normal (Oper or Prog)	Read/Write
PCmd_Reset	Input	BOOL		0	Decimal	0	0	Program Command to ResetShed Latches and Cleared Alarms	Read/Write
PCmd_FailToStartAck	Input	BOOL	FailToStart.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Fail to Start Alarm	Read/Write
PCmd_FailToStartSuppress	Input	BOOL	FailToStart.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Fail to Start Alarm	Read/Write
PCmd_FailToStartUnsuppress	Input	BOOL	FailToStart.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Fail to Start Alarm	Read/Write
PCmd_FailToStartUnshelve	Input	BOOL	FailToStart.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Fail to Start Alarm	Read/Write
PCmd_FailToStopAck	Input	BOOL	FailToStop.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Fail to Stop Alarm	Read/Write
PCmd_FailToStopSuppress	Input	BOOL	FailToStop.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Fail to Stop Alarm	Read/Write
PCmd_FailToStopUnsuppress	Input	BOOL	FailToStop.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Fail to Stop Alarm	Read/Write
PCmd_FailToStopUnshelve	Input	BOOL	FailToStop.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Fail to Stop Alarm	Read/Write
PCmd_IntlkTripAck	Input	BOOL	IntlkTrip.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Interlock Trip Alarm	Read/Write
PCmd_IntlkTripSuppress	Input	BOOL	IntlkTrip.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnsuppress	Input	BOOL	IntlkTrip.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnshelve	Input	BOOL	IntlkTrip.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Interlock Trip Alarm	Read/Write



PCmd_IOFaultAck	Input	BOOL	IOFault.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge I/O Fault Alarm	Read/Write
PCmd_IOFaultSuppress	Input	BOOL	IOFault.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress I/O Fault Alarm	Read/Write
PCmd_IOFaultUnsuppress	Input	BOOL	IOFault.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress I/O Fault Alarm	Read/Write
PCmd_IOFaultUnshelve	Input	BOOL	IOFault.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve I/O Fault Alarm	Read/Write
MCmd_Rel	Input	BOOL	CmdSrc.MCmd_Rel	0	Decimal	0	0	Maintenance Command to Release (Maint to Oper/Prog/Ovrd)	Read/Write
OCmd_Unlock	Input	BOOL	CmdSrc.OCmd_Unlock	0	Decimal	0	0	Operator Command to Unlock Operator (allow Prog to acquire)	Read/Write
XCmd_Start	Input	BOOL		0	Decimal	0	0	External Command to Start Motor	Read/Write
XCmd_Stop	Input	BOOL		0	Decimal	0	0	External Command to Stop Motor	Read/Write
XCmd_Jog	Input	BOOL		0	Decimal	0	0	External Command to Jog Motor	Read/Write
XCmd_Acq	Input	BOOL	CmdSrc.XCmd_Acq	0	Decimal	0	0	External Command to Acquire	Read/Write
XCmd_Rel	Input	BOOL	CmdSrc.XCmd_Rel	0	Decimal	0	0	External Command to Release	Read/Write
XCmd_Reset	Input	BOOL		0	Decimal	0	0	External Command to reset shed latches and cleared alarms	Read/Write
Out_Run	Output	BOOL		0	Decimal	0	1	1=Run Motor, 0=Stop Motor	Read Only
Out_Start	Output	BOOL		0	Decimal	0	0	1=Start Motor, 0=Motor left in current state	Read Only
Out_Stop	Output	BOOL		0	Decimal	0	0	1=Stop Motor, 0=Motor left in current state	Read Only
Out_Horn	Output	BOOL		0	Decimal	0	1	1=Sound audible prior to commanded motor start	Read Only



SrcQ_IO	Output	DINT		0	Decimal	0	0	Source and Quality of primary I/O (enumeration)	Read Only
SrcQ	Output	DINT		0	Decimal	0	0	Source and Quality of primary Val/Sts (enumeration)	Read Only
Val_Cmd	Output	DINT		0	Decimal	0	0	Device Command 0=None, 1=Stop, 2=Start	Read Only
Val_Fdbk	Output	DINT		0	Decimal	0	0	Device Feedback 0=Stopped, 1=Running	Read Only
Val_Sts	Output	DINT		0	Decimal	0	0	Device Sts: 0=? 1=Stopped 2=RunFwd 3=RunRev 4=RunSlow 5=StartFwd 6=StartRev 7=StartSlow 8=JogFwd 9=JogRev 10=Sopping	Read Only
Val_Fault	Output	DINT		0	Decimal	0	0	Device Fault Status 0=None, 16=Fail to Start, 17 = Fail to Stop, 32=I/O Fault, 34=Config Error	Read Only
Val_NotifyAll	Output	DINT		0	Decimal	0	0	Highest Alarm prio and ack status this object + channel (enum)	Read Only
Val_UnackAlmC	Output	DINT		0	Decimal	0	0	Count of Unacknowledged Alarms	Read Only
Val_Owner	Output	DINT		0	Decimal	0	0	Current Object Owner ID (0=not owned)	Read Only
Sts_Horn	Output	BOOL		0	Decimal	0	0	1=Motor Horn Active	Read Only
Sts_Stopped	Output	BOOL		1	Decimal	0	1	1=Motor requested to stop and is confirmed stopped	Read Only
Sts_Starting	Output	BOOL		0	Decimal	0	1	1=Motor requested to run and awaiting run feedback	Read Only
Sts_Running	Output	BOOL		0	Decimal	0	1	1=Motor requested to run and is confirmed running	Read Only
Sts_Stopping	Output	BOOL		0	Decimal	0	1	1=Motor requested to stop and awaiting stopped feedback	Read Only
Sts_Jogging	Output	BOOL		0	Decimal	0	1	1=Motor requested to Jog	Read Only



Sts_Available	Output	BOOL		0	Decimal	0	0	1=Motor available for control by automation (Prog)	Read Only
Sts_Bypass	Output	BOOL		0	Decimal	0	0	1=Bypassable Interlocks and Permissives are Bypassed	Read Only
Sts_BypActive	Output	BOOL		0	Decimal	0	0	1=Bypassing Active (Bypassed or Maintenance)	Read Only
Sts_NotRdy	Output	BOOL		0	Decimal	0	0	1=Device Not Ready, see detail bits for reason	Read Only
Nrdy_CfgErr	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Configuration Error	Read Only
Nrdy_Fail	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device Failure (Shed Requires Reset)	Read Only
Nrdy_Intlk	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Interlock Not OK	Read Only
Nrdy_IOFault	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: I/O Fault (Shed Requires Reset)	Read Only
Nrdy_OoS	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device is Out of Service	Read Only
Nrdy_Perm	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Permissive Not OK	Read Only
Nrdy_PrioStop	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Oper/Ext Priority Stop Requires Reset	Read Only
Sts_MaintByp	Output	BOOL		0	Decimal	0	0	1=A Maintenance Bypass is Active, display icon	Read Only
Sts_Almlnh	Output	BOOL		0	Decimal	0	0	1=An Alarm is Disabled or Shelved, display icon	Read Only
Sts_Err	Output	BOOL		0	Decimal	0	1	1=Error in Config: see detail bits for reason	Read Only
Err_Timer	Output	BOOL		0	Decimal	0	0	1=Error in Config: Start/Stop Check timer preset (use 0 to 2147483)	Read Only
Err_Sim	Output	BOOL		0	Decimal	0	0	1=Error in Config: Simulation timer preset (use 0 to 2147483)	Read Only



Err_Alarm	Output	BOOL		0	Decimal	0	0	1=Error in Config: Alarm Min On Time, Shelf Time, Severity	Read Only
Sts_Hand	Output	BOOL	CmdSrc.Sts_Hand	0	Decimal	0	1	1=Hand is selected (supersedes OoS, Maint, Ovr, Ext, Prog, Oper)	Read Only
Sts_OoS	Output	BOOL	CmdSrc.Sts_OoS	0	Decimal	0	1	1=Out of Service is selected (supersedes Maint, Ovr, Ext, Prog, Oper)	Read Only
Sts_Maint	Output	BOOL	CmdSrc.Sts_Maint	0	Decimal	0	1	1=Maintenance is selected (supersedes Ovr, Ext, Prog, Oper)	Read Only
Sts_Ovr	Output	BOOL	CmdSrc.Sts_Ovr	0	Decimal	0	1	1=Override is selected (supersedes Ext, Prog, Oper)	Read Only
Sts_Ext	Output	BOOL	CmdSrc.Sts_Ext	0	Decimal	0	1	1=External is selected (supersedes Prog, Oper)	Read Only
Sts_Prog	Output	BOOL	CmdSrc.Sts_Prog	0	Decimal	0	1	1=Program is selected	Read Only
Sts_ProgLocked	Output	BOOL	CmdSrc.Sts_ProgLocked	0	Decimal	0	0	1=Program is selected and Locked	Read Only
Sts_Oper	Output	BOOL	CmdSrc.Sts_Oper	0	Decimal	0	1	1=Operator is selected	Read Only
Sts_OperLocked	Output	BOOL	CmdSrc.Sts_OperLocked	0	Decimal	0	0	1=Operator is selected and Locked	Read Only
Sts_Normal	Output	BOOL	CmdSrc.Sts_Normal	0	Decimal	0	0	1=Selection equals the Normal (Prog or Oper)	Read Only
Sts_ExtReqInh	Output	BOOL	CmdSrc.Sts_ExtReqInh	0	Decimal	0	0	1=External request inhibited	Read Only
Sts_ProgReqInh	Output	BOOL	CmdSrc.Sts_ProgReqInh	0	Decimal	0	0	1=Program request inhibited, cannot Get to Program from Current State	Read Only
Sts_MAcqRcvd	Output	BOOL	CmdSrc.Sts_MAcqRcvd	0	Decimal	0	0	1=Maintenance Acquire command received this scan	Read Only
Sts_RdyReset	Output	BOOL	ORdy_Reset	0	Decimal	0	0	1=A latched alarm or shed condition is ready to be reset	Read Only
Sts_RdyAck	Output	BOOL		0	Decimal	0	0	1=An alarm is ready to be acknowledged	Read Only



Sts_FailToStart	Output	BOOL	FailToStart.Inp	0	Decimal	0	0	1=Motor Failed to Start (one-shot)	Read/Write
Alm_FailToStart	Output	BOOL	FailToStart.Alm	0	Decimal	0	0	1=Motor Fail to Start Alarm	Read/Write
Ack_FailToStart	Output	BOOL	FailToStart.Ack	1	Decimal	0	0	1=Fail to Start Alarm has been acknowledged	Read/Write
Sts_FailToStartDisabled	Output	BOOL	FailToStart.Disabled	0	Decimal	0	0	1=Fail to Start Alarm has been Disabled by Maintenance	Read/Write
Sts_FailToStartShelved	Output	BOOL	FailToStart.Shelved	0	Decimal	0	0	1=Fail to Start Alarm has been Shelved by Operator	Read/Write
Sts_FailToStartSuppressed	Output	BOOL	FailToStart.Suppressed	0	Decimal	0	0	1=Fail to Start Alarm has been Suppressed by Program	Read/Write
Sts_FailToStop	Output	BOOL	FailToStop.Inp	0	Decimal	0	0	1=Motor Failed to Stop	Read/Write
Alm_FailToStop	Output	BOOL	FailToStop.Alm	0	Decimal	0	0	1=Motor Fail to Stop Alarm	Read/Write
Ack_FailToStop	Output	BOOL	FailToStop.Ack	1	Decimal	0	0	1=Fail to Stop Alarm has been acknowledged	Read/Write
Sts_FailToStopDisabled	Output	BOOL	FailToStop.Disabled	0	Decimal	0	0	1=Fail to Stop Alarm has been Disabled by Maintenance	Read/Write
Sts_FailToStopShelved	Output	BOOL	FailToStop.Shelved	0	Decimal	0	0	1=Fail to Stop Alarm has been Shelved by Operator	Read/Write
Sts_FailToStopSuppressed	Output	BOOL	FailToStop.Suppressed	0	Decimal	0	0	1=Fail to Stop Alarm has been Suppressed by Program	Read/Write
Sts_IntlkTrip	Output	BOOL	IntlkTrip.Inp	0	Decimal	0	0	1=Motor stopped by an Interlock NOT OK (one-shot)	Read/Write
Alm_IntlkTrip	Output	BOOL	IntlkTrip.Alm	0	Decimal	0	0	1=Alarm: Motor stopped by an Interlock NOT OK	Read/Write
Ack_IntlkTrip	Output	BOOL	IntlkTrip.Ack	1	Decimal	0	0	1=Interlock Trip Alarm has been acknowledged	Read/Write
Sts_IntlkTripDisabled	Output	BOOL	IntlkTrip.Disabled	0	Decimal	0	0	1=Interlock Trip Alarm has been Disabled by Maintenance	Read/Write



Sts_IntlkTripShelved	Output	BOOL	IntlkTrip.Shelved	0	Decimal	0	0	1=Interlock Trip Alarm has been Shelved by Operator	Read/Write
Sts_IntlkTripSuppressed	Output	BOOL	IntlkTrip.Suppressed	0	Decimal	0	0	1=Interlock Trip Alarm has been Suppressed by Program	Read/Write
Sts_IOFault	Output	BOOL	IOFault.Inp	0	Decimal	0	0	I/O Comm Fault Status (0=OK, 1=Bad)	Read/Write
Alm_IOFault	Output	BOOL	IOFault.Alm	0	Decimal	0	0	1=I/O Fault Alarm	Read/Write
Ack_IOFault	Output	BOOL	IOFault.Ack	1	Decimal	0	0	1=I/O Fault Alarm has been acknowledged	Read/Write
Sts_IOFaultDisabled	Output	BOOL	IOFault.Disabled	0	Decimal	0	0	1=I/O Fault Alarm has been Disabled by Maintenance	Read/Write
Sts_IOFaultShelved	Output	BOOL	IOFault.Shelved	0	Decimal	0	0	1=I/O Fault Alarm has been Shelved by Operator	Read/Write
Sts_IOFaultSuppressed	Output	BOOL	IOFault.Suppressed	0	Decimal	0	0	1=I/O Fault Alarm has been Suppressed by Program	Read/Write
MRdy_Rel	Output	BOOL	CmdSrc.MRdy_Rel	0	Decimal	0	0	1=Ready for MCmd_Rel (enables HMI button)	Read Only
ORdy_Unlock	Output	BOOL	CmdSrc.ORdy_Unlock	0	Decimal	0	0	1=Ready for OCmd_Unlock (enables HMI button)	Read Only
P_Motor	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



12 P_Motor FB Definition

Name	Usage	Data Type	Alias For	Default	Style	Req	Vis	Description	External Access
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_RunFdbk	Input	BOOL		0	Decimal	0	1	Input Signal: RUN feedback from motor	Read/Write
Inp_PermOK	Input	BOOL		1	Decimal	0	1	1=Permissives OK, motor can start	Read/Write
Inp_NBPermOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Permissives OK, motor can start	Read/Write
Inp_IntlkOK	Input	BOOL		1	Decimal	0	1	1=Interlocks OK, motor can start/run	Read/Write
Inp_NBIntlkOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Interlocks OK, motor can start/run	Read/Write
Inp_IntlkAvail	Input	BOOL		0	Decimal	0	0	1 = Interlock Availability OK	Read/Write
Inp_OvldNotify	Input	DINT		0	Decimal	0	0	Related Overload object alarm prio and ack status (enum)	Read/Write
Inp_IOFault	Input	BOOL		0	Decimal	0	0	Input Communication Status 0=OK, 1=fail	Read/Write
Inp_Sim	Input	BOOL		0	Decimal	0	0	1=Simulate working motor; 0=Start/Stop/ Monitor actual motor	Read/Write
Inp_Hand	Input	BOOL	CmdSrc.Inp_Hand	0	Decimal	0	0	1=Acquire Hand (typ. hardwired local), 0=Release Hand	Read/Write
Inp_Ovrd	Input	BOOL	CmdSrc.Inp_Ovrd	0	Decimal	0	0	1=Acquire Override (higher priority program logic), 0=Release Override	Read/Write
Inp_OvrdCmd	Input	DINT		0	Decimal	0	0	Override Mode Command: 0=None, 1=Stop, 2=Start	Read/Write



Inp_ExtInh	Input	BOOL	CmdSrc.Inp_ExtInh	0	Decimal	0	0	1=Inhibit External Acquisition, 0=Allow External Acquisition	Read/Write
Inp_HornInh	Input	BOOL		0	Decimal	0	0	1 = Inhibit audible alert, 0 = Allow audible alert	Read/Write
Inp_Reset	Input	BOOL		0	Decimal	0	0	1=Reset Shed Latches and Cleared Alarms	Read/Write
Cfg_HasJog	Input	BOOL		0	Decimal	0	0	1=Motor Jog Command enabled/visible, 0=Motor Jog Command not allowed	Read/Write
Cfg_HasRunFdbk	Input	BOOL		0	Decimal	0	0	1=Motor provides run feedback	Read/Write
Cfg_UseRunFdbk	Input	BOOL		0	Decimal	0	0	1=Motor run feedback should be used for failure checking	Read/Write
Cfg_AllowLocal	Input	BOOL		0	Decimal	0	0	1=Allow Local Start/Stop without alarm, 0=Start/Stop from HMI/prog only	Read/Write
Cfg_HasPermObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to permissive object	Read/Write
Cfg_HasIntlkObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to interlock object	Read/Write
Cfg_HasResInhObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to restart inhibit object	Read/Write
Cfg_HasRunTimeObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to run time object	Read/Write
Cfg_HasOvldObj	Input	BOOL		0	Decimal	0	0	1=Enable navigation to overload object	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
Cfg_OperStopPrio	Input	BOOL		0	Decimal	0	0	1=OCmd_Stop any time, 0=OCmd_Stop only when Oper selected	Read/Write
Cfg_ExtStopPrio	Input	BOOL		0	Decimal	0	0	1=XCmd_Stop any time, 0=XCmd_Stop only when Ext selected	Read/Write
Cfg_OCmdResets	Input	BOOL		0	Decimal	0	0	1=New motor OCmd resets shed latches and cleared alarms, 0=OCmdReset req'd.	Read/Write



Cfg_XCmdResets	Input	BOOL		0	Decimal	0	0	1=New motor XCmd resets shed latches and cleared alarms, 0=XCmdReset req'd.	Read/Write
Cfg_OvrdrPermlntlk	Input	BOOL		0	Decimal	0	0	1=Override ignores Bypassable Perm/ Intlk; 0=always use Perm/Intlk	Read/Write
Cfg_ShedOnFailToStart	Input	BOOL		1	Decimal	0	0	1=Stop Motor and Alarm on Fail to Start; 0=Alarm only on Fail to Start	Read/Write
Cfg_ShedOnIOFault	Input	BOOL		1	Decimal	0	0	1=Stop Motor and Alarm on I/O Fault; 0=Alarm only on I/O Fault	Read/Write
Cfg_HasFailToStartAlm	Input	BOOL	FailToStart.Cfg_Exists	0	Decimal	0	0	1=Fail to Start Alarm exists and will be checked	Read/Write
Cfg_HasFailToStopAlm	Input	BOOL	FailToStop.Cfg_Exists	0	Decimal	0	0	1=Fail to Stop Alarm exists and will be checked	Read/Write
Cfg_HasIntlkTripAlm	Input	BOOL	IntlkTrip.Cfg_Exists	0	Decimal	0	0	1=Interlock Trip Alarm exists and will be checked	Read/Write
Cfg_HasIOFaultAlm	Input	BOOL	IOFault.Cfg_Exists	0	Decimal	0	0	1=I/O Fault Alarm exists and will be checked	Read/Write
Cfg_FailToStartResetReqd	Input	BOOL	FailToStart.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Fail to Start Alarm	Read/Write
Cfg_FailToStopResetReqd	Input	BOOL	FailToStop.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Fail to Stop Alarm	Read/Write
Cfg_IntlkTripResetReqd	Input	BOOL	IntlkTrip.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Interlock Trip Alarm	Read/Write
Cfg_IOFaultResetReqd	Input	BOOL	IOFault.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear I/O Fault Alarm	Read/Write
Cfg_FailToStartAckReqd	Input	BOOL	FailToStart.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Fail to Start Alarm	Read/Write
Cfg_FailToStopAckReqd	Input	BOOL	FailToStop.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Fail to Stop Alarm	Read/Write
Cfg_IntlkTripAckReqd	Input	BOOL	IntlkTrip.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Interlock Trip Alarm	Read/Write
Cfg_IOFaultAckReqd	Input	BOOL	IOFault.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for I/O Fault Alarm	Read/Write

Cfg_FailToStartSeverity	Input	DINT	FailToStart.Cfg_Severity	1000	Decimal	0	0	Fail To Start Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_FailToStopSeverity	Input	DINT	FailToStop.Cfg_Severity	1000	Decimal	0	0	Fail To Stop Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_IntlkTripSeverity	Input	DINT	IntlkTrip.Cfg_Severity	500	Decimal	0	0	Interlock Trip Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_IOFaultSeverity	Input	DINT	IOFault.Cfg_Severity	1000	Decimal	0	0	I/O Fault Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_StartHornT	Input	REAL		0	Float	0	0	Time to sound audible on commanded start (sec) (0=disabled)	Read/Write
Cfg_SimFdbkT	Input	REAL		2	Float	0	0	Feedback delay in Simulation (sec)	Read/Write
Cfg_FailToStartT	Input	REAL		10	Float	0	0	Time after Start for running feedback before Fault (sec)	Read/Write
Cfg_FailToStopT	Input	REAL		10	Float	0	0	Time after Stop for stopped feedback (=0) before Fault (sec)	Read/Write
Cfg_MaxJogT	Input	REAL		0	Float	0	0	Maximum jog time (sec, 0=unlimited)	Read/Write
PSet_Owner	Input	DINT		0	Decimal	0	0	Program Owner Request ID (non- zero) or Release (zero)	Read/Write
PCmd_Start	Input	BOOL		0	Decimal	0	0	Program Command to Start Motor	Read/Write
PCmd_Stop	Input	BOOL		0	Decimal	0	0	Program Command to Stop Motor	Read/Write
PCmd_Prog	Input	BOOL	CmdSrc.PCmd_Prog	0	Decimal	0	0	Program Command to select Program (Oper to Prog)	Read/Write
PCmd_Oper	Input	BOOL	CmdSrc.PCmd_Oper	0	Decimal	0	0	Program Command to select Operator (Prog to Oper)	Read/Write
PCmd_Lock	Input	BOOL	CmdSrc.PCmd_Lock	0	Decimal	0	0	Program Command to Lock Program (disallow Operator)	Read/Write
PCmd_Unlock	Input	BOOL	CmdSrc.PCmd_Unlock	0	Decimal	0	0	Program Command to Unlock Program (allow Oper to acquire)	Read/Write



PCmd_Normal	Input	BOOL	CmdSrc.PCmd_Normal	0	Decimal	0	0	Program Command to select Normal (Oper or Prog)	Read/Write
PCmd_Reset	Input	BOOL		0	Decimal	0	0	Program Command to ResetShed Latches and Cleared Alarms	Read/Write
PCmd_FailToStartAck	Input	BOOL	FailToStart.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Fail to Start Alarm	Read/Write
PCmd_FailToStartSuppress	Input	BOOL	FailToStart.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Fail to Start Alarm	Read/Write
PCmd_FailToStartUnsuppress	Input	BOOL	FailToStart.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Fail to Start Alarm	Read/Write
PCmd_FailToStartUnshelve	Input	BOOL	FailToStart.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Fail to Start Alarm	Read/Write
PCmd_FailToStopAck	Input	BOOL	FailToStop.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Fail to Stop Alarm	Read/Write
PCmd_FailToStopSuppress	Input	BOOL	FailToStop.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Fail to Stop Alarm	Read/Write
PCmd_FailToStopUnsuppress	Input	BOOL	FailToStop.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Fail to Stop Alarm	Read/Write
PCmd_FailToStopUnshelve	Input	BOOL	FailToStop.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Fail to Stop Alarm	Read/Write
PCmd_IntlkTripAck	Input	BOOL	IntlkTrip.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Interlock Trip Alarm	Read/Write
PCmd_IntlkTripSuppress	Input	BOOL	IntlkTrip.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnsuppress	Input	BOOL	IntlkTrip.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnshelve	Input	BOOL	IntlkTrip.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Interlock Trip Alarm	Read/Write
PCmd_IOFaultAck	Input	BOOL	IOFault.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge I/O Fault Alarm	Read/Write
PCmd_IOFaultSuppress	Input	BOOL	IOFault.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress I/O Fault Alarm	Read/Write



PCmd_IOFaultUnsuppress	Input	BOOL	IOFault.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress I/O Fault Alarm	Read/Write
PCmd_IOFaultUnshelve	Input	BOOL	IOFault.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve I/O Fault Alarm	Read/Write
MCmd_Rel	Input	BOOL	CmdSrc.MCmd_Rel	0	Decimal	0	0	Maintenance Command to Release (Maint to Oper/Prog/Ovrd)	Read/Write
OCmd_Unlock	Input	BOOL	CmdSrc.OCmd_Unlock	0	Decimal	0	0	Operator Command to Unlock Operator (allow Prog to acquire)	Read/Write
XCmd_Start	Input	BOOL		0	Decimal	0	0	External Command to Start Motor	Read/Write
XCmd_Stop	Input	BOOL		0	Decimal	0	0	External Command to Stop Motor	Read/Write
XCmd_Jog	Input	BOOL		0	Decimal	0	0	External Command to Jog Motor	Read/Write
XCmd_Acq	Input	BOOL	CmdSrc.XCmd_Acq	0	Decimal	0	0	External Command to Acquire	Read/Write
XCmd_Rel	Input	BOOL	CmdSrc.XCmd_Rel	0	Decimal	0	0	External Command to Release	Read/Write
XCmd_Reset	Input	BOOL		0	Decimal	0	0	External Command to reset shed latches and cleared alarms	Read/Write
Out_Run	Output	BOOL		0	Decimal	0	1	1=Run Motor, 0=Stop Motor	Read Only
Out_Start	Output	BOOL		0	Decimal	0	0	1=Start Motor, 0=Motor left in current state	Read Only
Out_Stop	Output	BOOL		0	Decimal	0	0	1=Stop Motor, 0=Motor left in current state	Read Only
Out_Horn	Output	BOOL		0	Decimal	0	1	1=Sound audible prior to commanded motor start	Read Only
SrcQ_IO	Output	DINT		0	Decimal	0	0	Source and Quality of primary I/O (enumeration)	Read Only
SrcQ	Output	DINT		0	Decimal	0	0	Source and Quality of primary Val/Sts (enumeration)	Read Only



Val_Cmd	Output	DINT		0	Decimal	0	0	Device Command 0=None, 1=Stop, 2=Start	Read Only
Val_Fdbk	Output	DINT		0	Decimal	0	0	Device Feedback 0=Stopped, 1=Running	Read Only
Val_Sts	Output	DINT		0	Decimal	0	0	Device Sts: 0=? 1=Stopped 2=RunFwd 3=RunRev 4=RunSlow 5=StartFwd 6=StartRev 7=StartSlow 8=JogFwd 9=JogRev 10=Sopping	Read Only
Val_Fault	Output	DINT		0	Decimal	0	0	Device Fault Status 0=None, 16=Fail to Start, 17 = Fail to Stop, 32=I/O Fault, 34=Config Error	Read Only
Val_NotifyAll	Output	DINT		0	Decimal	0	0	Highest Alarm prio and ack status this object + channel (enum)	Read Only
Val_UnackAlmC	Output	DINT		0	Decimal	0	0	Count of Unacknowledged Alarms	Read Only
Val_Owner	Output	DINT		0	Decimal	0	0	Current Object Owner ID (0=not owned)	Read Only
Sts_Horn	Output	BOOL		0	Decimal	0	0	1=Motor Horn Active	Read Only
Sts_Stopped	Output	BOOL		1	Decimal	0	1	1=Motor requested to stop and is confirmed stopped	Read Only
Sts_Starting	Output	BOOL		0	Decimal	0	1	1=Motor requested to run and awaiting run feedback	Read Only
Sts_Running	Output	BOOL		0	Decimal	0	1	1=Motor requested to run and is confirmed running	Read Only
Sts_Stopping	Output	BOOL		0	Decimal	0	1	1=Motor requested to stop and awaiting stopped feedback	Read Only
Sts_Jogging	Output	BOOL		0	Decimal	0	1	1=Motor requested to Jog	Read Only
Sts_Available	Output	BOOL		0	Decimal	0	0	1=Motor available for control by automation (Prog)	Read Only
Sts_Bypass	Output	BOOL		0	Decimal	0	0	1=Bypassable Interlocks and Permissives are Bypassed	Read Only
Sts_BypActive	Output	BOOL		0	Decimal	0	0	1=Bypassing Active (Bypassed or Maintenance)	Read Only



Sts_NotRdy	Output	BOOL		0	Decimal	0	0	1=Device Not Ready, see detail bits for reason	Read Only
Nrdy_CfgErr	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Configuration Error	Read Only
Nrdy_Fail	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device Failure (Shed Requires Reset)	Read Only
Nrdy_Intlk	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Interlock Not OK	Read Only
Nrdy_IOFault	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: I/O Fault (Shed Requires Reset)	Read Only
Nrdy_OoS	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device is Out of Service	Read Only
Nrdy_Perm	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Permissive Not OK	Read Only
Nrdy_PrioStop	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Oper/Ext Priority Stop Requires Reset	Read Only
Sts_MaintByp	Output	BOOL		0	Decimal	0	0	1=A Maintenance Bypass is Active, display icon	Read Only
Sts_Almlnh	Output	BOOL		0	Decimal	0	0	1=An Alarm is Disabled or Shelved, display icon	Read Only
Sts_Err	Output	BOOL		0	Decimal	0	1	1=Error in Config: see detail bits for reason	Read Only
Err_Timer	Output	BOOL		0	Decimal	0	0	1=Error in Config: Start/Stop Check timer preset (use 0 to 2147483)	Read Only
Err_Sim	Output	BOOL		0	Decimal	0	0	1=Error in Config: Simulation timer preset (use 0 to 2147483)	Read Only
Err_Alarm	Output	BOOL		0	Decimal	0	0	1=Error in Config: Alarm Min On Time, Shelf Time, Severity	Read Only
Sts_Hand	Output	BOOL	CmdSrc.Sts_Hand	0	Decimal	0	1	1=Hand is selected (supersedes OoS, Maint, Ovrd, Ext, Prog, Oper)	Read Only
Sts_OoS	Output	BOOL	CmdSrc.Sts_OoS	0	Decimal	0	1	1=Out of Service is selected (supersedes Maint, Ovrd, Ext, Prog, Oper)	Read Only



Sts_Maint	Output	BOOL	CmdSrc.Sts_Maint	0	Decimal	0	1	1=Maintenance is selected (supersedes Ovr, Ext, Prog, Oper)	Read Only
Sts_Ovr	Output	BOOL	CmdSrc.Sts_Ovr	0	Decimal	0	1	1=Override is selected (supersedes Ext, Prog, Oper)	Read Only
Sts_Ext	Output	BOOL	CmdSrc.Sts_Ext	0	Decimal	0	1	1=External is selected (supersedes Prog, Oper)	Read Only
Sts_Prog	Output	BOOL	CmdSrc.Sts_Prog	0	Decimal	0	1	1=Program is selected	Read Only
Sts_ProgLocked	Output	BOOL	CmdSrc.Sts_ProgLocked	0	Decimal	0	0	1=Program is selected and Locked	Read Only
Sts_Oper	Output	BOOL	CmdSrc.Sts_Oper	0	Decimal	0	1	1=Operator is selected	Read Only
Sts_OperLocked	Output	BOOL	CmdSrc.Sts_OperLocked	0	Decimal	0	0	1=Operator is selected and Locked	Read Only
Sts_Normal	Output	BOOL	CmdSrc.Sts_Normal	0	Decimal	0	0	1=Selection equals the Normal (Prog or Oper)	Read Only
Sts_ExtReqInh	Output	BOOL	CmdSrc.Sts_ExtReqInh	0	Decimal	0	0	1=External request inhibited	Read Only
Sts_ProgReqInh	Output	BOOL	CmdSrc.Sts_ProgReqInh	0	Decimal	0	0	1=Program request inhibited, cannot Get to Program from Current State	Read Only
Sts_MAcqRcvd	Output	BOOL	CmdSrc.Sts_MAcqRcvd	0	Decimal	0	0	1=Maintenance Acquire command received this scan	Read Only
Sts_RdyReset	Output	BOOL	ORdy_Reset	0	Decimal	0	0	1=A latched alarm or shed condition is ready to be reset	Read Only
Sts_RdyAck	Output	BOOL		0	Decimal	0	0	1=An alarm is ready to be acknowledged	Read Only
Sts_FailToStart	Output	BOOL	FailToStart.Inp	0	Decimal	0	0	1=Motor Failed to Start (one-shot)	Read/Write
Alm_FailToStart	Output	BOOL	FailToStart.Alm	0	Decimal	0	0	1=Motor Fail to Start Alarm	Read/Write
Ack_FailToStart	Output	BOOL	FailToStart.Ack	1	Decimal	0	0	1=Fail to Start Alarm has been acknowledged	Read/Write



