Water and Wastewater Accelerator Toolkit

Quick Start
Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at [http://www.rockwellautomation.com/literature/](http://www.rockwellautomation.com/literature/)) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

<table>
<thead>
<tr>
<th>WARNING</th>
<th>Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMPORTANT</td>
<td>Identifies information that is critical for successful application and understanding of the product.</td>
</tr>
<tr>
<td>ATTENTION</td>
<td>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.</td>
</tr>
<tr>
<td>SHOCK HAZARD</td>
<td>Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.</td>
</tr>
<tr>
<td>BURN HAZARD</td>
<td>Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.</td>
</tr>
</tbody>
</table>

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Introduction

The Water and Wastewater Quick Start Guide contains step by step instructions for using the Water and Wastewater Accelerator Toolkit (WWWAT). This toolkit is a valuable resource for designing, installing, operating, and maintaining a Water and Wastewater project. The WWWAT resides on a CD containing:

- Pre-configured files
- Selection tools
- Examples of using a Logix Controller to connect to multiple devices (PowerFlex AC drives, motors, and HMI terminals) over EtherNet/IP and DeviceNet networks.
- System architecture drawings
- CAD drawings
- Basic status, control, and diagnostic logic
- FactoryTalk View SE faceplates

A new stand-alone Pump Controller Station Application based on the MicroLogix 1400 and PanelView Component C600 is also now included.

With these tools and the built-in best-practices design, the system designer is free to focus on their machine control design rather than designing overhead tasks.

Contact your local Rockwell Automation distributor or sales representative for a copy of the WWWATC CD (Publication IASIMP-SP012). You can also go to the Rockwell Automation Integrated Architecture Tools Website, http://www.ab.com/go/iatools and download the appropriate tools.

IMPORTANT Before using this guide and the contents of the WWWAT CD, read the Terms and Conditions README.pdf on the CD.
Use this flow chart to determine which chapters in this guide apply to your role in the Water and Wastewater project. Each chapter is organized according to the various Water and Wastewater project roles.

Water and Wastewater Quick Start Guide Chapter Organization

Once you've identified which section pertains to your role, read that section. Each section contains information on the existing documents’ content, usage, and location. All of this material is provided to help you get started on your project. This guide answers questions such as:

- What hardware do I need?
- How should it be programmed?
- What software standards should I use?
- How do I install this hardware?

See Appendix A for further resources and updates to existing information.
### Required Software

To utilize the applications provided in this Accelerator, the following software is required:

<table>
<thead>
<tr>
<th>Rockwell Automation Software</th>
<th>Catalog Number</th>
<th>Version</th>
<th>Required For</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSlogix 5000</td>
<td>9324-RLD300RNE</td>
<td>17 or later</td>
<td>All Water and Wastewater Controller Applications</td>
</tr>
<tr>
<td>Control Flash</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BootP/DHCP Utility (EtherNet.IP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSLinx Classic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FactoryTalk View Studio Site Edition</td>
<td>9701-VWSBxxxAENE</td>
<td>5.0 or later</td>
<td>PanelView Plus Applications</td>
</tr>
<tr>
<td>FactoryTalk Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSLinx Enterprises</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSLinx Classic</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
System Specification

Introduction

Use this chapter to learn about the Water and Wastewater product portfolio.

Procurement Specifications

The Water and Wastewater Accelerator Toolkit (WWWAT) CD contains procurement documents to help you develop the appropriate Request for Proposals (RFPs). We suggest that you copy and then paste these documents directly into your bid documentation package. Our objective is to save you time when writing these specifications.

Most of the hardware referenced on the CD has an associated procurement specification. This hardware includes:

- ControlLogix controllers
- L2x Compactions controllers
- PanelView Plus HMIs
- PowerFlex 70 variable frequency drives
- Development Software

Go to the product information section on the WWWAT CD to access the appropriate procurement documents

WWWAT CD Product Information Menu

A procurement document can save you time by eliminating the need to create complex items such as the bid specification. You only have to copy and paste the contents of these documents directly into the project specifications section instead of developing the content yourself.
Customizing Procurement Documents

Typically, the procurement documents do not require editing. However, since all RFP’s are unique in their requirements, you may need to use the following procedure to make the necessary changes.

1. Identify the section of the specification or RFP that is required. For example, is it a section on variable frequency drives or controllers?

2. Locate the appropriate procurement specification on the WWWAT CD.

3. Copy and paste the content of the procurement document into the specification or RFP.

4. Check the introduction of the new section that you’ve pasted into the specification. It is possible that you will need to change the introduction to better integrate into the existing document. The specification or RFP will already have a format and style, but some adjustments will be necessary to adhere to this style.

5. Check the format of the section numbering. Ensure that the procurement specification that you included matches the section numbering and does not disrupt the progression of section or page numbering.
The system architecture drawings provide value in many stages of the project lifecycle. While specifying a system, these architecture drawings can be included in either the RFP or the proposal itself as an overview of the control system. With one illustration, they provide a summary of all the hardware components of the control system and the method of communication among all those components. They also let control engineers quickly understand the scope of the control system and grasp the control technologies involved. System architecture drawings are important early in the project life-cycle because they efficiently summarize the control strategy.

### Accessing System Architecture Drawings

Go to the desired application and select the application of interest.

#### Selecting the System Architecture Application

![Selecting the System Architecture Application](image)

### Customizing System Architecture Drawings

System architecture drawings are intended to be used as a basis for your system design. They require modifications to illustrate your application correctly. Include the drawings in your RFP or the proposal itself.
The Water and Wastewater Treatment Plant documentation package contains the following system-level architectural drawings:

- Lift Station System
- Dosing Pump Station System
- Primary Treatment System
- Headworks System
- Secondary Treatment System
- Solids Handling System

**Lift Station System Architecture Drawing**

The following is an example of a typical Lift Station System Architecture Drawing.
The following table describes the key design points of the Lift Station System Architecture Drawing.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L23 Processor</td>
<td>Controls the Lift Station</td>
</tr>
<tr>
<td>EtherNet IP</td>
<td>Enables the HMI, hard drive, and system controller to communicate with each other</td>
</tr>
<tr>
<td>PanelView Plus</td>
<td>Human Machine Interface (HMI)</td>
</tr>
<tr>
<td>PowerFlex 70</td>
<td>Drives the pumps</td>
</tr>
<tr>
<td>DeviceNet</td>
<td>Controls I/O and other devices</td>
</tr>
<tr>
<td>Esteem Wireless Modem</td>
<td>Connects the Lift Station to the Supervisory System</td>
</tr>
</tbody>
</table>

The WWWAT CD contains architecture drawings that are only intended to be the basis for your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application.

- The HMI shown in the Lift Station Architecture Drawing is a PanelView Plus 600 with a keyboard. Do you have another size screen preference? Do you prefer display only with no keypad?
- The pumps in this application are controlled via contactors. Optionally shown are a PowerFlex 70 Drives to run the pumps, and higher horsepower drives may require a different PowerFlex series drive.
- I/O on this sheet is optionally shown as both Point I/O and Compact Block I/O. Select an I/O style based on your requirements.
- The number of PanelView could change based on the operating procedures at your facility. Simply add more PanelView stations as needed.
- The number of contactors or PowerFlex 70 Drives could change based on the number of pumps in the Lift Station. Add more contactors or PowerFlex Drives, as needed.
- The Ethernet Switch shown has a limited number of ports. Select the appropriate Stratix switch as required for the number of EtherNet/IP devices in the system.
- IP addresses and node numbers should be included on this drawing. They are specific to your application.
Dosing Pump System Architecture Drawing

The following is an example of a typical Dosing Pump System Architecture Drawing.

Dosing Pump System Architecture Drawing

The following table describes the key design points of the Dosing Pump System Architecture Drawing.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ControlLogix Processor</td>
<td>Controls the Dosing Pumps</td>
</tr>
<tr>
<td>1756 Series</td>
<td>Controls I/O</td>
</tr>
<tr>
<td>Remote 1756 Chassis with Analog and Discrete I/O Devices</td>
<td>Communicates with the Dosing Pumps</td>
</tr>
<tr>
<td>ControlNet</td>
<td>Communicates with the Dosing Pump System</td>
</tr>
</tbody>
</table>

The WWWAT CD also contains System Architecture Drawings that are intended only to support your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application:

- The Dosing Pumps are assumed to be run by a third party supplied controller. The ControlLogix interfaces to it via a remote chassis. This scenario should be reviewed and adjusted based on the strategy for the specific dosing pump control.
- The input and output card configuration in the remote chassis must be determined based on the specific needs of the inputs and outputs located in the proximity of that chassis.
Primary Treatment System Architecture Drawing

The following is an example of a typical Primary Treatment System Architecture Drawing.

The following table describes the key design points of the Primary Treatment System Architecture Drawing.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ControlLogix Processor</td>
<td>Controls the Primary Treatment System</td>
</tr>
<tr>
<td>1756 Series</td>
<td>Controls I/O</td>
</tr>
<tr>
<td>PowerFlex 700 Drive</td>
<td>Drives the pumps</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>Establishes a communication path between the ControlLogix Processor, PowerFlex 700 Drive, and the plant network</td>
</tr>
</tbody>
</table>
The WWWAT CD also contains System Architecture Drawings that are intended only to support your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application:

- Each specific site must determine the 1756 Chassis I/O card configuration based on the specific needs of the I/O devices adjacent to that chassis.
- The number of PowerFlex 700 Drives may change based on the number of pumps in the Primary Treatment System. Add more drives as needed.
- The Ethernet Switch has a limited number of ports. Select the appropriate Stratix switch as required for the number of EtherNet/IP devices in the system.
- IP addresses and node numbers are unique to the application and you must include them on this drawing.
Headworks System Architecture Drawing

The following is an example of a typical Headworks System Architecture Drawing.

The following table describes the key design points of the Headworks System Architecture Drawing.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ControlLogix Processor</td>
<td>Controls the Headworks System</td>
</tr>
<tr>
<td>1756 Series</td>
<td>Controls I/O</td>
</tr>
<tr>
<td>PowerFlex 700 Drive</td>
<td>Drives the motors</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>Establishes a communication path between the ControlLogix Processor, PowerFlex 700 Drive, and the plant network</td>
</tr>
</tbody>
</table>
The WWWAT CD also contains System Architecture Drawings that are intended only to support your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application:

- Each specific site must determine the 1756 Chassis I/O card configuration based on the specific needs of the I/O devices adjacent to that chassis.
- The number of PowerFlex 700 Drives may change based on the number of pumps in the Headworks System. Add more drives as needed.
- The Ethernet Switch has a limited number of ports. Select the appropriate Stratix switch as required for the number of EtherNet/IP devices in the system.
- IP addresses and node numbers are unique to your application and you must include them on this drawing.
Secondary Treatment System Architecture Drawing

This is a typical Secondary Treatment System Architecture Drawing.

The following table describes the key design points of the Secondary Treatment System Architecture Drawing:

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ControlLogix Processor</td>
<td>Controls the Secondary Treatment System</td>
</tr>
<tr>
<td>1756 Series</td>
<td>Controls I/O</td>
</tr>
<tr>
<td>PowerFlex 700 Drive</td>
<td>Drives the pumps</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>Establishes a communication path between the ControlLogix Processor, PowerFlex 700 Drive, and the plant network</td>
</tr>
</tbody>
</table>
Chapter 1

The WWWAT CD also contains System Architecture Drawings that are intended only to support your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application:

- Each specific site must determine the 1756 Chassis I/O card configuration based on the specific needs of the I/O devices adjacent to that chassis.
- The number of PowerFlex 700 Drives may change based on the number of pumps in the Secondary Treatment System. Add more drives as needed.
- The Ethernet Switch has a limited number of ports. Select the appropriate Stratix switch as required for the number of EtherNet/IP devices in the system.
- IP addresses and node numbers are unique to your application and you must include them on this drawing.
Solids Handling System Architecture Drawing

This is a typical Solids Handling System Architecture Drawing.

The following table describes the key design points of the Solids Handling System Architecture Drawing:

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ControlLogix Processor</td>
<td>Controls the Solids Handling System</td>
</tr>
<tr>
<td>1756 Series</td>
<td>Controls I/O</td>
</tr>
<tr>
<td>PowerView Plus</td>
<td>HMI</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>Establishes a communication path between the ControlLogix Processor, Control Panels, and the plant network</td>
</tr>
</tbody>
</table>
Chapter 1

The WWWAT CD also contains System Architecture Drawings that are intended only to support your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application:

- Each specific site must determine the 1756 Chassis I/O card configuration based on the specific needs of the I/O devices adjacent to that chassis.
- The number of PowerFlex 700 Drives may change based on the number of pumps in the Solids Handling System. Add more drives as needed.
- The Ethernet Switch has a limited number of ports. Select the appropriate Stratix switch as required for the number of EtherNet/IP devices in the system.
- IP addresses and node numbers are unique to your application and you must include them on this drawing.
The Water Treatment Plant documentation package contains the following system-level architectural drawings:

- Raw Water Intake Pump Station System
- Separation Station System
- High Service Pump Station System

**Raw Water Intake Pump Station System Architecture Drawing**

This is a typical Run Water Intake Pump System Architecture Drawing.

**Run Water Intake System Architecture Drawing**

The following table describes the key design points of the Raw Water Intake Pump Station System Architecture Drawing.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ControlLogix Processor</td>
<td>Controls the Raw Water Intake Pump Station System</td>
</tr>
<tr>
<td>1756 Series</td>
<td>Controls I/O</td>
</tr>
<tr>
<td>PowerFlex 700 Drive</td>
<td>Drives the pumps</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>Establishes a communication path between the ControlLogix Processor, PowerFlex 700 Drive, and the plant network</td>
</tr>
</tbody>
</table>

The WWWAT CD also contains System Architecture Drawings that are intended only to support your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application:

- Each specific site must determine the 1756 Chassis I/O card configuration based on the specific needs of the I/O devices adjacent to that chassis.
- The number of PowerFlex 700 Drives may change based on the number of pumps in the Run Water Intake Pump Station System. Add more drives as needed.
- The Ethernet Switch has a limited number of ports. Select the appropriate Stratix switch as required for the number of EtherNet/IP devices in the system.
- IP addresses and node numbers are unique to your application and you must include them on this drawing.
Chapter 1

Separation Station System Architecture Drawing

This is a typical Separation Station System Architecture Drawing.

The following table describes the key design points of the Separation Station System Architecture Drawing.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ControlLogix Processor</td>
<td>Controls the Separation Station System</td>
</tr>
<tr>
<td>1756 Series</td>
<td>Controls I/O</td>
</tr>
<tr>
<td>PowerFlex 700 Drive</td>
<td>Drives the pumps</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>Establishes a communication path between the ControlLogix Processor, PowerFlex 700 Drive, and the plant network</td>
</tr>
</tbody>
</table>
The WWWAT CD also contains System Architecture Drawings that are intended only to support your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application:

- Each specific site manager must determine the 1756 Chassis I/O card configuration based on the specific needs of the I/O devices adjacent to that chassis.
- The number of PowerFlex 700 Drives may change based on the number of pumps in the Separation Station System. Add more drives as needed.
- The Ethernet Switch has a limited number of ports. Select the appropriate Stratix switch as required for the number of EtherNet/IP devices in the system.
- IP addresses and node numbers are unique to your application and you must include them on this drawing.
High Service Pump Station System Architecture Drawing

This is a typical High Service Pump Station System Architecture Drawing.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ControlLogix Processor</td>
<td>Controls the High Service Pump Station System</td>
</tr>
<tr>
<td>1756 Series</td>
<td>Controls I/O</td>
</tr>
<tr>
<td>PowerFlex 700 Drive</td>
<td>Drives the pumps</td>
</tr>
<tr>
<td>EtherNet/IP</td>
<td>Establishes a communication path between the ControlLogix Processor, PowerFlex 700 Drive, and the plant network</td>
</tr>
</tbody>
</table>
The WWAT CD also contains System Architecture Drawings that are intended only to support your application. Hardware modifications may be required to fulfill your application needs. Consider these points when designing the hardware for your application:

- Each specific site manager must determine the 1756 Chassis I/O card configuration based on the specific needs of the I/O devices adjacent to that chassis.
- The number of PowerFlex 700 Drives may change based on the number of pumps in the High Service Pump Station System. Add more drives as needed.
- The Ethernet Switch has a limited number of ports. Select the appropriate Stratix switch as required for the number of EtherNet/IP devices in the system.
- IP addresses and node numbers are unique to your application and you must include them on this drawing.

### Pump Controller Station Architecture Drawing

This is a typical Pump Controller Station Architecture Drawing. The following table describes the key design points of the Pump Controller Station Architecture Drawing.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MicroLogix 1400</td>
<td>Controls the Pump Station</td>
</tr>
<tr>
<td>PanelView Component C600</td>
<td>HMI</td>
</tr>
<tr>
<td>PowerFlex 4</td>
<td>Drives the Pumps</td>
</tr>
</tbody>
</table>
Additional Resources

The WWWAT CD contains links to numerous websites where you can find more information on the System Specification and Procurement phases of your Water and Wastewater project. For more information on websites and documentation that will help you plan and design your Water and Wastewater project, see Appendix A.
Chapter 2

Hardware Design

Introduction

This chapter contains valuable resources to help you design the necessary Water and Wastewater hardware for your project.