Sts_FailToStartDisabled	Output	BOOL	FailToStart.Disabled	0	Decimal	0	0	1=Fail to Start Alarm has been Disabled by Maintenance	Read/Write
Sts_FailToStartShelved	Output	BOOL	FailToStart.Shelved	0	Decimal	0	0	1=Fail to Start Alarm has been Shelved by Operator	Read/Write
Sts_FailToStartSuppressed	Output	BOOL	FailToStart.Suppressed	0	Decimal	0	0	1=Fail to Start Alarm has been Suppressed by Program	Read/Write
Sts_FailToStop	Output	BOOL	FailToStop.Inp	0	Decimal	0	0	1=Motor Failed to Stop	Read/Write
Alm_FailToStop	Output	BOOL	FailToStop.Alm	0	Decimal	0	0	1=Motor Fail to Stop Alarm	Read/Write
Ack_FailToStop	Output	BOOL	FailToStop.Ack	1	Decimal	0	0	1=Fail to Stop Alarm has been acknowledged	Read/Write
Sts_FailToStopDisabled	Output	BOOL	FailToStop.Disabled	0	Decimal	0	0	1=Fail to Stop Alarm has been Disabled by Maintenance	Read/Write
Sts_FailToStopShelved	Output	BOOL	FailToStop.Shelved	0	Decimal	0	0	1=Fail to Stop Alarm has been Shelved by Operator	Read/Write
Sts_FailToStopSuppressed	Output	BOOL	FailToStop.Suppressed	0	Decimal	0	0	1=Fail to Stop Alarm has been Suppressed by Program	Read/Write
Sts_IntlkTrip	Output	BOOL	IntlkTrip.Inp	0	Decimal	0	0	1=Motor stopped by an Interlock NOT OK (one-shot)	Read/Write
Alm_IntlkTrip	Output	BOOL	IntlkTrip.Alm	0	Decimal	0	0	1=Alarm: Motor stopped by an Interlock NOT OK	Read/Write
Ack_IntlkTrip	Output	BOOL	IntlkTrip.Ack	1	Decimal	0	0	1=Interlock Trip Alarm has been acknowledged	Read/Write
Sts_IntlkTripDisabled	Output	BOOL	IntlkTrip.Disabled	0	Decimal	0	0	1=Interlock Trip Alarm has been Disabled by Maintenance	Read/Write
Sts_IntlkTripShelved	Output	BOOL	IntlkTrip.Shelved	0	Decimal	0	0	1=Interlock Trip Alarm has been Shelved by Operator	Read/Write
Sts_IntlkTripSuppressed	Output	BOOL	IntlkTrip.Suppressed	0	Decimal	0	0	1=Interlock Trip Alarm has been Suppressed by Program	Read/Write
Sts_IOFault	Output	BOOL	IOFault.Inp	0	Decimal	0	0	I/O Comm Fault Status (0=OK, 1=Bad)	Read/Write



Alm_IOFault	Output	BOOL	IOFault.Alm	0	Decimal	0	0	1=I/O Fault Alarm	Read/Write
Ack_IOFault	Output	BOOL	IOFault.Ack	1	Decimal	0	0	1=I/O Fault Alarm has been acknowledged	Read/Write
Sts_IOFaultDisabled	Output	BOOL	IOFault.Disabled	0	Decimal	0	0	1=I/O Fault Alarm has been Disabled by Maintenance	Read/Write
Sts_IOFaultShelved	Output	BOOL	IOFault.Shelved	0	Decimal	0	0	1=I/O Fault Alarm has been Shelved by Operator	Read/Write
Sts_IOFaultSuppressed	Output	BOOL	IOFault.Suppressed	0	Decimal	0	0	1=I/O Fault Alarm has been Suppressed by Program	Read/Write
MRdy_Rel	Output	BOOL	CmdSrc.MRdy_Rel	0	Decimal	0	0	1=Ready for MCmd_Rel (enables HMI button)	Read Only
ORdy_Unlock	Output	BOOL	CmdSrc.ORdy_Unlock	0	Decimal	0	0	1=Ready for OCmd_Unlock (enables HMI button)	Read Only
P_Motor	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



13 P_Intlk FB Definition

Name	Usage	Data Type	Alias For	Default	Style	Req	Vis	Description	External Access
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_Intlk00	Input	BOOL	Wrk_Inp.0	0	Decimal	0	1	Interlock Cond. 00, Stop if not in configured OK state	Read/Write
Inp_Intlk01	Input	BOOL	Wrk_Inp.1	0	Decimal	0	1	Interlock Cond. 01, Stop if not in configured OK state	Read/Write
Inp_Intlk02	Input	BOOL	Wrk_Inp.2	0	Decimal	0	1	Interlock Cond. 02, Stop if not in configured OK state	Read/Write
Inp_Intlk03	Input	BOOL	Wrk_Inp.3	0	Decimal	0	1	Interlock Cond. 03, Stop if not in configured OK state	Read/Write
Inp_Intlk04	Input	BOOL	Wrk_Inp.4	0	Decimal	0	1	Interlock Cond. 04, Stop if not in configured OK state	Read/Write
Inp_Intlk05	Input	BOOL	Wrk_Inp.5	0	Decimal	0	1	Interlock Cond. 05, Stop if not in configured OK state	Read/Write
Inp_Intlk06	Input	BOOL	Wrk_Inp.6	0	Decimal	0	1	Interlock Cond. 06, Stop if not in configured OK state	Read/Write
Inp_Intlk07	Input	BOOL	Wrk_Inp.7	0	Decimal	0	1	Interlock Cond. 07, Stop if not in configured OK state	Read/Write
Inp_Intlk08	Input	BOOL	Wrk_Inp.8	0	Decimal	0	0	Interlock Cond. 08, Stop if not in configured OK state	Read/Write
Inp_Intlk09	Input	BOOL	Wrk_Inp.9	0	Decimal	0	0	Interlock Cond. 09, Stop if not in configured OK state	Read/Write
Inp_Intlk10	Input	BOOL	Wrk_Inp.10	0	Decimal	0	0	Interlock Cond. 10, Stop if not in configured OK state	Read/Write
Inp_Intlk11	Input	BOOL	Wrk_Inp.11	0	Decimal	0	0	Interlock Cond. 11, Stop if not in configured OK state	Read/Write



Inp_Intlk12	Input	BOOL	Wrk_Inp.12	0	Decimal	0	0	Interlock Cond. 12, Stop if not in configured OK state	Read/Write
Inp_Intlk13	Input	BOOL	Wrk_Inp.13	0	Decimal	0	0	Interlock Cond. 13, Stop if not in configured OK state	Read/Write
Inp_Intlk14	Input	BOOL	Wrk_Inp.14	0	Decimal	0	0	Interlock Cond. 14, Stop if not in configured OK state	Read/Write
Inp_Intlk15	Input	BOOL	Wrk_Inp.15	0	Decimal	0	0	Interlock Cond. 15, Stop if not in configured OK state	Read/Write
Inp_BypActive	Input	BOOL		0	Decimal	0	1	1=Interlock Bypassing is currently active	Read/Write
Inp_LatchDefeat	Input	BOOL		0	Decimal	0	1	Latch Defeat 1=Do not latch inputs even if configured for latching	Read/Write
Inp_Reset	Input	BOOL		0	Decimal	0	1	1=Reset Latched Interlocks that are now OK	Read/Write
Cfg_OKState	Input	INT		2#0000_0000_0000_0000	Binary	0	0	Bits indicate which state (0 or 1) of each input is OK to run	Read/Write
Cfg_Latched	Input	INT		2#0000_0000_0000_0000	Binary	0	0	Set bits indicate which conditions are latched (sealed in)	Read/Write
Cfg_Bypassable	Input	INT		2#0000_0000_0000_0000	Binary	0	0	Set bits indicate which conditions can be bypassed	Read/Write
Cfg_HasNav	Input	INT		2#0000_0000_0000_0000	Binary	0	0	Set bits indicate which Navigation buttons are enabled	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
PCmd_Reset	Input	BOOL		0	Decimal	0	0	Program Command to Reset Latched Interlocks	Read/Write
Sts_IntlkOK	Output	BOOL		1	Decimal	0	1	Overall Interlock Status (1=OK to run, 0=Stop)	Read Only
Sts_NBIntlkOK	Output	BOOL		1	Decimal	0	1	Non-Bypassable Interlock Status (1=All NB Interlocks OK to run)	Read Only
Sts_BypActive	Output	BOOL		0	Decimal	0	0	1=Interlock Bypassing is Active (ignore bypassable interlocks)	Read Only



Sts_RdyReset	Output	BOOL	ORdy_Reset	0	Decimal	0	0	1=A latched interlock (returned to OK) is ready to be reset	Read Only
Sts_Intlk	Output	INT		2#0000_0000_0000_0000	Binary	0	1	Individual Interlock Status (1=Stop, 0=OK)	Read Only
Sts_FirstOut	Output	INT		2#0000_0000_0000_0000	Binary	0	1	Interlock First Out Status (bit 1 is First Not-OK condition)	Read Only
P_Intlk	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



14 P_ResInh FB Definition

Name	Usage	Data Type	Alias For	Default	Style	Req	Vis	Description	External Access
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_Stopped	Input	BOOL		0	Decimal	0	1	Equipment is confirmed Stopped	Read/Write
Inp_Starting	Input	BOOL		0	Decimal	0	1	Equipment is Starting, indicating a start attempt	Read/Write
Inp_Running	Input	BOOL		1	Decimal	0	1	Equipment is confirmed Running	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
Cfg_ThreeColdStarts	Input	REAL		0.5	Float	0	0	Time within which three starts are allowed if cold (hr)	Read/Write
Cfg_FirstFailCold	Input	REAL		0.5	Float	0	0	Time for cold motor to wait after 1st start failure before ready to start (hr)	Read/Write
Cfg_SubseqFailCold	Input	REAL		4	Float	0	0	Time for cold motor to wait after 2nd and subsequent start failure before ready (hr)	Read/Write
Cfg_FirstFailHot	Input	REAL		0.5	Float	0	0	Time for hot motor to wait after 1st start failure before ready to start (hr)	Read/Write
Cfg_SubseqFailHot	Input	REAL		4	Float	0	0	Time for hot motor to wait after 2nd and subsequent start failure before ready (hr)	Read/Write
Cfg_HotRestartOK	Input	REAL		1	Float	0	0	Time for hot motor to run so it can immediately restart after stop (hr)	Read/Write
Cfg_RestartHot	Input	REAL		1	Float	0	0	Time for hot motor to wait after stop if stopped before Hot Restart OK time (hr)	Read/Write
Cfg_HotToCold	Input	REAL		16	Float	0	0	Time for a stopped hot motor to become cold (hr)	Read/Write



Val_MinToReady	Output	DINT		0	Decimal	0	1	Minutes yet inhibited before ready to start (mmm:ss)	Read Only
Val_SecToReady	Output	DINT		0	Decimal	0	1	Seconds yet inhibited before ready to start (mmm:ss)	Read Only
Val_Fdbk	Output	DINT		0	Decimal	0	0	Device Feedback 0=None/Multiple, 1=Stopped, 2=Starting, 3=Running	Read Only
Val_State	Output	DINT		0	Decimal	0	0	State Number (see State Diagram in docs) for HMI	Read Only
Sts_Ready	Output	BOOL		0	Decimal	0	1	Permissive for unit to start 1=ready, 0=not ready	Read Only
Sts_Err	Output	BOOL		0	Decimal	0	1	1=Error in Config: Invalid Time (use 0.0 to 2147483)	Read Only
P_ResInh	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



15 P_RunTime FB Definition

Name	Usage	Data Type	Alias For	Default	Style	Req	Vis	Description	External Access
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_Starting	Input	BOOL		0	Decimal	0	1	1=Motor is Starting (from motor instruction)	Read/Write
Inp_Running	Input	BOOL		1	Decimal	0	1	1=Motor is Running (from motor instruction)	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
PCmd_ClearStarts	Input	BOOL		0	Decimal	0	0	Program Command to Clear Count of Starts (attempts)	Read/Write
PCmd_ClearMaxHrs	Input	BOOL		0	Decimal	0	0	Program Command to Clear Maximum (continuous) Run Time for any start	Read/Write
PCmd_ClearTotHrs	Input	BOOL		0	Decimal	0	0	Program Command to Clear Total Running Time	Read/Write
Val_Starts	Output	DINT		0	Decimal	0	1	Total number of motor starts or attempts	Read Only
Val_CurRunHrs	Output	REAL		0	Float	0	1	Current running time this start (hours)	Read Only
Val_MaxRunHrs	Output	REAL		0	Float	0	1	Maximum continuous running time for a given start (hours)	Read Only
Val_TotRunHrs	Output	REAL		0	Float	0	1	Total accumulated running time (hours)	Read Only
P_RunTime	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



16 P_ValveMO FB Definition

Name	Usage	Data Type	Alias For	Default	Style	Req	Vis	Description	External Access
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_OpenLS	Input	BOOL		0	Decimal	0	1	Valve Open Limit Switch 1=confirmed OPEN	Read/Write
Inp_ClosedLS	Input	BOOL		0	Decimal	0	1	Valve Closed Limit Switch 1=confirmed CLOSED	Read/Write
Inp_ActuatorFault	Input	BOOL		0	Decimal	0	1	Valve Actuator Fault (overload, etc.), 0=OK, 1=Fault)	Read/Write
Inp_OpenPermOK	Input	BOOL		1	Decimal	0	1	1=Open Permissives OK, Valve can motor open	Read/Write
Inp_OpenNBPermOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Open Permissives OK, valve can motor open	Read/Write
Inp_ClosePermOK	Input	BOOL		1	Decimal	0	1	1=Close Permissives OK, Valve can motor closed	Read/Write
Inp_CloseNBPermOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Close Permissives OK, valve can motor closed	Read/Write
Inp_IntlkOK	Input	BOOL		1	Decimal	0	1	1=Interlocks (affects Availability) OK, valve can open/close	Read/Write
Inp_NBIntlkOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Interlocks OK, valve can open/close	Read/Write
Inp_IntlkAvail	Input	BOOL		0	Decimal	0	0	1 = Interlock Availability OK	Read/Write
Inp_IOFault	Input	BOOL		0	Decimal	0	0	Input Communication Status 0=OK, 1=fail	Read/Write
Inp_Sim	Input	BOOL		0	Decimal	0	0	1=Simulate working valve; 0=Open/Close/ Monitor actual valve	Read/Write

Inp_Hand	Input	BOOL	CmdSrc.Inp_Hand	0	Decimal	0	0	1=Acquire Hand (typ. hardwired local), 0=Release Hand	Read/Write
Inp_Ovrd	Input	BOOL	CmdSrc.Inp_Ovrd	0	Decimal	0	0	1=Acquire Override (higher priority program logic), 0=Release Override	Read/Write
Inp_OvrdCmd	Input	DINT		0	Decimal	0	0	Override Command 0=None, 1=Close, 2=Open, 3=Stop	Read/Write
Inp_ExtInh	Input	BOOL	CmdSrc.Inp_ExtInh	0	Decimal	0	0	1=Inhibit External Acquisition, 0=Allow External Acquisition	Read/Write
Inp_HornInh	Input	BOOL		0	Decimal	0	0	1 = Inhibit audible alert, 0 = Allow audible alert	Read/Write
Inp_Reset	Input	BOOL		0	Decimal	0	0	1=Reset all fault conditions and latched Alarms	Read/Write
Cfg_HasStop	Input	BOOL		0	Decimal	0	0	1=Stop output can be used to break local seal-in and stop valve motion	Read/Write
Cfg_HasOpenLS	Input	BOOL		0	Decimal	0	0	1=Valve provides an Open Limit Switch signal	Read/Write
Cfg_HasClosedLS	Input	BOOL		0	Decimal	0	0	1=Valve provides a Closed Limit Switch signal	Read/Write
Cfg_UseOpenLS	Input	BOOL		0	Decimal	0	0	1=Valve Open LS should be used for failure checking	Read/Write
Cfg_UseClosedLS	Input	BOOL		0	Decimal	0	0	1=Valve Closed LS should be used for failure checking	Read/Write
Cfg_LSFail	Input	BOOL		0	Decimal	0	0	1=both switches ON=fail, 0=both switches OFF=fail	Read/Write
Cfg_CoastToLS	Input	BOOL		0	Decimal	0	0	1=Coasting into LS when stopped changes state (compat. with 3.5-04), 0=Stop is independent	Read/Write
Cfg_HasIntlkObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_Intlk is connected to Inp_IntlkOK	Read/Write
Cfg_HasOpenPermObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_Perm is connected to Inp_OpenPermOK	Read/Write

Cfg_HasClosePermObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_Perm is connected to Inp_ClosePermOK	Read/Write
Cfg_HasStatsObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_ValveStats is monitoring this valve	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
Cfg_OCcmdResets	Input	BOOL		0	Decimal	0	0	1=New valve OCcmd resets shed latches and cleared alarms, 0=OCcmdReset req'd.	Read/Write
Cfg_XCcmdResets	Input	BOOL		0	Decimal	0	0	1=New Valve XCcmd resets shed latches and cleared alarms, 0=XCcmdReset req'd.	Read/Write
Cfg_OvrPerm	Input	BOOL		0	Decimal	0	0	1=Override ignores Bypassable Perm; 0=always use Perm	Read/Write
Cfg_ShedOnFullStall	Input	BOOL		0	Decimal	0	0	1=Stop Valve and Alarm on Full Stall; 0=Alarm only on Full Stall	Read/Write
Cfg_ShedOnTransitStall	Input	BOOL		0	Decimal	0	0	1=Stop Valve and Alarm on Transit Stall; 0=Alarm only on Transit Stall	Read/Write
Cfg_ShedOnActuatorFault	Input	BOOL		0	Decimal	0	0	1=Stop Valve and Alarm on Actuator Fault; 0=Alarm only on Actuator Fault	Read/Write
Cfg_ShedOnIOFault	Input	BOOL		0	Decimal	0	0	1=Stop Valve and Alarm on I/O Fault; 0=Alarm only on I/O Fault	Read/Write
Cfg_HasFullStallAlm	Input	BOOL	FullStall.Cfg_Exists	0	Decimal	0	0	1=Full Stall Alarm exists and will be checked	Read/Write
Cfg_HasTransitStallAlm	Input	BOOL	TransitStall.Cfg_Exists	0	Decimal	0	0	1=Transit Stall Alarm exists and will be checked	Read/Write
Cfg_HasActuatorFaultAlm	Input	BOOL	ActuatorFault.Cfg_Exists	0	Decimal	0	0	1=Actuator Fault Alarm exists and will be checked	Read/Write
Cfg_HasIOFaultAlm	Input	BOOL	IOFault.Cfg_Exists	0	Decimal	0	0	1=I/O Fault Alarm exists and will be checked	Read/Write
Cfg_HasIntlkTripAlm	Input	BOOL	IntlkTrip.Cfg_Exists	0	Decimal	0	0	1=Interlock Trip Alarm exists and will be checked	Read/Write
Cfg_FullStallResetReqd	Input	BOOL	FullStall.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Full Stall Alarm	Read/Write

Cfg_TransitStallResetReqd	Input	BOOL	TransitStall.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Transit Stall Alarm	Read/Write
Cfg_ActuatorFaultResetReqd	Input	BOOL	ActuatorFault.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Actuator Fault Alarm	Read/Write
Cfg_IOFaultResetReqd	Input	BOOL	IOFault.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear I/O Fault Alarm	Read/Write
Cfg_IntlkTripResetReqd	Input	BOOL	IntlkTrip.Cfg_ResetReqd	1	Decimal	0	0	1=Reset required to clear Interlock Trip Alarm	Read/Write
Cfg_FullStallAckReqd	Input	BOOL	FullStall.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Full Stall Alarm	Read/Write
Cfg_TransitStallAckReqd	Input	BOOL	TransitStall.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Transit Stall Alarm	Read/Write
Cfg_ActuatorFaultAckReqd	Input	BOOL	ActuatorFault.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Actuator Fault Alarm	Read/Write
Cfg_IOFaultAckReqd	Input	BOOL	IOFault.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for I/O Fault Alarm	Read/Write
Cfg_IntlkTripAckReqd	Input	BOOL	IntlkTrip.Cfg_AckReqd	1	Decimal	0	0	1=Acknowledge required for Interlock Trip Alarm	Read/Write
Cfg_FullStallSeverity	Input	DINT	FullStall.Cfg_Severity	1000	Decimal	0	0	Full Stall Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_TransitStallSeverity	Input	DINT	TransitStall.Cfg_Severity	1000	Decimal	0	0	Transit Stall Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_ActuatorFaultSeverity	Input	DINT	ActuatorFault.Cfg_Severity	1000	Decimal	0	0	Actuator Fault Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_IOFaultSeverity	Input	DINT	IOFault.Cfg_Severity	1000	Decimal	0	0	I/O Fault Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write

Cfg_IntlkTripSeverity	Input	DINT	IntlkTrip.Cfg_Severity	1000	Decimal	0	0	Interlock Trip Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_StartHornT	Input	REAL		0	Float	0	0	Time to sound audible on commanded start (sec) (0=disabled)	Read/Write
Cfg_OutPulseT	Input	REAL		5	Float	0	0	Time (in seconds) to pulse valve outputs (0 = outputs maintained ON)	Read/Write
Cfg_SimFdbkT	Input	REAL		20	Float	0	0	Delay to echo back of Open/Closed status when in Simulation (sec)	Read/Write
Cfg_FullStallT	Input	REAL		15	Float	0	0	After command, time with no motion before Fault (sec)	Read/Write
Cfg_TransitStallT	Input	REAL		60	Float	0	0	After command, time to reach position before Fault (sec)	Read/Write
PSet_Owner	Input	DINT		0	Decimal	0	0	Program Owner Request ID (non-zero) or Release (zero)	Read/Write
PCmd_Open	Input	BOOL		0	Decimal	0	0	Program Command to Open Valve	Read/Write
PCmd_Close	Input	BOOL		0	Decimal	0	0	Program Command to Close Valve	Read/Write
PCmd_Stop	Input	BOOL		0	Decimal	0	0	Program Command to Stop Valve Motion	Read/Write
PCmd_Prog	Input	BOOL	CmdSrc.PCmd_Prog	0	Decimal	0	0	Program Command to select Program (Oper to Prog)	Read/Write
PCmd_Oper	Input	BOOL	CmdSrc.PCmd_Oper	0	Decimal	0	0	Program Command to select Operator (Prog to Oper)	Read/Write
PCmd_Lock	Input	BOOL	CmdSrc.PCmd_Lock	0	Decimal	0	0	Program Command to Lock Program (disallow Operator)	Read/Write
PCmd_Unlock	Input	BOOL	CmdSrc.PCmd_Unlock	0	Decimal	0	0	Program Command to Unlock Program (allow Oper to acquire)	Read/Write
PCmd_Normal	Input	BOOL	CmdSrc.PCmd_Normal	0	Decimal	0	0	Program Command to select Normal (Oper or Prog)	Read/Write

PCmd_Reset	Input	BOOL		0	Decimal	0	0	Program Command to clear shed latches and cleared alarms	Read/Write
PCmd_FullStallAck	Input	BOOL	FullStall.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Full Stall Alarm	Read/Write
PCmd_FullStallSuppress	Input	BOOL	FullStall.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Full Stall Alarm	Read/Write
PCmd_FullStallUnsuppress	Input	BOOL	FullStall.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Full Stall Alarm	Read/Write
PCmd_FullStallUnshelve	Input	BOOL	FullStall.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Full Stall Alarm	Read/Write
PCmd_TransitStallAck	Input	BOOL	TransitStall.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Transit Stall Alarm	Read/Write
PCmd_TransitStallSuppress	Input	BOOL	TransitStall.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Transit Stall Alarm	Read/Write
PCmd_TransitStallUnsuppress	Input	BOOL	TransitStall.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Transit Stall Alarm	Read/Write
PCmd_TransitStallUnshelve	Input	BOOL	TransitStall.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Transit Stall Alarm	Read/Write
PCmd_ActuatorFaultAck	Input	BOOL	ActuatorFault.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Actuator Fault Alarm	Read/Write
PCmd_ActuatorFaultSuppress	Input	BOOL	ActuatorFault.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Actuator Fault Alarm	Read/Write
PCmd_ActuatorFaultUnsuppress	Input	BOOL	ActuatorFault.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Actuator Fault Alarm	Read/Write
PCmd_ActuatorFaultUnshelve	Input	BOOL	ActuatorFault.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Actuator Fault Alarm	Read/Write
PCmd_IOFaultAck	Input	BOOL	IOFault.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge I/O Fault Alarm	Read/Write
PCmd_IOFaultSuppress	Input	BOOL	IOFault.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress I/O Fault Alarm	Read/Write
PCmd_IOFaultUnsuppress	Input	BOOL	IOFault.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress I/O Fault Alarm	Read/Write



PCmd_IOFaultUnshelve	Input	BOOL	IOFault.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve I/O Fault Alarm	Read/Write
PCmd_IntlkTripAck	Input	BOOL	IntlkTrip.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Interlock Trip Alarm	Read/Write
PCmd_IntlkTripSuppress	Input	BOOL	IntlkTrip.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnsuppress	Input	BOOL	IntlkTrip.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnshelve	Input	BOOL	IntlkTrip.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Interlock Trip Alarm	Read/Write
MCmd_Rel	Input	BOOL	CmdSrc.MCmd_Rel	0	Decimal	0	0	Maintenance Command to Release (Maint to Oper/Prog/Ovrd)	Read/Write
OCmd_Unlock	Input	BOOL	CmdSrc.OCmd_Unlock	0	Decimal	0	0	Operator Command to Unlock Operator (allow Prog to acquire)	Read/Write
XCmd_Open	Input	BOOL		0	Decimal	0	0	External Command to Open Valve	Read/Write
XCmd_Close	Input	BOOL		0	Decimal	0	0	External Command to Close Valve	Read/Write
XCmd_Stop	Input	BOOL		0	Decimal	0	0	External Command to Stop Valve Motion	Read/Write
XCmd_Acq	Input	BOOL	CmdSrc.XCmd_Acq	0	Decimal	0	0	External Command to Acquire	Read/Write
XCmd_Rel	Input	BOOL	CmdSrc.XCmd_Rel	0	Decimal	0	0	External Command to Release	Read/Write
XCmd_Reset	Input	BOOL		0	Decimal	0	0	External Command to clear shed latches and cleared alarms	Read/Write
Out_Open	Output	BOOL		0	Decimal	0	1	1=Run actuator motor to OPEN Valve	Read Only
Out_Close	Output	BOOL		0	Decimal	0	1	1=Run actuator motor to CLOSE Valve	Read Only
Out_Stop	Output	BOOL		0	Decimal	0	0	1=Break seal-in circuit in actuator to STOP Valve motion	Read Only



Out_Horn	Output	BOOL		0	Decimal	0	1	1=Sound audible prior to commanded motor start	Read Only
SrcQ_IO	Output	DINT		0	Decimal	0	0	Source and Quality of primary I/O (enumeration)	Read Only
SrcQ	Output	DINT		0	Decimal	0	0	Source and Quality of primary Val/Sts (enumeration)	Read Only
Val_Cmd	Output	DINT		0	Decimal	0	0	Device Command 0=None, 1=Close, 2=Open, 3=Stop	Read Only
Val_Fdbk	Output	DINT		0	Decimal	0	0	Device Feedback 0=Moving, 1=Closed, 2=Opened, 3=Limit Switch Failure	Read Only
Val_Sts	Output	DINT		0	Decimal	0	0	Device Confirmed Sts 0=? 1=Closed 2=Open 3=Cmd To Close 4=Cmd to Open 5=Closing 6=Opening 7=Stopped	Read Only
Val_Fault	Output	DINT		0	Decimal	0	0	Device Fault Status 0=None, 16=Transit Stall, 17 = Full Stall, 19=Actuator Fault, 32=I/O Fault, 34=Config Error	Read Only
Val_NotifyAll	Output	DINT		0	Decimal	0	0	Highest Alarm prio and ack status this object + channel (enum)	Read Only
Val_UnackAlmC	Output	DINT		0	Decimal	0	0	Count of Unacknowledged Alarms	Read Only
Val_Owner	Output	DINT		0	Decimal	0	0	Current Object Owner ID (0=not owned)	Read Only
Sts_Closed	Output	BOOL		0	Decimal	0	1	1=Valve requested to Close and is confirmed Closed	Read Only
Sts_CmdToOpen	Output	BOOL		0	Decimal	0	1	1=Valve commanded to Open, has not yet moved off Open LS	Read Only
Sts_Opening	Output	BOOL		0	Decimal	0	1	1=Valve requested to open and awaiting open feedback	Read Only
Sts_Opened	Output	BOOL		0	Decimal	0	1	1=Valve requested to open and is confirmed Opened	Read Only
Sts_CmdToClose	Output	BOOL		0	Decimal	0	1	1=Valve commanded to Close, has not yet moved off Closed LS	Read Only



Sts_Closing	Output	BOOL		0	Decimal	0	1	1=Valve requested to Close and awaiting Closed feedback	Read Only
Sts_Stopped	Output	BOOL		0	Decimal	0	0	1=Valve requested to Stop and is not at either end of travel	Read Only
Sts_Horn	Output	BOOL		0	Decimal	0	0	1=Valve Horn Active	Read Only
Sts_Available	Output	BOOL		0	Decimal	0	0	1=Valve available for control by automation (Prog)	Read Only
Sts_Bypass	Output	BOOL		0	Decimal	0	0	1=Bypassable Interlocks and Permissives are Bypassed	Read Only
Sts_BypActive	Output	BOOL		0	Decimal	0	0	1=Bypassing Active (Bypassed or Maintenance)	Read Only
Sts_LSFail	Output	BOOL		0	Decimal	0	0	1=Limit Switch Overlap Failure	Read Only
Sts_NotRdy	Output	BOOL		0	Decimal	0	0	1=Device Not Ready, see detail bits for reason	Read Only
Nrdy_CfgErr	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Configuration Error	Read Only
Nrdy_EqpFault	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: External Equipment Fault (Fault or Shed Requires Reset)	Read Only
Nrdy_Fail	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device Failure (Shed Requires Reset)	Read Only
Nrdy_IOFault	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: I/O Fault (Shed Requires Reset)	Read Only
Nrdy_OoS	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device is Out of Service	Read Only
Nrdy_Perm	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Permissive Not OK	Read Only
Nrdy_Intlk	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Interlock Not OK	Read Only
Sts_MaintByp	Output	BOOL		0	Decimal	0	0	1=A Maintenance Bypass is Active, display icon	Read Only



Sts_Almlnh	Output	BOOL		0	Decimal	0	0	1=An Alarm is Disabled or Shelved, display icon	Read Only
Sts_Err	Output	BOOL		0	Decimal	0	1	1=Error in Config: see detail bits for reason	Read Only
Err_Timer	Output	BOOL		0	Decimal	0	0	1=Error in Config: Invalid Check or Pulse Time (use 0 to 2147483)	Read Only
Err_Sim	Output	BOOL		0	Decimal	0	0	1=Error in Config: Simulation timer preset (use 0 to 2147483)	Read Only
Err_Alarm	Output	BOOL		0	Decimal	0	0	1=Error in Config: Alarm Min On Time, Shelf Time, Severity	Read Only
Sts_Hand	Output	BOOL	CmdSrc.Sts_Hand	0	Decimal	0	1	1=Hand is selected (supersedes OoS, Maint, Ovr, Ext, Prog, Oper)	Read Only
Sts_OoS	Output	BOOL	CmdSrc.Sts_OoS	0	Decimal	0	1	1=Out of Service is selected (supersedes Maint, Ovr, Ext, Prog, Oper)	Read Only
Sts_Maint	Output	BOOL	CmdSrc.Sts_Maint	0	Decimal	0	1	1=Maintenance is selected (supersedes Ovr, Ext, Prog, Oper)	Read Only
Sts_Ovr	Output	BOOL	CmdSrc.Sts_Ovr	0	Decimal	0	1	1=Override is selected (supersedes Ext, Prog, Oper)	Read Only
Sts_Ext	Output	BOOL	CmdSrc.Sts_Ext	0	Decimal	0	1	1=External is selected (supersedes Prog, Oper)	Read Only
Sts_Prog	Output	BOOL	CmdSrc.Sts_Prog	0	Decimal	0	1	1=Program is selected	Read Only
Sts_ProgLocked	Output	BOOL	CmdSrc.Sts_ProgLocked	0	Decimal	0	0	1=Program is selected and Locked	Read Only
Sts_Oper	Output	BOOL	CmdSrc.Sts_Oper	0	Decimal	0	1	1=Operator is selected	Read Only
Sts_OperLocked	Output	BOOL	CmdSrc.Sts_OperLocked	0	Decimal	0	0	1=Operator is selected and Locked	Read Only
Sts_Normal	Output	BOOL	CmdSrc.Sts_Normal	0	Decimal	0	0	1=Selection equals the Normal (Prog or Oper)	Read Only
Sts_ExtReqInh	Output	BOOL	CmdSrc.Sts_ExtReqInh	0	Decimal	0	0	1=External request inhibited	Read Only



Sts_ProgReqInh	Output	BOOL	CmdSrc.Sts_ProgReqInh	0	Decimal	0	0	1=Program request inhibited, cannot Get to Program from Current State	Read Only
Sts_MAcqRcvd	Output	BOOL	CmdSrc.Sts_MAcqRcvd	0	Decimal	0	0	1=Maintenance Acquire command received this scan	Read Only
Sts_RdyReset	Output	BOOL	ORdy_Reset	0	Decimal	0	0	1=A latched alarm or shed condition is ready to be reset	Read Only
Sts_RdyAck	Output	BOOL		0	Decimal	0	0	1=An alarm is ready to be acknowledged	Read Only
Sts_FullStall	Output	BOOL	FullStall.Inp	0	Decimal	0	0	1=Valve Full Stall (failed to move at all) (One-Shot)	Read/Write
Alm_FullStall	Output	BOOL	FullStall.Alm	0	Decimal	0	0	1=Valve Full Stall (failed to move at all) Alarm	Read/Write
Ack_FullStall	Output	BOOL	FullStall.Ack	1	Decimal	0	0	1=Full Stall Alarm has been acknowledged	Read/Write
Sts_FullStallDisabled	Output	BOOL	FullStall.Disabled	0	Decimal	0	0	1=Full Stall Alarm has been Disabled by Maintenance	Read/Write
Sts_FullStallShelved	Output	BOOL	FullStall.Shelved	0	Decimal	0	0	1=Full Stall Alarm has been Shelved by Operator	Read/Write
Sts_FullStallSuppressed	Output	BOOL	FullStall.Suppressed	0	Decimal	0	0	1=Full Stall Alarm has been Suppressed by Program	Read/Write
Sts_TransitStall	Output	BOOL	TransitStall.Inp	0	Decimal	0	0	1=Valve Transit Stall (did not reach target position) (One-Shot)	Read/Write
Alm_TransitStall	Output	BOOL	TransitStall.Alm	0	Decimal	0	0	1=Valve Transit Stall (did not reach target pos.) Alarm	Read/Write
Ack_TransitStall	Output	BOOL	TransitStall.Ack	1	Decimal	0	0	1=Transit Stall Alarm has been acknowledged	Read/Write
Sts_TransitStallDisabled	Output	BOOL	TransitStall.Disabled	0	Decimal	0	0	1=Transit Stall Alarm has been Disabled by Maintenance	Read/Write
Sts_TransitStallShelved	Output	BOOL	TransitStall.Shelved	0	Decimal	0	0	1=Transit Stall Alarm has been Shelved by Operator	Read/Write
Sts_TransitStallSuppressed	Output	BOOL	TransitStall.Suppressed	0	Decimal	0	0	1=Transit Stall Alarm has been Suppressed by Program	Read/Write

Sts_ActuatorFault	Output	BOOL	ActuatorFault.Inp	0	Decimal	0	0	1=Actuator Fault detected (input)	Read/Write
Alm_ActuatorFault	Output	BOOL	ActuatorFault.Alm	0	Decimal	0	0	1=Alarm: Actuator Fault Detected	Read/Write
Ack_ActuatorFault	Output	BOOL	ActuatorFault.Ack	1	Decimal	0	0	1=Actuator Fault Alarm has been acknowledged	Read/Write
Sts_ActuatorFaultDisabled	Output	BOOL	ActuatorFault.Disabled	0	Decimal	0	0	1=Actuator Fault Alarm has been Disabled by Maintenance	Read/Write
Sts_ActuatorFaultShelved	Output	BOOL	ActuatorFault.Shelved	0	Decimal	0	0	1=Actuator Fault Alarm has been Shelved by Operator	Read/Write
Sts_ActuatorFaultSuppressed	Output	BOOL	ActuatorFault.Suppressed	0	Decimal	0	0	1=Actuator Fault Alarm has been Suppressed by Program	Read/Write
Sts_IOFault	Output	BOOL	IOFault.Inp	0	Decimal	0	0	I/O Comm Fault Status (0=OK, 1=Bad)	Read/Write
Alm_IOFault	Output	BOOL	IOFault.Alm	0	Decimal	0	0	1=I/O Fault Alarm	Read/Write
Ack_IOFault	Output	BOOL	IOFault.Ack	1	Decimal	0	0	1=I/O Fault Alarm has been acknowledged	Read/Write
Sts_IOFaultDisabled	Output	BOOL	IOFault.Disabled	0	Decimal	0	0	1=I/O Fault Alarm has been Disabled by Maintenance	Read/Write
Sts_IOFaultShelved	Output	BOOL	IOFault.Shelved	0	Decimal	0	0	1=I/O Fault Alarm has been Shelved by Operator	Read/Write
Sts_IOFaultSuppressed	Output	BOOL	IOFault.Suppressed	0	Decimal	0	0	1=I/O Fault Alarm has been Suppressed by Program	Read/Write
Sts_IntlkTrip	Output	BOOL	IntlkTrip.Inp	0	Decimal	0	0	1=Valve stopped by an Interlock NOT OK (one-shot)	Read/Write
Ack_IntlkTrip	Output	BOOL	IntlkTrip.Ack	1	Decimal	0	0	1=Interlock Trip Alarm has been acknowledged	Read/Write
Alm_IntlkTrip	Output	BOOL	IntlkTrip.Alm	0	Decimal	0	0	1=Interlock Trip Alarm	Read/Write
Sts_IntlkTripDisabled	Output	BOOL	IntlkTrip.Disabled	0	Decimal	0	0	1=Interlock Trip Alarm has been Disabled by Maintenance	Read/Write



Sts_IntlkTripShelved	Output	BOOL	IntlkTrip.Shelved	0	Decimal	0	0	1=Interlock Trip Alarm has been Shelved by Operator	Read/Write
Sts_IntlkTripSuppressed	Output	BOOL	IntlkTrip.Suppressed	0	Decimal	0	0	1=Interlock Trip Alarm has been Suppressed by Program	Read/Write
MRdy_Rel	Output	BOOL	CmdSrc.MRdy_Rel	0	Decimal	0	0	1=Ready for MCmd_Rel (enables HMI button)	Read Only
ORdy_Unlock	Output	BOOL	CmdSrc.ORdy_Unlock	0	Decimal	0	0	1=Ready for OCmd_Unlock (enables HMI button)	Read Only
P_ValveMO	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



17 P_ValveStats FB Definition

Name	Usage	Data Type	Alias For	Default	Style	Req	Vis	Description	External Access
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_Closed	Input	BOOL		0	Decimal	0	1	1=Valve is confirmed Closed (from valve instruction)	Read/Write
Inp_Opened	Input	BOOL		0	Decimal	0	1	1=Valve is confirmed Opened (from valve instruction)	Read/Write
Inp_StopOther	Input	BOOL		0	Decimal	0	0	1=Valve is confirmed Stopped / Other (from valve instruction)	Read/Write
Cfg_HasStopOther	Input	BOOL		0	Decimal	0	0	1=Valve has Stopped or other state(s) to be monitored	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
Cfg_SlowOpenT	Input	REAL		10	Float	0	0	Maximum Time Opening (sec) before raising Sts_SlowOpen	Read/Write
Cfg_SlowCloseT	Input	REAL		10	Float	0	0	Maximum Time Closing (sec) before raising Sts_SlowClose	Read/Write
PCmd_ClearTotTimes	Input	BOOL		0	Decimal	0	0	Program Command to Clear Total Time statistics	Read/Write
PCmd_ClearMaxTimes	Input	BOOL		0	Decimal	0	0	Program Command to Clear Maximum Time statistics	Read/Write
PCmd_ClearStrokeCounts	Input	BOOL		0	Decimal	0	0	Program Command to Clear Stroke Count statistics	Read/Write
PCmd_ClearSlowCounts	Input	BOOL		0	Decimal	0	0	Program Command to Clear Valve Slow Count statistics	Read/Write
PCmd_ClearMAvgs	Input	BOOL		0	Decimal	0	0	Program Command to Clear Moving Average Stroke Times	Read/Write



Val_CurrClosedT	Output	REAL		0	Float	0	1	Current time in Closed state (sec)	Read Only
Val_LastClosedT	Output	REAL		0	Float	0	1	Time in Closed state (sec) last time valve was closed	Read Only
Val_TotClosedT	Output	REAL		0	Float	0	1	Accumulated time in Closed state (hours)	Read Only
Val_MaxClosedT	Output	REAL		0	Float	0	1	Maximum time in Closed state (hours) of any occurrence	Read Only
Val_CurrOpeningT	Output	REAL		0	Float	0	1	Current time in Opening state (sec)	Read Only
Val_LastOpeningT	Output	REAL		0	Float	0	1	Time in Opening state (sec) last time valve was opening	Read Only
Val_TotOpeningT	Output	REAL		0	Float	0	1	Accumulated time in Opening state (hours)	Read Only
Val_MaxOpeningT	Output	REAL		0	Float	0	1	Maximum time in Opening state (sec) of any occurrence	Read Only
Val_MAvgOpeningT	Output	REAL		0	Float	0	1	Moving average Open stroke time, last 10 complete open strokes (sec)	Read Only
Val_CurrOpenedT	Output	REAL		0	Float	0	1	Current time in Opened state (sec)	Read Only
Val_LastOpenedT	Output	REAL		0	Float	0	1	Time in Opened state (sec) last time valve was opened	Read Only
Val_TotOpenedT	Output	REAL		0	Float	0	1	Accumulated time in Opened state (hours)	Read Only
Val_MaxOpenedT	Output	REAL		0	Float	0	1	Maximum time in Opened state (hours) of any occurrence	Read Only
Val_CurrClosingT	Output	REAL		0	Float	0	1	Current time in Closing state (sec)	Read Only
Val_LastClosingT	Output	REAL		0	Float	0	1	Time in Closing state (sec) last time valve was closing	Read Only
Val_TotClosingT	Output	REAL		0	Float	0	1	Accumulated time in Closing state (hours)	Read Only



Val_MaxClosingT	Output	REAL		0	Float	0	1	Maximum time in Closing state (sec) of any occurrence	Read Only
Val_MAvgClosingT	Output	REAL		0	Float	0	1	Moving average Close stroke time, last 10 complete close strokes (sec)	Read Only
Val_CurrStopOtherT	Output	REAL		0	Float	0	0	Current time in Stopped / Other state (sec)	Read Only
Val_LastStopOtherT	Output	REAL		0	Float	0	0	Time in Stopped / Other state (sec) last time valve was stopped (or other)	Read Only
Val_TotStopOtherT	Output	REAL		0	Float	0	0	Accumulated time in Stopped / Other state (hours)	Read Only
Val_MaxStopOtherT	Output	REAL		0	Float	0	0	Maximum time in Stopped / Other state (hours) of any occurrence	Read Only
Val_CpltOpenC	Output	DINT		0	Decimal	0	1	Count of complete valve Open strokes (Closed to Opened)	Read Only
Val_CpltCloseC	Output	DINT		0	Decimal	0	1	Count of complete valve Close strokes (Opened to Closed)	Read Only
Val_IncpltOpenC	Output	DINT		0	Decimal	0	1	Count of incomplete valve Open strokes (Closed - Moving - Closed)	Read Only
Val_IncpltCloseC	Output	DINT		0	Decimal	0	1	Count of incomplete valve Close strokes (Opened - Moving - Opened)	Read Only
Val_StopOtherC	Output	DINT		0	Decimal	0	0	Count of valve Stopped / Other occurrences	Read Only
Val_SlowOpenC	Output	DINT		0	Decimal	0	1	Count of valve Slow to Open occurrences	Read Only
Val_SlowCloseC	Output	DINT		0	Decimal	0	1	Count of valve Slow to Close occurrences	Read Only
Sts_SlowOpen	Output	BOOL		0	Decimal	0	1	1=Last Closed to Opened stroke exceeded configured time threshold	Read Only
Sts_SlowClose	Output	BOOL		0	Decimal	0	1	1=Last Opened to Closed stroke exceeded configured time threshold	Read Only
Sts_Err	Output	BOOL		0	Decimal	0	1	1=Configuration Error: invalid Slow Open Time or Slow Close Time	Read Only



P_ValveStats	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



18 Run Time FB Definition

NAME	USAGE	TYPE	ALIAS FOR	DEFAULT	STYLE	REQ	VIS	DESCRIPTION	EXTERNAL ACCESS
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Inp_Starting	Input	BOOL		0	Decimal	0	1	1=Motor is Starting (from motor instruction)	Read/Write
Inp_Running	Input	BOOL		1	Decimal	0	1	1=Motor is Running (from motor instruction)	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
PCmd_ClearStarts	Input	BOOL		0	Decimal	0	0	Program Command to Clear Count of Starts (attempts)	Read/Write
PCmd_ClearMaxHrs	Input	BOOL		0	Decimal	0	0	Program Command to Clear Maximum (continuous) Run Time for any start	Read/Write
PCmd_ClearTotHrs	Input	BOOL		0	Decimal	0	0	Program Command to Clear Total Running Time	Read/Write
Val_Starts	Output	DINT		0	Decimal	0	1	Total number of motor starts or attempts	Read Only
Val_CurRunHrs	Output	REAL		0	Float	0	1	Current running time this start (hours)	Read Only
Val_MaxRunHrs	Output	REAL		0	Float	0	1	Maximum continuous running time for a given start (hours)	Read Only
Val_TotRunHrs	Output	REAL		0	Float	0	1	Total accumulated running time (hours)	Read Only
P_RunTime	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write



19 VSD FB Definition

NAME	USAGE	TYPE	ALIAS FOR	DEFAULT	STYLE	REQ	VIS	DESCRIPTION	EXTERNAL ACCESS
EnableIn	Input	BOOL		1	Decimal	0	0	Enable Input - System Defined Parameter	Read Only
EnableOut	Output	BOOL		0	Decimal	0	0	Enable Output - System Defined Parameter	Read Only
Ref_FaultCodeList	InOut	P_DescList[1]				1	1	Tag containing List of Fault Codes (DINT) and their Descriptions (STRING)	
Inp_SpeedFdbk	Input	REAL		0	Float	0	1	Speed Feedbak in Drive Units (typ. 0-32767 = 0 to max freq.)	Read/Write
Inp_LastFaultCode	Input	DINT		0	Decimal	0	1	Most recent drive fault code (enumeration)	Read/Write
Inp_Datalink	Input	REAL		0	Float	0	0	Auxiliary Signal (datalink) Input in Drive (raw) Units	Read/Write
Inp_Ready	Input	BOOL		1	Decimal	0	1	1=Drive is ready to run	Read/Write
Inp_Running	Input	BOOL		0	Decimal	0	1	1=Drive is Running (active)	Read/Write
Inp_CommandDir	Input	BOOL		1	Decimal	0	1	1=Drive is commanded Forward, 0=Drive is commanded Reverse	Read/Write
Inp_ActualDir	Input	BOOL		1	Decimal	0	1	1=Drive is running Forward, 0=Drive is running Reverse	Read/Write
Inp_Accelerating	Input	BOOL		0	Decimal	0	1	1=Drive is accelerating	Read/Write
Inp_Decelerating	Input	BOOL		0	Decimal	0	1	1=Drive is decelerating	Read/Write
Inp_Alarm	Input	BOOL		0	Decimal	0	1	1=Drive has an Alarm Condition (see drive display or manual)	Read/Write



Inp_Faulted	Input	BOOL		0	Decimal	0	1	1=Drive has Faulted (see drive display or manual)	Read/Write
Inp_AtSpeed	Input	BOOL		0	Decimal	0	1	1=Drive is at commanded speed	Read/Write
Inp_FwdPermOK	Input	BOOL		1	Decimal	0	1	1=Permissives OK, drive can start Forward	Read/Write
Inp_FwdNBPermOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Permissives OK, drive can start Forward	Read/Write
Inp_RevPermOK	Input	BOOL		1	Decimal	0	1	1=Permissives OK, drive can start Reverse	Read/Write
Inp_RevNBPermOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Permissives OK, motor can start Reverse	Read/Write
Inp_IntlkOK	Input	BOOL		1	Decimal	0	1	1=Interlocks OK, drive can start/run	Read/Write
Inp_NBIntlkOK	Input	BOOL		1	Decimal	0	1	1=Non-Bypassable Interlocks OK, drive can start/run	Read/Write
Inp_IntlkAvail	Input	BOOL		0	Decimal	0	0	1 = Interlock Availability OK	Read/Write
Inp_IOFault	Input	BOOL		0	Decimal	0	0	Input Communication Status 0=OK, 1=fail	Read/Write
Inp_Sim	Input	BOOL		0	Decimal	0	0	1=Simulate working drive; 0=Start/Stop/Monitor actual drive	Read/Write
Inp_Hand	Input	BOOL	CmdSrc.Inp_Hand	0	Decimal	0	0	1=Acquire Hand (typ. hardwired local), 0=Release Hand	Read/Write
Inp_Ovrd	Input	BOOL	CmdSrc.Inp_Ovrd	0	Decimal	0	0	1=Acquire Override (higher priority program logic), 0=Release Override	Read/Write
Inp_OvrdCmd	Input	DINT		0	Decimal	0	0	Override Command: 0=None, 1=Stop, 2=Start Fwd 3=Start Rev	Read/Write
Inp_OvrdSpeed	Input	REAL		0	Float	0	0	Value to set Speed Reference in Override Mode (SpeedRef EU)	Read/Write



Inp_OvrdOutDatalink	Input	REAL		0	Float	0	0	Value to set Output Datalink in Override Mode (OutDatalink EU)	Read/Write
Inp_ExtInh	Input	BOOL	CmdSrc.Inp_ExtInh	0	Decimal	0	0	1=Inhibit External Acquisition, 0=Allow External Acquisition	Read/Write
Inp_HornInh	Input	BOOL		0	Decimal	0	0	1 = Inhibit audible alert, 0 = Allow audible alert	Read/Write
Inp_Reset	Input	BOOL		0	Decimal	0	0	1=Reset Shed Latches and Cleared Alarms	Read/Write
Cfg_HasReverse	Input	BOOL		0	Decimal	0	0	1=Drive can be run reverse, 0=Forward only	Read/Write
Cfg_HasJog	Input	BOOL		0	Decimal	0	0	1=Drive Jog Command enabled/visible, 0=Drive Jog Command not allowed	Read/Write
Cfg_AllowLocal	Input	BOOL		0	Decimal	0	0	1=Allow Local Start/Stop without alarm, 0=Start/Stop from HMI/prog only	Read/Write
Cfg_HasRunFdbk	Input	BOOL		0	Decimal	0	0	1=Drive provides feedback signal on Inp_Running when running	Read/Write
Cfg_UseRunFdbk	Input	BOOL		0	Decimal	0	0	1=Drive run feedback should be used for failure checking	Read/Write
Cfg_HasSpeedFdbk	Input	BOOL		0	Decimal	0	0	1=Drive provides speed feedback on Inp_SpeedFdbk	Read/Write
Cfg_UseSpeedFdbk	Input	BOOL		0	Decimal	0	0	1=Drive speed determines running state, 0=state determined by drive Active input bit	Read/Write
Cfg_HasInpDatalink	Input	BOOL		0	Decimal	0	0	1=A signal is connected to Inp_Datalink	Read/Write
Cfg_HasOutDatalink	Input	BOOL		0	Decimal	0	0	1=A signal is connected to Out_Datalink	Read/Write
Cfg_HasFwdPermObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_Perm is connected to Inp_FwdPerm	Read/Write



Cfg_HasRevPermObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_Perm is connected to Inp_RevPerm	Read/Write
Cfg_HasIntlkObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_Intlk is connected to Inp_Intlk	Read/Write
Cfg_HasResInhObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_ResInh Restart Inhibit is connected	Read/Write
Cfg_HasRunTimeObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI a P_RunTime is connected	Read/Write
Cfg_HasMoreObj	Input	BOOL		0	Decimal	0	0	1=Tells HMI an object with more info is available	Read/Write
Cfg_SetTrack	Input	BOOL		1	Decimal	0	0	1=Settings track for unselected sources, 0=no tracking	Read/Write
Cfg_SetTrackOvrHand	Input	BOOL		0	Decimal	0	0	1=Prog/Oper/Ext Settings track Override/Hand	Read/Write
Cfg_OperStopPrio	Input	BOOL		0	Decimal	0	0	1=OCmd_Stop any time, 0=OCmd_Stop only when Oper selected	Read/Write
Cfg_ExtStopPrio	Input	BOOL		0	Decimal	0	0	1=XCmd_Stop any time, 0=XCmd_Stop only when Ext selected	Read/Write
Cfg_OCmdResets	Input	BOOL		0	Decimal	0	0	1=New drive OCmd resets shed latches and cleared alarms, 0=OCmdReset req'd.	Read/Write
Cfg_XCmdResets	Input	BOOL		0	Decimal	0	0	1=New drive XCmd resets shed latches and cleared alarms, 0=XCmdReset req'd.	Read/Write
Cfg_OvrPermIntlk	Input	BOOL		0	Decimal	0	0	1=Override ignores Bypassable Perm/ Intlk; 0=always use Perm/Intlk	Read/Write
Cfg_ShedOnFailToStart	Input	BOOL		1	Decimal	0	0	1=Stop Motor and Alarm on Fail to Start; 0=Alarm only on Fail to Start	Read/Write
Cfg_ShedOnIOFault	Input	BOOL		1	Decimal	0	0	1=Stop Motor and Alarm on I/O Fault; 0=Alarm only on I/O Fault	Read/Write



Cfg_SimScaleEU	Input	BOOL		0	Decimal	0	0	1=In simulation, scale Speed Ref EU to Speed Fdbk EU	Read/Write
Cfg_SimScaleRaw	Input	BOOL		0	Decimal	0	0	1=In simulation, scale Speed Ref EU to raw, then raw to Speed Fdbk EU	Read/Write
Cfg_DecPlcs	Input	DINT		2	Decimal	0	0	Number of decimal places for speed ref/fdbk display (0..6)	Read/Write
Cfg_InpDLDecPlcs	Input	DINT		2	Decimal	0	0	Number of decimal places for Input Datalink display (0..6)	Read/Write
Cfg_OutDLDecPlcs	Input	DINT		2	Decimal	0	0	Number of decimal places for Output Datalink display (0..6)	Read/Write
Cfg_HasFailToStartAlm	Input	BOOL	FailToStart.Cfg_Exists	0	Decimal	0	0	1=Fail to Start Alarm exists and will be checked	Read/Write
Cfg_HasFailToStopAlm	Input	BOOL	FailToStop.Cfg_Exists	0	Decimal	0	0	1=Fail to Stop Alarm exists and will be checked	Read/Write
Cfg_HasIntlkTripAlm	Input	BOOL	IntlkTrip.Cfg_Exists	0	Decimal	0	0	1=Interlock Trip Alarm exists and will be checked	Read/Write
Cfg_HasDriveFaultAlm	Input	BOOL	DriveFault.Cfg_Exists	0	Decimal	0	0	1=Drive Fault alarm exists and will be checked	Read/Write
Cfg_HasIOFaultAlm	Input	BOOL	IOFault.Cfg_Exists	0	Decimal	0	0	1=I/O Fault Alarm exists and will be checked	Read/Write
Cfg_FailToStartResetReqd	Input	BOOL	FailToStart.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Fail to Start Alarm	Read/Write
Cfg_FailToStopResetReqd	Input	BOOL	FailToStop.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Fail to Stop Alarm	Read/Write
Cfg_IntlkTripResetReqd	Input	BOOL	IntlkTrip.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Interlock Trip Alarm	Read/Write
Cfg_DriveFaultResetReqd	Input	BOOL	DriveFault.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear Drive Fault Alarm	Read/Write
Cfg_IOFaultResetReqd	Input	BOOL	IOFault.Cfg_ResetReqd	0	Decimal	0	0	1=Reset required to clear I/O Fault Alarm	Read/Write



Cfg_FailToStartAckReqd	Input	BOOL	FailToStart.Cfg_AckReqd	??	Decimal	0	0	1=Acknowledge required for Fail to Start Alarm	Read/Write
Cfg_FailToStopAckReqd	Input	BOOL	FailToStop.Cfg_AckReqd	??	Decimal	0	0	1=Acknowledge required for Fail to Stop Alarm	Read/Write
Cfg_IntlkTripAckReqd	Input	BOOL	IntlkTrip.Cfg_AckReqd	??	Decimal	0	0	1=Acknowledge required for Interlock Trip Alarm	Read/Write
Cfg_DriveFaultAckReqd	Input	BOOL	DriveFault.Cfg_AckReqd	??	Decimal	0	0	1=Acknowledge required for Drive Fault Alarm	Read/Write
Cfg_IOFaultAckReqd	Input	BOOL	IOFault.Cfg_AckReqd	??	Decimal	0	0	1=Acknowledge required for I/O Fault Alarm	Read/Write
Cfg_FailToStartSeverity	Input	DINT	FailToStart.Cfg_Severity	??	Decimal	0	0	Fail To Start Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_FailToStopSeverity	Input	DINT	FailToStop.Cfg_Severity	??	Decimal	0	0	Fail To Stop Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_IntlkTripSeverity	Input	DINT	IntlkTrip.Cfg_Severity	??	Decimal	0	0	Interlock Trip Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_DriveFaultSeverity	Input	DINT	DriveFault.Cfg_Severity	??	Decimal	0	0	Drive Fault Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_IOFaultSeverity	Input	DINT	IOFault.Cfg_Severity	??	Decimal	0	0	I/O Fault Alarm Severity: 1..250=Low, 251..500=Medium, 501..750=High, 751..1000=Urgent	Read/Write
Cfg_MinSpdRef	Input	REAL		??	Float	0	0	Minimum Speed Reference in EU (for limiting)	Read/Write
Cfg_MaxSpdRef	Input	REAL		??	Float	0	0	Maximum Speed Reference in EU (for limiting)	Read/Write



Cfg_SpeedRefRawMin	Input	REAL		??	Float	0	0	Speed Reference Minimum in Drive (raw) Units (for scaling)	Read/Write
Cfg_SpeedRefRawMax	Input	REAL		??	Float	0	0	Speed Reference Maximum in Drive (raw) Units (for scaling)	Read/Write
Cfg_SpeedRefEUMin	Input	REAL		??	Float	0	0	Speed Reference Minimum in Engineering Units (for scaling)	Read/Write
Cfg_SpeedRefEUMax	Input	REAL		??	Float	0	0	Speed Reference Maximum in Engineering Units (for scaling)	Read/Write
Cfg_SpeedFdbkRawMin	Input	REAL		??	Float	0	0	Speed Feedback Minimum in Drive (raw) Units (for scaling)	Read/Write
Cfg_SpeedFdbkRawMax	Input	REAL		??	Float	0	0	Speed Feedback Maximum in Drive (raw) Units (for scaling)	Read/Write
Cfg_SpeedFdbkEUMin	Input	REAL		??	Float	0	0	Speed Feedback Minimum in Engineering Units (for scaling)	Read/Write
Cfg_SpeedFdbkEUMax	Input	REAL		??	Float	0	0	Speed Feedback Maximum in Engineering Units (for scaling)	Read/Write
Cfg_InpDatalinkRawMin	Input	REAL		??	Float	0	0	Input Datalink Minimum in Drive (raw) Units (for scaling)	Read/Write
Cfg_InpDatalinkRawMax	Input	REAL		??	Float	0	0	Input Datalink Maximum in Drive (raw) Units (for scaling)	Read/Write
Cfg_InpDatalinkEUMin	Input	REAL		0	Float	0	0	Input Datalink Minimum in Engineering Units (for scaling)	Read/Write
Cfg_InpDatalinkEUMax	Input	REAL		409.5	Float	0	0	Input Datalink Maximum in Engineering Units (for scaling)	Read/Write
Cfg_OutDatalinkMin	Input	REAL		0	Float	0	0	Minimum Output Datalink in EU (for limiting)	Read/Write
Cfg_OutDatalinkMax	Input	REAL		100	Float	0	0	Maximum Output Datalink in EU (for limiting)	Read/Write
Cfg_OutDatalinkRawMin	Input	REAL		0	Float	0	0	Output Datalink Minimum in Drive (raw) Units (for scaling)	Read/Write



Cfg_OutDatalinkRawMax	Input	REAL		4095	Float	0	0	Output Datalink Maximum in Drive (raw) Units (for scaling)	Read/Write
Cfg_OutDatalinkEUMin	Input	REAL		0	Float	0	0	Output Datalink Minimum in Engineering Units (for scaling)	Read/Write
Cfg_OutDatalinkEUMax	Input	REAL		409.5	Float	0	0	Output Datalink Maximum in Engineering Units (for scaling)	Read/Write
Cfg_StartHornT	Input	REAL		0	Float	0	0	Time to sound audible on commanded start (sec) (0=disabled)	Read/Write
Cfg_SimRampT	Input	REAL		10	Float	0	0	Time to ramp speed fdbk when in Simulation (sec)	Read/Write
Cfg_FailToStartT	Input	REAL		15	Float	0	0	Time after Start to get Run Feedback before Fault (sec)	Read/Write
Cfg_FailToStopT	Input	REAL		15	Float	0	0	Time after Stop to drop Run Feedback before Fault (sec)	Read/Write
Cfg_ResetPulseT	Input	REAL		2	Float	0	0	Time to pulse Out_Reset to clear drive fault	Read/Write
Cfg_MaxJogT	Input	REAL		0	Float	0	0	Maximum jog time (sec, 0=unlimited)	Read/Write
Cfg_OperKeep	Input	SINT		2#0000_0000	Binary	0	0	Oper keeps control in Prog / Ext: .0=Reference, .1=Start/Stop/Fwd/ Rev, .3=OutDatalink	Read/Write
Cfg_ProgKeep	Input	SINT		2#0000_0000	Binary	0	0	Prog keeps control in Oper / Ext: .0=Reference, .1=Start/Stop/Fwd/ Rev, .3=OutDatalink	Read/Write
Cfg_ExtKeep	Input	SINT		2#0000_0000	Binary	0	0	Ext keeps control in Prog / Oper: .0=Reference, .1=Start/Stop/Fwd/ Rev, .3=OutDatalink	Read/Write
PSet_SpeedRef	Input	REAL		0	Float	0	0	Program Setting of Speed Reference (EU)	Read/Write
PSet_OutDatalink	Input	REAL		0	Float	0	0	Program Setting of Output Datalink (EU)	Read/Write



PSet_Owner	Input	DINT		0	Decimal	0	0	Program Owner Request ID (non-zero) or Release (zero)	Read/Write
XSet_SpeedRef	Input	REAL		0	Float	0	0	External Setting of Speed Reference (EU)	Read/Write
XSet_OutDatalink	Input	REAL		0	Float	0	0	External Setting of Output Datalink (EU)	Read/Write
PCmd_StartFwd	Input	BOOL		0	Decimal	0	0	Program Command to Start Drive Forward	Read/Write
PCmd_StartRev	Input	BOOL		0	Decimal	0	0	Program Command to Start Drive Reverse	Read/Write
PCmd_Stop	Input	BOOL		0	Decimal	0	0	Program Command to Stop Drive	Read/Write
PCmd_Prog	Input	BOOL	CmdSrc.PCmd_Prog	0	Decimal	0	0	Program Command to select Program (Oper to Prog)	Read/Write
PCmd_Oper	Input	BOOL	CmdSrc.PCmd_Oper	0	Decimal	0	0	Program Command to select Operator (Prog to Oper)	Read/Write
PCmd_Lock	Input	BOOL	CmdSrc.PCmd_Lock	0	Decimal	0	0	Program Command to Lock Program (disallow Operator)	Read/Write
PCmd_Unlock	Input	BOOL	CmdSrc.PCmd_Unlock	0	Decimal	0	0	Program Command to Unlock Program (allow Oper to acquire)	Read/Write
PCmd_Normal	Input	BOOL	CmdSrc.PCmd_Normal	0	Decimal	0	0	Program Command to select Normal (Oper or Prog)	Read/Write
PCmd_Reset	Input	BOOL		0	Decimal	0	0	Program Command to Reset drive fault and all Alarms requiring Reset	Read/Write
PCmd_FailToStartAck	Input	BOOL	FailToStart.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Fail to Start Alarm	Read/Write
PCmd_FailToStartSuppress	Input	BOOL	FailToStart.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Fail to Start Alarm	Read/Write
PCmd_FailToStartUnsuppress	Input	BOOL	FailToStart.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Fail to Start Alarm	Read/Write

PCmd_FailToStartUnshelve	Input	BOOL	FailToStart.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Fail to Start Alarm	Read/Write
PCmd_FailToStopAck	Input	BOOL	FailToStop.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Fail to Stop Alarm	Read/Write
PCmd_FailToStopSuppress	Input	BOOL	FailToStop.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Fail to Stop Alarm	Read/Write
PCmd_FailToStopUnsuppress	Input	BOOL	FailToStop.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Fail to Stop Alarm	Read/Write
PCmd_FailToStopUnshelve	Input	BOOL	FailToStop.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Fail to Stop Alarm	Read/Write
PCmd_IntlkTripAck	Input	BOOL	IntlkTrip.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Interlock Trip Alarm	Read/Write
PCmd_IntlkTripSuppress	Input	BOOL	IntlkTrip.PCmd_Suppress	0	Decimal	0	0	Program Command to Suppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnsuppress	Input	BOOL	IntlkTrip.PCmd_Unsuppress	0	Decimal	0	0	Program Command to Unsuppress Interlock Trip Alarm	Read/Write
PCmd_IntlkTripUnshelve	Input	BOOL	IntlkTrip.PCmd_Unshelve	0	Decimal	0	0	Program Command to Unshelve Interlock Trip Alarm	Read/Write
PCmd_DriveFaultAck	Input	BOOL	DriveFault.PCmd_Ack	0	Decimal	0	0	Program Command to Acknowledge Drive Fault Alarm	Read/Write
PCmd_DriveFaultSuppress	Input	BOOL	DriveFault.PCmd_Suppress	??	Decimal	0	0	Program Command to Suppress Drive Fault Alarm	Read/Write
PCmd_DriveFaultUnsuppress	Input	BOOL	DriveFault.PCmd_Unsuppress	??	Decimal	0	0	Program Command to Unsuppress Drive Fault Alarm	Read/Write
PCmd_DriveFaultUnshelve	Input	BOOL	DriveFault.PCmd_Unshelve	??	Decimal	0	0	Program Command to Unshelve Drive Fault Alarm	Read/Write
PCmd_IOFaultAck	Input	BOOL	IOFault.PCmd_Ack	??	Decimal	0	0	Program Command to Acknowledge I/O Fault Alarm	Read/Write
PCmd_IOFaultSuppress	Input	BOOL	IOFault.PCmd_Suppress	??	Decimal	0	0	Program Command to Suppress I/O Fault Alarm	Read/Write