Hardware Drawings

The WWWAT CD contains a System Architecture folder, which contains a drawing package for each application. Each of these drawing packages consists of a system overview and the basic electrical drawings for wiring the I/O. The Lift Station package also includes device-level wiring information. These examples can be used in the actual wiring of the field devices for the project.

Each Water and Wastewater project is unique. These hardware drawings provide you with a starting point for the hardware engineering. You must customize your project to meet your site requirements.

Water and Wastewater Treatment Plant Hardware Drawings

The Water and Wastewater Treatment Plant Hardware documentation package contains the following system-level drawing packages:

- Lift Station System
- Dosing Pump Station System
- Primary Treatment System
- Headworks System
- Secondary Treatment System
- Solids Handling System
- Chemical Feed System
- Flushing System

The Lift Station and Dosing Pump Station drawings are included in this section for reference. These are typical of the others- all can be found on the WWWAT CD (Publication IASIMP-SP012). You can also go to the Rockwell Automation Integrated Architecture Tools Website, http://www.ab.com/go/iatools and download the drawings.
Lift Station Hardware Drawings

One of the System Architecture sub-folders on the WWWAT CD is the Lift Station folder and it contains the following drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Layout Sheets
- Device Wiring Schematics

Title Page and Sheet Index

Lift Station Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-150</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of the drawing package for your application.</td>
</tr>
</tbody>
</table>
Chapter 2

Process Flow Diagram

Lift Station System Process Flow Diagram

This diagram depicts a Lift Station consisting of two pumps with particular I/O. Any changes to the number of pumps or I/O for the Lift Station must be reflected on this diagram.

Network Diagram

Lift Station System Network Diagram

For details, see page 12.
Panel I/O Layout Sheets

Lift Station System Panel I/O Layout Sheets

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-180</td>
<td>Panel I/O Layout (Sheet 1 of 2)</td>
<td>Inputs and outputs to the controller are shown on these diagrams. The format uses three cards per sheet. Inputs to the card are shown with the input device to the left of the input card. Output devices are shown to the right of the output card. For every additional input or output card, new sheets must be added.</td>
</tr>
<tr>
<td>E-181</td>
<td>Panel I/O Layout (Sheet 2 of 2)</td>
<td></td>
</tr>
</tbody>
</table>

These sheets contain one example of each type of digital and analog I/O module typically used in a Lift Station application.

Note: These modules are the input and output points physically located on the L23 controller. Different I/O modules require changes to these sheets. You should modify these sheets to show the I/O specific to your application. Use these sheets as a template for applications even if the specific I/O points vary.
Device Wiring Schematics

Lift Station System Device Wiring Schematics

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-182</td>
<td>Device Wiring Schematics</td>
<td>This sheet provides power distribution and manual (hand) selector switch wiring information. For this application example, we recommend you use an Allen-Bradley power supply to feed the L23 power, Stratix Ethernet switch, and the PanelView Plus 600. Modify this sheet to show any additional 24-volt devices required in the design. During the project’s Hardware Engineering phase, this 24 volt power supply must be accurately sized based on the current requirements of the devices connected to it.</td>
</tr>
</tbody>
</table>
Dosing Pump Hardware Drawings

One of the System Architecture sub-folders on the WWWAT CD is the Dosing Pump folder and it contains the following drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Layout Sheets

Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-100</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of your application's drawing package.</td>
</tr>
</tbody>
</table>
Process Flow Diagram

Dosing Pump System Process Flow Diagram

The Dosing Pump System Process Flow diagram depicts a two pump alum addition process. You make any changes to the number of pumps or I/O for this process on this drawing. For example, if you require additional pumps in an application, update this sheet with the appropriate pumps and their associated I/O information.

The Dosing Pump System Process Flow diagram is very helpful for a quick summary of the controls and the process being controlled.

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-110</td>
<td>System Process Flow Diagram</td>
<td>The Dosing Pump System Process Flow diagram depicts a two pump alum addition process. You make any changes to the number of pumps or I/O for this process on this drawing. For example, if you require additional pumps in an application, update this sheet with the appropriate pumps and their associated I/O information. The Dosing Pump System Process Flow diagram is very helpful for a quick summary of the controls and the process being controlled.</td>
</tr>
</tbody>
</table>
Network Diagram

Dosing Pump System Network Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-120</td>
<td>Network Diagram</td>
<td>For details, see page 14.</td>
</tr>
</tbody>
</table>
Panel I/O Layout Sheets

Dosing Pump System Panel I/O Layout Sheets

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-130</td>
<td>Panel I/O Layout (Sheet 1 of 3)</td>
<td>These diagrams show the I/O to the controller. The format uses three cards per sheet. This drawing depicts inputs to the card with the input device to the left of the Input card. It also shows output devices to the right of the output card. You must add a new sheet for each additional input or output card.</td>
</tr>
<tr>
<td>E-131</td>
<td>Panel I/O Layout (Sheet 2 of 3)</td>
<td>This drawing package was designed with space reserved for all the Controller Chassis card slots. In this example drawing package, slot 3 is empty. This empty slot is represented on sheet E-131 with an empty area on the sheet and the text &quot;Spare.&quot; If you add a card to slot three, you should show it in this spare area. If an additional chassis is required, use this same format with space reserved in the drawings for any empty slots of the chassis. This provides a pre-determined location in the drawing package for all the I/O modules.</td>
</tr>
<tr>
<td>E-132</td>
<td>Panel I/O Layout (Sheet 3 of 3)</td>
<td>Include I/O information specific to your application on this drawing. We expect you to modify these sheets to fit your application. You use these sheets as a template for use with many applications even though the specific I/O points vary. These sheets include digital input and output modules as well as analog input and output modules. The Dosing Pump Panel I/O Layout Sheet contains one example of each type of module that will typically be used in a lift station application. Note, that these modules are 1756 style I/O modules. Different I/O modules will require changes to these sheets.</td>
</tr>
</tbody>
</table>
The Water Treatment Plant (WTP) Hardware documentation package contains the following system-level drawing packages:

- Raw Water Intake Pump Station System
- Separation Station System
- High Service Pump Station System

The Raw Water Intake System Pump Station drawings are included in this section for reference. These are typical of the others- all can be found on the WWWAT CD (Publication IASIMP-SP012). You can also go to the Rockwell Automation Integrated Architecture Tools Website, http://www.ab.com/go/iatools and download the drawings.

**Raw Water Intake Pump Station System Hardware Drawings**

The System Architecture folder on the WWWAT CD contains the Raw Water Intake System sub-folder. Select this sub-folder to view the following Raw Water Intake System drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Layout Sheets
## Title Page and Sheet Index

### Raw Water Intake System Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1100</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of the drawing package for your application.</td>
</tr>
</tbody>
</table>
**Process Flow Diagram**

Raw Water Intake System Process Flow Diagram

The flow diagram assumes a Raw Water Intake System with particular I/O. Any changes to the I/O for the Raw Water Intake System should be reflected on this diagram.

**Network Diagram**

Raw Water Intake System Network Diagram

For details, see page 23.
Panel I/O Layout Sheets

Raw Water Intake System Panel I/O Layout Sheets

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1130</td>
<td>Panel I/O Layout (Sheet 1 of 2)</td>
<td>This diagram depicts inputs and outputs to the controller. This format uses three cards per sheet. Inputs to the card are shown with the input device to the left of the input card. Output devices are shown to the right of the output card. You must add a new drawing sheet for every additional input or output card.</td>
</tr>
<tr>
<td>E-1131</td>
<td>Panel I/O Layout (Sheet 2 of 2)</td>
<td>This drawing package reserves space for all the &quot;slots&quot; of a controller’s chassis. If an additional chassis is required, use this same format with space reserved in the drawings for any empty slots of the chassis. This provides a pre-determined location in the drawing package for all the I/O modules. I/O specific to an application are shown here and it is expected that these sheets are heavily modified for each application. These sheets provide a template for use for many applications though even if the specific I/O points vary. These sheets include digital input and output modules as well as analog input and output modules. This provides one example of each type of module that will typically be used in a Raw Water Intake System application. <strong>Note:</strong> This drawing depicts 1756 style I/O modules. If you use different I/O modules, you must also update these sheets.</td>
</tr>
</tbody>
</table>
Chapter 2

Pump Controller Station
Hardware Drawings

One of the System Architecture sub-folders on the WWWAT CD is the Pump Controller Station folder and it contains the following drawings:

- **Title Page and Sheet Index**
- **Communications Diagram**
- **Panel Layout Diagram**
- **Power Layout Sheets**
- **Panel I/O Layout Sheets**

**Title Page and Sheet Index**

**Pump Controller Station Title Page and Sheet Index**

**ROCKWELL AUTOMATION**

**WATER/WASTEWATER**

**ACCELERATOR TOOL KIT**

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of the drawing package for your application.</td>
</tr>
</tbody>
</table>
Communications Diagram

Pump Controller Station Communications Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-12</td>
<td>Pump Control Communications Diagram</td>
<td>Refer to Pump Controller Station Architecture Drawing on page 28 for details.</td>
</tr>
</tbody>
</table>
### Panel Layout Diagram

#### Pump Controller Station Panel Layout Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Pump Controller Station Panel Layout Diagram</td>
<td>You can modify this as needed for your application requirements.</td>
</tr>
</tbody>
</table>
Chapter 2

Power Layout Sheets

Pump Controller Station Power Layout Sheets
### Chapter 2

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3 and 5</td>
<td>Power Layout Sheets</td>
<td>Pump Control Power Distribution, 480VAC Power, and 24VDC Power Drawings.</td>
</tr>
</tbody>
</table>
Panel I/O Layout Sheets

Pump Controller Station Panel I/O Layout Sheets
CAD Figures

The WWWAT CD contains both AutoCAD® and Adobe® PDF formatted hardware template files that you can use when designing your application. Template files are available in .dwg, .dxf and .pdf file format.
Accessing the CAD Images from the WWWAT CD

The CAD files can be imported into your AutoCAD project for use in the development of drawing packages for your water and wastewater application.


How to Access Additional CAD Figures from the Website

Use these steps to access the additional CAD figures from the Rockwell Automation website.


2. On the Product Selection tab, type the catalog number of the part you want, click on the product directory for additional information, or use the Product Configuration Assistant.

Additional Resources

To assist you in the hardware design phase of your water or wastewater project, the WWWAT CD contains links to numerous websites where you can find useful and up-to-date information. For more information on websites and documentation that will help you plan and design your Water and Wastewater project, see Appendix A.
Notes:
Additional Resources

To assist you in the hardware design phase of your Water and Wastewater project, refer to the Water and Wastewater Accelerator Toolkit (WWWAT). This toolkit resides on a CD and contains links to numerous websites that contain useful and up-to-date information. Refer to the Preface for more information about the WWWAT.

For more information on websites and documentation that will help you plan and design your Water and Wastewater project, see Appendix A.

Process Library Module

The Process Library is a collection of RSLogix 5000 and FactoryTalk View SE component Add-On-Instructions (AOIs), also known as faceplates. Rockwell Automation developed these Faceplates to facilitate the efficient development of flexible and robust process systems. This library is included on the WWWAT CD along with the associated documentation (refer to the Preface’s Introduction section for more information).

Selecting the Process Library

All systems share common components, although the precise functionality of individual process systems varies. For example, process systems typically include many of these hardware components:

- Digital Inputs/Outputs
- Analog Inputs/Outputs
- Single Speed Motors
- Variable Speed Drives
- Motor and Solenoid Operated Valves
You must develop code to manage the interface between the Controller and these devices. You must also create several of the following logical constructs to merge this collection of hardware into a cohesive system:

- Alarms
- Interlocks
- Permissives
- Rule Base Inhibits

The Process Library includes RSLogix 5000 AOIs for performing each of these tasks. In addition, the Library includes graphical objects for use in building a Visual Interface to your Controller. The combination of code and graphics ensures a visually and functionally consistent system.

The Process Library enables you to:

- Speed up development time and focus your energies on the custom aspects of your application.
- Increase quality by reusing well-tested code to reduce the likelihood of code bugs.
- Aids in producing well-structured code - in addition the standard graphics increases the consistency of your HMI thus reducing the need for operator training.
- Leverage scalability - build ever larger systems using the same reusable modules.
Using the Process Library Module

The Process Library is a collection of components that provide a large amount of flexibility. You can choose to use any number of the modules and it does not require you to code within a rigid structure. You also retain the flexibility of a Logix System, while saving yourself the trouble of writing and maintaining standard functionality.

The Process Library makes extensive use of AOIs, which are custom instructions that a user designs and creates. Using AOIs, you can create new commonly-used logic instruction sets, provide a common interface to this logic, and provide instruction documentation.

AOIs are intended to be used to encapsulate commonly used functions or device control. They are not intended to be a high-level hierarchical design tool. Programs with routines are better suited to contain code for the area or unit levels of your application. These are some benefits to using an AOI.

Reuse Code

AOIs promote consistency between projects by reusing commonly-used control algorithms. For algorithms that will be used multiple times in the same project or across multiple projects, it may make sense to incorporate that code inside an AOI to make it modular and easier to reuse.

Provide an Easier to Understand Interface

AOIs enable you to design a more user friendly interface by:

- Placing complicated algorithms inside of an AOI and marking the essential Parameters as visible or required.
- Reduce documentation development time through automatically generated instruction help.
**Intellectual Property Protection**

An AOI enables you to insert Proprietary code inside it using source protection to prevent unauthorized users from viewing or changing your code. You can use AOIs across multiple projects. You can define the instructions, the instructions can be provided by someone else, or they can be copied from another project.

Once defined in a project, AOIs behave similarly to the built-in instructions already available in the RSLogix 5000 software. They appear on the instruction tool bar and in the instruction browser for easy access, just like built-in RSLogix 5000 software instructions.

This is an example of AOIs in the instruction tool bar.

**AOI Instruction Tool bar**
**Using Add-On Instructions**

This section lists the modules that exist in the Process Library and provides a brief functional description for each of them. Refer to each module's documentation for more detailed information. The Process Library section of the WWWAT CD contains separate documentation files for each of the modules. Refer to the Preface for more information about the WWWAT.

**Alarm (P_Alarm)**

The following table describes the Alarm (P_Alarm) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
</table>
| Alarm (P_Alarm)| This instruction monitors an input condition and when it has been true for a specified time, initiates an alarm. It also monitors Alarm Acknowledgement, Alarm Reset, Alarm Inhibiting /Disabling, and Alarm Suppression (for FactoryTalk Alarm and Events). | - You want to develop your own AOIs and have it generate alarms that are compatible with the alarm setup for the Process AOIs. Use the P_Alarm instruction embedded within your AOI.  
- You have a condition in your logic (outside of any AOI) that you need to generate an Alarm. Use the P_Alarm instruction stand-alone within your program logic. | - You have a discrete input signal from a flow switch, pressure switch, level switch, or other device and want to display the device state, generate alarms, or condition the alarm based on time or gating signals. Use the P_Alarm (Alarm) or P_DIn (Discrete Input) AOI instead.  
- You need synchronized time stamping features or other FactoryTalk Alarm and Event features not supported by P_Alarm. Instead, use the ALMD built-in instruction. |

Once the system initiates an alarm, the alarm displays change color according to their severity. A small bell appears in the upper right-hand corner of the display to indicate that an alarm is active. If you must acknowledge the alarm, this bell blinks.

**Alarm AOI**

![Alarm AOI Diagram]

Color indicates severity  
Blinks when acknowledge required  

Acknowledge button
Analog Input basic Instruction (P_Aln)

The following table describes the Analog Input Basic Instruction (P_Aln) parameter and its usage.