PCmd_IOFaultUnsuppress	Input	BOOL	IOFault.PCmd_Unsuppress	??	Decimal	0	0	Program Command to Unsuppress I/O Fault Alarm	Read/Write
PCmd_IOFaultUnshelve	Input	BOOL	IOFault.PCmd_Unshelve	??	Decimal	0	0	Program Command to Unshelve I/O Fault Alarm	Read/Write
MCmd_Rel	Input	BOOL	CmdSrc.MCmd_Rel	??	Decimal	0	0	Maintenance Command to Release (Maint to Oper/Prog/Ovrd)	Read/Write
OCmd_Unlock	Input	BOOL	CmdSrc.OCmd_Unlock	??	Decimal	0	0	Operator Command to Unlock Operator (allow Prog to acquire)	Read/Write
XCmd_StartFwd	Input	BOOL		??	Decimal	0	0	External Command to Start Drive Forward	Read/Write
XCmd_StartRev	Input	BOOL		??	Decimal	0	0	External Command to Start Drive Reverse	Read/Write
XCmd_Stop	Input	BOOL		??	Decimal	0	0	External Command to Stop Drive	Read/Write
XCmd_JogFwd	Input	BOOL		??	Decimal	0	0	External Command to Jog Drive Forward	Read/Write
XCmd_JogRev	Input	BOOL		??	Decimal	0	0	External Command to Jog Drive Reverse	Read/Write
XCmd_Acq	Input	BOOL	CmdSrc.XCmd_Acq	??	Decimal	0	0	External Command to Acquire	Read/Write
XCmd_Rel	Input	BOOL	CmdSrc.XCmd_Rel	??	Decimal	0	0	External Command to Release	Read/Write
XCmd_Reset	Input	BOOL		??	Decimal	0	0	Ext Cmd to clear shed latches and cleared alarms	Read/Write
Out_SpeedRef	Output	REAL		??	Float	0	1	Drive Speed Reference in Drive Units (typ. 0-32767 = 0 to max freq.)	Read Only
Out_Datalink	Output	REAL		??	Float	0	1	Auxiliary Signal (datalink) Output in Drive (raw) Units	Read Only
Out_Run	Output	BOOL		??	Decimal	0	0	1=Start/Run Drive, 0=Stop Drive (for held starter type)	Read Only
Out_Stop	Output	BOOL		??	Decimal	0	1	1=Stop Drive, 0=drive left in current state	Read Only



Out_Start	Output	BOOL		??	Decimal	0	1	1=Start Drive, 0=drive left in current state	Read Only
Out_Jog	Output	BOOL		??	Decimal	0	1	1=Jog drive at Jog Speed, -->0=stop jogging	Read Only
Out_ClearFault	Output	BOOL		??	Decimal	0	1	1=Attempt to clear Drive Fault	Read Only
Out_Fwd	Output	BOOL		??	Decimal	0	1	1=Set drive direction to Forward	Read Only
Out_Rev	Output	BOOL		??	Decimal	0	1	1=Set drive direction to Reverse	Read Only
Out_Horn	Output	BOOL		??	Decimal	0	1	1=Sound audible prior to commanded motor start	Read Only
Val_SpeedRef	Output	REAL		??	Float	0	1	Speed Reference (target) to drive	Read Only
Val_SpeedFdbk	Output	REAL		??	Float	0	1	Speed Feedback (actual) from drive	Read Only
Val_InpDatalink	Output	REAL		??	Float	0	1	Input Datalink value from drive	Read Only
Val_OutDatalink	Output	REAL		??	Float	0	1	Output Datalink value to drive	Read Only
Val_SpeedRefEUMin	Output	REAL		0	Float	0	0	Minimum of Speed Reference = MIN (Cfg_SpeedFdbkEUMin, Cfg_SpeedFdbkEUMax)	Read Only
Val_SpeedRefEUMax	Output	REAL		130	Float	0	0	Maximum of Speed Reference = MAX (Cfg_SpeedFdbkEUMin, Cfg_SpeedFdbkEUMax)	Read Only
Val_SpeedFdbkEUMin	Output	REAL		0	Float	0	0	Minimum of Speed Feedback = MIN (Cfg_SpeedFdbkEUMin, Cfg_SpeedFdbkEUMax)	Read Only
Val_SpeedFdbkEUMax	Output	REAL		130	Float	0	0	Maximum of Speed Feedback = MAX (Cfg_SpeedFdbkEUMin, Cfg_SpeedFdbkEUMax)	Read Only
Val_LastFaultCode	Output	DINT		0	Decimal	0	0	Most recent drive fault code (enumeration)	Read Only



SrcQ_IO	Output	DINT		0	Decimal	0	0	Source and Quality of primary I/O (enumeration)	Read Only
SrcQ	Output	DINT		0	Decimal	0	0	Source and Quality of primary Val/Sts (enumeration)	Read Only
Val_Cmd	Output	DINT		0	Decimal	0	0	Device Command 0=None, 1=Stop, 2=StartFwd 3=StartRev 4=JogFwd 5=JogRev	Read Only
Val_Fdbk	Output	DINT		0	Decimal	0	0	Device Feedback 0=Stopped, 1=Running Fwd 2=Running Rev 3=Accelerating 4=Decelerating	Read Only
Val_Sts	Output	DINT		0	Decimal	0	0	Device Sts: 0=? 1=Stopped 2=RunFwd 3=RunRev 4=RunSlow 5=StartFwd 6=StartRev 7=StartSlow 8=JogFwd 9=JogRev 10=Stopping	Read Only
Val_Fault	Output	DINT		0	Decimal	0	1	Device Fault Status 0=None, 16=Fail to Start, 17 = Fail to Stop, 18=Drive Fault, 32=I/O Fault, 34=Config Error	Read Only
Val_NotifyAll	Output	DINT		0	Decimal	0	0	Highest Alarm prio and ack status this object + channel (enum)	Read Only
Val_UnackAlmC	Output	DINT		0	Decimal	0	0	Count of Unacknowledged Alarms	Read Only
Val_Owner	Output	DINT		0	Decimal	0	0	Current Object Owner ID (0=not owned)	Read Only
Sts_Stopped	Output	BOOL		0	Decimal	0	1	1=Drive requested to stop and is confirmed stopped	Read Only
Sts_StartingFwd	Output	BOOL		0	Decimal	0	1	1=Drive requested to run forward and awaiting run feedback	Read Only
Sts_StartingRev	Output	BOOL		0	Decimal	0	1	1=Drive requested to run reverse and awaiting run feedback	Read Only

Sts_RunningFwd	Output	BOOL		0	Decimal	0	1	1=Drive requested to run and is confirmed running forward	Read Only
Sts_RunningRev	Output	BOOL		0	Decimal	0	1	1=Drive requested to run and is confirmed running reverse	Read Only
Sts_StoppingFwd	Output	BOOL		0	Decimal	0	1	1=Drive running forward requested to stop and awaiting stopped feedback	Read Only
Sts_StoppingRev	Output	BOOL		0	Decimal	0	1	1=Drive running reverse requested to stop and awaiting stopped feedback	Read Only
Sts_JoggingFwd	Output	BOOL		0	Decimal	0	1	1=Drive requested to Jog Forward	Read Only
Sts_JoggingRev	Output	BOOL		0	Decimal	0	1	1=Drive requested to Jog Reverse	Read Only
Sts_Horn	Output	BOOL		0	Decimal	0	0	1=Motor Horn Active	Read Only
Sts_CommandDir	Output	BOOL		0	Decimal	0	0	1=Drive commanded to Forward, 0=Reverse	Read Only
Sts_ActualDir	Output	BOOL		0	Decimal	0	1	1=Drive Actual direction is Forward, 0=Reverse	Read Only
Sts_Accel	Output	BOOL		0	Decimal	0	0	1=Drive is Accelerating	Read Only
Sts_Decel	Output	BOOL		0	Decimal	0	0	1=Drive is Decelerating	Read Only
Sts_NotReady	Output	BOOL		0	Decimal	0	0	1=Drive is Not Ready (cannot be started) Check alarms, stops, faults	Read Only
Sts_Alarm	Output	BOOL		0	Decimal	0	1	1=Drive has an Alarm (see drive display or manual)	Read Only
Sts_AtSpeed	Output	BOOL		0	Decimal	0	1	1=Drive is running at reference speed	Read Only
Sts_SpeedLimited	Output	BOOL		0	Decimal	0	1	1=Speed Reference Setting exceeds configured Max/Min limit	Read Only

Sts_Available	Output	BOOL		0	Decimal	0	1	1=Drive available for control by automation (Prog)	Read Only
Sts_Bypass	Output	BOOL		0	Decimal	0	0	1=Bypassable Interlocks and Permissives are Bypassed	Read Only
Sts_BypActive	Output	BOOL		0	Decimal	0	0	1=Bypassing Active (Bypassed or Maintenance)	Read Only
Sts_NotRdy	Output	BOOL		0	Decimal	0	0	1=Device Not Ready, see detail bits for reason	Read Only
Nrdy_CfgErr	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Configuration Error	Read Only
Nrdy_DriveNR	Output	BOOL		0	Decimal	0	0	1=Device Note Ready: Drive Not Ready	Read Only
Nrdy_Fail	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device Failure (Shed Requires Reset)	Read Only
Nrdy_Intlk	Output	BOOL		0	Decimal	0	1	1=Device Not Ready: Interlock Not OK	Read Only
Nrdy_IOFault	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: I/O Fault (Shed Requires Reset)	Read Only
Nrdy_OoS	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Device is Out of Service	Read Only
Nrdy_Perm	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Permissive Not OK	Read Only
Nrdy_PrioStop	Output	BOOL		0	Decimal	0	0	1=Device Not Ready: Oper/Ext Priority Stop Requires Reset	Read Only
Nrdy_Trip	Output	BOOL		??	Decimal	0	0	1=Device not Ready: Deivce Tripped (Drive Fault)	Read Only
Sts_MaintByp	Output	BOOL		??	Decimal	0	0	1=A Maintenance Bypass is Active, display icon	Read Only
Sts_Almlnh	Output	BOOL		??	Decimal	0	0	1=An Alarm is Disabled or Shelved, display icon	Read Only
Sts_Err	Output	BOOL		??	Decimal	0	1	1=Error in Config: see detail bits for reason	Read Only



Err_Timer	Output	BOOL		??	Decimal	0	0	1=Error in Config: Invalid Check or Reset Pulse Time (use 0 to 2147483)	Read Only
Err_Sim	Output	BOOL		??	Decimal	0	0	1=Error in Config: simulation timer preset: use 0 to 2147483)	Read Only
Err_Alarm	Output	BOOL		??	Decimal	0	0	1=Error in Config: Alarm Min On Time, Shelf Time, Severity	Read Only
Err_FdbkRaw	Output	BOOL		??	Decimal	0	0	1=Error in Config: Speed Fdbk Raw Min = Max	Read Only
Err_FdbkEU	Output	BOOL		??	Decimal	0	0	1=Error in Config: Speed Fdbk EU Min = Max	Read Only
Err_RefLim	Output	BOOL		??	Decimal	0	0	1=Error in Config: Speed Ref Limit Min > Max	Read Only
Err_RefEU	Output	BOOL		??	Decimal	0	0	1=Error in Config: Speed Ref EU Min = Max	Read Only
Err_RefRaw	Output	BOOL		??	Decimal	0	0	1=Error in Config: Speed Ref Raw Min = Max	Read Only
Err_InpDLRaw	Output	BOOL		??	Decimal	0	0	1=Error in Config: Input Datalink Raw Min = Max	Read Only
Err_InpDLEU	Output	BOOL		??	Decimal	0	0	1=Error in Config: Input Datalink EU Min = Max	Read Only
Err_OutDLLim	Output	BOOL		??	Decimal	0	0	1=Error in Config: Output Datalink Limits Min > Max	Read Only
Err_OutDLEU	Output	BOOL		??	Decimal	0	0	1=Error in Config: Output Datalink EU Min = Max	Read Only
Err_OutDLRaw	Output	BOOL		??	Decimal	0	0	1=Error in Config: Output Datalink Raw Min = Max	Read Only
Sts_Hand	Output	BOOL	CmdSrc.Sts_Hand	??	Decimal	0	1	1=Hand is selected (supersedes OoS, Maint, Ovr, Ext, Prog, Oper)	Read Only
Sts_OoS	Output	BOOL	CmdSrc.Sts_OoS	??	Decimal	0	1	1=Out of Service is selected (supersedes Maint, Ovr, Ext, Prog, Oper)	Read Only

Sts_Maint	Output	BOOL	CmdSrc.Sts_Maint	??	Decimal	0	1	1=Maintenance is selected (supersedes Ovr, Ext, Prog, Oper)	Read Only
Sts_Ovr	Output	BOOL	CmdSrc.Sts_Ovr	??	Decimal	0	1	1=Override is selected (supersedes Ext, Prog, Oper)	Read Only
Sts_Ext	Output	BOOL	CmdSrc.Sts_Ext	??	Decimal	0	1	1=External is selected (supersedes Prog, Oper)	Read Only
Sts_Prog	Output	BOOL	CmdSrc.Sts_Prog	??	Decimal	0	1	1=Program is selected	Read Only
Sts_ProgLocked	Output	BOOL	CmdSrc.Sts_ProgLocked	??	Decimal	0	0	1=Program is selected and Locked	Read Only
Sts_Oper	Output	BOOL	CmdSrc.Sts_Oper	0	Decimal	0	1	1=Operator is selected	Read Only
Sts_OperLocked	Output	BOOL	CmdSrc.Sts_OperLocked	0	Decimal	0	0	1=Operator is selected and Locked	Read Only
Sts_Normal	Output	BOOL	CmdSrc.Sts_Normal	0	Decimal	0	0	1=Selection equals the Normal (Prog or Oper)	Read Only
Sts_ExtReqInh	Output	BOOL	CmdSrc.Sts_ExtReqInh	0	Decimal	0	0	1=External request inhibited	Read Only
Sts_ProgReqInh	Output	BOOL	CmdSrc.Sts_ProgReqInh	0	Decimal	0	0	1=Program request inhibited, cannot Get to Program from Current State	Read Only
Sts_MAcqRcvd	Output	BOOL	CmdSrc.Sts_MAcqRcvd	0	Decimal	0	0	1=Maintenance Acquire command received this scan	Read Only
Sts_RdyReset	Output	BOOL	ORdy_Reset	0	Decimal	0	0	1=A latched alarm or shed condition is ready to be reset	Read Only
Sts_RdyAck	Output	BOOL		0	Decimal	0	0	1=An alarm is ready to be acknowledged	Read Only
Sts_FailToStart	Output	BOOL	FailToStart.Inp	0	Decimal	0	0	1=Drive Failed to Start (One-Shot)	Read/Write
Alm_FailToStart	Output	BOOL	FailToStart.Alm	0	Decimal	0	0	1=Drive Fail to Start Alarm	Read/Write
Ack_FailToStart	Output	BOOL	FailToStart.Ack	1	Decimal	0	0	1=Fail to Start Alarm has been acknowledged	Read/Write

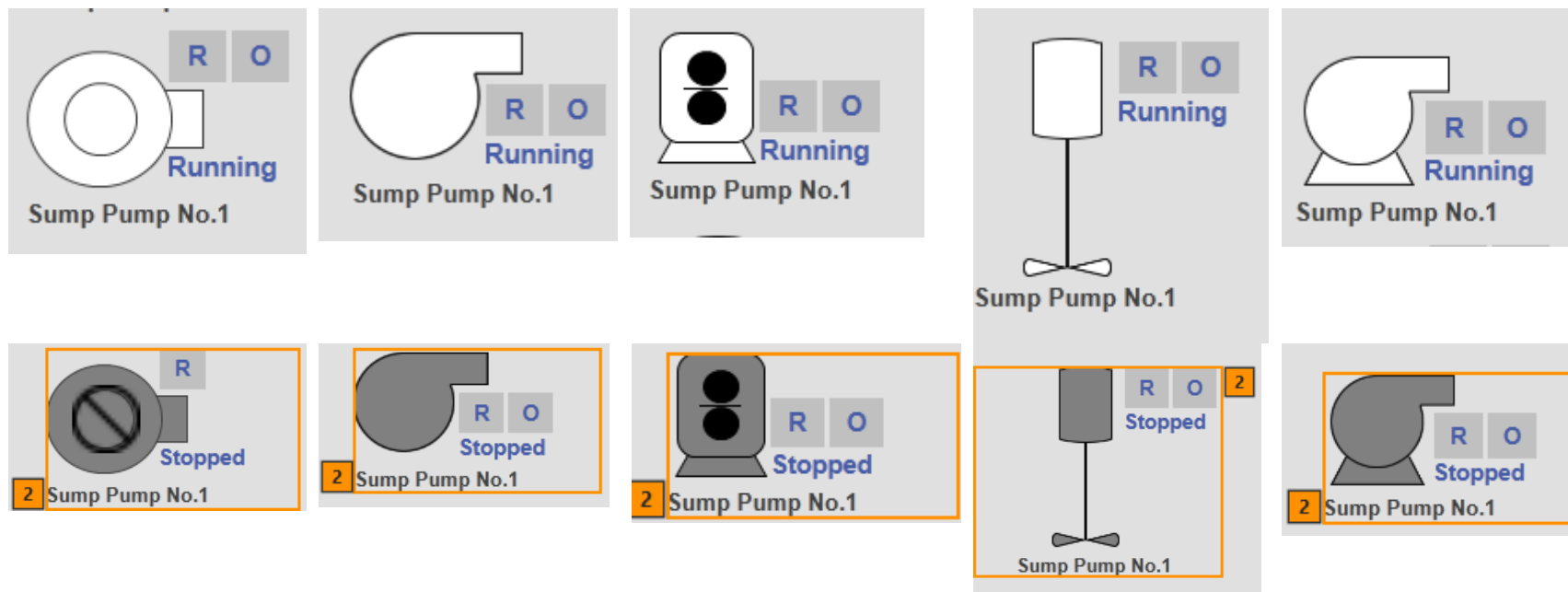


Sts_FailToStartDisabled	Output	BOOL	FailToStart.Disabled	0	Decimal	0	0	1=Fail to Start Alarm has been Disabled by Maintenance	Read/Write
Sts_FailToStartShelved	Output	BOOL	FailToStart.Shelved	0	Decimal	0	0	1=Fail to Start Alarm has been Shelved by Operator	Read/Write
Sts_FailToStartSuppressed	Output	BOOL	FailToStart.Suppressed	0	Decimal	0	0	1=Fail to Start Alarm has been Suppressed by Program	Read/Write
Sts_FailToStop	Output	BOOL	FailToStop.Inp	0	Decimal	0	0	1=Drive Failed to Stop	Read/Write
Alm_FailToStop	Output	BOOL	FailToStop.Alm	0	Decimal	0	0	1=Drive Fail to Stop Alarm	Read/Write
Ack_FailToStop	Output	BOOL	FailToStop.Ack	1	Decimal	0	0	1=Fail to Stop Alarm has been acknowledged	Read/Write
Sts_FailToStopDisabled	Output	BOOL	FailToStop.Disabled	0	Decimal	0	0	1=Fail to Stop Alarm has been Disabled by Maintenance	Read/Write
Sts_FailToStopShelved	Output	BOOL	FailToStop.Shelved	0	Decimal	0	0	1=Fail to Stop Alarm has been Shelved by Operator	Read/Write
Sts_FailToStopSuppressed	Output	BOOL	FailToStop.Suppressed	0	Decimal	0	0	1=Fail to Stop Alarm has been Suppressed by Program	Read/Write
Sts_IntlkTrip	Output	BOOL	IntlkTrip.Inp	0	Decimal	0	0	1=Drive was stopped by an Interlock NOT OK (One-Shot)	Read/Write
Alm_IntlkTrip	Output	BOOL	IntlkTrip.Alm	0	Decimal	0	0	1=Alarm: Drive stopped by an Interlock NOT OK	Read/Write
Ack_IntlkTrip	Output	BOOL	IntlkTrip.Ack	1	Decimal	0	0	1=Interlock Trip Alarm has been acknowledged	Read/Write
Sts_IntlkTripDisabled	Output	BOOL	IntlkTrip.Disabled	0	Decimal	0	0	1=Interlock Trip Alarm has been Disabled by Maintenance	Read/Write
Sts_IntlkTripShelved	Output	BOOL	IntlkTrip.Shelved	0	Decimal	0	0	1=Interlock Trip Alarm has been Shelved by Operator	Read/Write
Sts_IntlkTripSuppressed	Output	BOOL	IntlkTrip.Suppressed	0	Decimal	0	0	1=Interlock Trip Alarm has been Suppressed by Program	Read/Write

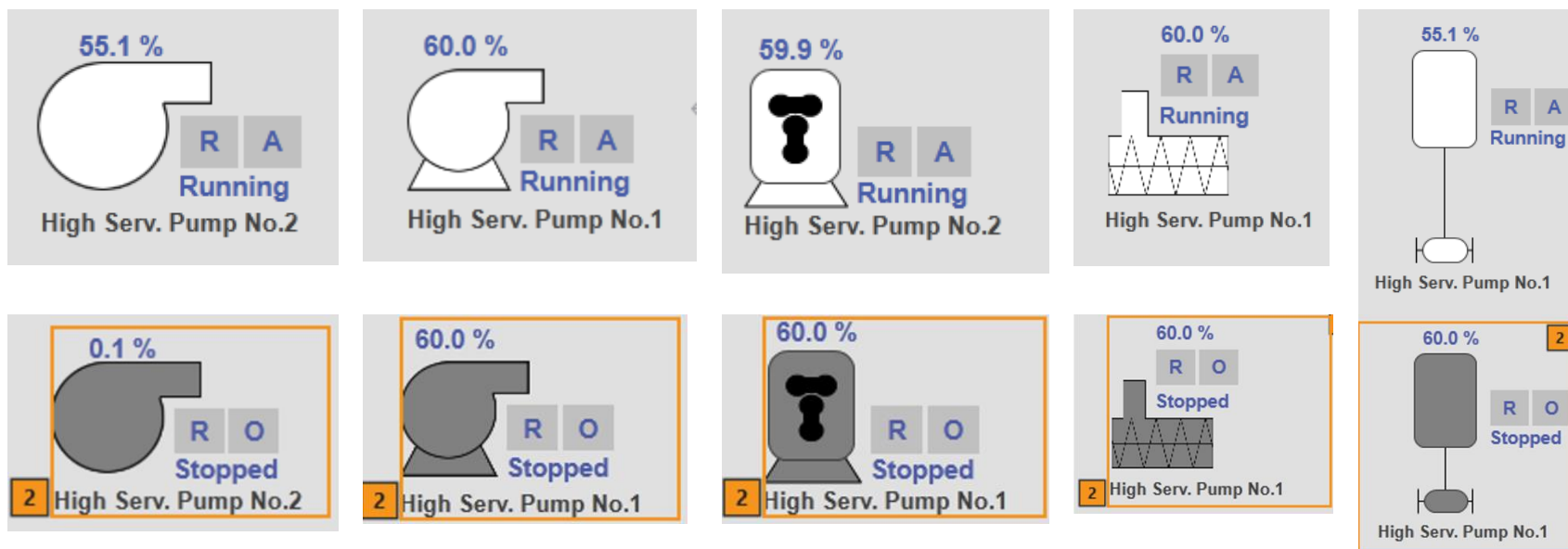
Sts_DriveFault	Output	BOOL	DriveFault.Inp	0	Decimal	0	0	1=Drive Fault (see drive display or manual)	Read/Write
Alm_DriveFault	Output	BOOL	DriveFault.Alm	0	Decimal	0	0	1=Alarm: Drive Fault (see drive display or manual)	Read/Write
Ack_DriveFault	Output	BOOL	DriveFault.Ack	1	Decimal	0	0	1=Drive Fault Alarm has been acknowledged	Read/Write
Sts_DriveFaultDisabled	Output	BOOL	DriveFault.Disabled	0	Decimal	0	0	1=Drive Fault Alarm has been Disabled by Maintenance	Read/Write
Sts_DriveFaultShelved	Output	BOOL	DriveFault.Shelved	0	Decimal	0	0	1=Drive Fault Alarm has been Shelved by Operator	Read/Write
Sts_DriveFaultSuppressed	Output	BOOL	DriveFault.Suppressed	0	Decimal	0	0	1=Drive Fault Alarm has been Suppressed by Program	Read/Write
Sts_IOFault	Output	BOOL	IOFault.Inp	0	Decimal	0	0	I/O Comm Fault Status (0=OK, 1=Bad)	Read/Write
Alm_IOFault	Output	BOOL	IOFault.Alm	0	Decimal	0	0	1=I/O Fault Alarm	Read/Write
Ack_IOFault	Output	BOOL	IOFault.Ack	1	Decimal	0	0	1=I/O Fault Alarm has been acknowledged	Read/Write
Sts_IOFaultDisabled	Output	BOOL	IOFault.Disabled	0	Decimal	0	0	1=I/O Fault Alarm has been Disabled by Maintenance	Read/Write
Sts_IOFaultShelved	Output	BOOL	IOFault.Shelved	0	Decimal	0	0	1=I/O Fault Alarm has been Shelved by Operator	Read/Write
Sts_IOFaultSuppressed	Output	BOOL	IOFault.Suppressed	0	Decimal	0	0	1=I/O Fault Alarm has been Suppressed by Program	Read/Write
MRdy_Rel	Output	BOOL	CmdSrc.MRdy_Rel	0	Decimal	0	0	1=Ready for MCmd_Rel (enables HMI button)	Read Only
ORdy_Unlock	Output	BOOL	CmdSrc.ORdy_Unlock	0	Decimal	0	0	1=Ready for OCmd_Unlock (enables HMI button)	Read Only
P_VSD	Output	BOOL		0	Decimal	0	0	Unique Parameter Name for auto - discovery	Read/Write

20 Graphical Elements

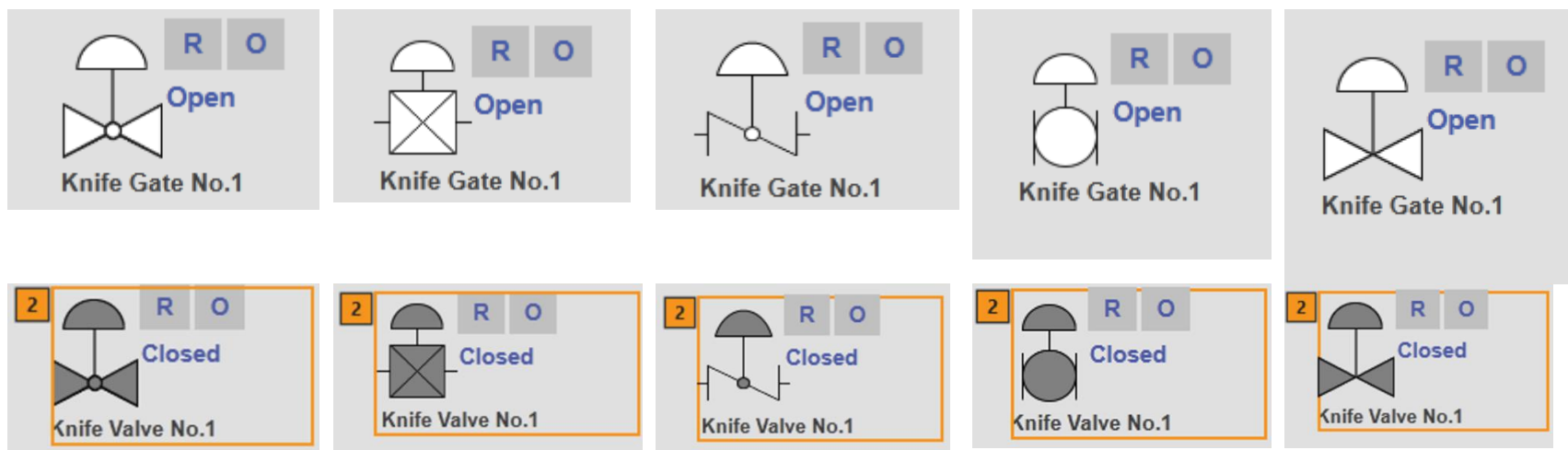
20.1 Constant speed equipment



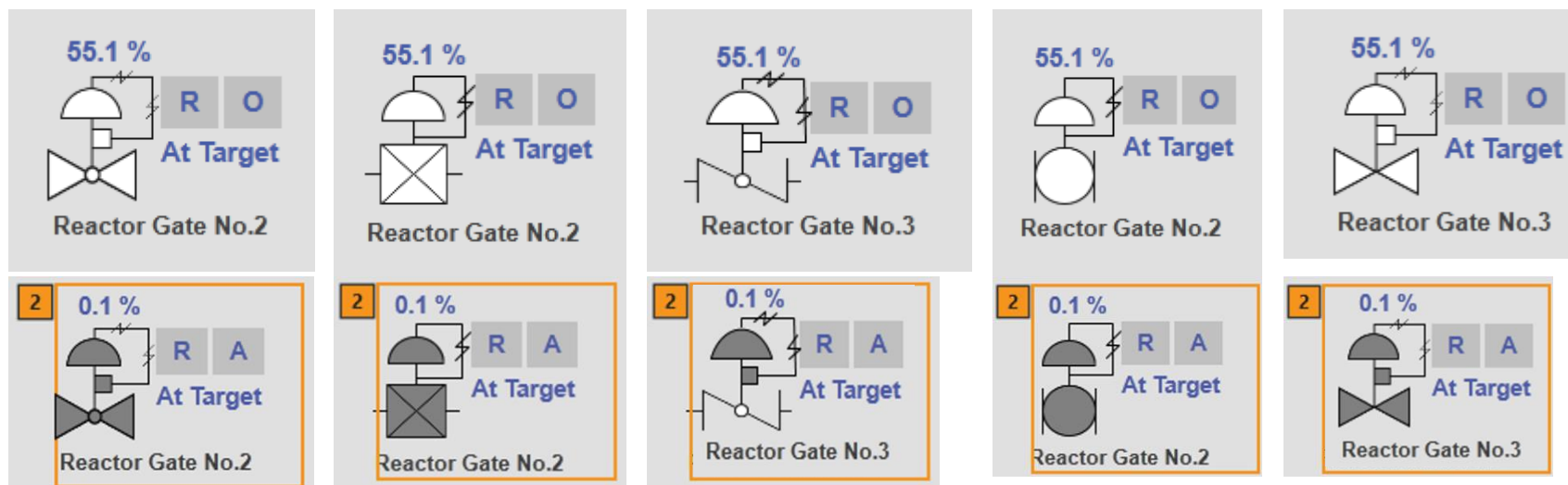
20.2 Variable Speed Equipment



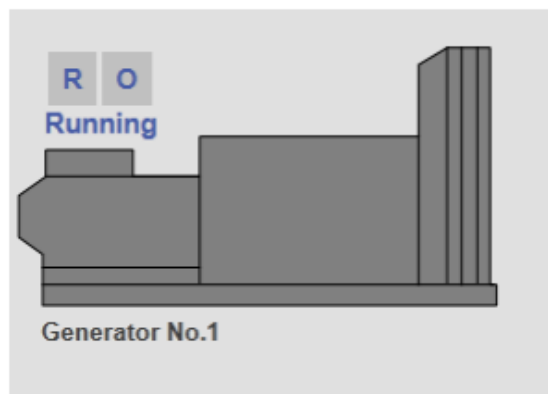
20.3 Open/Close Valves



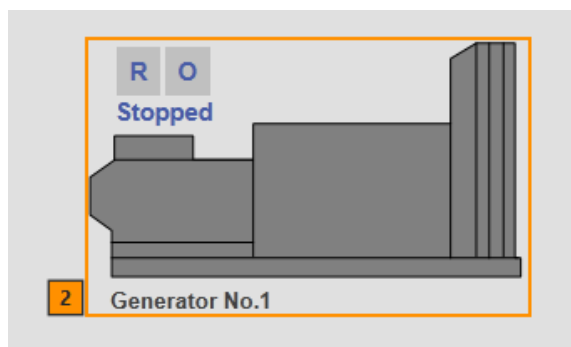
20.4 Modulating Valves



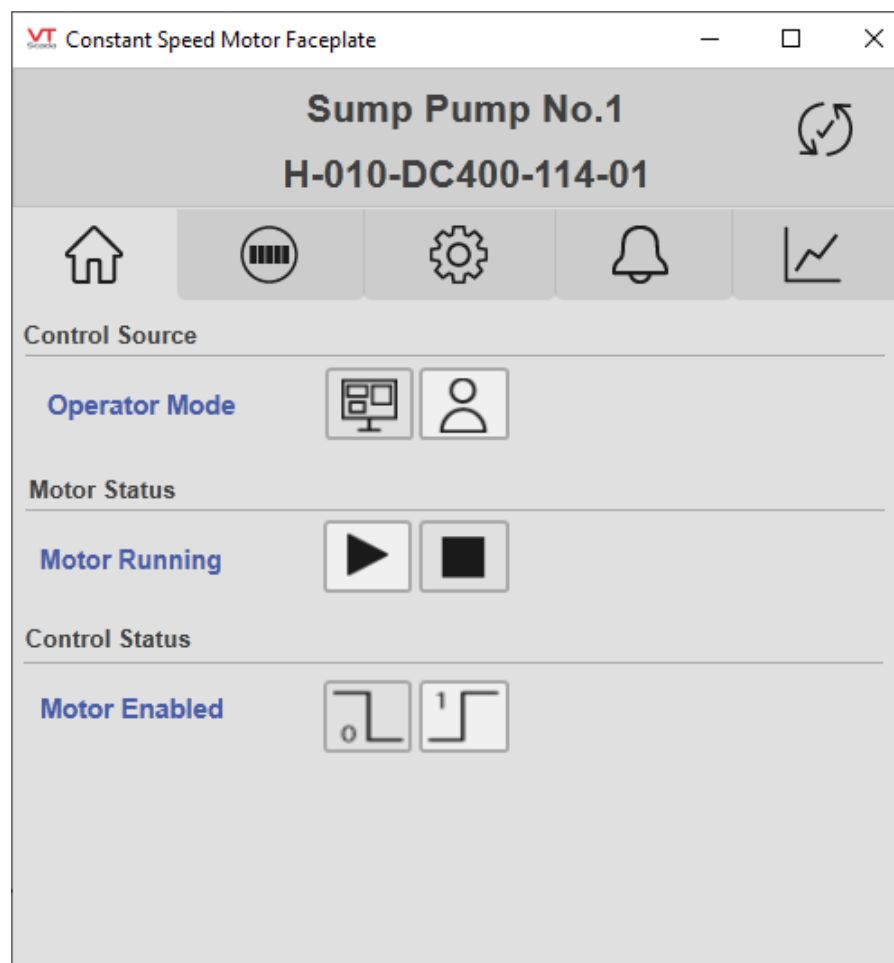
20.5 Misc Equipment



MCC No.1	
H-010-MCC190-760-01	
Main Status Ok	Current 33 A Voltage 51 V
Tie Status Ok	Real Pwr. 5515 KW Apparent Pwr. 57 KVA Reactive Pwr. 100 KVAR