### Analog Input Basic Instruction (P_Aln)

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Input</td>
<td>This instruction monitors one analog value, typically from an analog input I/O module, and provide alarms when the analog value exceeds user-specified limits (high and low). The Analog Input Instruction also provides capabilities for linear scaling of an analog input value from “raw” (input) units to “engineering” (output) units, and entry of a Substitute Process Variable provides handling of an out-of-range or faulted input. To keep the Instruction memory and execution footprint small, certain capabilities, used less frequently, are reserved for the Advanced Analog Input AOI.</td>
<td>• You want to display a temperature, flow, pressure, level, or another signal from a field instrument on your HMI. • You need any of the Scaling, Alarming, or HMI features for an Analog Input, or any Analog (quantity) value. • You want Linear scaling from Raw to Engineering Units. • You need High, Low, High-High, Low-Low, and Out of Range alarms (with dead band and delay per alarm). • You use an indicator graphic object with label and engineering units. • You use a faceplate with mode selection, alarm limit entry, and maintenance capability for substitute PV.</td>
<td>• The analog input signal works with another instruction. For example, the Speed Feedback for a variable speed drive is completely handled by the P_VSD Instruction. It is not necessary to use the P_AIn instruction first. Wire or map the input directly to P_VSD. • You only need to display a number on a screen and do not need any of the scaling or alarming features. (Just use a numeric display field.) • You need advanced capabilities such as square root extraction (for example, orifice flow meters), rate-of-change alarming or limiting, or alarming for deviation from a reference value. Use the P_AInAdv (Advanced Analog Input) Instruction instead. • You have the dual sensors for one process variable (such as dual pH meters) and need to select one or the other sensor (or their average). Use the P_AInDual (Dual Analog Input) Instruction instead.</td>
</tr>
</tbody>
</table>
Analog Input (P Aln) Process Variable Faceplate

Operator Tab

Maintenance Tab

Mode Indicator
Requested Mode Indicator

Current Process Variable Graph

I/O Status Indicator

Operator Mode Unlock and Lock Command Button

High and High-High Limits

Current Process Variable

Low and Low-Low Limits

Buttons to select InputPV or substitute PV

Maintenance Mode Acquire and Release Command Button

Level Alarm Thresholds and Deadbands

Threshold | Deadband
---|---
High-High Alarm | 90.00 | 1.00
High Alarm | 80.00 | 1.00
Low Alarm | 20.00 | 1.00
Low-Low Alarm | 10.00 | 1.00
Out-of-Range High | 110.00 | 0.00
Out-of-Range Low | -10.00 | 0.00

Bumpless Program/Operator Transition
Analog Input (P_A1n) Engineering Tab Faceplate

Configure Device Description, Label, and Tag

Configure Input and Scaled Ranges
## Digital Input Instruction (P_Dln)

The following table describes the Digital Input Instruction (P_Dln) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
</table>
| Digital Input (P_Dln) | This AOI receives and processes a single discrete condition (bit or PV), typically for a channel of a discrete input card. It can be used with any discrete (BOOL) signal. The P_Dln AOI includes the capability to generate a discrete input alarm, such as from a low level switch, high vibration switch, or flow switch. | - You want to display the state of a process temperature, level, flow, proximity, pressure, or other switch.  
- You need any of these signal processing or alarming features for a discrete input or any discrete (bit) value.  
- You require debounce of a Discrete Input signal.  
- You want the system to activate an alarm when the Discrete Input is not in a target state for some period of time.  
- You want the system to enable an alarm when a gating condition is true for some period of time.  
- You want the system to display the switch state with configurable text on an HMI object with operator Faceplate call-up.  
- You need Maintenance to be able to provide a substitute value when the device has failed. | - You need only to show or not show the state of a bit on an HMI display. Use basic display objects (text, multi-state indicators) with appropriate animation instead.  
- You need only to generate an alarm from some condition you already have in your code. Use the P_Alarm AOI or the ALMD built-in instruction instead. |
Digital Input (P_Din) Faceplate
## Interlock Instruction (P\_Intlk)

The following table describes the Interlock Instruction (P\_Intlk) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
</table>
| Interlock (P\_Intlk) | This AOI collects ("sums up") the Interlock conditions which stop a running (energized, open) piece of equipment or prevent it from starting. Interlocks are always evaluated to de-energize equipment. For "permissive" conditions, such as those that must be made to start the equipment but which are ignored once the equipment is running, use the P\_Perm (Permissives) AOI. | • You have multiple interlock conditions or cascaded interlock conditions (an interlock hierarchy) which stop some equipment (motor, valve, drive) or keep it from starting. Link the P\_Intlk Status bits to the Inp\_IntlkOK and Inp\_NBIIntlkOK inputs of the motor, valve, or drive.  
• You need a first-out indication of which interlock condition shut down the equipment.  
• You want configurable text descriptions of shutdown conditions and other features of the P\_Intlk Faceplates. | • You have conditions that prevent starting equipment, but which are ignored once the equipment is running. Those are permissive, not interlock conditions. Use the P\_Perm AOI instead.  
• You have only one interlock condition for the equipment. Connect the condition directly to the interlock input on the device. |
Interlock (P_Intlk) Faceplate

- Status Indicator
- Bypass Indicator
- Reset Button

**Operator Tab**

- Condition Met
- Condition Bypassed Input Good
- Condition Bypassed Input Bad
- Condition Not Met
- First Interlock to Fail

**Engineering Tab**

- Description
- Can Bypass
- Must Reset

- Clear Program Commands on receipt
**Mode (P_Mode)**

The following table describes the Mode (P_Mode) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode (P_Mode)</td>
<td>This AOI provides selection of the Mode (owner) of an instruction or control strategy. The Mode instruction is usually embedded within other instructions to extend their functionality. It is possible to use a stand-alone Mode instruction to enhance a program where modes are wanted.</td>
<td>- Creating an AOI for a device which: &lt;ul&gt;&lt;li&gt;Requires separate acquisition by an operator and Program logic&lt;/li&gt;&lt;li&gt;Supports Override or Hand capabilities&lt;/li&gt;&lt;li&gt;Needs a separate Maintenance Mode&lt;/li&gt;&lt;/ul&gt; Embed the P_Mode instruction within your AOI.  &lt;br&gt;Use the P_Mode instruction stand-alone within your strategy and condition Commands and Actions in the strategy on the P_Mode AOI mode Status bits.</td>
<td>- Creating an AOI which does not do anything differently for: &lt;ul&gt;&lt;li&gt;operators versus Program logic&lt;/li&gt;&lt;li&gt;Override or Hand conditions&lt;/li&gt;&lt;li&gt;Maintenance users. You do not need Modes or the P_Mode instruction.&lt;/li&gt;&lt;/ul&gt; - Creating a complex strategy for shared equipment (Shared Use Common Resource) which has complex rules for arbitration and allocation of the equipment. You need rule-based sharing logic beyond the capabilities of the P_Mode instruction.</td>
</tr>
</tbody>
</table>
The modes have the following priority (also shown in the illustration above):

1. Hand (highest)
2. Maintenance
3. Override
4. Operator and Program (lowest)

The AOI still processes and retains the lesser priority mode requests, but the resultant mode is that of the highest priority request.
### Selecting Modes

This table shows how to request, verify, and release a mode. It also shows the trigger input cycle.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Request (Input)</th>
<th>Acquired (Output)</th>
<th>Release (Input)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand</td>
<td>Inp_Hand=1(level)</td>
<td>Sts_Hand=1</td>
<td>Inp_Hand=0 (level)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>MCmd_Acq=1(edge)</td>
<td>Sts_Maint=1</td>
<td>MCmdRel=1(edge)</td>
</tr>
<tr>
<td>Override</td>
<td>Inp_Ovrd=1(level)</td>
<td>Sts_Ovrd=1</td>
<td>Inp_Ovrd=0(level)</td>
</tr>
<tr>
<td>Operator</td>
<td>OCmd_AcqLock=1</td>
<td>Sts_Oper=1</td>
<td>OCmd_UnLock=1</td>
</tr>
<tr>
<td>Program</td>
<td>See Program Mode</td>
<td>See Program Mode</td>
<td>See Program Mode</td>
</tr>
</tbody>
</table>

**Program Mode**

The Program Command functionality depends on the configuration for clearing Program Commands (Cfg_PCmdClear).

<table>
<thead>
<tr>
<th>Mode</th>
<th>Option</th>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td>Cfg_PCmdClear=1</td>
<td>PCmd_Acq=1 (edge)</td>
<td>Request Program Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCmd_Rel=1 (edge)</td>
<td>Release Program Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCmd_Lock=1 (edge)</td>
<td>Lock Program Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCmd_Unlock=1 (edge)</td>
<td>Unlock Program Mode</td>
</tr>
<tr>
<td></td>
<td>Cfg_PCmdClear=0</td>
<td>PCmd_Acq=1 (level)</td>
<td>Request Program Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCmd_Acq=0 (level)</td>
<td>Release Program Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCmd_Lock=1 (level)</td>
<td>Lock Program Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCmd_Lock=0 (level)</td>
<td>Unlock Program Mode</td>
</tr>
</tbody>
</table>
**Motor (P_Motor)**

The following table describes the Motor (P_Motor) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
</table>
| Motor (P_Motor)  | The P_Motor [single speed motor] object controls a non-reversing, single speed motor in a variety of modes and monitors for fault conditions. | • You want to control a single-speed (running or stopped) motor. The motor can use a full voltage starter (FVNR), a soft starter or other motor protective equipment. However, it might provide run feedback. The P_Motor AOI provides Faceplates and graphic symbols for the operator display, control and appropriate modes/alarms. | • You want to control a two-speed (fast/slow/stopped) motor. Use the P_Motor2Spd (two speed motor) AOI instead.  
• You want to control a reversing (forward/stopped/reverse) motor. Use the P_MotorRev Reverse Motor) AOI instead.  
• You want to control a motor with continuously-varying speed. Use the P_VSD (Variable Speed Drive) AOI instead.  
• You want to control a motor that is part of a valve actuator. Use the P_ValveMO (Motor-Operated Valve) AOI instead. |
Motor (P_Motor) Operator Tab Process Variable Faceplate

Motor (P_Motor) Maintenance Tab Process Variable Faceplate
Motor (P_Motor) Engineering Tab Process Variable Faceplate

Configure Motor Description, Label and Tag
## Permissive (P_Perm)

The following table describes the Permissive (P_Perm) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
</table>
| Permissive (P_Perm) | This AOI collects (“sums up”) the Permissive conditions which allow a piece of equipment to start (run, energize, open, etc.).  
Permissive conditions generally must only be true to start the equipment. Once the equipment is running, Permissives are ignored.  
Use the P_Intlk (Interlocks) AOI for collecting conditions which stop running equipment as well as prevent it from starting. | - You have multiple or cascaded Permissive conditions which prevent some equipment (motor, valve, and drive) from starting, but which are ignored once the equipment is running. Link the P_Perm Status bits to the Inp_PermOK and Inp_NBPermOK inputs of the motor, valve, or drive.  
- You want configurable text descriptions of the Permissive conditions and other features of the P_Perm Faceplates. | - You have conditions that shut down running equipment as well as prevent it from starting. These are interlock, not Permissive conditions. Use the P_Intlk Instruction instead.  
- You have only one Permissive condition for the equipment - connect the condition directly to the permissive input on the device. |
## Reset (P_Reset)

The following table describes the Reset (P_Reset) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset (P_Reset)</td>
<td>This AOI provides a central point at which to reset equipment faults and latched alarms for a control strategy. The P_Reset accepts an Operator Reset Command, a Program Reset Command, and a Reset Input. These commands are initiated from a button input, higher-level P_Reset AOI (from a containing control strategy, say a Unit Reset sent to a P_Reset at Equipment Module scope), or from any other source. The Reset AOI also includes a &quot;Reset Required&quot; input for collecting the &quot;Ready to Reset&quot; outputs of the various instructions it resets and providing a &quot;ready to reset&quot; (&quot;reset required&quot;) status which can illuminate a button or make an HMI reset button visible. The Reset AOI includes a timer function which causes its output to be held on for at least a minimum time. This allows the reset signal to be sent via physical output cards to field devices that may required it (e.g., motor drives) and gives time for the cleared status from the device to propagate back to an Interlock or Permissive inputs to the system.</td>
<td>- You want a common reset point (&quot;Master Reset&quot;) for alarms and fault conditions for a control strategy, process unit, process cell or equipment group, process area or plant section, or even a small site. Tie the output of the P_Reset instruction to the Inp_Reset input of the equipment to be reset. - You want a cascading reset strategy, where there is a P_Reset instruction for a small equipment scope such as a strategy which incorporates resets from wider scope (unit, cell, area, site) resets. Tie the output of the higher-level P_Reset instruction to the Inp_Reset input of the lower-level P_Reset instruction.</td>
<td>- You want to reset a single piece of equipment (valve, motor). Use the Operator or Program Reset Command directly on the equipment.</td>
</tr>
</tbody>
</table>
Reset Inhibit (P_ResetInh)

The following table describes the Reset Inhibit (P_ResetInh) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
</table>
| Reset Inhibit (P_ResetInh) | This AOI prevents damage to a large motor through repeated starts. The high starting current for a large motor causes considerable heating. Because the thermal mass of a large motor is much smaller relative to its horsepower and starting current compared to smaller motors, repeated starts (or start attempts) over a short time will overheat the motor windings, potentially damaging the motor permanently. The Restart Inhibit AOI provides a rule-based state model for restarts and is NOT intended to model or monitor the motor heating. It cannot replace sensor-based motor monitoring systems. It can, however, be a simple solution to avoid overstressing a motor without the cost (money or Controller resources) of more extensive modeling and monitoring. | • You have a large motor or other piece of equipment where repeated start/stop cycles or failures to start may damage the equipment.  
• The state model of the P_ResetInh instruction is appropriate for limiting the restarts of the equipment ("Three Starts" rule, hot/cold model, etc.).  
• You don’t have the sensors or equipment for more advanced motor monitoring or modeling. | • You have more advanced motor monitoring equipment or motor heating models available. Use the advanced equipment to provide a start permissive instead.  
• You have a small motor that can repeatedly start and stop without damage, or a simple thermal cutout provided with the motor is sufficient to protect it. |
Run Time (P_RunTime)

The following table describes the Run Time (P_RunTime) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runtime (P_RunTime)</td>
<td>This AOI is used to accumulate the total run time and count of starts for a motor or other equipment. It is a software implementation of the mechanical “hour meter” that is often mounted in the door of a motor control center (MCC) bucket to show total motor run time. The time and number of starts are variables used by maintenance personnel to determine when to perform maintenance activities on motor or other equipment.</td>
<td>• You want the functionality of a run time meter or start counter without having to add hardware devices for these functions to your Motor Control Center.</td>
<td>• You have advanced software for monitoring equipment run time that only needs the equipment running status as its input.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• You need the total run time, current run time, maximum run time or start count information for a piece of equipment on the operator display and you do not have monitoring software that provides the information.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Your equipment monitoring software expects the Controller to provide equipment run time and starts values rather than just a Running status.</td>
<td></td>
</tr>
</tbody>
</table>
Run Time (P_RunTime) Process Variable Faceplates
Motor Operated Valve (P_ValveMO)

The following table describes the Motor Operated Valve (P_ValveMO) parameter and its usage.

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
</table>
| Variable Speed Drive (P_ValveMo) | This AOI operates (open and close) a motor-operated valve in a variety of modes (see below), monitoring for fault conditions. | • To use a motor-operated valve or other valve that requires separate open and close outputs. This valve may use limit switch feedback for the ends of travel. The valve may also require an output to trigger a "valve stop" function, such as breaking a seal-in circuit on the valve operator to stop travel or switch the direction of travel. | • You need to operate a single-solenoid spring-return valve (fail closed or fail open). Use the P_ValveSO Solenoid-Operated Valve AOI instead.  
  • You need to operate a multi-solenoid valve such as a Mix-Proof Valve that has positions (such as CIP) other than "opened" and "closed." You will need specific Mix-Proof Valve logic. (A Mix-Proof Valve Add-On Instruction may be added in the future.)  
  • You need to monitor a valve that is primarily operated by hand. The valve could support a "trip" output to drive it to a "safe" position. Use the P_ValveHO Hand-Operated Valve Add-On Instruction instead. |
Motor Operated Valve (P_ValveMO) Operator Tab Process Variable Faceplate
Motor Operated Valve (P_ValveMO) Maintenance Tab Process Variable Faceplate

![Motor Operated Valve (P_ValveMO) Maintenance Tab Process Variable Faceplate](image-url)
Motor Operated Valve (P_ValveMO) Engineering Tab Process Variable Faceplate
### Variable Speed Drive (P_VSD)

The following table describes the Variable Speed Drive (P_VSD) parameter and its usage.

### Variable Speed Drive (P_VSD)

<table>
<thead>
<tr>
<th>AOI</th>
<th>Description</th>
<th>Use This Instruction When</th>
<th>Do Not Use This Instruction When</th>
</tr>
</thead>
</table>
| Variable Speed Drive (P_VSD) | This AOI is used to operate one variable speed motor using a Drive (AC variable frequency or DC) in a variety of Modes, monitoring for fault conditions. |  • You need to operate a motor connected to a variable-speed drive. The drive can be an AC (variable frequency) or DC drive, and can be connected via an I/O or control network (intelligent drive) or via hardwired analog and discrete I/O. This instruction is designed to work with all currently-available and many legacy Allen-Bradley drives, including Bulletin 1336, Bulletin 1395, PowerFlex 4 / 40 / 70 / 700 / 7000 and PowerFlex DC. This instruction will also work with drives and other variable-speed motor control products via discrete I/O for the start/stop/running signals and analog I/O for the speed reference and speed feedback signals. |  • You need to operate a single-speed motor (running / stopped only). Use the P_Motor Instruction instead.  
• You need to operate a two-speed motor (fast / slow / stopped only). Use the P_Motor2Spd Instruction instead.  
• You need to operate a simple reversing motor (forward, reverse, stopped only). Use the P_MotorRev Instruction instead.  
• You need to operate a motor with multiple discrete speeds. You will need specific logic for this motor. The P_VSD Instruction is designed for motors with continuously variable (analog) speed, not multiple discrete speed selection. |
Variable Speed Drive (P_VSD) Process Variable Faceplate

Operator Tab

Maintenance Tab
Chapter 3

Variable Speed Drive (P_VSD) Engineering Tab Process Variable Faceplate

![Image of Balanced Eccentric Energy Reducer interface with parameters and scaling details.]
WWWAT CD Applications

The WWWAT CD contains sample applications that you can use to begin your Water and Wastewater project.

There are three major application groupings on the WWWAT CD - Water Treatment Development Tools, Wastewater Treatment Development Tools, and Pump Controller Station. Refer to Pump Controller Station on page 234.

Water/Wastewater Development Tools

Press the Water or Wastewater Development Tools to locate these applications.

Water/Wastewater Treatment Application Framework

All Water/Wastewater Treatment applications on the WWWAT CD share a common framework. This section examines that framework.

The WWWAT CD (Phase 4) contains the following Water/Wastewater Treatment applications:

- Lift Station System
- Dosing Pump Station System
- Headworks System
- Secondary Treatment System
- Solids Handling System
- Chemical Feed System
- Flushing System
- Raw Water Intake Pump Station System
- Separation Station System
- High Service Pump Station System
The System Controller organization includes:

1. Task - Main Task, for example
2. Program - Pumps, for example
3. Routine - A01_DiscreteInputs for example

The components of this organization correspond to areas of the application. The task component is application-wide. The Program component should be used with the application’s functional area and each routine is dedicated to a specific action within this functional area. For example, the entire Lift Station System is contained within a Task. Pump control is contained within a program and functionality within a pump, such as pump control versus pump alarming is separated into different routines.

Lift Station System Application Organization

All programs contain a routine (Main) which is used to call all the other routines in the task. A Job Status Report (JSR) must be included in the Main routine for every routine in the program. For example, the following depicts a
Lift Station program for Pumps and its associated Main routine with a JSR to all other routines: 

**Program Example**
**Inputs and Outputs**

The philosophy for real-world inputs and outputs are that they are "mapped" to tags in the Controller. Each I/O point occurs once in the Controller on the rung where it is mapped. For example, consider this rung:

In the Lift Station application, the Wet Well Low Level Sensor has been electrically connected to the 10th input on the card in slot one of the Local Rack.

The mapping of physical I/O to internal bits is good programming practice for the following reasons:

- If the electrical design changes, you only have to make one change in the program.
- Keeping all this inputs and outputs together keeps your application clean and consistent.

This mapping should be done on the same rung as the object that uses the input for the following reasons:

- When troubleshooting an object, you can immediately see the state of the I/O associated with it and check that the correct I/O is mapped to the correct location.
- It provides a simple understanding of which I/O applies to a particular object.
The following example depicts the P_Motor object. All I/O associated with this motor is mapped on the rung with the motor object.
AOIs

Add-On Instructions populate their own folder in the Controller Organizer.

These applications contain two AOI classes, Process Library Modules (identified with the prefix P_) and User Modules (prefix U_). The applications included in the WWWAT include AOIs from both the Process Library and those created specifically for these applications.
Chapter 3

Using the Process Modules

The Process Modules are included in this Toolkit and can be imported into your application as required. These modules are distributed as XML (.L5X) and must be imported into your application as AOIs. To import an XML file into your application:

1. Click File > Import Component > Add-On Instruction.

Select/Import AOIs

Once you import an AOI, the system lists it in the Controller Organizer’s AOI folder. The Process Library Module code may be viewed but not edited.

User Modules

The applications in this toolkit also contain user modules. These modules can be identified by the prefix U_ and have been written exclusively for the WWWAT and its associated applications. Use these AOIs as written or customize them as required.
The Water and Wastewater Treatment Plant (WWTP) documentation package contains the following applications:

- Lift Station System
- Dosing Pump Station System
- Headworks System
- Secondary Treatment System
- Solids Handling System

**Lift Station System Application**

The WWWAT CD contains a Lift Station system application. This application is written assuming up to six pumps transfer the Lift Station building well contents to the Raw Sewage wet well at the Wastewater Treatment Plant. You can also modify the application use in a pumping application where pump control is based on the level of a wet well.

The Water and Wastewater sections of the WWWAT contain the Lift Station system application because of its general applicability. Its Controller organization is shown below:
Lift Station System Application Controller Organization

The functionality for each program and routine is:

• Main Program handles Lift Station-wide inputs and outputs.
  – Main routine calls the other routines in this program and includes a Wall Clock AOI that calculates the day of the week. It also includes a Pump Inputs simulation bit that you can use when testing the application.
  – A01_DiscreteInput maps inputs that are relevant throughout the Lift Station.
  – A02_AnalogInput maps analog inputs that are relevant throughout the Lift Station.
  – A03_AnalogInputs maps inputs that are relevant throughout the Lift Station.
  – A04_AnalogOutputs maps outputs that are relevant throughout the Lift Station.

• Pump System determines how many pumps to run and which pumps to start. This is a supervisor of the pumps.
  – Main routine calls the other routines in this program.
  – A01_StartOrder determines the order in which to start the pumps.
Chapter 3

- A02_Control calculates the pump demand (the number of pumps to start).

- Pumps handle only pump control. Start and Stop commands are issued to these programs and they handle unit level control of the pump motors.
  
  - Main routine calls the other routines in this program.
  
  - A0x_Pumpn_Alarms handles inputs and alarms relating to a specific pump.
  
  - A0x_Pumpn_Control handles pump control - permissives and interlocks for the motor as well as the control of the motor itself are handled here.
Control Description

Normally, the wet well pumps transfer the Lift Station well contents when the well level rises above the programmed high water level in the well. Alternatively, floats in the wet well control the pumps, in case of a Programmable Logic Controller (PLC) fault or level transmitter malfunction. This allows the pumps to turn on via a hard-wired circuit if the water level is too high.

Hand Mode

Place the pumps in Hand control:

1. Select Hand mode on the Drive Speed selector switch at the Feed Pump control panel.
2. Select Hand mode on the Pump Start selector switch at the Feed Pump control panel.
3. In Hand position, press the button station located on the control panel to start/stop a pump.

Remote Operator Mode

Place the pumps in Remote Operator control:

1. Select Remote on the MCC for pumps 1 and 2. Verify that circuit breakers and disconnects are turned on.
2. Select Operator mode on the Lift Station Pump No.x Faceplate screen for each of the pumps 1 and 2.
3. Verify that the pump status is in service on the Lift Station Pump No.x Faceplate screen with no faults.

Human Machine Interface (HMI) Control

Go to the Lift Station screen from the HMI screen:

1. Click the Lift Station 1 button. The system displays the Lift Station screen.
Selecting the Lift Station 1 Button on the HMI Screen

2. Click the **Wet Well Level Faceplate**. The system displays the Process Library Faceplate for the analog module that is monitoring the Wet Well Level.

**Lift Station Screen**
Lift Station Level Faceplate

This analog faceplate provides detailed information about the wet well level.

The Lift Station screen depicts the Wet Well Level with a water animation.

Lift Station Wet Well Level Animation

This animation shows a low wet well level of 1.90 feet.
Chapter 3

Lift Station Wet Well Level Animation

This animation shows a high wet well level of 12 feet.

Pump Faceplates

For each pump in the Lift Station, there are a Pump, Motor, and Digital Input Faceplate.

Lift Station Pump Faceplate
Chapter 3

Lift Station Motor Faceplate

Lift Station Digital Input Faceplate
Pump Setpoints

The Pump Setpoint screen provides you with information about when each pump should start and stop.

1. Click the Pump Setpoints button that appears on the Lift Station screen. The system displays the Pump Setpoint screen.

2. Use the Start or Stop fields to adjust the setpoint for when each pump starts and stops. The setpoints are based on the Wet Well Level.

   For example, in the illustration above, the lead pump starts pumping when the well level goes above 1.0 feet. The pump stops when the level drops below 0.5 feet. This results in a dead band of 0.5 feet. The lag pump operates similarly, except that it starts at 2.0 feet and stops at 1.5 feet. You can easily adjust all of these values on this single screen.

3. Adjust the Lead and Lag pumps using the Operator Settings switches in the lower right side of this screen.
a. Click the appropriate radio button to assign a pump as Lead or Lag. The screen contains **Lead** and **Lag** radio buttons for Pump 1 and Pump 2.

For example, in the illustration below, pump 1 is assigned as the lag pump and pump 2 is assigned as the lead pump. Pump 2 will start when the water level reaches the start level for the lead pump and stop when the water level drops to the stop level. You can change these assignments at any time.

**Lift Station Pump Setpoint Screen**

The sequence of pumps is shown below these switches. The sequence displayed will reflect the sequence currently active in the Controller. If any pump fails to start, the next pump in the sequence will start.

For example, if the lead pump's disconnect is pulled and does not start, the next pump in the sequence will run. The above illustration is showing only two pumps. The sample code in the Controller provides routines for up to six pumps.

There is a development screen provided that can be used as a starter for additional pumps. It can be opened on the HMI by selecting the Test 6 Pumps button from the overview screen.

Wet Well pumps are not interlocked with the main plant well. If the main well is in an alarm state, the Lift Station pumps will start in Auto.

**Run Pumps Manually**

Use the following steps to run the pumps manually from the **HMI**:

1. While in **Maintenance** or **Operator** mode, navigate to the **Lift Station** screen.
2. Click on the desired pump and then click on the **Play** button.
3. Click on the **Stop** button to stop the pump from the **Control** screen. In manual mode, the pump will continue to run regardless of a low **Wet Well** level.

**Run Pumps Manually**

![Image of pump control interface]

**Place Pumps in Remote Program**

Place the pumps in **Remote Program** control.

1. Select **Remote** on the MCC for pumps 1 and 2.
2. Verify that the circuit breakers and disconnects are turned on.
3. Make sure on the **Lift Station Pump N.ox Faceplate**, for pump numbers 1 and 2 are in the unlocked **Operator** mode.
4. Verify that the pump status is in service on the **Lift Station Pump N.ox Faceplate** screen with no faults.
5. Verify that the correct pump rotation sequence has been selected and the **start/stop** pump set points are set to the correct level.
Alarms

The Lift Station generates these two types of alarms.

- Process Alarms
- Equipment Alarms

Process Alarms

These are the six different types of Process Alarms:

- Low Level (the wet well is low)
- High Level (the wet well is high)
- Low Low Level (the wet well is extremely low)
- High High Level (the wet well is extremely high/or is overflowing)
- High Level Float
- Low Level Float

Equipment Alarms

These are the four different types of Equipment Alarms.

- **Pump Permissive** - Inhibit Restart
- **Pump Interlock** - Motor Overload, Motor High Temperature, or Low Water Cutoff
- **Start-Stop Pump Failure** - Check the MCC selector switch and local disconnect
- **I/O Fault**

Use the Lift Station Level Faceplate to configure the analog Process Alarms changing condition. Users with the correct security level can also inhibit both alarms.
Customization

The example programs included on the WWWAT CD provide you with a start to the application development. Typically, many customizations and adjustments have to be made to the application to make it operational for a particular project.

Customization is a vital part of the software development. This section outlines some of the basic tasks that must be done for this customization and other steps may be necessary. The important point to remember is that these example applications only serve as a start. It is the responsibility of the application engineer to assess the requirements of the project, take ownership of the application, and drive it to completion.

Some general customization concepts will be discussed in this section. Though you may not be interested in the Lift Station application, it is an important section to read because the customization information contained in this section applies to other areas as well.

I/O Assignment

As mentioned earlier in this document, I/O is mapped at one place in the application for each I/O point. As part of customizing the example Lift
Station application, be sure to check all the locations for I/O that is mapped including the following:

- MainProgram - A01_DiscreteInput - rungs 0 - 4
- MainProgram - A02_AnalogInput - rungs 0 - 3
- MainProgram - A03_DiscreteOutputs - as needed
- MainProgram - A04_AnalogOutputs - as needed - this routine is not used in the example

For Pump I/O, each pump has its own routines in the Pumps program. The routines are numbered sequentially, A01, A02, etc. For I/O mapping go to the following rungs:

- Pumps - A0x_Pumpn_Alarms - rungs 0 - 4
- Pumps - A0x_Pumpn_Control - rungs 3 - 5

Where: x = sequential routine number, n = pump number

This is not intended to be a complete list of the I/O assignments necessary. It is only intended to point out some required rungs that must be customized for a particular application. As an important step in the software development process, care should be taken to properly assign I/O to all the necessary places in the software. Many I/O points for a specific application may not be anticipated by this example application. In these situations, additional software must be developed to account for these points.

**Motor Permissives and Interlocks**

The sample Lift Station application provides places for additional permissives and interlocks to be added to the program. Keep the following points in mind:

- Permissives allow or prevent a motor from starting. If a permissive is not true, the motor will not start when it receives a start command. But once the motor is started, it will continue to run on a loss of a permissive.
- Interlocks allow or prevent a motor from continuously running. If an interlock is not true, the motor will not run when it receives a start command. Once the motor is started, it will stop on a loss of an interlock.
- To include additional permissives for a pump motor to start, add contacts to rung 3 of A02_Control in Pump 1 or Pump 2.
- Each permissive input is mapped on a branch in this rung. All these permissives are inputs to the Process Library AOI that is located on the last branch of the rung. All permissives must be true to allow the pump to start. If there is an input that is normally closed, use an XIO instruction on the branch of the rung to properly map it into this AOI.
Fault and Alarm resets in the application are accomplished through a P_Reset block from the Process Library. This reset object distributes the Reset command to all the Process Library AOIs that may require a reset.

Care must be taken in deciding how to distribute the reset commands. This must be planned before the customizations that follow can be completed. Considerations include questions such as:

- What devices will reset when a particular button is pressed?
- How are devices to be grouped they are reset at the same time with the same reset button?
- Do some devices overlap into more than one Reset group?

For example, in the Lift Station application provided in the WWWAT, the reset is distributed to all the pumps. Rung 2 of each Pump Control routine has a
branch for the Reset button. To remove a pump from this Reset group, tie a different Reset button to this branch.

In general, there are three important customizations that are required with this object:

- Assigning all the Reset Required bits to the P_Reset object
- Assigning all the devices, such as buttons that can initiate a reset to the P_Reset object
- Properly distributing the Reset command to all objects that will use its reset.

Lift Station Pump Control Rung 2

Assigning the Device That Initiates the Reset

Assigning the device that initiates the reset is also done on the rung with the P_Reset object. Add branches here for all devices that can initiate a Reset command to this P_Reset object. These devices may include commands from the HMI, hard-wired reset buttons or other operator interfaces that provide a Reset command.

Assigning the Reset Required

Assigning the Reset Required bits is done on the rung with the P_Reset object. All Reset Required bits from all objects that will receive the reset command must provide a Reset Required bit to this reset. Add branches to this rung for each device that will fall within the group for this P_Reset. The illustration below demonstrates these reset required bits and the branch required.
Distributing the Reset Command

Once a reset is initiated and the P_Reset sends its Reset command, all devices that are to receive this reset must be mapped to the proper Reset bit. This is done in a distributed manner. Each device that is to receive the reset will have a branch on the rung mapping this Reset command to its Reset input. See the Lift Station Reset Command with a Digital Input Object illustration for an example with a Digital Input object. The idea is the same for all other objects that accept a reset. Each rung for an object that requires a reset will require a branch like the one shown below.
Lift Station Reset Command with a Digital Input Object

Mode Selection

Routines for Pump 1 and Pump 2 include a rung that handles mode operation of the routine. This rung is shown in the Lift Station Pump 1/Pump 2 Mode Selection Rung illustration.
Lift Station Pump 1/Pump 2 Mode Selection Rung

By latching on the Program Acquire Command, the application will default to Program Control of the application in the absence of a request to switch to Maintenance or Hand modes. When one of these modes is requested, the program will switch to these modes. However, when the request is no longer active, the application reverts to Program Control.

Unlatching the Program Command Clear bit determines the style of mode control. With this bit set to zero, a level type of control is required for mode selection. This means that to remain in a particular mode, the request for that mode must be maintained. For example, to select Program mode, the Program request command bit must remain 1. Latching this Program Command Clear bit would select an Edge type of control where setting the Program bit once on a one-shot will trigger the transition to Program mode. Once the transition occurs, the command bit is turned off. The command to change the mode is called a command acquisition bit. Within the application, modes change by manipulating these PCmd_Acq or OCmd_Acq bits. PCmd is the request for program control or automatic, OCmd is operator control.

In general, the change of mode with the Program Command Clear bit latched is sensitive to the change of state of the mode acquire bit whereas with the Program Command Clear bit unlatched, the state is determined by the state of the mode acquire bit itself.

This application is using the program command clear bit unlatched as the style of mode selection - this is the maintained style of mode control. If you wish to change this type of control to the Edge style, an understanding of the method of mode selection within the Process Library is required. These paragraphs have touched on this topic, but more information can be found within the Process Library documentation. Refer to the manual for the Mode object for more detailed information.
Adding or Removing Pumps

The Controller application provides routines for up to six pumps. The HMI application is written for two pumps although a test screen is provided to serve as a start or seed for adding additional pumps to the HMI. Both applications can be adjusted to suit your process but this requires an understanding of the software and careful customization. This section describes some of the details that must be tended to as pumps are added or removed.

To adjust the number of pumps in the Controller, first add or delete routines as necessary to have one alarm and one control routine for each pump. Note that these routines are numbered sequentially with A0x where x is the sequential. You may number the pumps or name them as required for your application. You may choose to name a pump PumpWest instead of Pump1 for example.