MCC No.1	
H-010-MCC190-760-01	
Main Status Fault	Current 33 A Voltage 51 V
Tie Status Ok	Real Pwr. 5515 KW Apparent Pwr. 57 KVA Reactive Pwr. 100 KVAR





Constant Speed Motor Faceplate

Sump Pump No.1

H-010-DC400-114-01

590.4 Total Run Time Hours

99.7 Current Run Time Hours

24.0 Number of Starts

Clear Runtime

Clear Starts

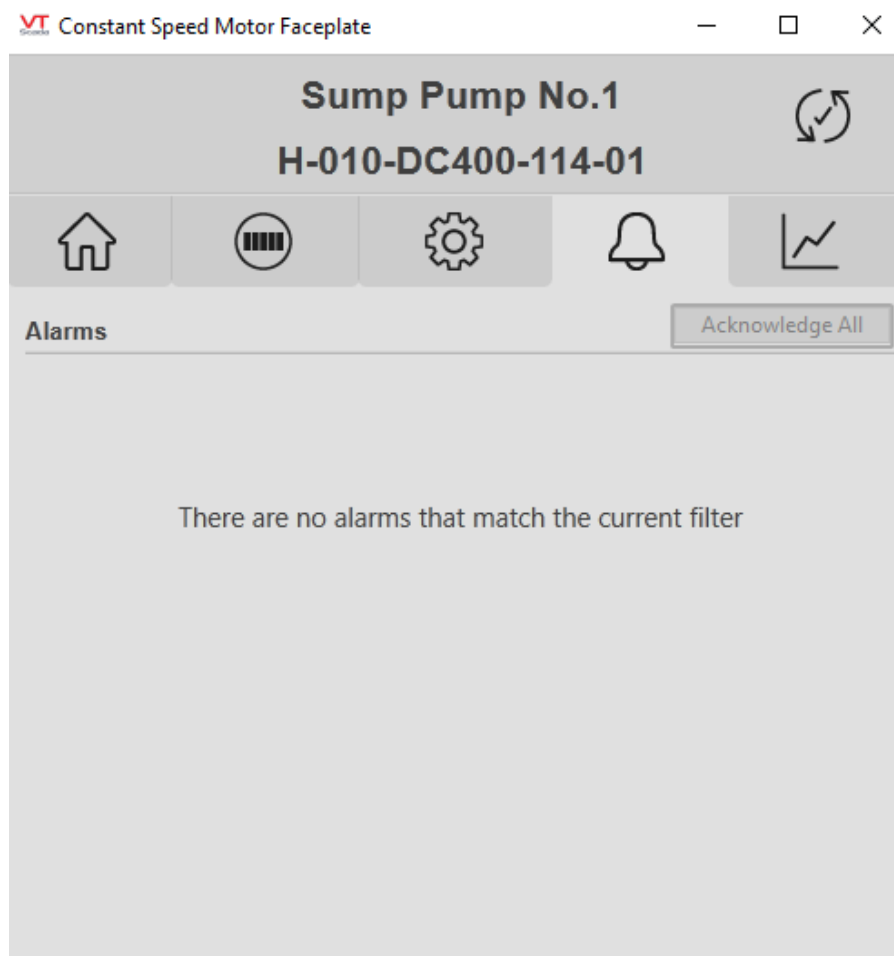


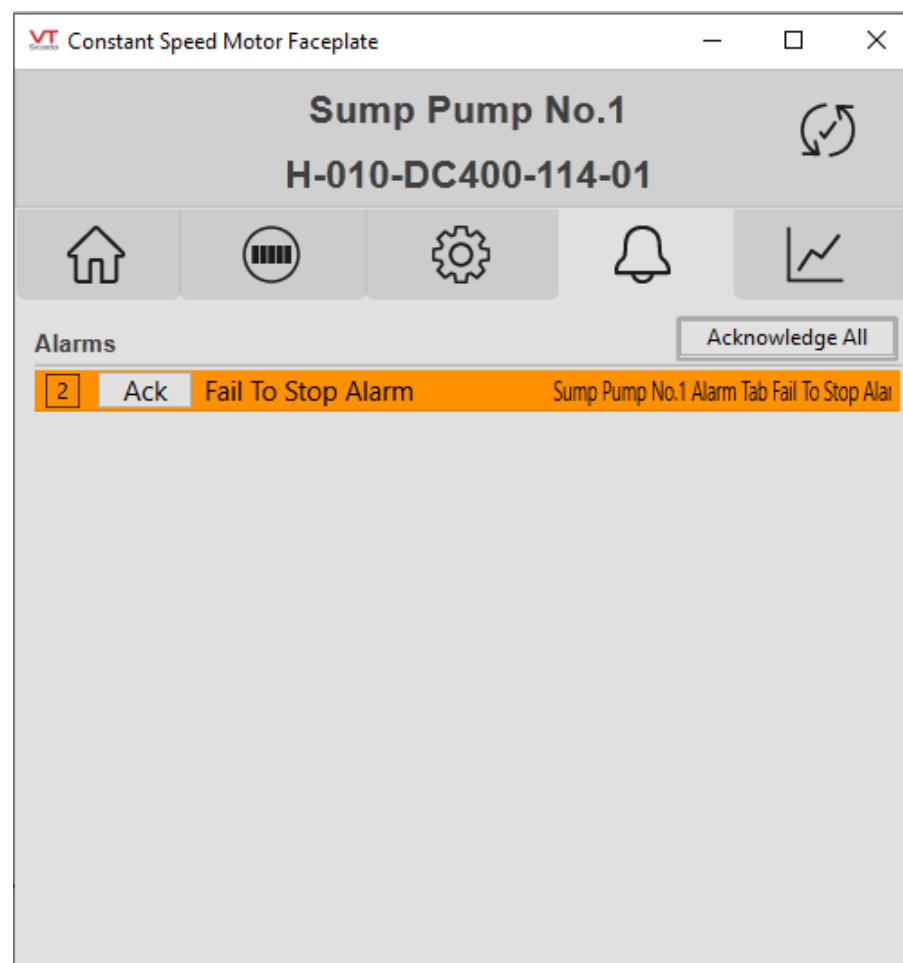
Constant Speed Motor Faceplate

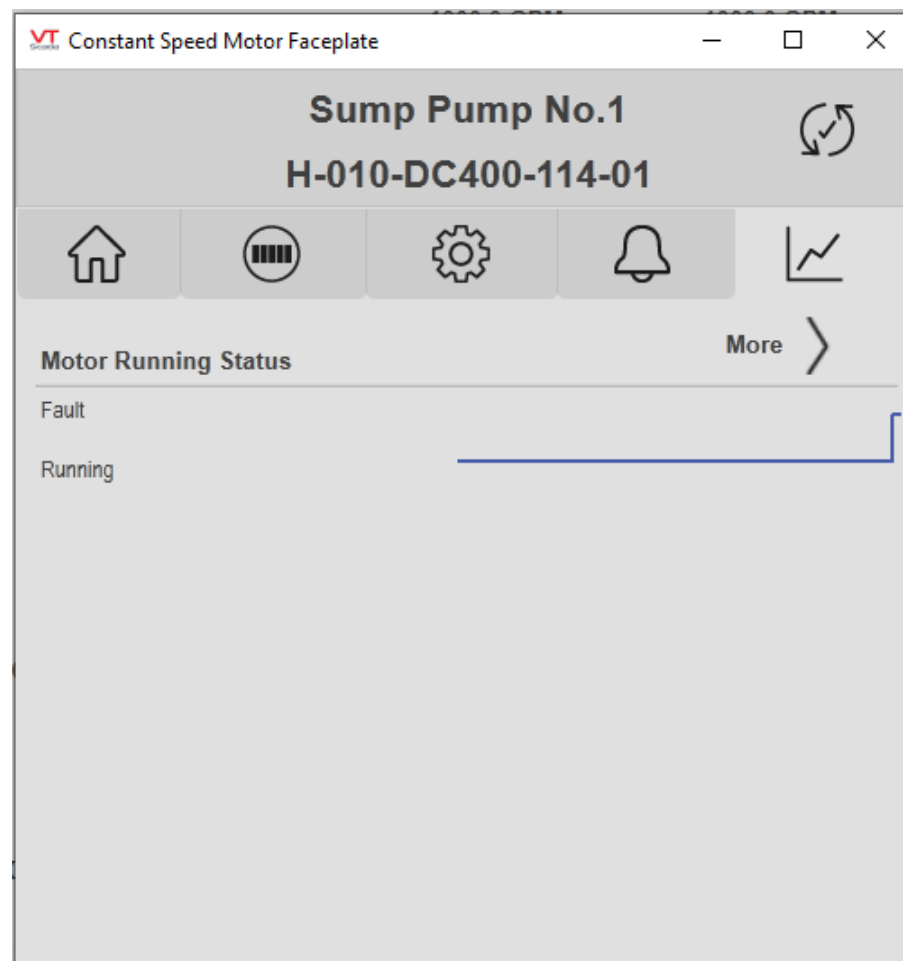
Sump Pump No.1

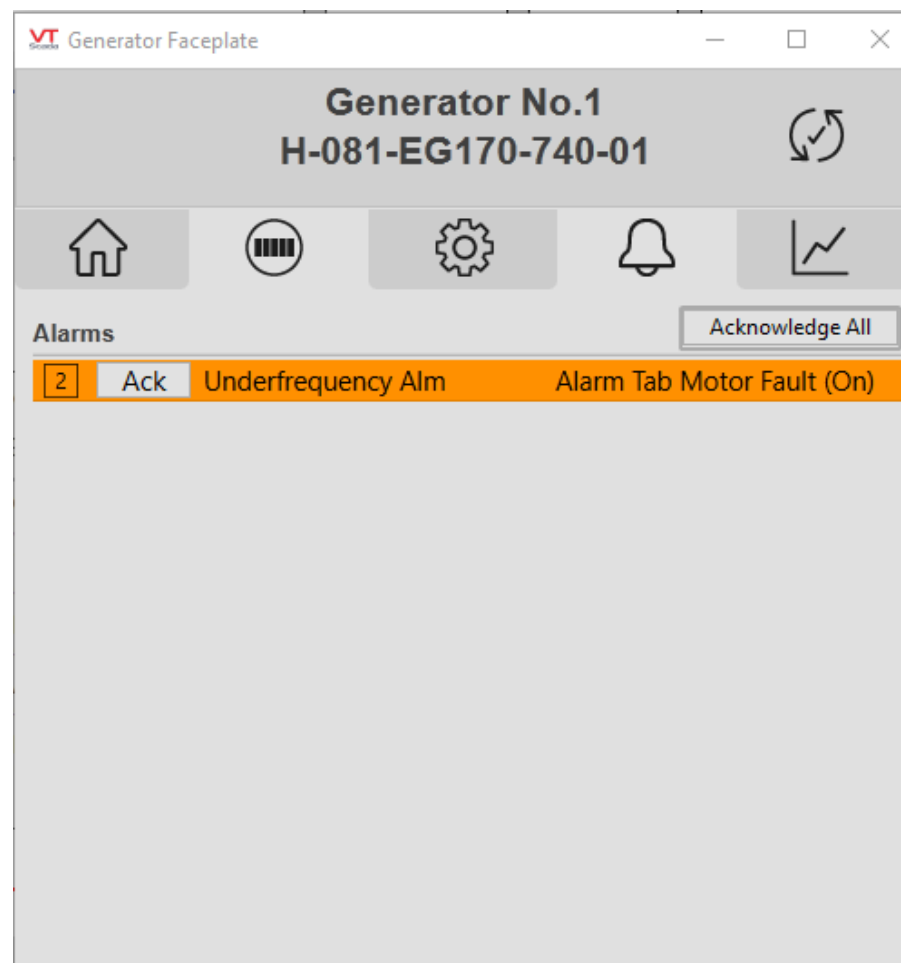
H-010-DC400-114-01

10.0	Min	Cold Restart Time Frame	
4.0	Min	First Fault Restart Delay	
2.0	Min	Subsequent Fault Restart Delay	Cold Motor
5.0	Min	First Fault Restart Delay	
5.0	Min	Subsequent Fault Restart Delay	
10.0	Min	Hot Restart Okay	
10.0	Min	Hot Restart Delay	
15.0	Min	Hot To Cold Delay	Hot Motor
20.0	Sec	Fail to Start Delay	
30.0	Sec	Fail to Stop Delay	











Generator Faceplate

Generator No.1
H-081-EG170-740-01

10.0

Min

Cold Restart Time Frame

4.0

Min

First Fault Restart Delay

2.0

Min

Subsequent Fault Restart Delay

Cold Engine

5.0

Min

First Fault Restart Delay

5.0

Min

Subsequent Fault Restart Delay

10.0

Min

Hot Restart Okay

10.0

Min

Hot Restart Delay

15.0

Min

Hot To Cold Delay

Hot Engine

20.0

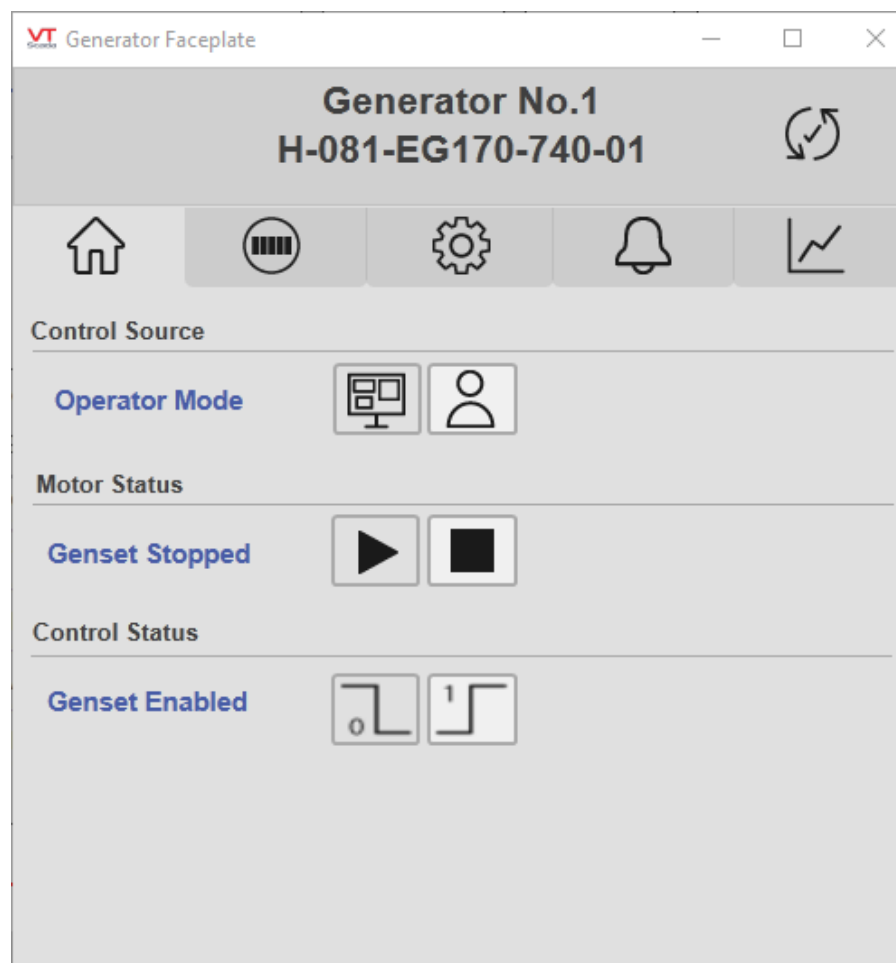
Sec

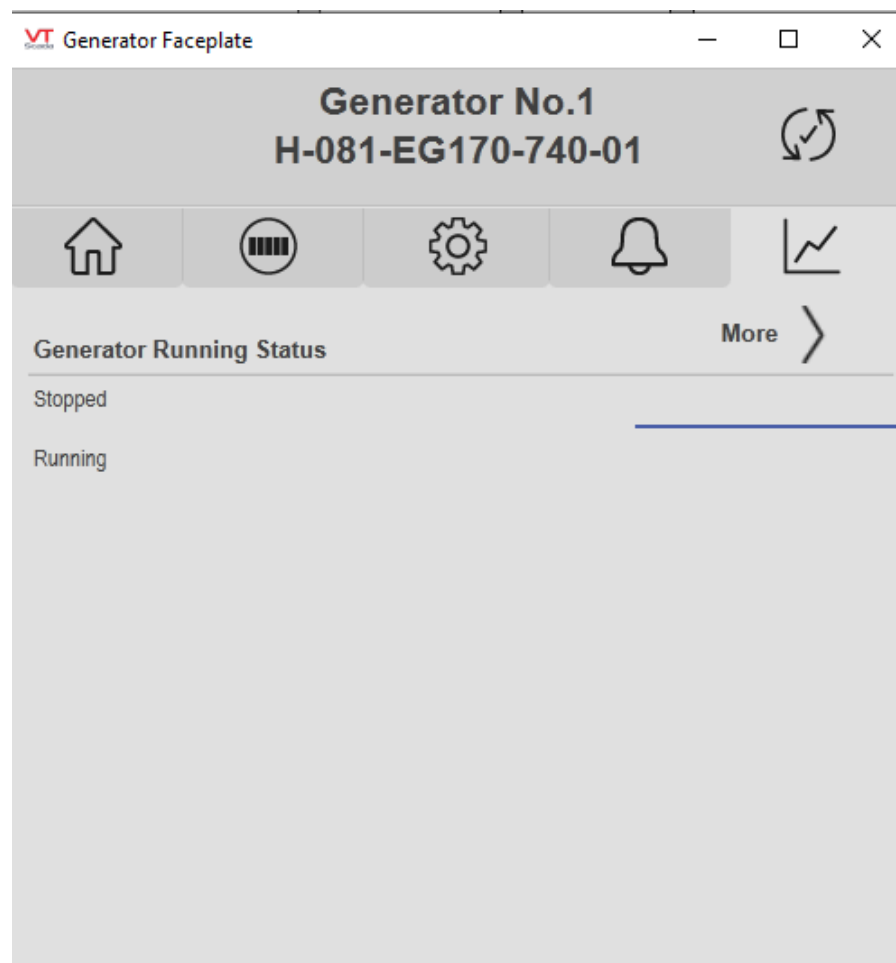
Fail to Start Delay

30.0

Sec

Fail to Stop Delay







Generator Faceplate

Generator No.1
H-081-EG170-740-01

0.0 Total Run Time Hours

Clear Runtime

0.0 Current Run Time Hours

0.0 Number of Starts

Clear Starts

Output Current

Output Voltage

0.0 A Phase A

0.0 V Phase A

0.0 A Phase B

0.0 V Phase B

0.0 A Phase C

0.0 V Phase C



VT LLS Faceplate

HSP Motor Group LLS Manager
H-010-MPS015-104-00

Home Settings Alarms Graph

Alarms Acknowledge All

2	Ack	Motor Group Fail to Start	Motor Group Fail to Start (On)
2	Ack	Motor Group Fail to Stop	Motor Group Fail to Stop (On)

VT LLS Faceplate

HSP Motor Group LLS Manager
H-010-MPS015-104-00

Home Settings Alarms Graph

Date-Time Alternation Mode Sp
24 Hour 30 Min. 42 Sec.

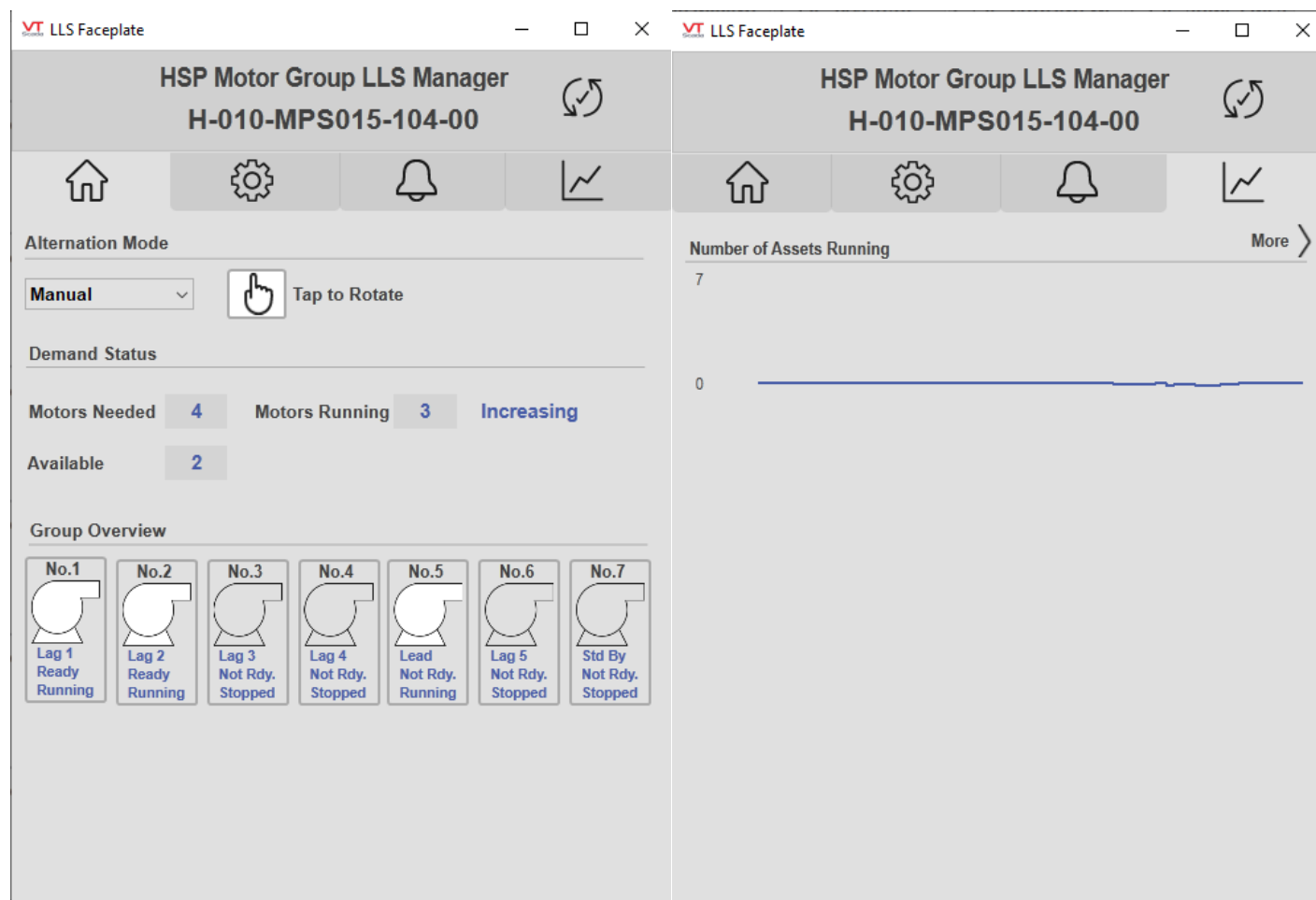
Timer Based Alternation Mode Sp
10 Hr Delay

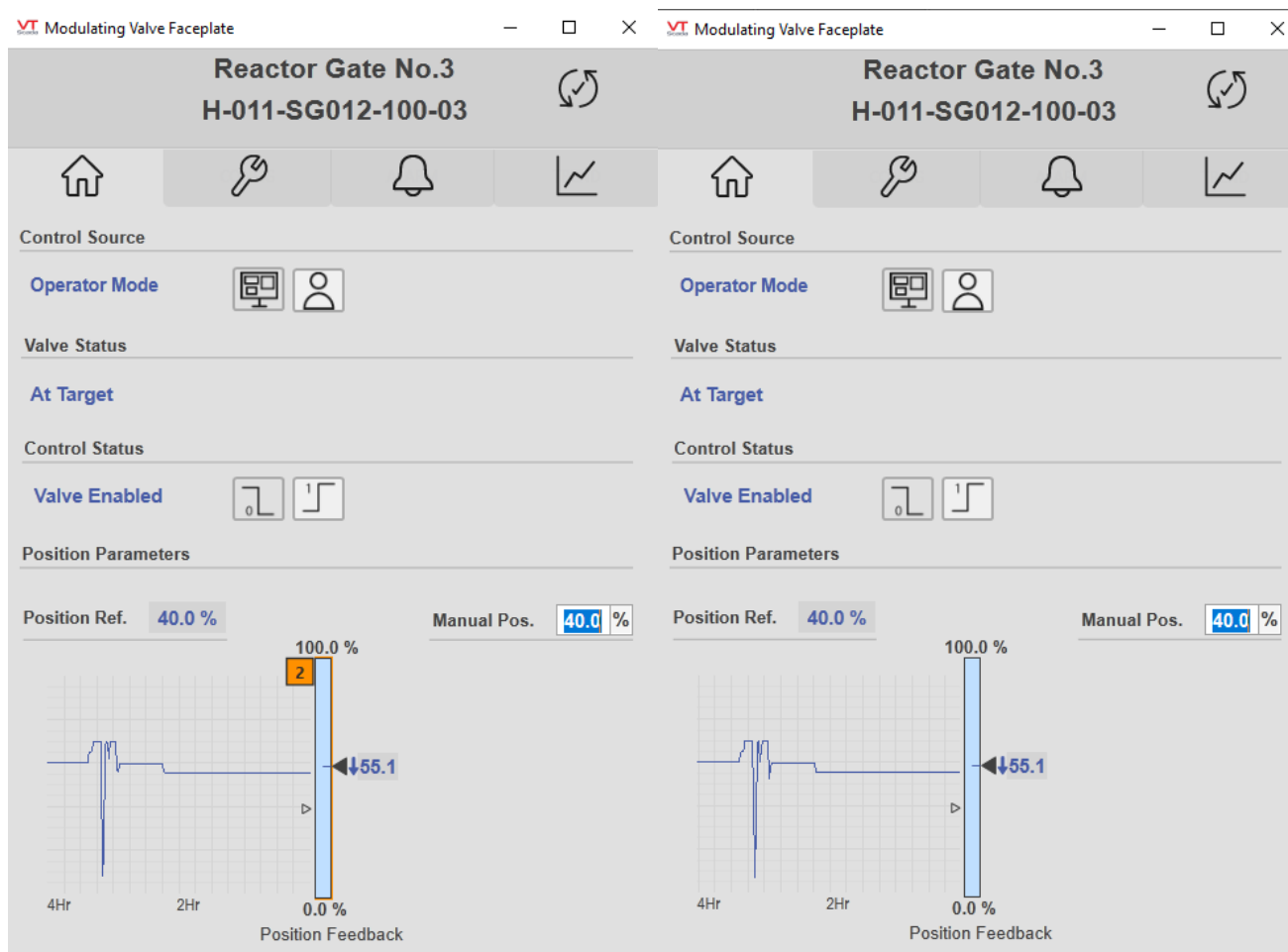
Motor Group Configuration

10 Sec Start Offset Delay 40 Sec Demand Increase Timer
10 Sec Stop Offset Delay 20 Sec Demand Decrease Timer

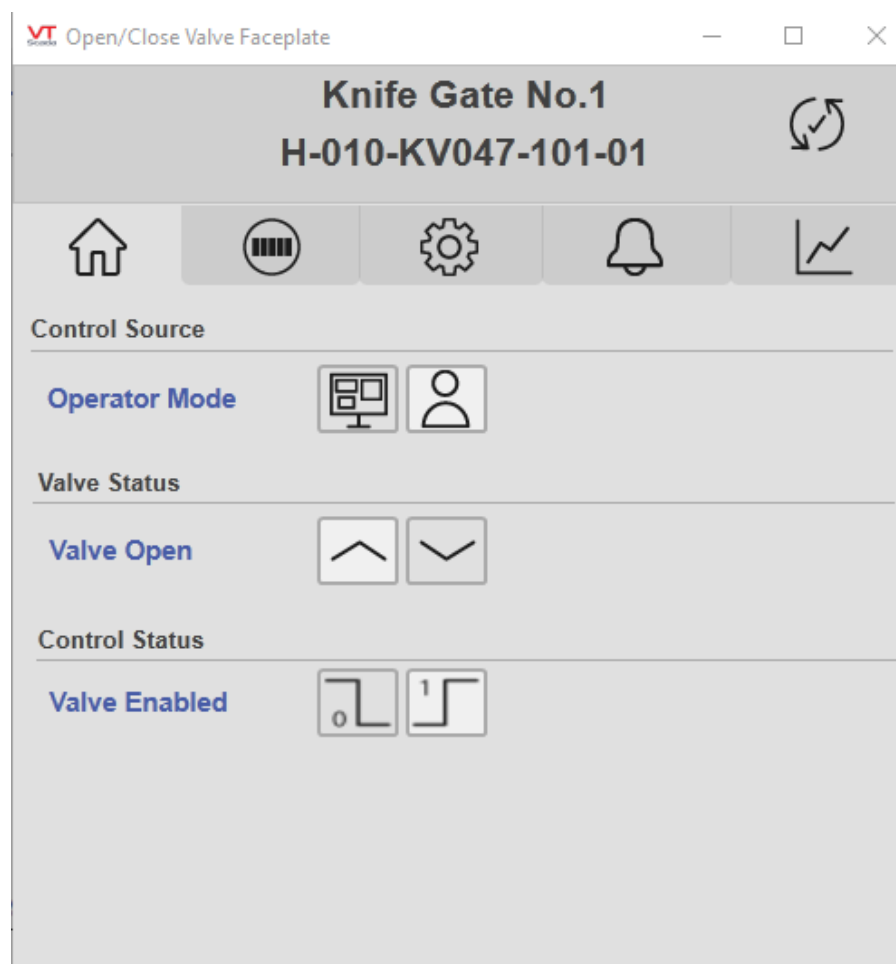
7 Number of Motors in the Group
5 Max Number of Motors to Run
4 Min. Number of Motors to Run

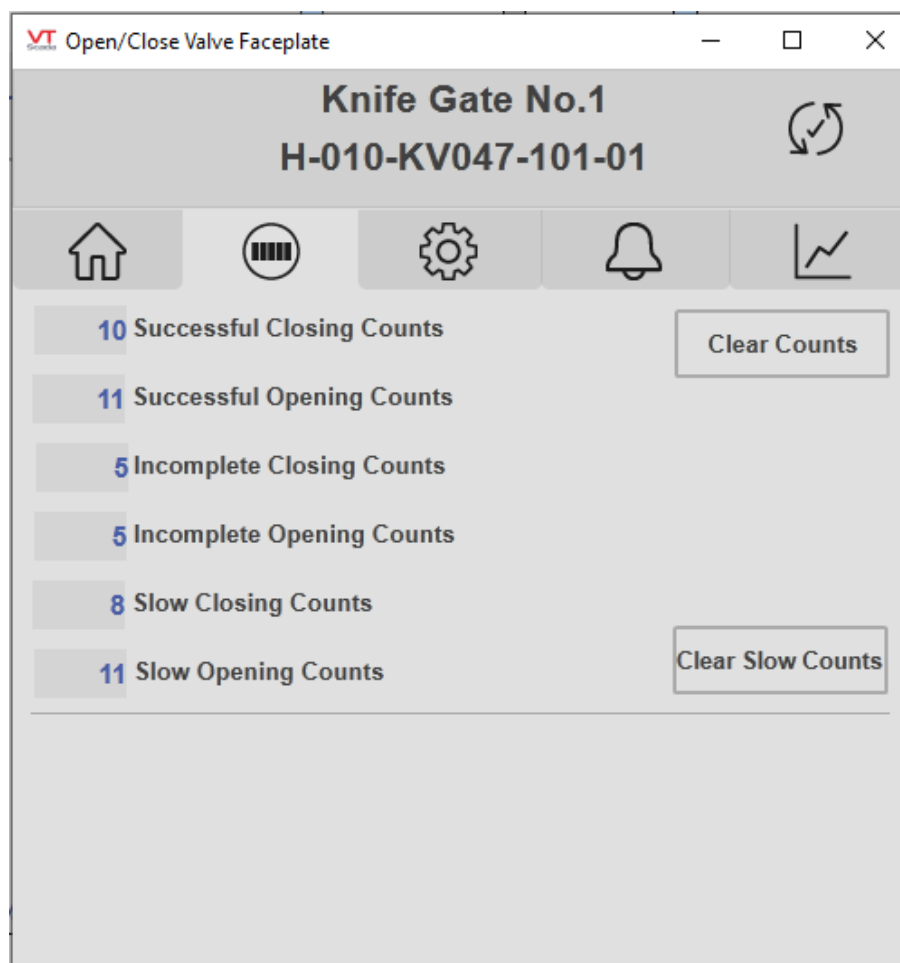
☒ Allow Rotation
☐ First On / First Off
☐ Rotate on Stop