Lift Station Pump Controller Routines

All these routines should be contained in the Pumps program and every routine must have a JSR instruction in the Main routine.
In A02_Control of the Pump System Program, configure the number of pumps total by setting Pump.Demand.CFG_PosTotal to equal the number of installed pumps.
Lift Station Pump 1/Pump 2 Mod

After making these changes, map all the I/O associated with the additional pumps. Refer to the I/O Assignment section of this document.

Changes to the HMI application can be summarized by explaining that adding pumps to the HMI simply requires duplicating existing animation on the screen and assigning the proper pump tags to each of the HMI components. Be sure to not only add additional animations for the pumps, but also for the discrete inputs located under each pump and for pump sequence control indicating lead and lag.

Below are examples of all the components that should be duplicated for this application. Note that the descriptions change for each. For example, Pump 1 to Pump 3 and the backing tags must be updated to the appropriate tag in the Controller. Some of these animations are on the main Lift Station overview screen and some are on the Pump Setpoints screen.

Lift Station Duplicated Component Examples
A basic test screen for 6 pumps is provided to give you a start on creating additional pumps. This can be accessed via the Test 6 Pumps button on the Lift Station screen.

This Test 6 Pumps button is not intended to remain in a working application and should be removed once it is determined how many pumps the application will have. The Lift Station Test 6 Pumps Example illustration depicts a test screen with six pumps. This serves only as a start from which to customize your application.

Lift Station Test 6 Pumps Example
Dosing Pumps Application

The Dosing Pumps application is provided on the WWWAT CD. This is the Dosing Pump application’s organization within the Controller.

Dosing Pumps System Application Controller Organization

This task resides in a Controller located in the main facility of the plant using the Dosing Pump application. It is not intended to be the only application in the Controller. A ControlLogix processor is specified for this application for that specific reason. It is assumed the processor will be running other systems of the plant.
The organization of this application is similar to that of the Lift Station. Specifically, the functionality for each program and routine is:

- **Main Program** handles general Dosing Pump application’s functionality, including:
  - Main routine calls the other routines in this program and includes a Wall Clock AOI that calculates the day of the week. It also includes a Pump Inputs simulation bit that you can use when testing the application.
  - A01_DiscreteInput maps inputs that are relevant throughout the Dosing Pumps.
  - A02_AnalogInput maps analog inputs that are relevant throughout the Dosing Pumps.
  - A03_AnalogInputs maps inputs that are relevant throughout the Dosing Pumps.

- **PSys** determines how many pumps to run and which pumps to start. This is a supervisor of the pumps.
  - Main routine calls the other routines in this program.
  - A01_Control contains the code for the pump decisions and metering.

- **Feed Pump 1 and Pump 2** handle only pump control. Start and Stop commands are issued to these programs and they handle unit level control of the pump motors.
  - Main routine calls the other routines in this program
  - A01_Alarms handles inputs and alarms relating to a specific pump
  - A02_Control handles pump control - permissives and interlocks for the motor as well as the motor control itself are handled here.

Add-On Instructions are used extensively in this application. There is a collection of Process Library AOIs and a collection of other AOIs developed specifically for this application. Process Library AOIs can be identified by a prefix "P_" in their name. The other AOIs have a prefix of "U_" as shown in the AOI illustration.
Phosphorus concentrations in the final effluent are limited by the National Pollutant Discharge Elimination System (NPDES) Permit, meaning that the plant is required to implement treatment steps. Feeding Alum to the wastewater increases the amount of sludge generated which will result in larger quantities sludge in the secondary clarifiers.

The Alum is pumped from the two storage tanks by two metering pumps (numbers 1, and 2). These pumps are paced by the plant flow rate.

WARNING Alum is a potentially dangerous substance and must be handled with care.

From the overview screen, click the Alum button or the Alum Storage Tank icon to display the Dosing Pump Application screen.
Chapter 3

Selecting the Alum Button

The lower left of the Alum Feed screen shows the status of the Alum storage. The Alum storage tanks are equipped with ultrasonic level sensors to measure the gallons stored Alum in each tank. The tank volume and pump status are displayed on the Alum Feed Overview screen. Selecting the Alum Storage
Level display opens the Analog Input Faceplate for the Alum level. This is a standard Process Library Faceplate.

To obtain pump status and control, click either pump icon. Clicking a pump opens the Process Library Faceplate for VFDs. The variable speed Alum Feed Pumps may be operated in either Hand or Remote mode as selected by a Remote-Off-Hand selector switch at the associated control panel.

**Hand Mode**

Use the following steps to place the Feed Pumps in Hand Control mode.

1. Select Hand mode on the Drive Speed selector switch at the Feed Pump control panel.
2. Select Hand mode on the Pump Start selector switch at the Feed Pump control panel. In Hand position, the operator starts and stops the pump using the appropriate button station located on the control panel. To adjust chemical dosing use the Motor Speed potentiometer at the Feed Pump Control Panel.

**Remote Operator Mode**

Use the following steps to place the Feed Pumps in Remote Operator control mode:

1. Select Remote mode on the Drive Speed selector switch at the Feed Pump control panel.
2. Select Remote mode on the Pump Start selector switch at the Feed Pump control panel.
3. Select Operator mode from the HMI.
4. The pump is started and stopped remotely from the HMI screen. A faceplate is displayed by clicking on the Feed Pump icon.
5. To start the pump, press Play and to stop the pump, press Stop.
6. To modulate the Feed Pump rate, either click in the Operator Setpoint box and type in a value between 0 and 100 percent to change the speed value in the Speed Setpoint box.
7. To remove the Feed Pump from service, click Disable, and to place the unit back in service, click Enable.

**Remote Program Mode**

Use the following steps to place the Feed Pumps in Remote Program Control mode:

1. Select Remote mode on the Drive Speed selector switch at the Feed Pump control panel.
2. Select Remote mode on the Pump Start selector switch at the Feed Pump Control Panel.

3. Select the Program mode from the HMI.

The pump runs and the output (feed rate) is controlled by the flow pacing signal and the dosage (adjustable at the HMI from 0- X ppm), entered by the operator. Transfer between the Controller operator and Program modes is smooth. The pump output in gallons per hour (feed rate) and stroke speed setpoint is calculated. The Program Logic Controller (PLC) will output the speed signal to the pump based on the appropriate flow pacing signal.

**Alum Control Setpoints**

![Alum Control Setpoints Diagram]
Alarms

The Supervisory Control and Data Acquisition (SCADA) system generates these two types of alarms.

- Process
- Equipment

Process Alarms

There are the four types of Process Alarms.

- Low Level (the Alum storage tank is low)
- High Level (the Alum storage tank is high)
- Low Low Level (the Alum storage tank is extremely low)
- High High Level (the Alum storage tank is extremely High)

Using the Analog Signal faceplate, all four process alarms can be configured for changing condition. Users with the correct security level can also inhibit all alarms.

Equipment Alarms

These are the two types of Equipment Alarms.

- **Alum Fault** - Check the Feed Pump control panel for system or over current faults.
- **Start-Stop Pump Failure** - Check the local disconnect and pump status.

Process Alarms

![Image of Process Alarms configuration](image-url)
Customization of the Dosing Pumps Application

General customization notes are included in the Lift Station Application section (page 102) of this chapter. Refer to this section before customizing any application, including the Dosing Pumps. This section describes customization specific to the Dosing Pumps application.

I/O Assignment

As in the Lift Station, I/O is mapped into this application. This is done in the following project locations:

- MainProgram - A01_DiscreteInput - rungs 0 - 4
- MainProgram - A02_AnalogInput - rung 0
- MainProgram - A03_Outputs - as needed - this routine is not used in the example
- FeedPump1 - A01_Alarms - rungs 0 - 4
- FeedPump1 - A02_Control - rungs 3 - 5
- FeedPump2 - A01_Alarms - rungs 0 - 4
- FeedPump2 - A02_Control - rung 5 for the motor related I/O

Additional Pumps

To add additional pumps to the Dosing Pump application:

1. Adjust A01_Control in FeedPSys to include for the additional pumps. Modifying A01_Control in FeedPSys requires customization that is specific to the application. You must use your judgment to determine how to incorporate these changes.

2. Add additional pump programs as required. These will be duplicates of FeedP1 and FeedP2.

To add additional Feed Pumps:

1. Copy and paste the existing FeedP1 or P2 program. Both programs are identical, so either one can be copied.
Chapter 3

Feed Pump Program Folders

2. Create new controller-scoped tags for the third pump.

Controller Scoped Tags

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ WWT_FEEDP1</td>
<td>U_MotorVSD</td>
</tr>
<tr>
<td>+ WWTP_FEEDP1_FlowPacing</td>
<td>U_FlowPacing</td>
</tr>
<tr>
<td>+ WWTP_FEEDP1_OverLoad</td>
<td>P_Din</td>
</tr>
<tr>
<td>+ WWTP_FEEDP2</td>
<td>U_MotorVSD</td>
</tr>
<tr>
<td>+ WWTP_FEEDP2_FlowPacing</td>
<td>U_FlowPacing</td>
</tr>
<tr>
<td>+ WWTP_FEEDP2_OverLoad</td>
<td>P_Din</td>
</tr>
<tr>
<td>+ WWTP_FEEDP3</td>
<td>U_MotorVSD</td>
</tr>
<tr>
<td>+ WWTP_FEEDP3_FlowPacing</td>
<td>U_FlowPacing</td>
</tr>
<tr>
<td>+ WWTP_FEEDP3_OverLoad</td>
<td>P_Din</td>
</tr>
</tbody>
</table>

3. Locate the program scoped tags for the new Pump 3 program.

4. Define the Alias for Device (and the other associated tags) as this new Controller-scoped tag.

Alias Device Definition Screen

5. Configure and alias for all I/O for the new pump. The Required Pump I/O illustration depicts the subset of the I/O required.

Required Pump I/O

<table>
<thead>
<tr>
<th>Alias</th>
<th>Name</th>
<th>Alias For</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Device</td>
<td>WWT_FEEDP3(C)</td>
</tr>
<tr>
<td></td>
<td>Device_Auto</td>
<td>WWT_FEEDP3_OverLoad(C)</td>
</tr>
<tr>
<td></td>
<td>Device_Auto0</td>
<td>WWT_FEEDP3_OverLoad(I0Fault)(C)</td>
</tr>
<tr>
<td></td>
<td>Device_Auto0_Input</td>
<td>WWT_FEEDP3_OverLoad(I0Fault)(C)</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_Fault</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Data6</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_Fault_I0Fault</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Fault6</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_InAuto</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Fault4</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_InAuto_I0Fault</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Fault7</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_OverLoad</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Data4</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_OverLoad_I0Fault</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Fault4</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_OverLoad_FIFOault</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Fault7</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_SpeedDsk</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Data5</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_SpeedDsk_FIFOault</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Fault5</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_PumpFdb</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Data3</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_PumpFdb_FIFOault</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Fault3</td>
</tr>
<tr>
<td></td>
<td>I_FEEDP3_PumpFdb_FIFOault_0</td>
<td>WWTP_CLX_RACK02_SLOT00_CN8-I Slot[1]Fault3</td>
</tr>
</tbody>
</table>
Be sure to alias all the I/O to the new points for the additional pump. Be certain that all inputs and outputs are aliased to the correct location.

6. Verify the new routines verify and ensure that they contain no errors. The most commonly overlooked issues will be reconciling all the tags used in the routine. The ladder diagram itself will likely verify since this is a duplicate of another function routine.

Pump I/O Verification Screen

```
Verifying program: FeedP3...
Verifying routine A01_Alarms of Program FeedP3
Verifying routine A02_Control of Program FeedP3
Verifying routine Main of Program FeedP3
Complete - 0 error(s), 0 warning(s)
```
Additional Flow Pacing

To include additional flow pacing for other pumps, add rungs to routine A01_Control in program FeedPSys. Each pump with flow pacing requires a U_FlowPacing AOI on its own rung. Add additional rungs below the existing Flow Pacing rungs as shown in the Adding Rungs To The FeedPSys Program A01_Control illustration.

Adding Rungs to the FeedPSys Program A01_Control
Headworks Application

The Headworks application is provided on the WWWAT CD. Refer to the Headworks System Application Controller Organization illustration to view the application’s organization within the Controller.

**Headworks System Application Controller Organization**

This task should reside in a Controller in the main facility of the plant where the Headworks application is present and it is not intended to be the only application in the Controller. A ControlLogix processor is specified for this application for that specific reason. It is assumed the processor will be running other systems of the plant.
The organization of this application is similar to that of the Lift Station. Specifically, the functionality for each program and routine is:

- **Main Program** handles general Headworks application and functionality, including:
  - Main routine calls the other routines in this program and includes a Wall Clock AOI that calculates the day of the week. It also includes a Pump Inputs simulation bit that you can use when testing the application.
  - A01_MiscDiscreteInput includes a template to map inputs that are relevant throughout the Headworks system. This routine is provided as a Function Block Diagram.
  - A02_MiscAnalogInput includes a template to map analog inputs that are relevant throughout the Headworks system. This routine is provided as a Function Block Diagram.
  - A03_MiscOutputs includes a template to map outputs that are relevant throughout the Headworks system.

- **BarScreen01** controls the motor, manages cycle times, and Flow Channel Differential levels for the Bar screen 1 system, including:
  - Main routine calls the other routines in this program.
  - A01_BarScreen01_LDR contains the code to monitor and control the Bar Screen 01 motor and reset alarms, interlocks, and faults associated with the motor. This routine is provided as a Ladder Diagram.
  - A02_BarScreen01_FBD contains the Single Speed Motor, Permissives and Interlock AOIs that monitor and control the Bar Screen 01 motor. This routine is provided as a Function Block Diagram.
  - A03_BarScreen01_Auto contains the Cycle Timer (including the U_RepeatCycTmr AOI) and High Differential Alarm code. This routine is provided as a Ladder Diagram.
  - A04_DiffLevel contains the Analog Input AOI that monitors the differential pressure levels of Preliminary Treatment Flow Channel No 1. This routine is provided as a Function Block Diagram.

- **BarScreen02** Controls the motor and manages cycle times and flow channel differential levels for the Bar Screen 2 system as described for BarScreen01 above.

- **GritTank01** Controls the motor and manages cycle times for the GritTank01 system, including:
  - Main routine calls the other routines in this program.
  - A01_GritTankDrive_LDR contains the code to monitor and control the Bar Screen 01 motor and reset alarms, interlocks and faults associated with the motor. This routine is provided as a Ladder Diagram.
– A02_GritTankDrive_FBD contains the Single Speed Motor, Permissives and Interlock AOIs that monitor and control the Grit Tank 01 motor. This routine is provided as a Function Block Diagram.

– A03_GritTankDrive_Auto contains the Cycle Timer (including the U_RepeatCycTmr AOI) code. This routine is provided as a Ladder Diagram.

– A04_GritTankFlow contains the Analog Input AOI and U_FlowTot AOI that aggregates the Grit Tank 01 flow. This routine is provided as a Function Block Diagram.

● Wet well monitors Wet well level and generates alarms, including:
  – Main routine calls the other routines in this program.
  – A01_Wellwell contains the code to monitor Wet Well level and generates alarms utilizing the Analog (P_AIn) and Discrete (P_Din) Input AOIs. This routine is provided as a Function Block Diagram.

AOIs are used extensively in this application. There is a collection of Process Library AOIs and a collection of other AOIs developed specifically for this application. Process Library AOIs can be identified by a prefix "P_" in their name. The other AOIs have a prefix of "U_" as shown in the AOI illustration.

AOIs

Process Description

The Headworks treatment consists of Screening, Influent Flow Measurement, and Grit Removal. From the inlet well, the wastewater enters one or two preliminary treatment flow channels. Each flow channel consists of an
**Inclined Bar** screen with a mechanical raking device to remove debris from the raw wastewater. The **Mechanical Bar** screens cycle periodically to rake debris from the bar rack and deposit the screenings on a belt conveyor. This conveyor runs during the screening cycle and moves the screenings to the Screenings Compactor which empties into the grit and screen hopper for subsequent disposal.

**HMI Description**

The operator controls and monitors these processes as follows:

1. Go to the **Overview** screen.
2. Click the **Headworks** button or the **Headworks** icon to display the **Headworks Application** screen.

*Selecting the Headworks Button*
The status information on the **Headworks/Primary Treatment Overview** screen includes:

- **Mechanical Bar** screen Numbers 1 and 2
- Grit Tank Drive No. 1
- Channel Numbers 1 and 2, Differential Level
- Channel Number 1 Flow
Control Description - Mechanical Bar Screen Numbers 1 and 2

This section describes the Mechanical Bar screen modes.

Hand Mode

The Mechanical Bar screens Number 1 and Number 2 are operated locally by selecting the Hand position on the Hand-Off-Auto selector switch, which is located at the MCC. The operator uses the BAR screen buttons located at the equipment. In this mode, the operator is responsible for operating the conveyor, compactor, and the Bar screen.

Mechanical Bar Screen

Remote Operator Mode

The operator must place the screening equipment in the this mode to use it from the HMI. The operator can place the Mechanical Bar screen in the Remote mode by selecting Auto on the Auto-Off-Hand selector switches located at the MCC for each equipment.