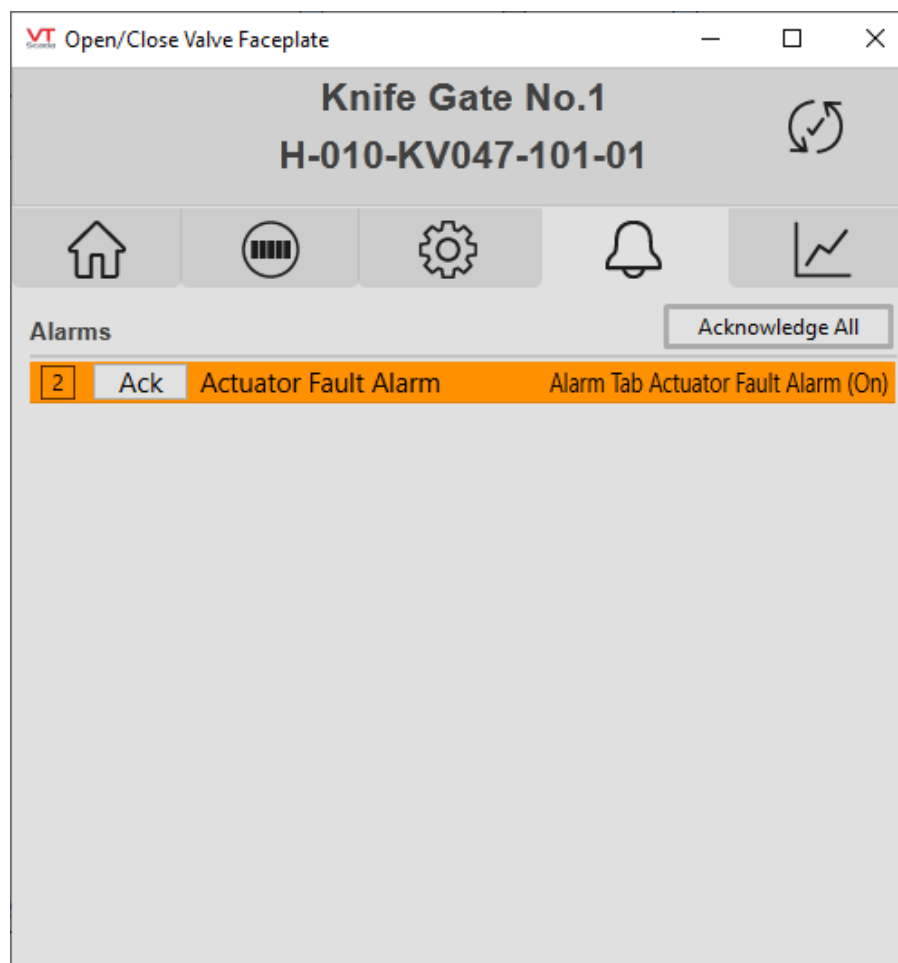
VT Open/Close Valve Faceplate

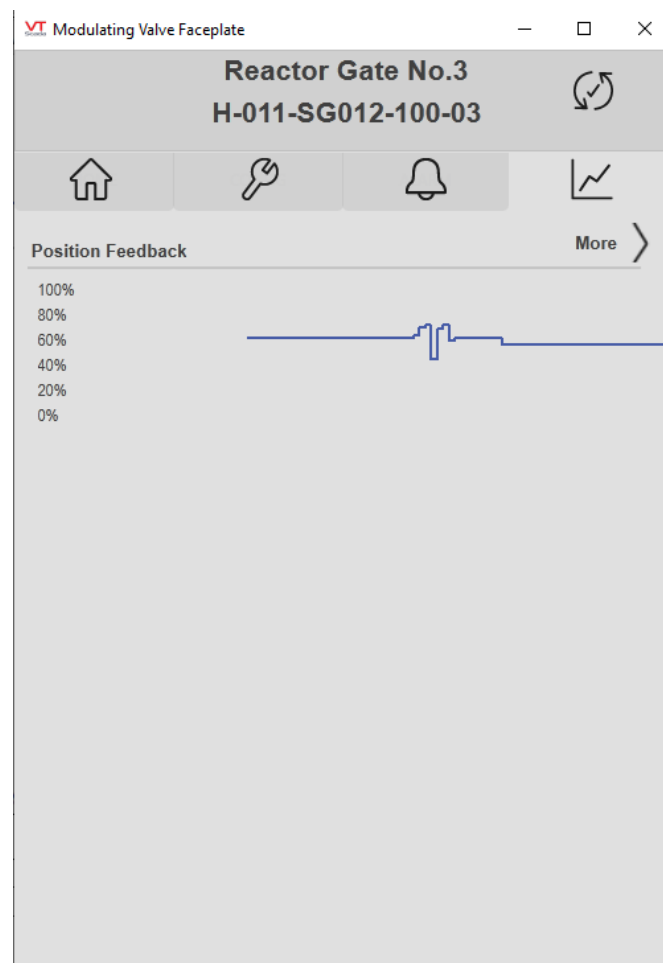
Knife Gate No.1

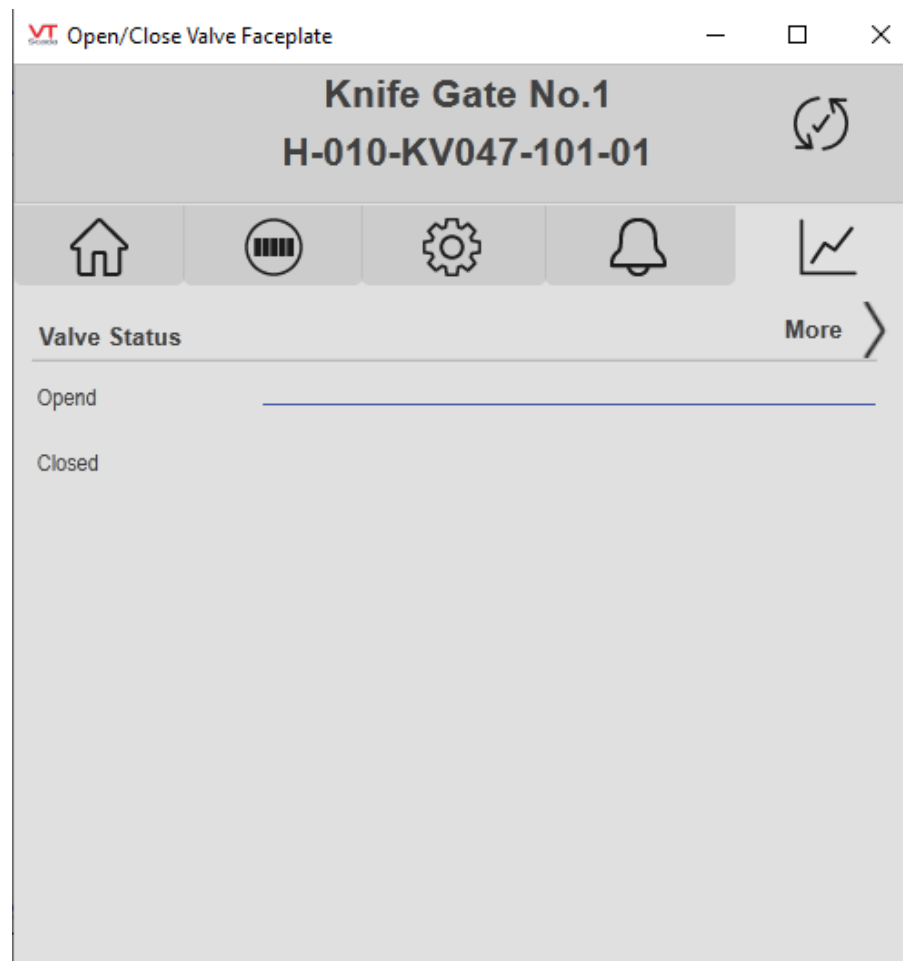
H-010-KV047-101-01

☐ Use Closed Limit Switch
☐ Use Opened Limit Switch
☒ Valve Has Open Limit Switch
☒ Valve Has Closed Limit Switch

Pulse Out Timer
 Full Stall Timer
 Transit Stall Timer









Level PID loop
H-010-PID015-104-01

Process Variable (PV) High Ft

Process Variable (PV) Low Ft

Process Variable (PV) Db Ft

Positive Deviation

Negative Deviation

Deviation Deadband

Level PID loop
H-010-PID015-104-01

PID Equation

Control Action

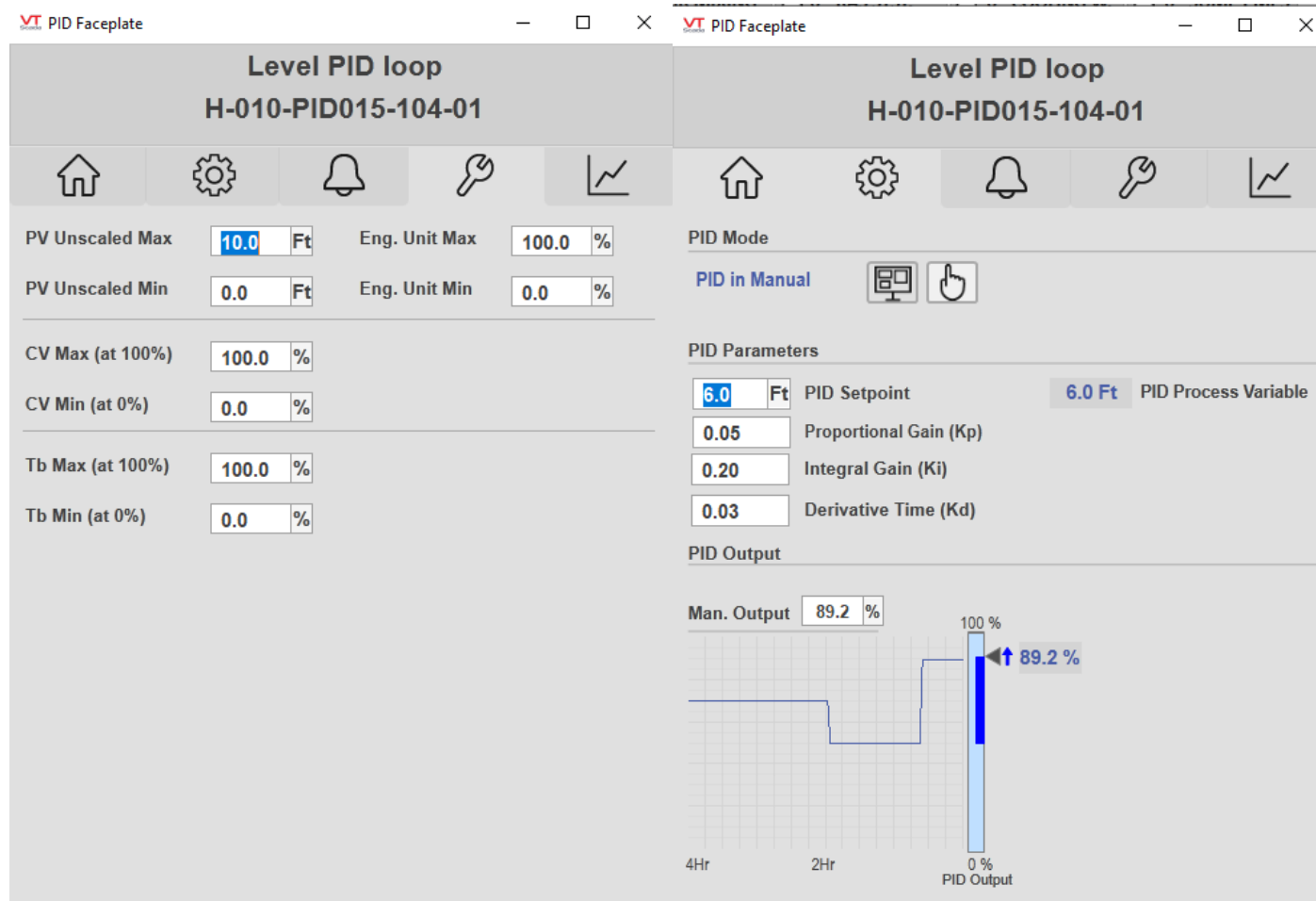
CV High Limit %

CV Low Limit %

Deadband

☐ No Derivative Smoothing

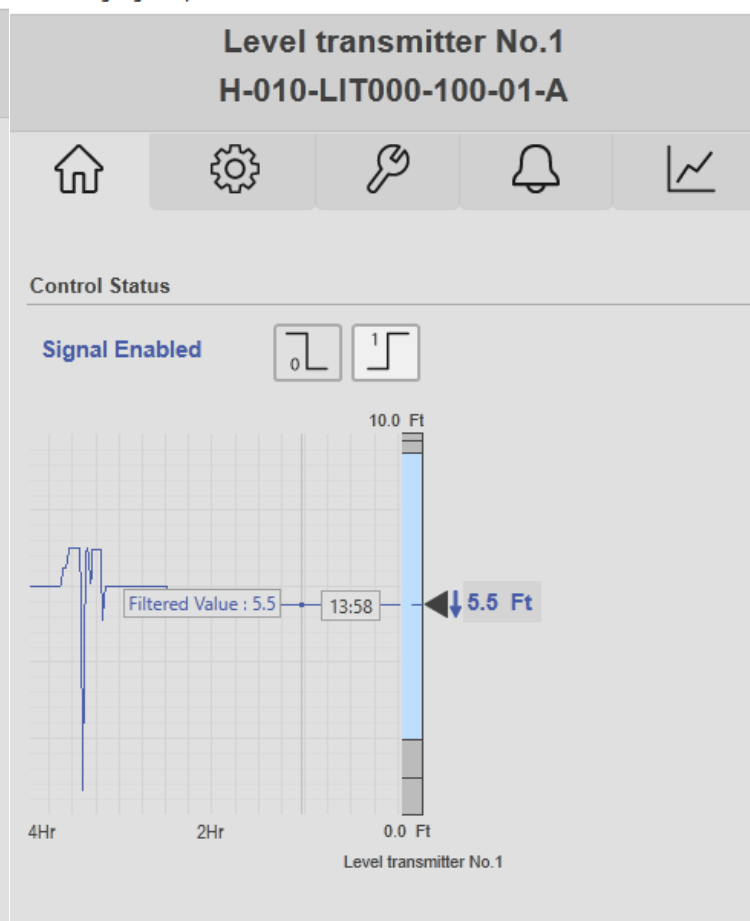
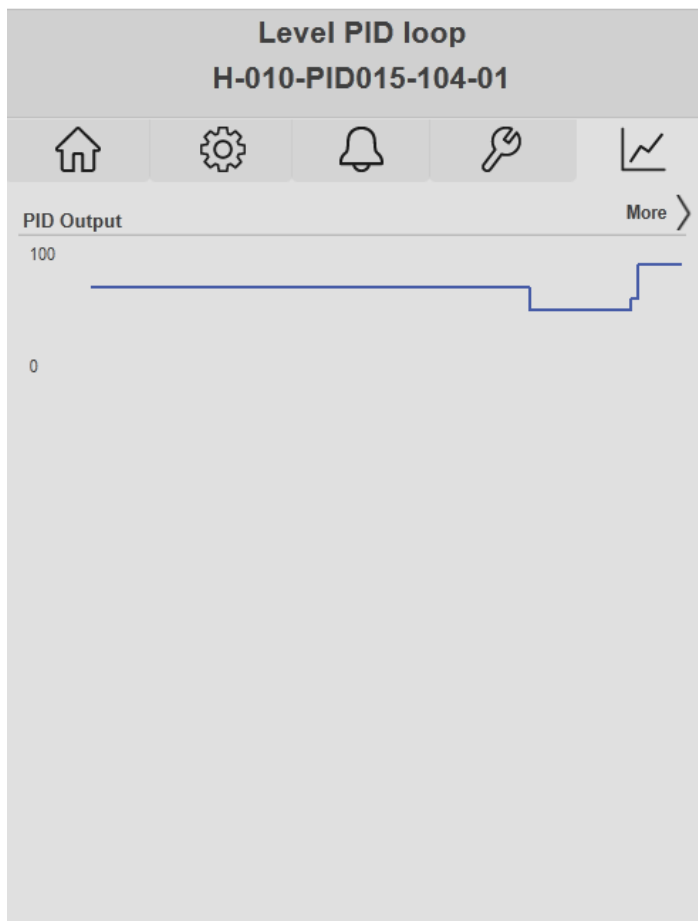
☒ No Zero Crossing for Deadband

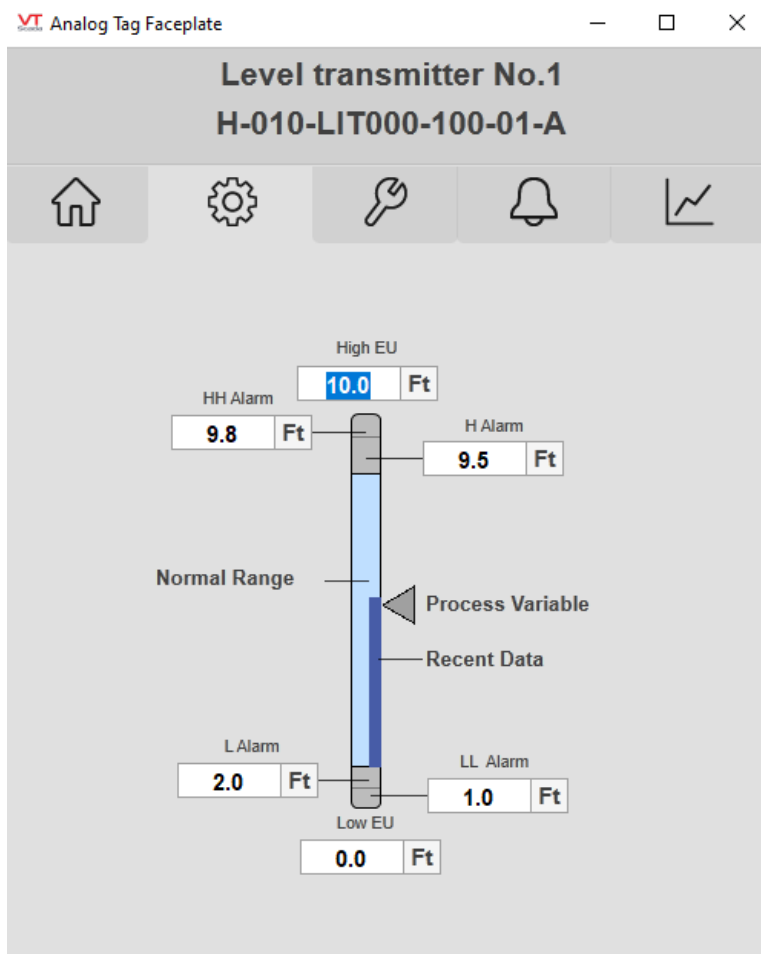




VT PID Faceplate

VT Analog Tag Faceplate







Analog Tag Faceplate

Level transmitter No.1
H-010-LIT000-100-01-A

PV Status

Normal

Tuning

10.0

Sec

Filter Time Constant

Sim. Parameters

120.0 Min

Simulation Timer Pre.

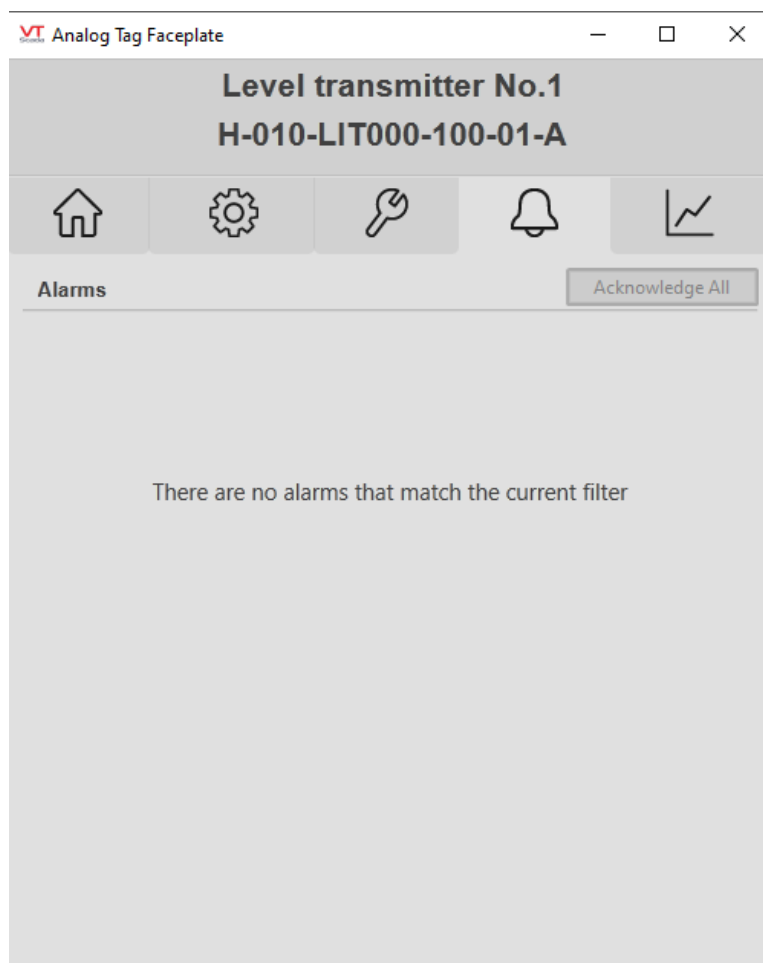
5.5 Ft

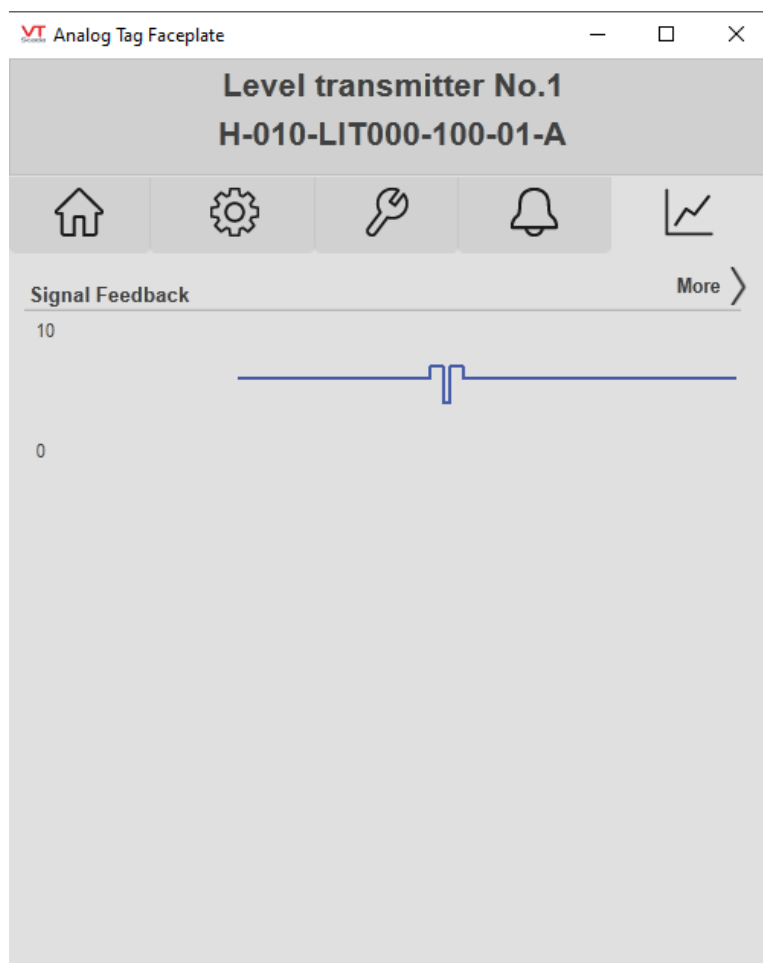
Simulated PV Setpoint

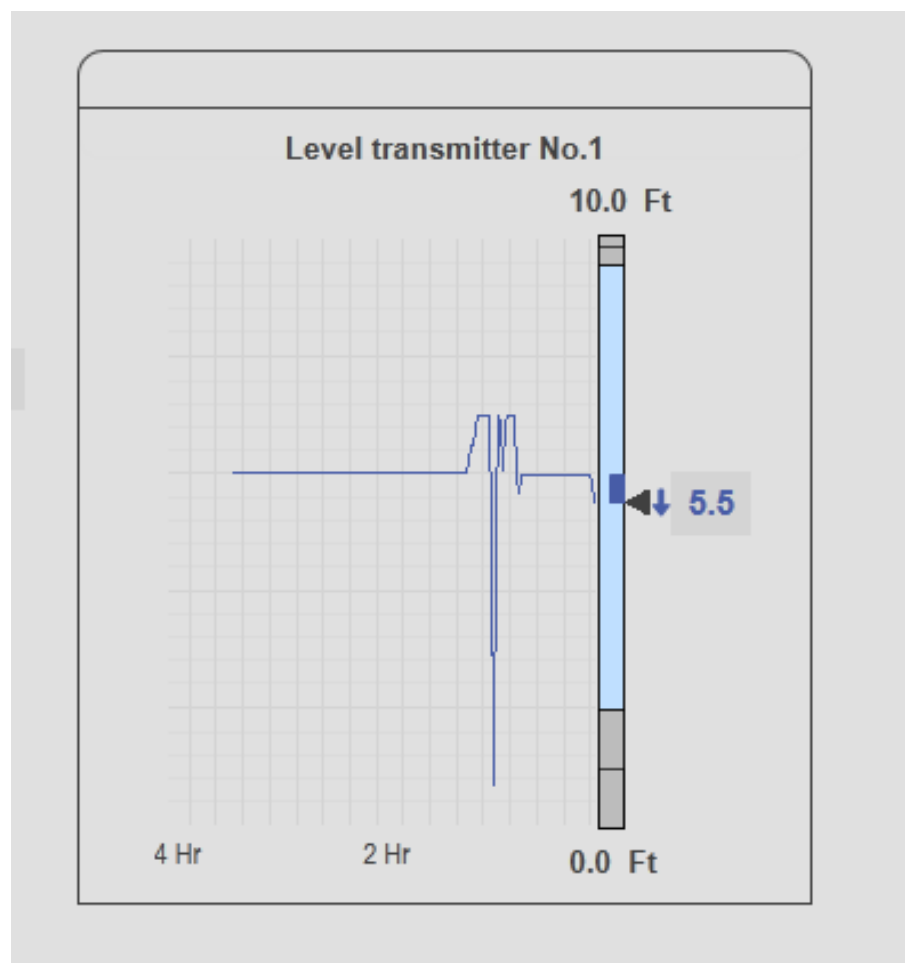
HFC AWTP Master Plan
Howard F. Curren AWTP
SCADA Standards Appendix A -
Definitions and General Reference

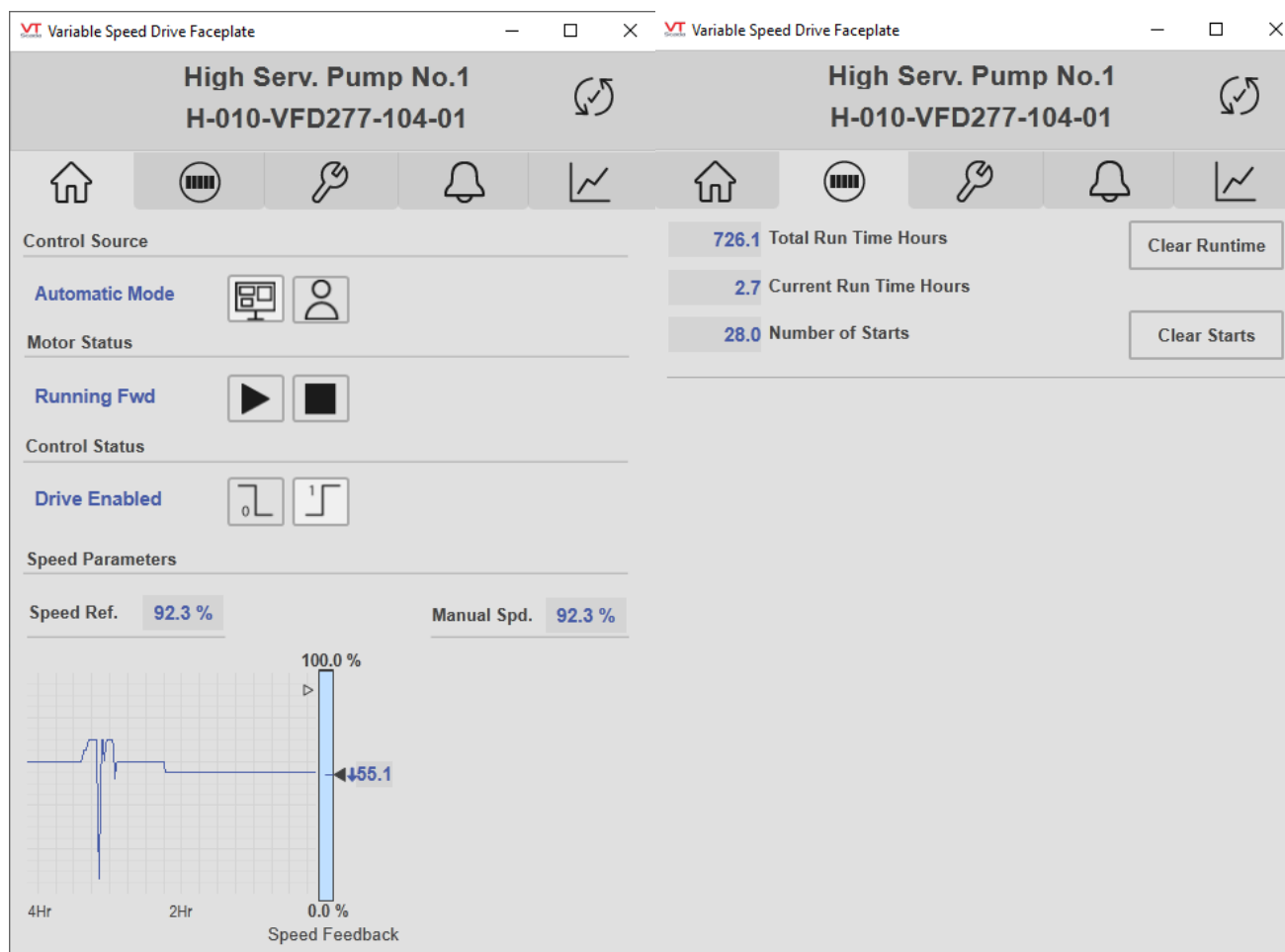
January 2025

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Variable Speed Drive Faceplate