In Remote mode, the operator may select Auto or Manual mode to control the process from the HMI.
Operator Mode (Manual)

Click the screening equipment to display the Single Speed Motor Faceplate screen.

Single Speed Motor Faceplate Screen (HMI Template)

For Manual Operator Control, select the Operator mode from the HMI equipment Faceplate. The Faceplate shown is used to control the screening equipment. The screening equipment is started and stopped remotely from the HMI screen. The available Bar screen commands include:

- Press the Play button to start the Bar screen.
- Press the Stop button to stop the Bar screen.
- Click the Disable button to remove the Bar screen from service.
- Click the Enable button to place the unit back in service.

Program Mode (Auto)

To place the Bar screen in Program Mode (Auto) control, perform the following:

1. Select Auto on the Auto-Off-Hand selector switches located at the MCC for each equipment to place the Bar screen in the Remote mode.
2. Select Program mode from the HMI Faceplate template. When in Remote Program mode, the screening will be called to start when the accumulated time is equal to the Cycle Timer pre-set or the differential level across the screen reaches setpoint.
### Bar Screen Cycle Timer

![Bar Screen Cycle Timer Image]

The following sequence will occur when the screening system is run in Auto:

1. The system commands the **Mechanical Bar** screen to start.
2. The **Mechanical Bar** screen will run for 2 minutes before being called to stop.
3. The operator can access the Control Setpoints by selecting the **Setpoints** button on the **Headworks/Primary Treatment Overview** screen.

#### Setpoints Button Location

![Setpoints Button Location Image]

### Grit Removal

This section describes the **Grit Removal**, **Hand**, **Remote Operator**, and **Program** modes.

#### Hand Mode - Grit Tank Drive (GTD) No. 1

Operate the drive in the **Local** mode by selecting **Hand** on the **Hand-Off-Auto** selector switch located at the MCC. The operator uses the buttons located at the tank to start or stop each drive.
Chapter 3

Grit Tank Drive

Remote Operator Mode

The operator must place the Grit Tank Drive in the Remote Operator mode to use it from the HMI. The Grit Tank Drive is placed in the Remote mode by selecting Auto on the Auto-Off-Hand selector switches located at the MCC for each equipment. In the Remote mode, the operator may select Auto or Manual mode to control the process from the HMI.

Operator Mode (Manual)

Once the operator clicks on the GTD equipment, the system displays a Faceplate screen.

HMI Equipment Faceplate Screen

The operator uses this Faceplate screen to control the GTD equipment. For Manual Operator Control, select the Operator mode from the HMI equipment Faceplate.
The operator starts/stops the GTD equipment remotely from the HMI screen. The available GTD screen commands include:

- Press the **Play** button to start the GTD screen.
- Press the **Stop** button to stop the GTD screen.
- Click the **Disable** button to remove the GTD screen from service.
- Click the **Enable** button to place the unit back in service.

**Program Mode (Auto)**

To place the GTD equipment in **Remote Program Mode (Auto)** control, perform the following:

1. Select **Auto** on the Auto-Off-Hand selector switches located at the MCC for each equipment to place the GTD equipment in the **Remote** mode.
2. Select **Program** mode from the HMI Faceplate template. When in **Remote Program** mode, the system calls the GTD equipment to start when the accumulated time is equal to the Cycle Timer pre-set.

**Bar Screen Cycle Timer**

3. The operator can access the Control Setpoints by selecting the **Setpoints** button on the **Headworks/Primary Treatment Overview** screen.

**Setpoints Button Location**
Alarms

The Supervisory Control and Data Acquisition (SCADA) system generates these two types of alarms.

- Process
- Equipment

Process Alarms

There are the six types of Process Alarms.

- Channel No. 1 Differential Level High Alarm
- Channel No. 2 Differential Level High Alarm
- Wet well Level High Alarm
- Wet well Level Low Alarm
- Wet well Float High High Alarm
- Wet well Float High Alarm
- Wet well Float Low Alarm

![Diff Pressure](image)
Equipment Alarms

These are the two types of Equipment Alarms.

- **Start/Stop Faults** - If the system calls the Mechanical Bar screen and it is not running after 5 seconds, the system generates a **Start/Stop Fail Alarm** and displays it at the HMI.
- **Start/Stop Faults** - If the system calls the GTD to start and is not running after 5 seconds, the system generates a **Start/Stop Fail Alarm** and displays it at the HMI.

Reporting Equipment Run Times

Run times are recorded for the Mechanical Bar screen mechanism by the SCADA system. Depending on the user's security level, the total run time may be reset by clicking on the **Total Reset** button next to the appropriate pump.

- Mechanical Bar Screen Numbers 1 and 2
- Grit Tank Drive Number 1

Single Speed Motor Run Time

![Image of Single Speed Motor Run Time](image-url)
Customization of the Headworks Application

General customization notes are included in the Lift Station Application section (page 102) of this chapter. Refer to this section before customizing any application, including the Headworks. This section describes customization specific to the Headworks application.

I/O Assignment

As in the Lift Station, I/O is mapped into this application. This is done in the following project locations:

- MainProgram - A01_DiscreteInput - as needed - this routine is provided as a template.
- MainProgram - A02_AnalogInput - as needed - this routine is provided as a template.
- MainProgram - A03_Outputs - as needed - this routine is provided as a template.

Additional Pumps/Motors (Single Speed Motor AOIs in a FBD Routine)

See the Customization of the Solids Application section for an example of how to add Single Speed Motor AOIs in a FBD routine.
Secondary Application

The WWAT CD contains the Secondary application. Refer to the Secondary System Application Controller Organization illustration to view the application's organization within the Controller.

Secondary System Application Controller Organization

This task resides in a Controller in the main facility of the plant where the Secondary application is present and it is not intended to be the only application in the Controller. A ControlLogix processor is specified for this application for that specific reason. It is assumed the processor will be running other systems of the plant.
Chapter 3

The organization of this application is similar to that of the Lift Station. Specifically, the functionality for each program and routine is:

- **Main Program** handles general Secondary application and functionality, including:
  - Main routine calls the other routines in this program and includes a Wall Clock AOI that calculates the day of the week. It also includes a Pump Inputs simulation bit that you can use when testing the application.
  - A01_MiscDiscreteInput includes a template to map inputs that are relevant throughout the Secondary system. This routine is provided as a Function Block Diagram.
  - A02_MiscAnalogInput includes a template to map analog inputs that are relevant throughout the Secondary system. This routine is provided as a Function Block Diagram.
  - A03_MiscOutputs includes a template to map outputs that are relevant throughout the Secondary system. This routine is provided as a Function Block Diagram.

- **SecTank01_Drive** Controls the motor for the Secondary Clarifier Tank 1 system, including:
  - Main routine calls the other routines in this program.
  - A01_Drive_LDR contains the code to monitor and control the Secondary Tank 01 motor and Reset Alarms, Interlocks, and Faults associated with the motor. This routine is provided as a Ladder Diagram.
  - A02_Drive_FBD contains the Single Speed Motor, Permissives, and Interlock AOIs that monitor and control the Secondary Tank 01 motor. (See the Using Add-On Instructions section above for more information.) This routine is provided as a Function Block Diagram.

- **SecTank 02_Drive** Controls the motor for the Secondary Clarifier Tank 2 system as described for the Secondary Clarifier Tank 1.

- **Aeration Blower** Controls the motor for the Blower system, including:
  - Main routine calls the other routines in this program.
  - A01_Blower_LDR contains the code to monitor and control the Blower motor and Reset Alarms, Interlocks, and Faults associated with the motor. This routine is provided as a Ladder Diagram.
  - A02_Blower_FBD contains the Single Speed Motor, Permissives and Interlock AOIs that monitor and control the Blower motor (See the Using Add-On Instructions section above for more information). This routine is provided as a Function Block Diagram.

- **SecTank01_RAS Pump** Controls the Variable Speed Drive for the RAS Pump, including:
  - Main routine calls the other routines in this program.
  - A01_Pump_LDR contains the code to monitor and control the VFD for the RAS Pump, Reset Alarms, Interlocks, and Faults associated with the pump. This routine is provided as a Ladder Diagram.
– A02_Pump_FBD contains the Variable Speed Drive, Permissives, and Interlock AOIs that monitor and control the RAS Pump. (See the Using Add-On Instructions section above for more information). This routine is provided as a Function Block Diagram.

– A04_PumpDischargeFlow contains the Analog Input AOI and U_FlowTot AOI that totalizes the RAS pump discharge flow. This routine is provided as a Function Block Diagram.

- AerationTk01_Mixer01 Controls the motor and manages cycle times and flow channel differential levels for the Aeration Tank 1 Mixer 1 system, including:
  - Main routine calls the other routines in this program.
  - A01_Mixer_LDR contains the code to monitor and control the Aeration Tank 1 Mixer 1 Reset Alarms, Interlocks, and Faults associated with the motor. This routine is provided as a Ladder Diagram.
  - A02_Mixer_FBD contains the Single Speed Motor, Permissives, and Interlock AOIs that monitor and control the Aeration Tank 1 Mixer 1 motor. (See the Using Add-On Instructions section above for more information). This routine is provided as a Function Block Diagram.

- AerationTk01_Mixer02 Controls the motor for the Aeration Tank 1 Mixer 2 system as described for the Aeration Tank 1 Mixer 1 system.

- AerationTk02_Mixer01 Controls the motor for the Aeration Tank 2 Mixer 1 system as described for the Aeration Tank 1 Mixer 1 system.

- AerationTk02_Mixer02 Controls the motor for the Aeration Tank 2 Mixer 2 system as described for the Aeration Tank 1 Mixer 1 system.

Add-On Instructions are used extensively in this application. There is a collection of Process Library AOIs and a collection of other AOIs developed specifically for this application. Process Library AOIs can be identified by a prefix "P_" in their name. The other AOIs have a prefix of "U_" as shown in the AOI illustration.
Process Description

The Secondary application consists of an aeration tank, blower, RAS pump, and a Secondary Clarifier tank.

Aeration Tank

Effluent from the Primary Settling Tanks (primary effluent) contains soluble and colloidal impurities which were not removed in the preliminary and primary treatment processes. Secondary treatment, employing the activated sludge process with biological phosphorus removal, removes most of these impurities before the wastewater is filtered, disinfected, and discharged.

Blower

In the activated sludge treatment process, oxygen is required to maintain aerobic conditions for the treatment process. If an adequate air supply is not maintained, such that the available dissolved oxygen (DO) satisfies the biochemical oxygen demand (BOD), the organisms will fail to reproduce effectively, and may perish due to lack of oxygen, in which case adequate treatment will not be provided.

Return Activated Sludge (RAS) Pump

A RAS pump is located near the Secondary Clarifier Settling Tank (SCST). The RAS pumps remove the aerated sludge that accumulates on the bottom of the SCST. The pumps discharge into the Aeration Tank’s Anoxic Zone where RAS is mixed with primary effluent.
Secondary Clarifier Settling Tank

The mixed liquor flows from the Aeration Tanks effluent channel to the SCST. In the SCST, many of the solids are settled out while the effluent exits over weirs and flows to the Secondary Effluent Pumping Station in the Tertiary Filter Building. The purpose of the SCST is primarily to produce a clarified effluent with a secondary objective of removing and returning sludge to the system.

The SCST is part of a discrete process train, including a Primary Clarifier, Aeration Tank, and a SCST. Flow from a Primary Clarifier flows into a corresponding Aeration Tank and then into the corresponding SCST.
HMI Description

The operator controls and monitors these processes as follows:

1. Go to the Wastewater Treatment Plant (WWTP) Overview screen.
2. Click the **Secondary** button or the **Secondary** icon to display the Secondary Overview screen.

Selecting the Secondary Overview Screen
Secondary Overview Screen

The status information on the Secondary Overview screen includes:

- Blower BLR-400
- Secondary Clarifier Setting Tank 1
- RAS Pump P-401
- Return Flow Rate FIT-401
Control Description - Blower BLR-400

This section describes the BLR-400 Blower modes.

Hand Mode

Select Hand on the Hand-Off-Auto selector switch (located at the MCC) to operate the blower locally. The operator uses the buttons located at the equipment to operate the blower.

Remote Operator Mode

Select the Auto position on the Auto-Off-Hand selector switches located at the MCC to put the BLR-400 Blower in the Remote mode.

Operator Mode (Manual)

Click on the BLR-400 Blower section of the Secondary Overview screen.

Selecting Blower BLR-400 on the Secondary Overview Screen

The system displays the Blower BLR-400 Faceplate.
**Blower BLR-400 Faceplate**

For manual Operator Control, select the **Operator** mode on the **BLR-400 Blower Faceplate**. The Faceplate shown is used to control the blower. The operator starts and stops the blower remotely from the **BLR-400 Blower Faceplate**, selecting the BLR-400 icon on the **Secondary Overview Screen**. The available Faceplate commands include:

- Press the **Play** button to start the blower.
- Press the **Stop** button to stop the blower.
- Click the **Disable** button to remove the blower from service.
- Click the **Enable** button to place the unit back in service.

**RAS Pump**

The RAS pumps are Variable Frequency Drive-controlled (VFD), which allows their speed to be throttled. The flow of the RAS is controlled by varying the speed of these pumps. There will be one pump for each secondary Clarifier Tank.

**Hand Mode**

Select Hand on the Hand-Off-Auto selector switch (located at the VFD) to operate the pump locally. The operator uses the buttons located at the VFD to operate the pump.

**Remote Operator Mode**

Select the Auto position on the Auto-Off-Hand selector switches located at the VFD to put the RAS Pump in the Remote mode.
Operator Mode (Manual)

Click on the RAS Pump section of the Secondary Overview screen.

Selecting the RAS Pump on the Secondary Overview Screen

The system displays the Blower RAS P-401 Faceplate.

RAS Pump P-401 Faceplate

For manual Operator Control, select the Operator mode on the RAS P-401 Pump Faceplate. The Faceplate shown is used to control the RAS pump. The operator starts and stops the pump remotely from the RAS P-401 Pump Faceplate, selecting RAS P-401 on the Secondary Overview screen. The available Faceplate commands include:

- Press the Play button to start the pump.
- Press the Stop button to stop the pump.
- Click the Disable button to remove the pump from service.
- Click the Enable button to place the unit back in service.
Secondary Clarifier Tank

Plant operators manually control the Secondary Clarifier Tank (SCT). The SCT center drive runs continuously and is protected from over-torque by overload switches set at the factory. The overload switches sense a build up of torque as the mechanism rotates. A factory pre-set overload switch will trip the Final Tank Mechanism Overload (common alarm), as the torque builds up. Further increasing torque will cause a second factory pre-set switch to trip and stop the mechanism from running. When the mechanism stops due to an overload or a power outage, the operator must restart the unit manually.

Hand Mode

Select Hand on the Hand-Off-Auto selector switch (located at the MCC) to operate the SCT locally. The operator uses the buttons located at the MCC to operate the SCT.

Remote Operator Mode

Select the Auto position on the Auto-Off-Hand selector switches located at the MCC to put the SCT in the Remote mode.

Operator Mode (Manual)

Click the SCT section of the Secondary Overview screen.

Selecting the SCT on the Secondary Overview Screen

The system displays the Tank Drive Faceplate.
For manual Operator Control, select the **Operator** mode on the **Tank Drive Faceplate**. The Faceplate shown is used to control the Tank Drive. The operator starts and stops the drive remotely from the **Tank Drive Faceplate**, selecting **Tank Drive** on the **Secondary Overview** screen. The available Faceplate commands include:

- Press the **Play** button to start the drive.
- Press the **Stop** button to stop the drive.
- Click the **Disable** button to remove the drive from service.
- Click the **Enable** button to place the unit back into service.

**Alarms**

The Supervisory Control and Data Acquisition (SCADA) system generates the following equipment alarms:

- **Start/Stop Faults**
  - If the blower is called to start and is not running after 5 seconds, the HMI generates a Start/Stop Fail alarm.
  - If the RAS pump is called to start and is not running after 5 seconds, the HMI generates a Start/Stop Fail alarm.
  - If the SCT center drive is called to start and is not running after 5 seconds, the HMI generates a Start/Stop Fail alarm.

- **Blower Fault** - This is a contact from the blower starter control panel, and once opened, the HMI generates a Blower Fault alarm.
• **SCT Center Drive Fault** - This is a contact from the center drive mechanism, and once opened, the HMI generates a SCT 1 Center Drive Mechanism Fault Alarm.

• **RAS Pump VFD Fault** - This is a messaged fault from the VFD drive unit. Once the PLC receives the fault message, the HMI generates a VFD alarm.

**RAS P-401 Alarms**

![RAS P-401 Alarms](image1)

**Single Speed Motor Run Time**

![Single Speed Motor Run Time](image2)
Reporting

The SCADA system records:

- **Process** - The system will trend common signals and record them for future viewing, including:
  - RAS Pump P-401
  - Output Frequency
  - Command Frequency

- **Equipment Run Times** - Runtimes are recorded for the blower, SCT center drive mechanism, and RAS Pump P-401. Depending on the user’s security level, the total run time may be reset by clicking on the **Total Reset** button next to the appropriate pump.