Variable Speed Drive Faceplate

High Serv. Pump No.1

H-010-VFD277-104-01

Home

Stop

Wrench

Bell

Graph

10.0

Min

Cold Restart Time Frame

4.0

Min

First Fault Restart Delay

2.0

Min

Subsequent Fault Restart Delay

Cold Motor

5.0

Min

First Fault Restart Delay

5.0

Min

Subsequent Fault Restart Delay

0.6

Min

Hot Restart Okay

0.6

Min

Hot Restart Delay

6.0

Min

Hot To Cold Delay

Hot Motor

30.0

Sec

Fail to Start Delay

30.0

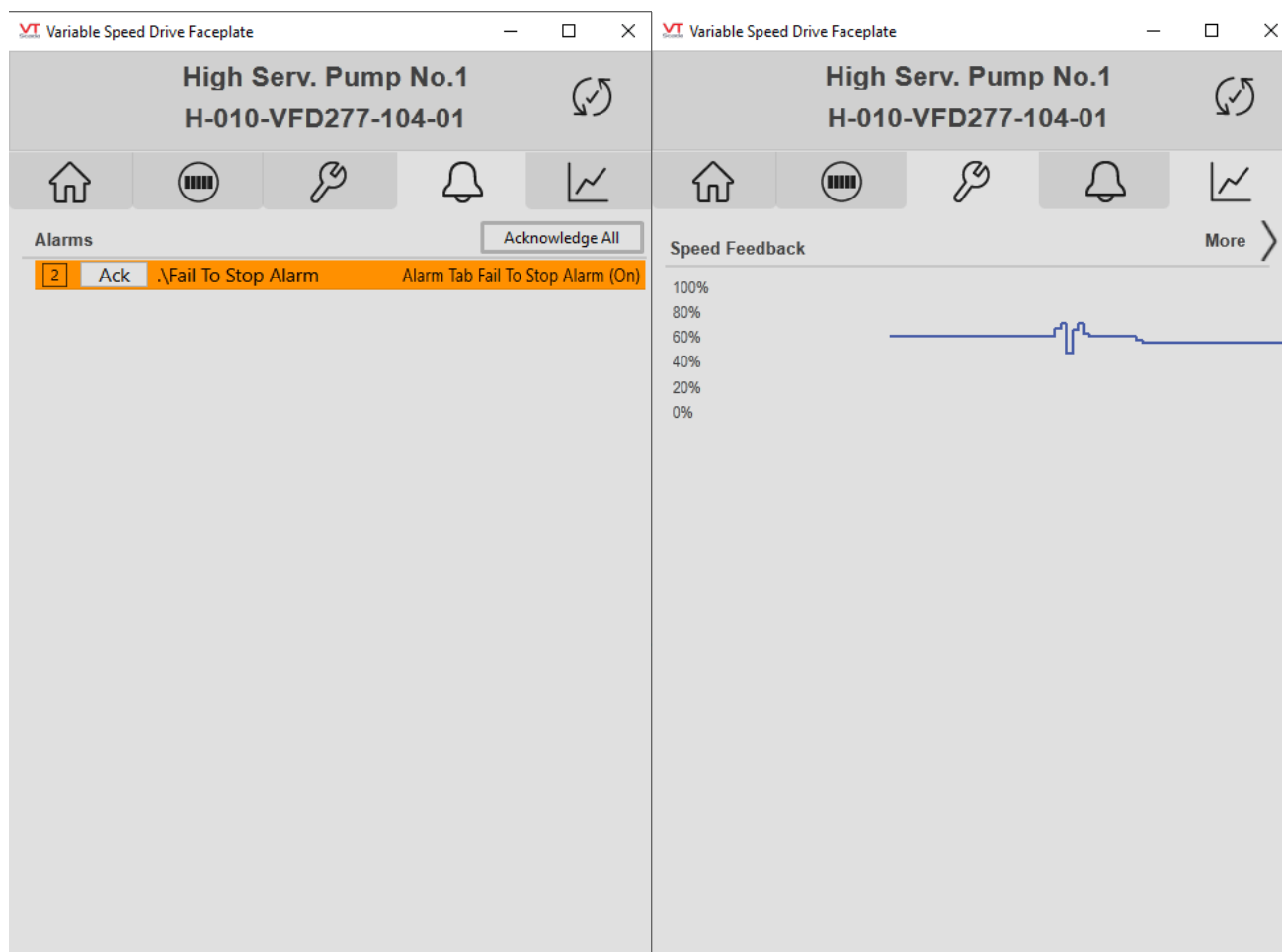
Sec

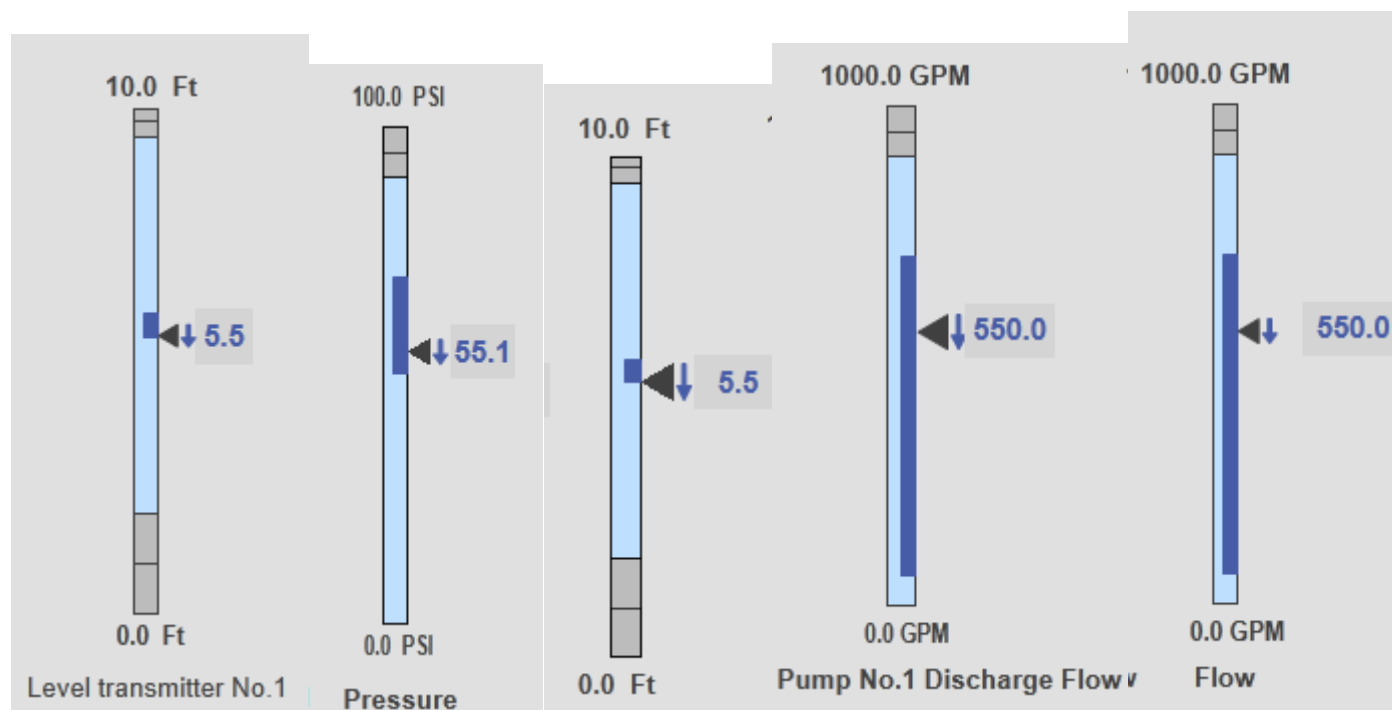
Fail to Stop Delay

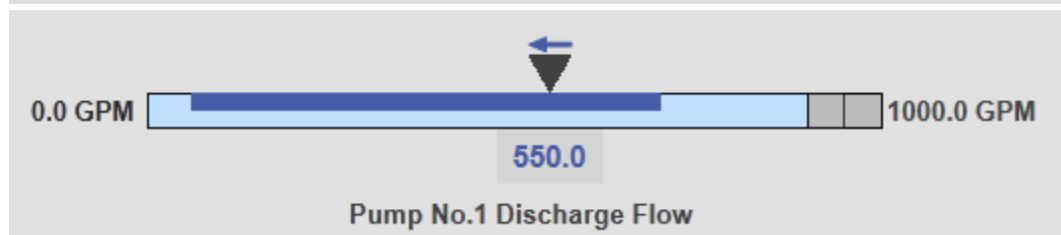
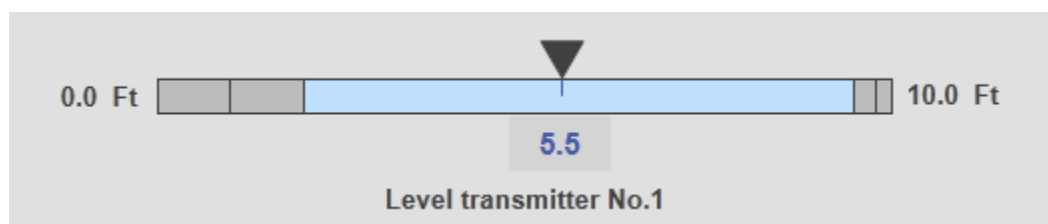
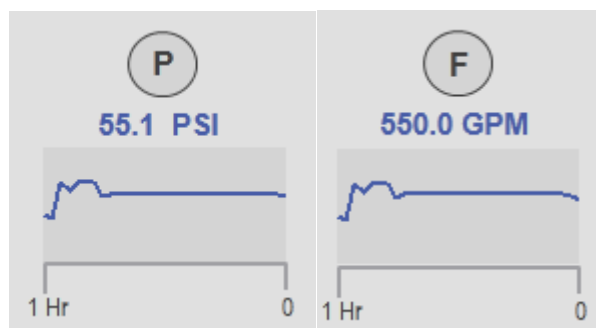
Alarms

Acknowledge All

There are no alarms that match the current filter









Tech. Data Description	Desc Tech Data

21 OIT Address Mapping

TAG	DEVICE	TYPE	ADDRESS	DESCRIPTION
GENERAL TAGS (LB0 - LB199)				
NAVIGATION & GENERAL VARIABLES (LB0-LB19)				
FP_HomeTab	Local HMI	LB	0	FP HomeTab is active
FP_UtilityTab	Local HMI	LB	1	FP UtilityTab is active
FP_ConfigTab	Local HMI	LB	2	FP ConfigurationTab is active
FP_AlarmTab	Local HMI	LB	3	FP AlarmTab is active
FP_AddUserTab	Local HMI	LB	4	FP Add User Tab is active
FP_EditUserTab	Local HMI	LB	5	FP Add User Tab is active
FP_DeleteUserTab	Local HMI	LB	6	FP Delete User Tab is active
FP_FieldInput_Enb	Local HMI	LB	7	FP Field input is enabled for the operator to enter a value (1: enabled / 0: disabled)
FP_RemoteCmd_Enb	Local HMI	LB	8	FP Remote Cmd is enable, no local status and no disble status (1: enabled / 0: disabled)
Login_out_Cmd	Local HMI	LB	9	Login/Logout Cmd has been issued
AddUser_Cmd	Local HMI	LB	10	Add User Cmd has been issued
AssignPriv_Cmd	Local HMI	LB	11	Assign privilege Cmd has been issued
DeleteUser_Cmd	Local HMI	LB	12	Delete User Cmd has been issued
ChangePass_Cmd	Local HMI	LB	13	Change password for an existing user Cmd has been issued
UserLoggedIn	Local HMI	LB	14	An user is currently logged in
COMMANDS ISSUED FROM OIT FACEPLATES (LB20-LB49)				
FP_Inp_Ovrd_btn_pressed	Local HMI	LB	20	FP Auto Mode/Operator Mode button was pressed
FP_EnableIn_btn_pressed	Local HMI	LB	21	FP Enable/Disable button was pressed
FP_Cmd_Open_btn_pressed	Local HMI	LB	22	FP Manual open button was pressed
FP_Cmd_Close_btn_pressed	Local HMI	LB	23	FP Manual close button was pressed
FP_Cmd_Start_btn_pressed	Local HMI	LB	24	FP Manual start button was pressed
FP_Cmd_Stop_btn_pressed	Local HMI	LB	25	FP Manual stop button was pressed
FP_Inp_Sim_btn_pressed	Local HMI	LB	26	FP Simulation Mode button was pressed
FP_PID_Manual_btn_pressed	Local HMI	LB	27	FP PID Manual/Auto control button has been pressed
FP_Alm_InpReset_btn_pressed	Local HMI	LB	28	FP Reset Alarms button was pressed
FP_LeadLag_ManRot_btn_pressed	Local HMI	LB	29	FP Manual Rotation button was pressed
OIT_DSBL	Local HMI	LB	30	FP Enable/Disable equipment from OIT (0:disabled, 1: enabled)
OIT_Inp_Ovrd	Local HMI	LB	31	FP Auto Mode/Operator Mode selection from OIT (0: Operator Mode, 1: Manual Mode)
OIT_PCcmd_Open	Local HMI	LB	32	FP Open Command issued from OIT (0: Open cmd not active, 1: Open cmd active)
OIT_PCcmd_Close	Local HMI	LB	33	FP Close Command issued from OIT (0: Close cmd not active, 1: Close cmd active)
OIT_PCcmd_Start	Local HMI	LB	34	FP Start Command issued from OIT (0: Start cmd not active, 1: Start cmd active)
OIT_PCcmd_Stop	Local HMI	LB	35	FP Stop Command issued from OIT (0: Stop cmd not active, 1: Stop cmd active)
OIT_Inp_Sim	Local HMI	LB	36	FP Start Simulation mode from OIT (1: Simulation mode active, 0: Simulation Mode not active)
OIT_Alm_Inp_Reset	Local HMI	LB	37	FP Command to reset all fault conditions and latched alarms
OIT_Manual_InputField_Flag	Local HMI	LB	38	FP Setting Input Filed from OIT
OIT_AI_SimTPreset_InputFieldd_Flag	Local HMI	LB	39	FP Setting Simulation timer from OIT in Simulation Mode
OIT_AI_SimPV_Setpoint_InputField_Flag	Local HMI	LB	40	FP Setting Simulation process variable setpoint from OIT in Simulation Mode
OIT_LeadLagMode_Selector	Local HMI	LB	41	FP LeadLag Mode selector
OIT_LeadLagManRot_Cmd	Local HMI	LB	42	FP LeadLag Manual Rotation Command
OIT_LeadLag_RotHr_InputField_Flag	Local HMI	LB	43	FP Setting time (hours) from OIT in Lead/Lag block Manual Mode
OIT_LeadLag_RotMin_InputField_Flag	Local HMI	LB	44	FP Setting time (minutes) from OIT in Lead/Lag block Manual Mode
OIT_LeadLag_RotSec_InputField_Flag	Local HMI	LB	45	FP Setting time (seconds) from OIT in Lead/Lag block Manual Mode
OIT_LeadLag_RotHrDelay_InputField_Flag	Local HMI	LB	46	FP Setting time (hours) from OIT in Lead/Lag block Manual Mode
STATUS VARIABLES READ FROM PLC (LB50-LB99)				
EnableOut	Local HMI	LB	50	Enable/Disable status feedback from equipment (0: disabled, 1: enabled)
Sts_Hand	Local HMI	LB	51	Local/Remote status feedback from equipment (0: remote, 1: local)
Sts_Ovrd	Local HMI	LB	52	Manual/Auto status feedback from equipment (0: operator mode, 1: auto mode)
Sts_Opened	Local HMI	LB	53	Open status feedback from equipment (0: not open, 1: open)
Sts_Closed	Local HMI	LB	54	Closed status feedback from equipment (0: not closed, 1: closed)
Inp_RunFdbk	Local HMI	LB	55	Running status feedback from equipment (0: not running, 1: running)
Sts_Stopped	Local HMI	LB	56	Stopping status feedback from equipment (0: not stopped, 1: stopped)
Actuator_UseClosedLS	Local HMI	LB	57	FP Open_Close_Actuator ConfigTab Parameter: Use Closed Limit Switch (read only)
Actuator_UseOpenLS	Local HMI	LB	58	FP Open_Close_Actuator ConfigTab Parameter: Use Opened Limit Switch (read only)
Actuator_HasClosedLS	Local HMI	LB	59	FP Open_Close_Actuator ConfigTab Parameter: Has closed Limit Switch (read only)
Actuator_HasOpenLS	Local HMI	LB	60	FP Open_Close_Actuator ConfigTab Parameter: Has open Limit Switch (read only)
PID_ManualControl	Local HMI	LB	61	FP PID Mode (0:Auto, 1: Manual)
PID_Equation	Local HMI	LB	62	FP Equation type
PID_ControlAction	Local HMI	LB	63	FP Control Action
PID_NoDerivS	Local HMI	LB	64	FP No Derivative Smoothing
PID_NoZeroCross	Local HMI	LB	65	FP No Zero crossing for DB
LeadLag_TimerBasedMode	Local HMI	LB	66	FP LeadLag TimerBased Mode active
LeadLag_DateandTimeMode	Local HMI	LB	67	FP LeadLag DateandTime Mode active
LeadLag_ManualMode	Local HMI	LB	68	FP LeadLag Manual Mode active
LeadLag_P1_Avail	Local HMI	LB	69	FP LeadLag P1 availability (Ready/Not Ready)
LeadLag_P2_Avail	Local HMI	LB	70	FP LeadLag P2 availability (Ready/Not Ready)
LeadLag_P3_Avail	Local HMI	LB	71	FP LeadLag P3 availability (Ready/Not Ready)
LeadLag_P4_Avail	Local HMI	LB	72	FP LeadLag P4 availability (Ready/Not Ready)
LeadLag_P5_Avail	Local HMI	LB	73	FP LeadLag P5 availability (Ready/Not Ready)

LeadLag_P6_Avail	Local HMI	LB	74 FP LeadLag P6 availability (Ready/Not Ready)
LeadLag_P7_Avail	Local HMI	LB	75 FP LeadLag P7 availability (Ready/Not Ready)
LeadLag_P8_Avail	Local HMI	LB	76 FP LeadLag P8 availability (Ready/Not Ready)
LeadLag_P9_Avail	Local HMI	LB	77 FP LeadLag P9 availability (Ready/Not Ready)
LeadLag_P10_Avail	Local HMI	LB	78 FP LeadLag P10 availability (Ready/Not Ready)
LeadLag_P1_RunningSts	Local HMI	LB	79 FP LeadLag P1 running status (Running/Stopped)
LeadLag_P2_RunningSts	Local HMI	LB	80 FP LeadLag P2 running status (Running/Stopped)
LeadLag_P3_RunningSts	Local HMI	LB	81 FP LeadLag P3 running status (Running/Stopped)
LeadLag_P4_RunningSts	Local HMI	LB	82 FP LeadLag P4 running status (Running/Stopped)
LeadLag_P5_RunningSts	Local HMI	LB	83 FP LeadLag P5 running status (Running/Stopped)
LeadLag_P6_RunningSts	Local HMI	LB	84 FP LeadLag P6 running status (Running/Stopped)
LeadLag_P7_RunningSts	Local HMI	LB	85 FP LeadLag P7 running status (Running/Stopped)
LeadLag_P8_RunningSts	Local HMI	LB	86 FP LeadLag P8 running status (Running/Stopped)
LeadLag_P9_RunningSts	Local HMI	LB	87 FP LeadLag P9 running status (Running/Stopped)
LeadLag_P10_RunningSts	Local HMI	LB	88 FP LeadLag P10 running status (Running/Stopped)
LeadLag_Cfg_AllowRotate	Local HMI	LB	89 1=Allow Rotate ("cycle lead") command to rotate motor assignments
LeadLag_Cfg_FirstOnFirstOff	Local HMI	LB	90 1=First started is first stopped, 0=First started is last stopped
LeadLag_Cfg_RotateOnStop	Local HMI	LB	91 1=Rotate (cycle lead to end of list) upon stopping all motors
STATUS VARIABLES READ FROM PLC (ALARMS) (LB100-LB299)			
Actuator_Alm_Fault	Local HMI	LB	100 ALARM Actuator Fault
Actuator_Alm_FullStall	Local HMI	LB	101 ALARM Actuator Full Stall
Actuator_Alm_TransitStall	Local HMI	LB	102 ALARM Actuator Transit Stall
Motor_Alm_FailToStart	Local HMI	LB	103 ALARM Fail To Start
Motor_Alm_FailToStop	Local HMI	LB	104 ALARM Fail To Stop
Motor_Alm_IOFault	Local HMI	LB	105 ALARM IO Fault
Motor_Alm_GeneralFault	Local HMI	LB	106 ALARM Motor Fault
Motor_Alm_HighTemperature	Local HMI	LB	107 ALARM Motor High Temperature
Motor_Alm_Moisture	Local HMI	LB	108 ALARM Motor Seal Leak
Motor_Alm_EstopActive	Local HMI	LB	109 ALARM Motor E-stop Active
Motor_Alm_InterlockTrip	Local HMI	LB	110 ALARM Motor Interlock Trip
AI_Alm_ProcessInputFault	Local HMI	LB	111 ALARM Process Input Fault
AI_Alm_LoLo	Local HMI	LB	112 ALARM Process Variable Low Low
AI_Alm_Lo	Local HMI	LB	113 ALARM Process Variable Low
AI_Alm_Hi	Local HMI	LB	114 ALARM Process Variable High
AI_Alm_HiHi	Local HMI	LB	115 ALARM Process Variable High High Alarm
ModulatingValve_Alm_ActuatorFault	Local HMI	LB	116 ALARM Actuator Fault
ModulatingValve_Alm_IOFault	Local HMI	LB	117 ALARM Position Feedback process Input Fault
LeadLag_Alm_Sts_CantStart	Local HMI	LB	118 ALARM Motor Group Fail to Start
LeadLag_Alm_Sts_CantStop	Local HMI	LB	119 ALARM Motor Group Fail to Stop
Generator_Alm_EngOverload	Local HMI	LB	120 ALARM Engine overload
Generator_Alm_UnderF	Local HMI	LB	121 ALARM Engine underfrequency
MPS(LB300-LB499)			
PROCESS SCREENS NAVIGATION			
MPS_Screen_BlowerSyst	Local HMI	LB	300 Screen Blower System active
MPS_Screen_Reactors	Local HMI	LB	301 Screen HPO Reactor active
MPS_Screen_PumpStation	Local HMI	LB	302 Screen Pump Station active
MPS_Screen_O2Supply	Local HMI	LB	303 Screen O2 Supply active
MPS_Screen_Compressors	Local HMI	LB	304 Screen Compressors active
MPS_Screen_AirMixing	Local HMI	LB	305 Screen Air Mixing active
MPS_Screen_RASSystem	Local HMI	LB	306 Screen RAS System active
MPS_Screen_CoolingW	Local HMI	LB	307 Screen Cooling Water active
MPS_Screen_SumpPumps	Local HMI	LB	308 Screen Sump Puactive
EQUIPMENT			
H_010_VFD015_104_01	Local HMI	LB	321 Pump No. 1
H_010_VFD015_104_02	Local HMI	LB	322 Pump No. 2
H_010_VFD015_104_03	Local HMI	LB	323 Pump No. 3
H_010_VFD015_104_04	Local HMI	LB	324 Pump No. 4
H_010_VFD015_104_05	Local HMI	LB	325 Pump No. 5
H_010_VFD015_104_06	Local HMI	LB	326 Pump No. 6
H_010_VFD015_104_07	Local HMI	LB	327 Pump No. 7
H_010_KV047_101_01	Local HMI	LB	328 Wetwell Knife Valve No. 1
H_010_KV047_101_02	Local HMI	LB	329 Wetwell Knife Valve No. 2
H_010_KV047_101_03	Local HMI	LB	330 Wetwell Knife Valve No. 3
H_010_KV047_101_04	Local HMI	LB	331 Wetwell Knife Valve No. 4
H_010_KV047_101_05	Local HMI	LB	332 Wetwell Knife Valve No. 5
H_010_KV047_101_06	Local HMI	LB	333 Wetwell Knife Valve No. 6
H_010_KV047_101_07	Local HMI	LB	334 Wetwell Knife Valve No. 7
H_010_SG012_100_01	Local HMI	LB	335 Wetwell Sluice Gate No. 1
H_010_SG012_100_02	Local HMI	LB	336 Wetwell Sluice Gate No. 2
H_010_SG012_100_03	Local HMI	LB	337 Wetwell Sluice Gate No. 3
H_010_SG012_100_04	Local HMI	LB	338 Wetwell Sluice Gate No. 4
H_010_SG012_100_05	Local HMI	LB	339 Wetwell Sluice Gate No. 5

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H_010_SG012_100_06	Local HMI	LB	340	Wetwell Sluice Gate No. 6
H_010_SG012_100_07	Local HMI	LB	341	Wetwell Sluice Gate No. 7
H_010_SG012_100_08	Local HMI	LB	342	Wetwell Sluice Gate No. 8
H_010_SG012_100_09	Local HMI	LB	343	Wetwell Sluice Gate No. 9
H_010_SG012_108_01	Local HMI	LB	344	Discharge Channel Sluice Gate No. 1
H_010_SG012_107_02	Local HMI	LB	345	Discharge Channel Sluice Gate No. 2
H_010_LIT000_100_01A	Local HMI	LB	346	Wetwell Level A
H_010_LIT000_100_01B	Local HMI	LB	347	Wetwell Level B
H_010_LIT000_100_01C	Local HMI	LB	348	Wetwell Level C
H_010_LIT000_111_01	Local HMI	LB	349	Sump Level
H_010_PIT000_114_01	Local HMI	LB	350	Dewatering Pump Discharge Pressure
H_010_LIT000_106_01	Local HMI	LB	351	Discharge Channel Level
H_010_PIT000_104_01	Local HMI	LB	352	Pump No. 1 Discharge Pressure
H_010_PIT000_104_02	Local HMI	LB	353	Pump No. 2 Discharge Pressure
H_010_PIT000_104_03	Local HMI	LB	354	Pump No. 3 Discharge Pressure
H_010_PIT000_104_04	Local HMI	LB	355	Pump No. 4 Discharge Pressure
H_010_PIT000_104_05	Local HMI	LB	356	Pump No. 5 Discharge Pressure
H_010_PIT000_104_06	Local HMI	LB	357	Pump No. 6 Discharge Pressure
H_010_PIT000_104_07	Local HMI	LB	358	Pump No. 7 Discharge Pressure
H_010_FIT000_104_01	Local HMI	LB	359	Pump No. 1 Discharge Flow
H_010_FIT000_104_02	Local HMI	LB	360	Pump No. 2 Discharge Flow
H_010_FIT000_104_03	Local HMI	LB	361	Pump No. 3 Discharge Flow
H_010_FIT000_104_04	Local HMI	LB	362	Pump No. 4 Discharge Flow
H_010_FIT000_104_05	Local HMI	LB	363	Pump No. 5 Discharge Flow
H_010_FIT000_104_06	Local HMI	LB	364	Pump No. 6 Discharge Flow
H_010_FIT000_104_07	Local HMI	LB	365	Pump No. 7 Discharge Flow
H_010_DC400_114_01	Local HMI	LB	366	Dewatering Pump
H_010_PID015_104_01	Local HMI	LB	367	Level PID Controller
H_010_MPS015_104_00	Local HMI	LB	368	Lead Lag Controller
H_010_MCC190_760_01	Local HMI	LB	369	MCC No. 1
H_081_EG170_740_01	Local HMI	LB	370	Generator No. 1
HPO (LB500-LB799)				
PROCESS SCREENS NAVIGATION				
EQUIPMENT				
H_011_SG012_100_02	Local HMI	LB	521	HPO Reactor No. 1 sluice gate 2
H_011_SG012_100_03	Local HMI	LB	522	HPO Reactor No. 1 sluice gate 3

TAG	DEVICE	TYPE	ADDRESS	DESCRIPTION
GENERAL TAGS (LW0 - LW199)				
FACEPLATES NAVIGATION & GENERAL VARIABLES (LW0-LW28)				
EQ_Id	Local HMI	LW	0	FP Id corresponding with the selected equipment (value is updated in macros)
EQ_Val_Sts	Local HMI	LW	2	Equipment Operation Status (texts have been linked with each status, refer to string table)
LowLim_Alm	Local HMI	LW	4	Low Limit Alarm
HighLim_Alm	Local HMI	LW	6	High Limit Alarm
Scale_Low	Local HMI	LW	8	Scale Low
Scale_High	Local HMI	LW	10	Scale High
Bar_Indicator_State_Ref	Local HMI	LW	14	Bar Indicator (arrow) State Reference
Bar_Indicator_YDistance_Ref	Local HMI	LW	15	Bar Indicator (arrow) Position Y axis Reference
Bar_Indicator_State_Fdbk	Local HMI	LW	18	Bar Indicator (arrow) State Feedback
Bar_Indicator_YDistance_Fdbk	Local HMI	LW	19	Bar Indicator (arrow) Position Y axis Feedback
CONFIGURATION PARAMETERS (LW30-LW188)				
Actuator_OutPulseT	Local HMI	LW	30	Pulse Output Timer (sec.)
Actuator_FullStallT	Local HMI	LW	32	Full Stall Timer (sec.)
Actuator_TransitStallT	Local HMI	LW	34	Transit Stall Timer (sec.)
Actuator_CplCloseC	Local HMI	LW	36	Successful Closing Counts
Actuator_CplOpenC	Local HMI	LW	38	Successful Opening Counts
Actuator_IncptCloseC	Local HMI	LW	40	Incomplete closing counts
Actuator_IncptOpenC	Local HMI	LW	42	Incomplete Opening Counts
Actuator_SlowCloseC	Local HMI	LW	44	Slow Closing Counts
Actuator_SlowOpenC	Local HMI	LW	46	Slow Opening Counts
Motor_Val_TotRunHrs	Local HMI	LW	48	Total Runtime hours
Motor_Val_CurRunHrs	Local HMI	LW	50	Current Runtime Hours
Motor_Val_Starts	Local HMI	LW	52	Total number of motor starts
Motor_Cfg_ThreeColdStarts	Local HMI	LW	54	Time within which three starts are allowed if cold
Motor_Cfg_FirstFailCold	Local HMI	LW	56	Time for cold motor to wait after 1st start failure before ready to start (hr)
Motor_Cfg_SubseqFailCold	Local HMI	LW	58	Time for cold motor to wait after 2nd and subsequent start failure before ready (hr)
Motor_Cfg_FirstFailHot	Local HMI	LW	60	Time for hot motor to wait after 1st start failure before ready to start (hr)
Motor_Cfg_SubseqFailHot	Local HMI	LW	62	Time for hot motor to wait after 2nd and subsequent start failure before ready (hr)
Motor_Cfg_HotRestartOK	Local HMI	LW	64	Time for hot motor to run so it can immediately restart after stop (hr)
Motor_Cfg_RestartHot	Local HMI	LW	66	Time for hot motor to wait after stop if stopped before Hot Restart OK time (hr)
Motor_Cfg_HotToCold	Local HMI	LW	68	Time for a stopped hot motor to become cold (hr)
Motor_Cfg_FailToStartT	Local HMI	LW	70	Fail to Start Timer
Motor_Cfg_FailToStopT	Local HMI	LW	72	Fail To Stop Timer
AI_Val	Local HMI	LW	74	Process value
AI_Inp_PV	Local HMI	LW	76	Raw value
AI_Cfg_HiAlarm	Local HMI	LW	78	High alarm
AI_Cfg_LoAlarm	Local HMI	LW	80	Low Alarm
AI_Cfg_FiltTC	Local HMI	LW	82	Filter Time Constant
AI_Cfg_SimTimer_Preset	Local HMI	LW	84	Simulation Timer Preset
AI_Cfg_SimPV_SetPoint	Local HMI	LW	86	Simulation Process Value Setpoint
AI_Cfg_SimTimeToRelease	Local HMI	LW	88	Time to release Simulation
AI_Cfg_SimTime_Acc	Local HMI	LW	90	Accumulated simulation time
AI_Flow_Cfg_Total	Local HMI	LW	92	Total Flow
AI_Flow_Cfg_OldTotal	Local HMI	LW	94	Old total
AI_Flow_Cfg_LowInCutoff	Local HMI	LW	96	Low In Cut off
VariableSpeedMotor_Inp_SpeedFdbk	Local HMI	LW	98	Speed feedback from motor
VariableSpeedMotor_PSet_SpeedRef	Local HMI	LW	100	Program Setting of speed reference (manual speed Ref)
VariableSpeedMotor_Out_SpeedRef	Local HMI	LW	102	Speed Reference in Override Mode (Auto Mode)
ModulatingValve_PSetCV	Local HMI	LW	104	Controlled variable output
ModulatingValve_Val_CVSet	Local HMI	LW	106	CV Target in Manual mode
ModulatingValve_Inp_PosFdbk	Local HMI	LW	108	Valve Position Feedback
ModulatingValve_Cfg_CloseRate	Local HMI	LW	110	Rate at which valve moves when closing (CV EU/sec)
ModulatingValve_Cfg_OpenRate	Local HMI	LW	112	Rate at which valve moves when opening (CV EU/sec)
ModulatingValve_Cfg_CVRoCLimInc	Local HMI	LW	114	CV Rate of Change Limit, Increasing, (EU/sec, 0=unlimited)
ModulatingValve_Cfg_CVRoCLimDec	Local HMI	LW	116	CV Rate of Change Limit, Decreasing, (EU/sec, 0=unlimited)
ModulatingValve_Cfg_MaxClosedPos	Local HMI	LW	118	Position above which valve is assumed open if limit switches not used
PID_PV	Local HMI	LW	120	Process Variable
PID_SP	Local HMI	LW	122	Setpoint
PID_KP	Local HMI	LW	124	Proportional Gain
PID_KI	Local HMI	LW	126	Integral Time
PID_KD	Local HMI	LW	128	Derivative Time
PID_ManualOutput	Local HMI	LW	130	Manual output set from SCADA
PID_Output	Local HMI	LW	132	Controller feedback output
PID_MaxO	Local HMI	LW	134	PID High Output
PID_MinO	Local HMI	LW	136	PID Low Output
PID_Deadband	Local HMI	LW	138	Deadband
PID_PV_High	Local HMI	LW	140	Process variable High
PID_PV_Low	Local HMI	LW	142	Process variable Low

PID_PV_DB	Local HMI	LW	144	Process variable DB
PID_PosDeviation	Local HMI	LW	146	Positive deviation
PID_NegDeviation	Local HMI	LW	148	Negative deviation
PID_DevDB	Local HMI	LW	150	Deviation deadband
PID_UnscaledMax	Local HMI	LW	152	PV unscaled Max
PID_UnscaledMin	Local HMI	LW	154	PV Unscaled Min
PID_EngUnitMax	Local HMI	LW	156	PV Engineering Unit Max
PID_EngUnitMin	Local HMI	LW	158	PV Engineering Unit Min
PID_CVMax	Local HMI	LW	160	Control Value Max
PID_CVMin	Local HMI	LW	162	Control Value Min
PID_TBMax	Local HMI	LW	164	Tieback Max
PID_TBMin	Local HMI	LW	166	Tieback Min
LeadLag_AltMode	Local HMI	LW	168	Pump alternation Mode (0: Timer based, 1: date and Time, 2: Manual Rotation)
LeadLag_Sts_MotorAvail	Local HMI	LW	170	Set bits indicate which motors are available for program control
LeadLag_Inv_OvrdDemand	Local HMI	LW	172	Override Mode setting for number of motors to run (MinDemand..MaxDemand)
LeadLag_Val_Sts	Local HMI	LW	174	Group Confirmed Status
LeadLag_MotorsRunning	Local HMI	LW	176	Number of motors running
LeadLag_P1_Rank	Local HMI	LW	178	Rank pump 1
LeadLag_P2_Rank	Local HMI	LW	180	Rank pump 2
LeadLag_P3_Rank	Local HMI	LW	182	Rank pump 3
LeadLag_P4_Rank	Local HMI	LW	184	Rank pump 4
LeadLag_P5_Rank	Local HMI	LW	186	Rank pump 5
LeadLag_P6_Rank	Local HMI	LW	188	Rank pump 6
LeadLag_P7_Rank	Local HMI	LW	190	Rank pump 7
LeadLag_RotHours	Local HMI	LW	192	Date and Time mode rotation hours
LeadLag_RotMin	Local HMI	LW	194	Date and Time mode rotation minutes
LeadLag_RotSec	Local HMI	LW	196	Date and Time mode rotation seconds
LeadLag_RotTimer_acc	Local HMI	LW	198	Timer base mode Accumulated time
LeadLag_CountDownRot	Local HMI	LW	200	Timer base mode count down rotation
LeadLag_Dem_Dec_TMR_SP	Local HMI	LW	202	Demand decrease timer setpoint
LeadLag_Dem_Inc_TMR_SP	Local HMI	LW	204	Demand increase timer setpoint
LeadLag_Cfg_MaxDemand	Local HMI	LW	206	Maximum number of motors to run (1..NumMotors)
LeadLag_Cfg_MinDemand	Local HMI	LW	208	Minimum number of motors to run (0..MaxDemand)
LeadLag_Cfg_NumMotors	Local HMI	LW	210	Number of motors in this Lead / Lag / Standby Group (2..30)
LeadLag_Rot_TMR_SP	Local HMI	LW	212	Timer based mode Rotation Timer SetPoint
LeadLag_Cfg_StartDelay	Local HMI	LW	214	Time (sec) after start or stop until next start is allowed (0..2M sec)
LeadLag_Cfg_StopDelay	Local HMI	LW	216	Time (sec) after start or stop until next stop is allowed (0..2M sec)
Generator_CurrentA	Local HMI	LW	218	Phase A current
Generator_CurrentB	Local HMI	LW	220	Phase B current
Generator_CurrentC	Local HMI	LW	222	Phase C current
Generator_VoltageA	Local HMI	LW	224	Phase A voltage
Generator_VoltageB	Local HMI	LW	226	Phase B voltage
Generator_VoltageC	Local HMI	LW	228	Phase C voltage
ALARMS				
Alm_Ack	Local HMI	LW	299	Variable designated to save an ack int value (11).
MPS				
PROCESS SCREENS VARIABLES (LW300 - LW400)				
MPS_Screen_Tank1_LowAlarm	Local HMI	LW	300	Low Limit Alarm for Tank 1
MPS_Screen_Tank1_HighAlarm	Local HMI	LW	302	High Limit Alarm for Tank 1
MPS_Screen_Tank1_MinValue	Local HMI	LW	304	Min. Value for Tank 1
MPS_Screen_Tank1_MaxValue	Local HMI	LW	306	Max. Value for Tank 1
MPS_Screen_Tank2_LowAlarm	Local HMI	LW	308	Low Limit Alarm for Tank 2
MPS_Screen_Tank2_HighAlarm	Local HMI	LW	310	High Limit Alarm for Tank 2
MPS_Screen_Tank2_MinValue	Local HMI	LW	312	Min. Value for Tank 2
MPS_Screen_Tank2_MaxValue	Local HMI	LW	314	Max. Value for Tank 2
MPS_Screen_LevelSelector	Local HMI	LW	316	Level transmitter selector for PID control



Howard F. Curren AWTP SCADA Standards Appendix B - Forms and Documents

SCADA Standards

City Project NO. 20-C-00001

Reliable Tampa Partners Project No. 23-502

Hazen and Sawyer Project No. 41077-013 Task 263, 264, 265

January 2025

HFC AWTP Master Plan
Howard F. Curren AWTP
SCADA Standards Appendix B -
Forms and Documents

January 2025



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Introduction

This is Appendix B of the City of Tampa's standards for Supervisory Control and Data Acquisition (SCADA) and Process Control System (PCS) programming, configuration and design standards for The City of Tampa referred to as "The City" or abbreviated as "COT" throughout this document

Appendix B contains the referenced forms and documents required to perform deviations of standards and changes of the City of Tampa's process control system.