**Single Speed Motor Run Time**
**Customization of the Secondary Application**

General customization notes are included in the Lift Station Application section (page 102) of this chapter. Refer to this section before customizing any application, including the Secondary. This section describes customization specific to the Secondary application.

**I/O Assignment**

As in the Lift Station, I/O is mapped into this application. This is done in the following project locations.

- MainProgram - A01_DiscreteInput - as needed - this routine is provided as a template.
- MainProgram - A02_AnalogInput - as needed - this routine is provided as a template.
- MainProgram - A03_Outputs - as needed - this routine is provided as a template.

**Additional Pumps/Motors (Single Speed Motor AOIs in a FBD Routine)**

See the [Customization of the Solids Application](#) section for an example of how to add Single Speed Motor AOIs in a FBD routine.
Solids Application

The WWWAT CD contains the Solids application. Refer to the Solids System Application Controller Organization illustration to view the application’s organization within the Controller.

Solids System Application Controller Organization

This task resides in a Controller in the main facility of the plant where the Solids application is present and it is not intended to be the only application in the Controller. A ControlLogix processor is specified for this application for that specific reason. It is assumed the processor will be running other systems of the plant.
The organization of this application is similar to that of the Lift Station. Specifically, the functionality for each program and routine is:

- **Main Program** handles general Solids application and functionality:
  - Main routine calls the other routines in this program and includes a Wall Clock AOI that calculates the day of the week. It also includes a Pump Inputs simulation bit that you can use when testing the application.
  - A01_MiscDiscreteInput provides a template to map inputs that are relevant throughout the secondary. This routine is provided as a Function Block Diagram.
  - A02_MiscAnalogInput provides a template to map analog inputs that are relevant throughout the secondary. This routine is provided as a Function Block Diagram.
  - A03_MiscDiscreteOutputs provides a template to map outputs that are relevant throughout the secondary. This routine is provided as a Function Block Diagram.
  - A04_MiscAnalogOutput provides a template to map analog inputs that are relevant throughout the secondary. This routine is provided as a Function Block Diagram.

- **SolidsTk01_Drive** controls the motor for the Solids Storage Tank Agitator.
  - Main routine calls the other routines in this program.
  - A01_Drive_LDR contains the code to map fault inputs, hand mode, and resets for the Solids Storage Tank Agitator motor. This routine is provided as a Ladder Diagram.
  - A02_Drive_FBD contains the Single Speed Motor, Permissives, and Interlock AOIs that monitor and control the Solids Storage Tank Agitator motor. (See the Using Add-On Instructions section for more information.) This routine is provided as a Function Block Diagram.

- **WAS_HoldTkValve600** controls the Waste Activated Sludge (WAS) Valve.
  - Main routine calls the other routines in this program.
  - A01_Valve_LDR contains the code to map fault inputs, hand mode, and resets for the Waste Activated Sludge (WAS) valve. This routine is provided as a Ladder Diagram.
  - A02_Valve_FBD contains the Motor Operated Valve and Permissives (AOIs that monitor and control the Waste Activated Sludge (WAS) valve. (See the Using Add-On Instructions section for more information). This routine is provided as a Function Block Diagram.

- **WAS_StorageTk_ToSolidsTk01_Pump600** controls the motor for the WAS Storage Tank to Solids Storage Tank pump.
  - Main routine calls the other routines in this program.
Chapter 3

- A01_Pump_LDR contains the code to map fault inputs, hand mode, and resets for the WAS Storage Tank to Solids Storage Tank pump. This routine is provided as a Ladder Diagram.
- A02_Pump_FBD contains the Single Speed Motor, Permissives, and Interlock AOIs that monitor and control the WAS Storage Tank to Solids Storage Tank pump. (See the Using Add-On Instructions section for more information.) This routine is provided as a Function Block Diagram.

- PrimTkToSolidsTk01_Pump601 Controls the motor for the Primary Tank to Solids Tank pump.
  - Main routine calls the other routines in this program.
  - A01_Pump_LDR contains the code to map fault inputs, hand mode, and resets for the Primary Tank to Solids Tank pump. This routine is provided as a Ladder Diagram.
  - A02_Pump_FBD contains the Single Speed Motor, Permissives, and Interlock AOIs that monitor and control the Primary Tank to Solids Tank pump. (See the Using Add-On Instructions section for more information.) This routine is provided as a Function Block Diagram.

- SolidsTk01ToFilterPress_Pump602 controls the motor for the Solids Tank to Belt Filter Press pump Screen 1 system.
  - Main routine calls the other routines in this program.
  - A01_Pump_LDR contains the code to monitor and control the Bar Screen 01 motor and Reset Alarms, Interlocks and Faults associated with the motor. This routine is provided as a Ladder Diagram.
  - A02_Pump_FBD contains the Single Speed Motor, Permissives, and Interlock AOIs that monitor and control the Bar Screen 01 motor. (See the Using Add-On Instructions section for more information.) This routine is provided as a Function Block Diagram.

Add-On Instructions are used extensively in this application. There is a collection of Process Library AOIs and a collection of other AOIs developed specifically for this application. Process Library AOIs can be identified by a prefix "P_" in their name. The other AOIs have a prefix of "U_" as shown in the AOI illustration.
### Process Description

The Solids Treatment application includes:

- Waste Activated Sludge (WAS) Valve
- Solids Storage Tank (SST)
- Solids Storage Tank Agitator (SSTA)
- Solids Transfer Pump (STP)

#### Waste Activated Sludge Valve

WAS is removed from the RAS discharge piping using a throttling valve. The throttling valve is controlled to provide the operated selected flow rate to the WAS holding tank.

#### Solids Storage Tank

The influent to the storage tank is comprised of primary solids (PS) and WAS. The contents are mixed by mechanical agitators. The Blending Tanks feed the dewatering system. A transfer pump, located in the basement of the Solids Building, is used to transfer the contents of the tank to the Belt Filter Press (BFP).

#### Solids Storage Tank Agitator

A Paddle Agitator mixing mechanism is provided in the tank to continually mix the tank contents prior to pumping. The mixing mechanism is used to minimize solids settling and to ensure that consistent feed solids characteristics are applied to the dewatering system.
Solids Transfer Pump

A transfer pump transfers blended solids from the storage tank to the BFP. Blended solids consist of PS and WAS. A grinder is located upstream of the BFP feed pump, and Pulsation Dampeners are located on the suction and discharge side of the pump. A flow meter is located on the discharge of the pump to the BFPs.

HMI Description

The operator controls and monitor these processes as follows:

1. Go to the Wastewater Treatment Plant (WWTP) Overview screen.
2. Click the Solids button or one of the Solids icons to display the Solids Overview screen.

Selecting the Solids Overview Screen
Solids Overview Screen

The status information on the Solids Overview screen includes:

- WAS Valve PV-600
- WAS Flow Rate FIT-600
- WAS Tank Level
- Solids Storage Tanks Mixing Drive
- Solids Transfer Pump
- Solids Storage Tank Level LIT-603
Control Description

Was Valve

Once the RAS process has been started, the operator starts the WAS wasting process.

Hand Mode

Select Hand on the Hand-Off-Auto selector switch (located on the WAS valve) to operate the WAS valve locally. The operator uses the buttons located on the valve to open/close it.

Selecting the WAS Valve (PV-600) on the Solids Overview Screen

Remote Operator Mode

Select the Auto position on the Auto-Off-Hand selector switches located on the WAS valve to put the valve in the Remote mode. Select Program mode from the WAS Valve_PV-600 Faceplate.

Operator Mode (Manual)

Click on the WAS Valve_PV-600 section of the Solids Overview screen. The system displays the WAS Valve_PV-600 Faceplate.
For manual Operator Control, select the Operator mode on the WAS Valve PV-600 Faceplate. The Faceplate shown is used to control the valve’s state. The operator open/closes the valve remotely from the WAS Valve PV-600 Faceplate. The available Faceplate commands include:

- Press the Open button to open the valve.
- Press the Close button to close the valve.
- Click the Disable button to remove the valve from service.
- Click the Enable button to place the unit back in service.

Solid Storage

The mechanism is protected from over-torque by overload switches set at the factory. The overload switches sense a buildup of torque as the mechanism revolves. A pre-set factory overload switch will trip to alarm the SCADA system as torque builds up. Further increasing torque will cause a second pre-set factory trip switch to trip and stop the mechanism from running. When the mechanism stops due to an overload or a power outage, the unit must be started manually.

The storage tank is equipped with a pressure-to-current (P/I) transmitter located near the bottom of the tank. The transmitter transmits a 420 mA signal to the Programmable Logic Controller (PLC). The signal is converted to indicate the tank levels on local indicators.
**Hand Mode**

Select Hand on the Hand-Off-Auto selector switch (located at the MCC) to operate the SST locally. The operator uses the buttons located at the MCC to operate the tank.

**Remote Operator Mode**

Select the Auto position on the Auto-Off-Hand selector switches located at the MCC to put the SST drive in the Remote mode.

**Operator Mode (Manual)**

Click the SST Drive section of the **Solids Overview** screen. The system displays the Solids Tank 1 Drive Faceplate.

**Solids Tank 1 Drive Faceplate**
For manual Operator Control, select the **Operator** mode on the Solids Tank 1 Drive Faceplate. The Faceplate shown is used to control the Storage Tank Drive (STD). The operator starts and stops the STD remotely from the Solids Tank 1 Drive Faceplate. The available Faceplate commands include:

- Press the **Play** button to start the STD.
- Press the **Stop** button to stop the STD.
- Click the **Disable** button to remove the STD from service.
- Click the **Enable** button to place the unit back in service.

**Solids Transfer Pump (STP)**

The STP is controlled manually by plant operators. The pump discharges to a Belt Filter press, which removes water from the sludge.

**Hand Mode**

Select Hand on the Hand-Off-Auto selector switch (located at the MCC) to operate the pump locally. The operator uses the buttons located at the MCC to operate the pump.

**Remote Operator Mode**

Select the Auto position on the Auto-Off-Hand selector switches located at the MCC to put the pump in the Remote mode.

**Operator Mode (Manual)**

Click the STP section of the **Solids Overview** screen.

**Selecting the STP on the Solids Overview Screen**

The system displays the **Tank Drive** Faceplate.
Solids Tank to Filter Press P-602 Faceplate

For manual Operator Control, select the Operator mode on the Solids Tank 1 to Filter Press P-602 Faceplate. The Faceplate shown is used to control the pump. The operator starts and stops the STD remotely from the Solids Tank 1 to Filter Press P-602 Faceplate. The available Faceplate commands include:

- Press the **Play** button to start the pump.
- Press the **Stop** button to stop the pump.
- Click the **Disable** button to remove the pump from service.
- Click the **Enable** button to place the unit back in service.

Alarms

The Supervisory Control and Data Acquisition (SCADA) system generates these two types of alarms.

- Process
- Equipment

*Process Alarms*

There are the eight types of Process Alarms.

- Solids Storage Tank High LIT-603
- Solids Storage Tank Low LIT-603
- Solids Storage Tank High-High LIT-603
- Solids Storage Tank Low-Low LIT-603
- WAS Tank High
- WAS Tank Low
- WAS Tank High-High
- WAS Tank Low-Low

**Process Alarms**

**Equipment Alarms**

These are the two types of Equipment Alarms.

- **Start/Stop Faults** - If the Solids Storage Tank Mechanism or Sludge Transfer Pump is called to start and is not running after 5 seconds, the system generates a Start/Stop Fail alarm at the HMI.
Reporting

The SCADA system records:

- **Process** - The system will trend common signals and record them for future viewing, including:
  - WAS Flow Rate
  - WAS Holding Tank Level
  - SST Level
- **Equipment Runtimes**
  - Runtimes are recorded for the STP and STD mechanism by the SCADA system. Depending on the user’s security level, the total runtime may be reset by clicking on the **Total Reset** button next to the appropriate pump.
  - SST Mechanism
  - STP

**Single Speed Motor Run Time**

![Run Time for Single Speed Motor](image)
Customization of the Solids Application

General customization notes are included in the Lift Station Application section (page 102) of this chapter. Refer to this section before customizing any application, including the Solids application. This section describes customization specific to the Solids application.

I/O Assignment

As in the Lift Station, I/O is mapped into this application. This is done in the following project locations:

- MainProgram - A01_DiscreteInput - as needed - this routine is provided as a template.
- MainProgram - A02_AnalogInput - as needed - this routine is provided as a template.
- MainProgram - A03_Outputs - as needed - this routine is provided as a template.
- MainProgram - A04_AnalogOuput - as needed - this routine is provided as a template.

Additional Pumps/Motors (Single Speed Motor AOIs in a FBD Routine)

Although the following specific example illustrates how to add a Solids Transfer Pump, the procedure can be followed for many of the pumps/motors in the toolkit using the Single Speed Motor AOIs in a FBD routine. To add additional Solid Transfer pumps to the Solids application, add additional pump programs as required - these will be duplicates of SolidsTk01ToFilterPress_Pump602.

To add additional Solid Transfer pumps:

1. Copy and paste the existing SolidsTk01ToFilterPress_Pump602 and rename it (the name SolidsTk01ToFilterPress_Pump603 is used here).

Selecting Additional Pumps

2. Create new controller-scoped tags for the new pump.
Creating New Controller-Scoped Tags

3. In the program scoped tags for the new pump program, define the Alias for Device (and the other associated tags) as this new controller-scoped tag.

Defining Device Aliases

<table>
<thead>
<tr>
<th>Device</th>
<th>Alias</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equip_Fault</td>
<td>L_P603_Fault(C)</td>
<td>Local:31.Data10(C)</td>
</tr>
<tr>
<td>Equip_FAULT</td>
<td>L_P603_FAULTIOFault(C)</td>
<td>Local:31.Fault10(C)</td>
</tr>
<tr>
<td>Equip_GroupReset</td>
<td>PLC_Device_ResetFB(C)</td>
<td>Local:31.Data11(C)</td>
</tr>
<tr>
<td>Equip_InAuto</td>
<td>L_P603_InAuto(C)</td>
<td>Local:31.Data11(C)</td>
</tr>
<tr>
<td>Equip_INAuto_OVFault</td>
<td>L_P603_INAuto_OVFault(C)</td>
<td>Local:31.Fault11(C)</td>
</tr>
<tr>
<td>Equip_INilk</td>
<td>P603_InIlk(C)</td>
<td>P603_InIlk(C)</td>
</tr>
<tr>
<td>Equip_IOFault</td>
<td>P603_IOFault</td>
<td>P603_IOFault</td>
</tr>
<tr>
<td>Equip_Motor</td>
<td>P603_Motor(C)</td>
<td>P603_Motor(C)</td>
</tr>
<tr>
<td>Equip_Out_Run</td>
<td>Q_P603_Out_Run(C)</td>
<td>Local:4.O.Data4(C)</td>
</tr>
<tr>
<td>Equip_RunFdbk</td>
<td>L_P603_RunFdbk(C)</td>
<td>Local:31.Data12(C)</td>
</tr>
<tr>
<td>Equip_RunFdbk_OVFault</td>
<td>L_P603_RunFdbk_OVFault(C)</td>
<td>Local:31.Fault12(C)</td>
</tr>
</tbody>
</table>

4. Configure and alias all I/O for the new pump. The Configuring and Aliasing New Pump I/O table depicts the subset of the I/O required.

Be sure to alias all the I/O to the new points for the additional pump. Be certain that all inputs and outputs are aliased to the correct location.

Configuring and Aliasing New Pump I/O

<table>
<thead>
<tr>
<th>I/O</th>
<th>Alias</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>L_P603_RunFdbk_OVFault</td>
<td>Local:31.Fault12</td>
<td>Local:4.O.Data4</td>
</tr>
</tbody>
</table>
5. Confirm that the new routines verify and contain no errors. The most commonly overlooked issues are reconciling all the tags used in the routine. The ladder and Function Block Diagrams themselves typically verify since they are duplicates of the original routines.

**Routine Verification**

```
Verifying program: SolidsTk01ToFiltFilterPress_Pump603...
Verifying routine A01_Pump_LDR of Program SolidsTk01ToFiltFilterPress_Pump603
Verifying routine A02_Pump_FED of Program SolidsTk01ToFiltFilterPress_Pump603
Verifying routine Main of Program SolidsTk01ToFiltFilterPress_Pump603
Complete - 0 error(s), 0 warning(s)
```
Flushing System Application

Process Description

The Flushing System application contained on the WWWAT CD is a typical example of a flushing system of up to seven valves (solenoid or motor type valves) used to flush out a basin.

In the below example, seven solenoid valves are used. These valves operate in sequence based on an operator-selectable "Flushing Time" input from a pop-up window located on the HMI flushing system overview screen. The flush system can be started, paused, or reset from this HMI pop-up.

When the flushing sequence begins, the system opens flushing valve #1 (FV1) and keeps it open for the duration of the operator-selectable flush time. Should a flushing valve be out of service for any reason (in manual mode or shut down for service, for example) the program will skip that valve and go to the next available valve in the sequence.
Control Description

The controller organization for the Flushing System application is as follows:

Main Program

There is no logic in the routine for this example.