The City SCADA & PCS Standards and Conventions Manual is intended to be applied by The City's contractors, consultants, and in-house personnel when developing or modifying any portion of The City's control system. The control system is a utility-wide system built upon a common human machine interface (HMI) system and is comprised of the following:

Process Control System (PCS): The industrial control system for processes within the boundaries of the plant (Howard F. Curren AWTP). The primary function of the system is control and monitoring of plant operations. The PCS is comprised of the local HMI subsystem and various programmable logic controllers (PLCs) and operator interface terminals (OITs).

Supervisory Control and Data Acquisition (SCADA) System: The industrial control system for processes outside the boundaries of the plants. The primary function of this system is data acquisition; remote sites are designed to run autonomously without supervisory control function. The SCADA system serves both Water SCADA and Sewer SCADA in an integrated environment and is comprised of telemetry equipment with a supervisory HMI.

This manual is divided into three main volumes plus two appendices:

Volume 1 contains the control system policies and procedures that apply to the management, maintenance and modification of the control system. Volume 1 includes policies for:

- Programming laptop use
- Management of change (MOC)
- Software and application revision control
- Cybersecurity
- Other related topics.



Volume 2 addresses practices for development and programming of control processors such as:

- Programmable logic controllers (PLCs) of various types

Including requirements for programming software

- Alarm processing
- Control loops
- Control logic structure
- Input/output (I/O) layout and signal processing
- Tagging and naming conventions.

Volume 3 contains practices for development and programming of human-machine interface (HMI) and operator interface terminals (OITs). Standards for programming and display development, historian data exchange, and security are included in this volume.

Appendix A Contains definitions and general references that provide clarity and detail to volumes 1 to 3 of the City of Tampa's SCADA standards manuals.

Appendix B Contains forms and documents needed for deviations and documentation of changes to the City's PCS or SCADA systems.

Compliance with the standards and conventions outlined in the manual is required for all projects that add to or modify the control system. If a contractor or staff member identifies a need for an addition or modification to the standards for a specific project, or if in the course of the work it is found that some part of the standards cannot be adhered to, a standards deviation request may be submitted in accordance with the requirements provided in Section 3 of Volume 2 or in this document

Contract Number:	
Requested by:	
When Available:	
When Required:	
Early Start Date:	
Latest Start Date:	
Estimated Man Hours:	
Sketch/Drawing:	
Affected Building:	
Job Description:	
Safety Precautions and Instructions:	
Approvals Required:	
COT Operations:	
COT Engineering:	
Scheduled Shutdown Date:	



Request For Shutdown Form Example

Contract Number:	1007
Requested by:	J. Bond
When Available:	
When Required:	
Early Start Date:	1/20/2025
Latest Start Date:	1/25/2025
Estimated Man Hours:	40
Sketch/Drawing:	See Attached
Affected Building:	Process area A building B
Job Description: PLC 5	
Safety Precautions and Instructions:	
Approvals Required:	
COT Operations:	
COT Engineering:	
Scheduled Shutdown Date:	



Contractor Extended Check-Out Request Form

Date of Request:	_____	Project Number:	_____
Name of Requester:	_____	Name of Firm:	_____
Phone Number:	_____	E-mail address:	_____
Anticipated Check-Out Date:	_____	Anticipated Check-In Date:	_____

Attach additional sheets as needed to provide the information required below.

List of Program Files Requested:	
Fully Explain Reasons for Extended Request:	
Supporting documentation attached? ☐ Yes ☐ No	
Requester Signature:	Date:

THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	_____
Date Returned:	_____
Reviewed by:	_____
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Contractor Extended Check-Out Request Form

Example

Date of Request:	1/20/2025	Project Number:	1234
Name of Requester:	J. Bond	Name of Firm:	MI6
Phone Number:	123-456-7890	E-mail address:	JBond@mi6.com
Anticipated Check-Out Date:	1/21/2025	Anticipated Check-In Date:	1/22/2025

Attach additional sheets as needed to provide the information required below.

List of Program Files Requested: PLC ABC Application	
Fully Explain Reasons for Extended Request: Logic rewrite for optimization as part of CIP project "Project 1"	
Supporting documentation attached? ☒ Yes ☐ No	
Requester Signature: <i>J. Bond</i>	Date: 1/20/25

THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	
Date Returned:	
Reviewed by:	
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Change Request Form

Date of Request: _____	Project Number: _____
Name of Requester: _____	Name of Firm: _____
Phone Number: _____	E-mail address: _____

Attach additional sheets as needed to provide the information required below.

Full description of change:		
PLC name(s):		
Subroutine(s):		
HMI Screen(s) affected:		
Historian modification:		
Fully explain the reason for change:		
Explain or attach back-out plan:		
Supporting documentation attached?	☐ Yes	☐ No
Test bed sign-off attached?	☐ Yes	☐ No
Retroactive for emergency change?	☐ Yes	☐ No
Production hold required?	☐ Yes	☐ No
Hold Date/Time Period:		
Requester's Signature: _____		Date: _____



THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	
Date Returned:	
Reviewed by:	
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Change Request Form Example

Date of Request:	1/20/2025	Project Number:	1234
Name of Requester:	J. Bond	Name of Firm:	MI6
Phone Number:	123-456-7890	E-mail address:	JBond@mi6.com

Attach additional sheets as needed to provide the information required below.

Full description of change: Addition of new OOS AOI per approved PCD.		
PLC name(s): PLC ABC		
Subroutine(s): All control routines		
HMI Screen(s) affected: Equipment 1 HMI		
Historian modification: None		
Fully explain the reason for change: Addition of logic to support alarm management plan.		
Explain or attach back-out plan: Fully revert to pre-modifications back-up file dated 1/20/2024 stored in backup and restoration server.		
Supporting documentation attached?	☒ Yes	☐ No
Test bed sign-off attached?	☒ Yes	☐ No
Retroactive for emergency change?	☒ Yes	☐ No
Production hold required?	☒ Yes	☐ No
Hold Date/Time Period:		
Requester's Signature:	<i>J. Bond</i>	Date: 1/20/2025



THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	
Date Returned:	
Reviewed by:	
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Change Request Form Attachment A Back-Out Plan Form

Date of Request: _____	Project Number: _____
Name of Requester: _____	Name of Firm: _____
Phone Number: _____	E-mail address: _____

Attach additional sheets as needed to provide the information required below.

Outage and/or Testing Time Requested:		
Maximum Allowable Time before acceptance or back-out:		
Back-out Plan (describe the specific steps to restore system to pre-change state):		
Emergency Contact Name:		
Emergency Contact Phone:		
Requester's Signature		Date

THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	
Date Returned:	
Reviewed by:	
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Change Request Form Attachment A Back-Out Plan Form Example

Date of Request:	1/20/2025	Project Number:	1234
Name of Requester:	J. Bond	Name of Firm:	MI6
Phone Number:	123-456-7890	E-mail address:	JBond@MI6.com

Attach additional sheets as needed to provide the information required below.

Outage and/or Testing Time Requested:	January 20 th – January 24 th , 2025 One (1) week		
Maximum Allowable Time before acceptance or back-out: Three (3) days			
Back-out Plan (describe the specific steps to restore system to pre-change state): Revert logic in PLC_Name by reset of test bit named STANDARDS_TEST located at top of Main routine. STANDARDS_TEST = 0 (original code), STANDARDS_TEST = 1 (new code).			
Emergency Contact Name:	J. Bond		
Emergency Contact Phone:	123-456-7890		
Requester's Signature	<i>J. Bond</i>	Date	1/20/2025

THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	
Date Returned:	
Reviewed by:	
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Programming Laptop Request Form

Date of Request: _____	Project Number: _____
Name of Requester: _____	Name of Firm: _____
Phone Number: _____	E-mail address: _____

Attach additional sheets as needed to provide the information required below.

Name of Programmer(s):	_____
Expected Duration of use:	
Required Software Application(s):	
Requester's Signature	Date

THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	_____
Date Returned:	_____
Reviewed by:	_____
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Programming Laptop Request Form Example

Date of Request:	1/20/2025	Project Number:	1234
Name of Requester:	J. Bond	Name of Firm:	MI6
Phone Number:	123-456-7890	E-mail address:	JBond@MI6.com

Attach additional sheets as needed to provide the information required below.

Name of Programmer(s):	J. Bond
Expected Duration of use: Two (2) months	
Required Software Application(s): Studio 5000 Logix Designer, Version 35.11	
Requester's Signature	<i>J. Bond</i>
Date	1/20/2025

THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	
Date Returned:	
Reviewed by:	
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Standards Deviation Request Form

Date of Request: _____	Project Number: _____
Name of Requester: _____	Name of Firm: _____
Phone Number: _____	E-mail address: _____

Attach additional sheets as needed to provide the information required below.

Standard(s) for which a deviation is requested (List document name, section(s), subsection(s):	
Fully explain reasons for deviation request:	
Proposed alternative implementation:	
Supporting documentation attached? ☐ Yes ☐ No	
Requester's Signature	Date

THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	
Date Returned:	
Reviewed by:	
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Standards Deviation Request Form Example

Date of Request:	1/20/2025	Project Number:	1234
Name of Requester:	J. Bond	Name of Firm:	MI6
Phone Number:	123-456-7890	E-mail address:	JBond@MI6.com

Attach additional sheets as needed to provide the information required below.

Standard(s) for which a deviation is requested (List document name, section(s), subsection(s): Use of Structure text for advanced calculations
Fully explain reasons for deviation request: Advanced calculations would require an excessive number of rungs to complete in ladder logic. The resulting logic would be difficult to troubleshoot, use of structured text will make the logic readable and easy to compare.
Proposed alternative implementation: None
Supporting documentation attached? ☒ Yes ☐ No
Requester's Signature <i>J. Bond</i> Date 1/20/2025

THIS AREA FOR CITY OF TAMPA USE ONLY

Date Received:	
Date Returned:	
Reviewed by:	
COT Decision	☐ Accepted ☐ Rejected
Comments/Limitations:	



Instructions for completing The Sub- (Contractor's/Consultants/ Suppliers) Solicited Form
(DMI 10 Form)

This form must be submitted with all bids or proposals. All subcontractors (regardless of ownership or size) solicited and subcontractors from whom unsolicited quotations were received must be included in this form. The instructions that follow correspond to the headings on the form required to be completed. **Note:** Ability or desire to perform all work shall not exempt the prime from Good Faith Efforts to achieve participation.

Contract No. This is the number assigned by the City of Tampa for the proposal.

- **Contract Name.** This is the name of the contract assigned by the City of Tampa for the bid or proposal.
- **Contractor Name.** The name of your business and/or doing business as (dba), if applicable.
- **Address.** The physical address of your business.
- **Federal ID. FIN.** A number assigned to your business for tax reporting purposes.
- **Phone.** Telephone number to contact the business.
- **Fax.** Fax number for business.
- **Email.** Provide email address for electronic correspondence.
- **No Firms were contacted or solicited for this contract.** Checking the box indicates that a pre-determined Subcontract Goal or Participation Plan Requirement was not set by the city, resulting in your business not using subcontractors and will self-perform all work. If, during the performance of the contract, you employ subcontractors, the City must pre-approve subcontractors. Use of the "Sub-(Contractors/Consultants/Suppliers) Payments" form (DMI 30 Form) must be submitted with every pay application and invoice. **Note:** Certified SLBE firms bidding as Primes are not exempt from outreach and solicitation of subcontractors.
- **No Firms were contacted because.** Provide a brief explanation of why no firms were contacted or solicited.
- **See attached documents.** Check the box if, after you have completed the DMI Form in its entirety, you need more space to list additional firms and/or if you have supplemental information/documentation relating to the form. All DMI data not submitted on the DMI 10 Form must be in the same format and include all the requested data from the DMI 10 Form.

The following instructions are for the information of all subcontractors solicited.

- **"S" = SLBE.** Enter "S" for firms Certified by the City as Small Local Business Enterprises; **"O" = non-certified others.**
- **Federal ID. FIN.** A number assigned to a business for tax reporting purposes. This information is critical in the proper identification and payment of the contractor/subcontractor.
- **Company Name, Address, Phone & Fax.** Provide company information for verification of payments.
- **Trade, Services, or Materials** indicate the trade, service, or materials provided by the subcontractor. NIGP codes, aka "National Institute of Governmental Purchasing," are listed in the top section of the document.
- **Contact Method L=letter, F=fax, E=Email, P=Phone.** Indicate with a letter the method(s) of soliciting for bids.
- **Quote or Resp. (response) Rec'd (received) Y/N.** Indicate "Y" Yes if you received a quotation or if you received a response to your solicitation. Indicate "N" No if you received no response to your solicitation from the subcontractor. Must keep records: log, ledger, documentation, etc. that can validate/verify.

If additional information is required or you have questions, please contact the Equal Business Opportunity Program - Office of Equal Business Opportunity at (813) 274-5522

Failure to Complete, Sign, and Submit Forms 10, 20, & 50 MAY render the Bid or Proposal Non-Responsive

Page 1 of 2 – DMI Solicited/Utilized** Schedules**
City of Tampa – Schedule of **All To-Be-Utilized Sub-(Contractors/Consultants/Suppliers)**
(DMI 20 Form)

Contract No.: _____ Contract Name: _____

Company Name: _____ Address: _____

Federal ID: _____ Phone: _____ Fax: _____ Email: _____

Check applicable box(es). Detailed Instructions for completing this form are on page 4 of 4.

☐ **See attached list of additional Firms Utilized and all supplemental information (List must comply with this form)**

Note: Form DMI-20 must list ALL subcontractors To-Be-Utilized.

☐ **No Subcontracting/consulting (of any kind) will be performed on this contract.**

☐ **No Firms are listed to be utilized because:** _____

NIGP Code General Categories: Buildings = 909, General = 912, Heavy = 913, Trades = 914, Architects = 906, Engineers & Surveyors = 925, Supplier = 912-77

↙ Enter "S" for firms Certified as Small Local Business Enterprises: "O" for Other Non-Certified

S = SLBE O =Neither Federal ID	Company Name Address Phone, Fax, Email	Trade, Services or Materials NIGP Code Listed above	\$ Amount of Quote. Letter of Intent (LOI) if available	Percent of Scope or Contract %

Total ALL Subcontract / Supplier Utilization \$ _____

Total SLBE Utilization \$ _____

Percent SLBE Utilization of Total Bid/Proposal Amt. _____%

It is hereby certified that the following information is a true and accurate account of utilization for sub-contracting opportunities on this Contract.

Signed: _____ Name/Title: _____ Date: _____

Failure to Complete, Sign and Submit Forms 10, 20, & 50 MAY render the Bid or Proposal Non-Responsive Forms must be included with Bid / Proposal

Page 2 of 2 DMI – Solicited/**Utilized**

Instructions for completing The Sub- (Contractor's/Consultants/ Suppliers) to be Utilized Form
(DMI 20 Form)

This form must be submitted with all bids or proposals. All subcontractors (regardless of ownership or size) projected to be utilized must be included in this form.

- **Contract No.** This is the number assigned by the City of Tampa for the proposal.
- **Contract Name.** This is the name of the contract assigned by the City of Tampa for the bid or proposal.
- **Contractor Name.** The name of your business and/or doing business as (dba) if applicable.
- **Address.** The physical address of your business.
- **Federal ID.** FIN. A number assigned to your business for tax reporting purposes.
- **Phone.** Telephone number to contact the business.
- **Fax.** Fax number for business.
- **Email.** Provide email address for electronic correspondence.
- **No Subcontracting/consulting (of any kind) will be performed on this contract.** Checking the box indicates your business will not use subcontractors when no Subcontract Goal or Participation Plan Requirement was set by the city but will self-perform all work. When subcontractors are utilized during the performance of the contract, the "Sub-(Contractors/Consultants/Suppliers) Payments" form (DMI 30 Form) must be submitted with every pay application and invoice. Note: Certified **SLBE firms** bidding as Primes **are not exempt** from outreach and solicitation of subcontractors, including completion and submission of Form-10 and Form-20.
- **No Firms listed To-Be-Utilized.** Check box: provide a brief explanation why no firms were retained when a goal or participation plan requirement was set on the contract. **Note: Mandatory compliance with Good Faith Effort outreach (GFECP) requirements applies (DMI 50 Form), and supporting documentation must accompany the bid.**
- **See attached documents.** Check the box if, after completing the DMI Form in its entirety, you need more space to list additional firms and/or if you have supplemental information/documentation relating to the scope/value/percent utilization of subcontractors. Reproduce copies of DMI-20 and attach. All data not submitted on duplicate forms must be in the same format and content as specified in these instructions.

The following instructions are for the information of all subcontractors To Be Utilized.

- **Federal ID.** FIN. A number assigned to a business for tax reporting purposes. This information is critical in the proper identification of the subcontractor.
- **"S" = SLBE,** enter "S" for firms Certified by the City as Small Local Business Enterprises; **"O" = non-certified others.**
- **Company Name, Address, Phone & Fax.** Provide company information for verification of payments.
- **Trade, Services, or Materials (NIGP code if known).** Indicate the trade, service, or material provided by the subcontractor. Abbreviated list of NIGP is available at <http://www.tampagov.net/DMI> "Information Resources".
- **Amount of Quote, Letters of Intent** (required for SLBEs).
- **Percent of Work/Contract.** Indicate the percentage of the total contract price the subcontract(s) represent. For CCNA only (i.e., Consultant A/E Services), you must indicate subcontracts as a percentage of the total scope/contract.
- **Total Subcontract/Supplier Utilization.** – Provide the total dollar amount of all subcontractors/suppliers projected to be used for the contract. (Dollar amounts may be optional in CCNA depending on solicitation format).

- **Total SLBE Utilization.** Provide the total dollar amount for all projected SLBE subcontractors/Suppliers used for this contract. (Dollar amounts may be optional in CCNA proposals depending on the solicitation format).
- **Percent SLBE Utilization.** Total amount allocated to SLBEs divided by the total bid/proposal amount.

If additional information is required or you have questions, please contact the Equal Business Opportunity Program - Office of Equal Business Opportunity at (813) 274-5522.

Good Faith Effort Compliance Plan (GFECP) Guidelines

for Small Local Business Enterprise Participation
City of Tampa - Equal Business Opportunity Program
(DMI 50 Form – See detailed instructions on page 3 of 3)

Contract Name _____ Bid Date _____
Bidder/Proposer _____
Signature _____ Date _____
Name _____ Title _____

The Compliance Plan with attachments is a true account of Good Faith Efforts (GFE) made to achieve the participation goals as specified for Small Local Business Enterprises (SLBE) on the referenced contract:

- ☐ SLBE participation **Goal is Not Specified for this Solicitation** however participation is aspirational and GFECP is required.
- ☐ SLBE participation **Goal is Met or Exceeded** (refer to Goal-Set DMI-90 Form).
- ☐ SLBE participation Goal is **Not Fully Achieved** (refer to Goal-Set DMI-90 Form).

For each checkbox above Bidders/Proposers shall submit DMI Forms 10 and 20 which accurately report all subcontractors solicited and all subcontractors to-be-utilized. The following list is an overview of the required baseline GFECP action steps for all bids/proposals. Furthermore, it is understood that these GFECP requirements are weighted in the compliance evaluation based on the veracity and demonstrable degree of documentation provided with the bid/proposal:

(Check applicable boxes below - Must enclose supporting documents accordingly with Qualifying Remarks)

- (1) Solicited through reasonable and available means the interest of SLBEs that have the capability to perform the work of the contract. The Bidder or Proposer must solicit this interest within enough time to allow the SLBEs to respond. The Bidder or Proposer must take appropriate steps to follow up initial solicitations with interested SLBEs. ☐ See DMI report forms for subcontractors solicited. ☐ See enclosed supplemental data on solicitation efforts.
 - ☐ Qualifying Remarks
- (2) Provided interested SLBEs with adequate, specific scope information about the plans, specifications, and requirements of the contract, including addenda, in a timely manner to assist them in responding to the requested scope identified by bidder/proposer for the solicitation. ☐ See enclosed actual solicitations used.
 - ☐ Qualifying Remarks
- (3) Negotiated in good faith with interested SLBEs that have submitted bids (e.g. adjusted quantities or scale). Documentation of negotiation must include the names, addresses, and telephone numbers of SLBEs that were solicited; the date of each such solicitation; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why agreements could not be reached with SLBEs to perform the work. Additional costs involved in soliciting and using subcontractors is not a sufficient reason for a bidder/proposer's failure to meet goals or achieve participation, as long as such costs are reasonable. Bidders are not required to accept excessive quotes in order to meet the goal.
 - ☐ DMI Utilized Forms for sub-(contractor/consultant) reflect genuine negotiations ☐ This project is an RFQ/RFP in nature and negotiations are limited to clarifications of scope/percentages, specifications, qualifications and subs fee schedules.
 - ☐ See enclosed documentation.
 - ☐ Qualifying Remarks
- (4) Not rejecting SLBEs as being unqualified without justification based on a thorough investigation of their capabilities. The SLBEs standing within its industry, membership in specific groups, organizations / associations and political or social affiliations are not legitimate causes for rejecting or not soliciting bids to meet the goals.
 - ☐ Not applicable. ☐ See attached justification for rejection of a subcontractor's bid or proposal. ☐ Qualifying Remarks
- (5) Made scope(s) of work available to SLBE subcontractors and suppliers; and, segmented portions of the work or material consistent with the available SLBE subcontractors and suppliers, to facilitate meeting the goal. ☐ In addition, Sub-Contractors could bid on their own choice of work or trade without restriction to a pre-determined portion. ☐ See enclosed comments. ☐ Qualifying Remarks
- (6) Made good faith efforts, despite the ability or desire of Bidder/Proposer to perform the sub-tasks of a contract with its

own forces/organization. A Bidder/Proposer who desires to self-perform the sub-tasks of a contract must demonstrate good faith efforts if the goal has not been met. ☐ **Sub-Contractors were not prohibited from submitting bids/proposals and were solicited on work typically self-performed by the prime.** ☐ **Qualifying Remarks w/Documents**

- (7) Segmented the portions of the work to be performed by SLBEs in order to increase the likelihood that the goals will be met. This includes, where appropriate, breaking out contract work items into economically feasible units (quantities/scale) to facilitate SLBE participation, even when the Bidder/Proposer might otherwise prefer to perform these work items with its own forces. ☐ **Sub-Contractors could bid on their own choice of work or trade without restriction to a pre- determined portion.**☐ **Sub-Contractors were not prohibited from submitting bids/proposals and were solicited on work typically self-performed by the prime.** ☐ **See enclosed comments.**☐ **Qualifying Remarks**
- (8) Made efforts to assist interested SLBEs in obtaining bonding, lines of credit, or insurance as required by the City or contractor. ☐ **See enclosed documentation on initiatives undertaken and methods to accomplish.** ☐ **Qualifying Remarks**
- (9) Made efforts to assist interested SLBEs in obtaining necessary equipment, supplies, materials, or related assistance or services, including participation in an acceptable mentor-protégé program. ☐ **See enclosed documentation of initiatives and/or agreements.** ☐ **Qualifying Remarks**
- (10) Effectively used the services of the City and other organizations that provide assistance in the recruitment and placement of SLBEs.
☐ **See enclosed documentation of services engaged.** ☐ **Overview (attached) of tactical actions and resources employed toward recruitment**

Note: Any unsolicited information in support of your Bid/RFP Compliance must accompany your submittal. ☐ **Identify Information Submitted**



Participation Plan: Guidance for Complying with Good Faith Efforts Outreach (page 3 of 3)

- (1) All firms on the SLBE Goal Setting List must be solicited and documentation provided for email, fax, letters, phone calls, and other methods of outreach/communication with the listed firms. The DMI Solicited and DMI-Utilized forms must be completed for all firms solicited and all firms utilized. Other opportunities for subcontracting should be explored to attain participation. May consult Tampa EBO Office and/or research the online Data Management Business System Directory for Tampa certified SLBE firms.
- (2) Solicitation of SLBEs, via written or electronic notification, should provide specific information on the services needed, where plans can be reviewed and assistance offered in obtaining these, if required. Solicitations should be sent a minimum of a week (i.e. 5 city business days or more) before the bid/proposal date. Actual copies of the bidder's solicitation containing their scope-specific instructions should be provided.
- (3) With any quotes received, a follow-up should be made when needed to confirm detail scope of work. For any SLBE low quotes rejected, an explanation shall be provided detailing negotiation efforts.
- (4) If a low bid SLBE is rejected or deemed unqualified the contractor must provide an explanation and supporting documentation for this decision.
- (5) Prime shall break down portions of work into economical feasible opportunities for subcontracting. The SLBE directory may be useful in identifying additional subcontracting opportunities and certified firms not listed in the "SLBE Goal Setting Firms Contact List."
- (6) Contractor shall not preclude SLBEs from bidding on any part of work, even if the Contractor may desire to self-perform aspects of the work.
- (7) Contractor shall avoid relying solely on subcontracting those scopes of work where SLBE availability is not sufficient to attain pre-determined goals; including RFP/RFQ solicitations, all of which require GFECF compliance to achieve sub-consultant participation.
- (8) In its solicitations, the Bidder should offer assistance to SLBEs in obtaining bonding, insurance, et cetera, if required of subcontractors by the City or Prime Contractor.
- (9) In its solicitation, the Bidder should offer assistance in obtaining equipment for a specific job to SLBEs, if needed. This includes mobilization where applicable.
- (10) Contractor should use the services offered by such agencies as the Small Business Development Center (SBDC) @ University South Fla.; SBDC @ Hillsborough County Entrepreneur Collaborative Center; Hillsborough NAACP Empowerment Center; Hillsborough County Economic Development Department DM/DWBE/SBE Program and Prospera-Hispanic Business Assoc. to name a few for the recruitment and placement of available SLBEs.



EBO Guidelines for Evaluation Points on RFP and CCNA Proposals

Points Pursuant to Designated Industry Category:

DMI-71 FORM

(Refer to DMI 50 Form - Good Faith Efforts (GFE) Outreach)

A or B	Evaluation Criteria	Point Values
A.	SLBE participating as the Prime Contractor (City of Tampa Certified Only) with meaningful subcontractor/subconsultant participation of City Certified SLBE firms.	5-15
*B.	Prime Contractor with meaningful subcontractor/subconsultant of City Certified SLBE firms.	0 - 10

Points are determined as follows (Requires DMI 50 Form - GFE):

- A. Five to Fifteen (5-15) rating points **may** be awarded when the Proposer is a City of Tampa Certified SLBE firm and utilizes SLBE certified firm(s) as sub-contractors/ sub-consultants and assigned to perform meaningful segments of the contractual services detailed herein and documented on the enclosed DMI 10 & 20 Forms.
- B. Zero to Ten (0-10) rating points **may** be awarded when the proposer is not a City of Tampa certified SLBE prime contractor but utilizes SLBE certified firm(s) as sub-contractors/ sub-consultants and is assigned to perform meaningful segments of the contractual services detailed herein and documented on the enclosed DMI 10 & 20 Forms.

*A maximum of three (3) “discretionary” rating points **may** be awarded when the Proposer provides SLBE participation from an external agency recognized by the City of Tampa. **In addition, evaluation points may be awarded for To-Be-Determined (TBD) participation.**

The maximum number of points available for SLBE participation will not exceed fifteen (15) points.



EBO Guidelines for Evaluation Points on RFP and CCNA Proposals

Equal Business Opportunity Evaluation Weighted Points: CCNA Proposal Guidelines

Under CCNA solicitations, proposers must submit to preconstruction Good Faith Efforts (GFE) requirements covering the inclusion of City of Tampa-certified SLBE firms. Such inclusion shall be clearly addressed and documented utilizing DMI 10, 20, and 50 Forms. Proof of certification shall include copies of current certification certificates. This applies to ALL Phase 1 preconstruction design services.

Points awarded during the shortlist selection process will be more heavily weighed predominantly on the design side (this does not preclude identification of phase 2 projections of construction participation that follow in the future, i.e., GMPs). In order to ensure the maximum points, a proposer must **clearly identify and quantify** its planned participation without ambiguity. Simply marking "To Be Determined" (TBD) will not satisfy this requirement and may result in significantly lower ratings. Finally, additional favorable consideration will be granted to the firm(s) that, beyond all others, provide the highest *relevant* and most binding participation.

Additional Evaluation Information:

The evaluation includes, but is not limited to, the following criteria:

- SLBE subcontractors listed to be utilized (DMI Form 20)
- Percentage of proposal/scope committed to SLBE subcontracting.
- The collective factors in determining the total points awarded will be based on the overall weight of evidence in the proposal that specified the participation.
- Subcontractors are utilized for meaningful tasks, which are viewed as related to the core scope of work.

In all cases, the Proposer and/or subcontractor(s) must be SLBE certified prior to the opening date and time of the RFP to be eligible to earn SLBE rating points. The City of Tampa's Office of Equal Business Opportunity will evaluate the SLBE participation evaluation process. The Successful Proposer will be required to execute the DMI 40 Form (Letter of Intent-LOI) with their subcontractors/sub-consultants prior to award.

RFQ TRANSMITTAL MEMORANDUM FOR A SUBMITTAL TO THE CITY OF TAMPA

TRANSMITTAL DATE: _____

RFQ NO. & TITLE: 26-D-00017 Howard F. Curren Advanced Wastewater Treatment Plant (HFC AWTP) Supervisory Control and Data Acquisition (SCADA) Migration and Fiber Replacement Design

TO: Brad L. Baird, P. E., Chairman Selection & Certification Committee (CCNA) c/o Contract Administration Department via ContractAdministration@tampagov.net 306 East Jackson Street, 4th Floor North, Tampa, Florida 33602

SUBMITTER ("Firm") NAME:

FEDERAL TAX ID#: _____

FIRM TYPE: ☐ Corporation ☐ Limited Liability Company ☐ Individual/Sole Proprietor
☐ Joint Venture (JV) ☐ Partnership (PN) ☐ Other:

FIRM CONTACT NAME:

EMAIL:

PHONE:

CERTIFICATIONS:

Firm is licensed, permitted, and certified as required to do business in Florida: ☐ Yes ☐ No

License/registration/certification number(s):

Per §287.133, Fla. Stat., individuals or entities (including those meeting the §287.133, Fla. Stat. definition of "affiliate") placed on the convicted vendor list ("List") following a conviction for public entity crimes may not submit a bid, proposal, or reply ("Response") on a contract to provide any goods or services to a public entity, may not submit a Response on a contract with a public entity for the repair or construction of a public building or public work, may not submit a Response for leases of real property to a public entity, and may not be awarded or perform work as a contractor, supplier, subcontractor, or consultant under a contract with any public entity; and may not transact business with any public entity in excess of the threshold amount provided in

§287.017, Fla. Stat. for CATEGORY TWO for a period of 36 months from the date of placement on the List. Neither Firm nor its affiliates have been placed on the List: ☐ Yes ☐ No

Pursuant to Tampa Code Section 2-284; Bidder's Criminal History Screening Practices("Ban-The-Box"), the Firm hereby;

☐ declines incentive points and attaches no documentation ☐ applies for incentive points and attaches all the required documentation.

Firm shall comply with all applicable governmental rules & regulations, including the City's Ethics Code (Sec. 2- 522, Tampa Code). The City's Charter & Ethics Code prohibit any City employee from receiving any substantial benefit or profit out of any award or obligation entered into with the City, or from having any direct or indirect financial interest in effecting any such award or obligation. If Firm is successful, it shall ensure no City employee receives any such benefit or interest as a result of such award (See Sec.2-514(d), Tampa Code): ☐ Yes ☐ No

Firm is not in arrears and is not in default upon any obligation to the City of Tampa: ☐Yes ☐No

Firm does not use coercion for labor or services as defined in Section 787.06, F.S.

Firm agrees that if the City of Tampa determines Firm has participated in any collusive, deceptive, or fraudulent practices with regard to this submittal, in addition to any other remedy it may exercise, the City will have the right to debar Firm and deem invalid any contract let under such circumstances: ☐ Yes ☐ No

Data or material Firm asserts to be exempted from public disclosure under Chapter 119, Fla. Stat., is submitted in a separate, single electronic searchable PDF file labeled with the above RFQ number and the phrase "Confidential Material", which identifies the data/material to be protected, states the reasons the data/material is exempt from public disclosure, and the specific Florida statute allowing such exemption (if "No" or otherwise, then Firm waives any possible or claimed exemption upon submission, effective at opening): ☐ Yes ☐ No

FAILURE TO COMPLETE THE ABOVE MAY RESULT IN FIRM'S SUBMITTAL BEING DECLARED NON-RESPONSIVE

Authorized Signature :

Printed Name:

Title:

(attach proof of authority)