BASIN1_FLUSHING_CONTROL_SYSTEM_PROGRAM

Main - This program contains the JSRs to all the routines in this program.

A001_FWV1_LDR - This routine contains all the logic that controls Flushing Water Valve1, called FV1. This routine is typical for all the flushing valves that can be in a program, for example, FV2, FV3...FV7. Here, FVx represents any program valve.
Chapter 3

Rung 0

This rung contains all conditions that would make the valve "unavailable" for use.

Rung 1

This rung opens FVx when the "start basin flush" HMI PB is pressed. This rung is typical for all valves.

Rung 2 and 3

These rungs take the flush time entered from the HMI and place it in a timer specific to the applicable valve. If a basin flush is active, the flush sequence is not complete, and the valve is opened, the timer is started for FVx. These rungs are typical for all valves.
Chapter 3

Rung 4

This rung indicates that the valve flush time has expired. Once expired, the next available valve is activated.

![Diagram of Rung 4]

Rung 5

This rung causes the valve to close when the next valve in the sequence is open and available. To customize this rung for an additional valve, the valve’s ladder and FBD routines are inserted and the next valve’s tags are inserted in sequence in this rung. For a valve following FV7, for example, valve FV8 tags would be added to the last 2 rungs.

![Diagram of Rung 5]

Rung 6

This rung indicates remote or local mode to the valve faceplate.

![Diagram of Rung 6]
A001_FWV1_FBD - These two sheets contain the P_perm (permissives) and the P_valveSO add-on instructions for FV1. This routine is typical for all valves.

Sheet #1

All valve permissions are added here.
This sheet contains the P_ValveSO add-on instruction for the valve. The real opened/closed limit switches are attached to the FV_Opened and FV_Closed tags, respectively. The real-world output attaches to the FV1_OUT tag.

**IMPORTANT** The routines for valves 2 through 7 are identical to the above routine for FV1. The only rung in each routine which has to be modified for an additional or a subtracted valve is Rung 5.

**A017_AUTO_LDR** - This routine contains the information which ties all the valves in your application together.

**Rung 0**

This rung examines the HMI start PB. When the button is pressed, the "StartBasin1Flush" bit is turned on. This bit is used throughout the application to indicate that a flush sequence has been started.
**Rungs 1 and 2**

These rungs ensure that a new sequence will not begin unless all valves are either closed or otherwise unavailable prior to the sequence start.

**Rungs 3 and 4**

These rungs ensure that all valves in the sequence have either completed their flushing or were unavailable at the time the sequence began. These lines of logic may also be modified to add or remove a valve from the sequence.
**Rung 6**

This rung tells the system that the entire flush sequence is complete. Additional flush sequences may also be added here.

**Rungs 7 and 8**

These rungs verify that all valves are either closed or unavailable, then all valves are activated. This bit must be "on" for a sequence to be complete. These lines of logic may also be modified to add or remove a valve from the sequence.
HMI Description

The following is a brief description of the HMI portion of this project.
Select Flush Mode

To operate the system:

1. Enter a time in the "Flushing Valve On Timer" field.

2. Click the "Start Basin 1 Flush" button (see figure below). The button will turn yellow, indicating that "Basin1 Flush" is active.
3. To pause the sequence, click the "Pause Basin1 Flush PB" button. Click the button again to resume the sequence.

4. To start cycle over from the beginning, click "Reset Basin1 Flush PB."

"Return all to Auto" Button

When pressed this will automatically put all the devices not in auto already - in auto for you.

Simulation Mode

To operate system in simulation mode:

1. Open RSLogix Emulate Version 19.11.

2. Insert PLC in slot 3.

3. Open copy of Flushing System PLC Version 19.1, go to WHO Active, find emulator in slot 3 and download to it.

4. When finished downloading, put PLC in run mode.

5. Open Factory Talk View SE client and start the HMI application.

Chemical Feed System Application

Process Description

The chemical feed pump application is a typical example of a chemical feed system that assumes up to five variable frequency drives (VFDs) and transfers chemicals from up to two storage tanks into an influent tank that mixes the chemicals with the incoming influent liquid. Three chemical feed mixer units located in the influent tank ensure the chemical is mixed with the influent liquid. In this application a PIDE block is used to control the chemical feed flow rate into the influent tank and has manual and calculated set points.

The five VFD pumps are controlled from the CV% (Control Variable). This application will demonstrate how to use the one CV% to control up to five VFDs (a very common real world situation). This is based on dividing the max CV (0-100%) by the number of VFD pumps. For this example 0-20% CV will
equal 0-100% speed for Pump 1. Pump 2 will use a CV of 21-40% to control 0-100% of its speed and so on. This is explained in more detail in the Chemical Feed System Program section.

**Control Description**

Refer to the Chemical Feed Application Controller Organization illustration to view the application's organization within the Controller.

**Chemical Feed Application Controller Organization**
The functionality for each program and routine is as follows:

**Main Program**

This program is used to display operator-assist messages and pop-ups on the HMI screen. It can also be used for all user routines that do not specifically affect direct operation of the system. Interlocks, heartbeats to other PLCs are examples of this.

**Chemical Tank Levels Program**

Main – This program contains the JSRs to all the routines in this program.

The B00_Chemical_Tank_1_Level_FBD and C00_Chemical_Tank_2_Level_FBD routines contain the P_AIn AOI.
function block that calculates the levels for chemical tanks 1 and 2 on sheet #1.

**Typical P_AIn instruction used for chemical tank level**

Sheet #2 contains the ALMD function blocks for the high and low level faults of the P_AIn block. Using the ALMD blocks automatically inserts the fault message into the alarm banner if you choose to have an alarm banner in your HMI application and it contains a P_AIn block that converts the actual level of the tank to a percentage (0-100%) that is used to animate the chemical tank level on the HMI application. For a detailed explanation of how to set up your alarms please refer to the *FactoryTalk Alarms and Events System Configuration Guide*. 
Typical P_AIn instruction used for the HMI tank level animation and the ALMD blocks used to display alarm messages on the alarm summary page (if used)

**Chapter 3**

This is used to animate the chemical tank level. It converts level to a value between 0-100% if it is used in the fill animation in FTVSE.

**Chemical_Tank_1_Level_Fill**

B00_Chemical_Tank_1_Level_LDR and C00_Chemical_Tank_2_Level_LDR – In this example program these routines are left blank.

X00_Auto_Control_LDR – This routine examines the LoLo alarm bit of the P_AIn instruction for chemical tanks 1 and 2. If the tanks are not at a Low-Low condition the “Chemical_Tank_Levels_OK” bit is set high and used as an interlock for the chemical feed pumps.
**P_AIn alarm bits analyzed for the chemical tank level ok interlock**

IS THE LEVEL IN CHEMICAL TANK 1 OR 2 HIGH ENOUGH TO ENABLE THE CHEMICAL PUMPS

Insert all Conditions that will allow PD to control chem feed units - when the “OK” bit is off
- it essentially disables PD control of the Chem Feed Units

---

**Influent Tank Level Program**

Main – This program contains the JSRs to all the routines in this program.

**B00_Influent_Level_FBD** – This routine contains the P_AIn AOI function block that calculates the influent tank level on sheet #1. Sheet #2 contains the ALMD function blocks for the high and low level faults of the P_AIn block and it contains a P_AIn block that converts the actual level of the tank to a percentage (0-100%) that is used to animate the influent tank level on the HMI application. For an example of how the function block diagram (FBD) is programmed see figures 3 and 4. For a detailed explanation of how to set up your alarms please refer to the *FactoryTalk Alarms and Events System Configuration Guide*.

**B00_Influent_Level_LDR** – In this example program this routine is left blank.

**X00_Auto_Control_LDR** – This routine examines the “LoLo” alarm bit of the P_AIn instruction and if the alarm bit is off the “Influent_Tank_Level_OK” and “Mixer_Lvl_Interlock” bits are set high and used as interlocks for the chemical feed pumps and chemical feed mixer interlocks.
**P_AIn alarm bit analyzed and used by the chemical feed pumps and mixers as interlocks**

LEVEL INTERLOCKS THAT TELLS THE CHEMICAL FEED PUMPS AND MIXERS THAT THE TANK LEVEL IS OK TO RUN

---

INTERLOCK THAT TELLS THE CHEMICAL FEED PUMPS THAT THE INFLUENT TANK LEVEL IS OK TO RUN

---

INTERLOCK THAT TELLS THE CHEMICAL FEED MIXERS THAT THE LEVEL IS OK TO RUN

---

**Influent Flow Program**

Main – This program contains the JSRs to all the routines in this program.

B00_Influent_Flow_FBD – This routine contains the P_AIn AOI function block that calculates the influent flow on sheet #1. Sheet #2 contains the ALMD function blocks for the high and low flow faults of the P_AIn block. Again, the ALMD blocks are used if the user wants to populate the alarm summary page with alarm messages. For a detailed explanation of how to set up your alarms please refer to the FactoryTalk Alarms and Events System Configuration Guide.
Typical P_AIn instruction used for Influent Flow

Sheet #2 contains the ALMD function blocks for the high and low flow faults of the P_AIn block. Again, the ALMD blocks are used if the user wants to populate the alarm summary page with alarm messages. For a detailed explanation of how to set up your alarms please refer to the FactoryTalk Alarms and Events System Configuration Guide.
ALMD blocks used to display alarm messages on the alarm summary page (if used)

**B00_Influent_Flow_LDR** – In this example program this routine is left blank.

**X00_Auto_Control_LDR** – The routine is left blank in this application but should the programmer need to add any logic for this program it would be placed in this routine.

**Chemical Flow Program**

**Main** – This program contains the JSRs to all the routines in this program.

**B00_Chemical_Flow_FBD** – P_AIn FBD used in calculating the chemical flow out of the chemical feed pumps. Note that in this application the “Chemical_Flow_P_AIn.Val” tag is used as our PV (process variable) in the “ChemicalFeedP_PIDE” routine PIDE.
Chapter 3

Typical P_AIn instruction used for Chemical Flow

B00_Chemical_Flow_LDR – In this example program this routine is left blank.

X00_Auto_Control_LDR – The routine is left blank in this application but should the programmer need to add any logic for this program it would be placed in this routine.

Chemical Feed System Program

This is the main part of the chemical feed system as this program contains the five chemical feed pump and mixer logic.

Main – This program contains the JSRs to all the routines in this program.

A000_CFP_Availability_LDR – The rungs in this program enable the operator to pick a pump sequence and it also checks the availability of the pump (can it be used in our sequence) – if it is not ready it is skipped during automatic cycle.

Customization

Should a pump need to be added the programmer can copy rung 4, paste it and change the tags to reflect new pump sequence.
Chapter 3

Typical logic to select pump sequence

The next step would be to add another pump to the “not available” section of logic.

Typical logic to indicate pump is not available

Finally, the following rung would need to be duplicated and changed to the new pump number. The purpose of this rung of logic is to indicate when a pump is at max speed. The max speed can be changed as explained in the “A001_Chemical_FeedP1_LDR” routine. There are some cases when the application or pump characteristics call for not waiting until the pump gets to 100% of its speed before the following pump is started. In this example when the pump reaches 90% of its top speed the next pump in sequence is started.

Typical logic to indicate pump at max speed

A000_CFP_PIDE_FBD – This routine contains the PIDE function block; PIDE is only available in function block format.
Chapter 3

PIDE function block that controls how many pumps are needed to achieve the GPM set point

A000_CFP_PIDE_LDR – In this routine the Chemical Feed Flow set point is copied from the HMI input and placed in the PIDE set point. Also the PV (process variable) is copied into the PIDE PV. The last part of this routine contains a small example of starting and stopping the automatic cycle of this system. The purpose is to stop the PIDE from executing and “zeroing” out the CV%, current set point and PV. This enables the operator to be able to stop the system quickly and start it again with a different set point. It is a simple method to be able to start from a clean slate.
Chapter 3

Set point, process variable and simple start/stop cycle logic

A001_Chemical_FeedP1_FBD – This routine contains the permissive, interlocks, VSD and alarm blocks for chemical feed Pump 1.
Chapter 3

Typical permissive and interlock function blocks for Pump 1

Customization

To add a pump the programmer would copy the above FBD routine, paste it into a new routine and then change the tag names. Notice the “Pump_1” tag is a UDT that just has to be copied and pasted with a new tag name. Then it can be used as desired in the program and routine.
A001_Chemical_FeedP1_LDR – The following routine contains most of the logic that controls Pump 1. It will be examined and explained rung by rung.

**RUNG0**

The following rung is where the programmer would put all the conditions that would make Pump 1 “not available.”

**Pump available logic**

**RUNG 1**

This rung contains the start pump logic:
If the chemical tank and basin levels are “OK”, we are calling for the pump to start and depending on what pump this is in the pump sequence we tell the pump to start. Notice we do not start the pump unless the pump ahead of it in the sequence is at max speed.

**RUNG 2**

Conditions to stop the pump: Since the CV is broken down into 20% increments (100% divided by 5) as the CV decreases the corresponding pump will stop.
Chapter 3

Stop pump logic

**RUNG 3**

Is pump in local or remote?

**Local or Remote**

**RUNG 4**

In this rung we examine the CV% and the pump sequence number, then we take the computed value of the speed and put it into the “Pset_SpeedRef” tag of the pump.

**Customization**

To add/delete a pump you would take the max CV (100%) and divide it by the number of pumps this value would then be split evenly between the low limit of the LIM blocks, then a new expression would be put into the CPT block to reflect the new number of pumps.
Chapter 3

Pump speed calculation

RUNG 5 and 6

Max speed calculation – the speed at which, when the pump reaches it, the next pump in the sequence is started. In this case at a value of 90% the next pump in line will start.

Max speed calculation
Chapter 3

Chemical Feed Mixers

These routines contain the P_Motor routines for the chemical mixers. If the “Influent Level” and a chemical feed pump are on, then the mixers are turned on.

L001_Chemical_Feed_Setpoint_Strategy_LDR& FBD

This routine will contain the set point strategies of your system. In our case it contains an operator manually set point and the FBD routine contains a simple calculated set point.

Y001_Status_LDR& FBD

This routine contains all the user pertinent Status bits used for the programming of the Chemical Feed system. “All pumps running,” “level status,” and “pump sequence selected” are examples of Status bits.

Status bits
HMI Description

The following is a brief description of the HMI portion of this project.

HMI Overview screen
Chapter 3

Chemical Feed set point and pump sequence selection

To operate system perform the following tasks:

1. In above pop-up choose “Manual Flow Set Point” and enter a flow value or select “Calculated Set Point.” When “Select Calculated Set Point” is chosen you must insert a value in the “Influent Flow” faceplate (see fig 24) since the calculated set point value is derived from “influent flow.”

2. Select a pump sequence.

3. Press the Start Cycle button.

Simulation Mode
To operate the system in simulation mode perform the following:


2. Open a copy of Chemical Feed System PLC Version 19.1, go to WHO Active, find the emulator in slot 3 and download to it.

3. When you are finished downloading, put PLC in run mode.

4. Open the FactoryTalk View SE client and start the HMI application.

Water Treatment Plant Applications

The Water Treatment Plant (WTP) documentation package contains the following applications:

- Raw Water Intake Pump Station System
- Separation Station System
- High Service Pump Station System

Raw Water Intake Application

The Raw Water Intake application is provided on the WWWAT CD. Refer to the Raw Water Intake System Application Controller Organization illustration to view the application’s organization within the Controller.
This task should reside in a Controller in the main facility of the plant where the Raw Water Intake application is present and it is not intended to be the only application in the Controller. A ControlLogix processor is specified for this application for that specific reason. It is assumed the processor will be running other systems of the plant.
The organization of this application is similar to the other applications in this toolkit. Specifically, the functionality for each program and routine is:

- **Main Program** handles general Raw Water Intake application and functionality, including:
  - Main routine calls the other routines in this program and includes a Wall Clock AOI that calculates the day of the week. It also includes a Pump Inputs simulation bit that you can use when testing the application.
  - A01_MiscDiscreteInput includes a template to map inputs that are relevant throughout the Raw Water Intake system. This routine is provided as a Function Block Diagram.
  - A02_MiscAnalogInput includes a template to map analog inputs that are relevant throughout the Raw Water Intake system. This routine is provided as a Function Block Diagram.
  - A03_MiscOutputs includes a template to map outputs that are relevant throughout the Raw Water Intake system. This routine is provided as a Function Block Diagram.

- **BarScreen01** controls the motor, manages cycle times, and Flow Channel Differential levels for the Bar Screen 1 system, including:
  - Main routine calls the other routines in this program.
  - A01_BarScreen01_LDR contains the code to monitor and control the Bar Screen 01 Motor and Reset Alarms, Interlocks, and Faults associated with the motor. This routine is provided as a Ladder Diagram.
  - A02_BarScreen01_FBD contains the Single Speed Motor, Permissives and Interlock AOIs that monitor and control the Bar Screen 01 motor. This routine is provided as a Function Block Diagram.
  - A03_BarScreen01_Auto contains the Cycle Timer (including the U_RepeatCycTmr AOI) and High Differential Alarm code. This routine is provided as a Ladder Diagram.
  - A04_DiffLevel contains the Analog Input AOI that monitors the preliminary treatment flow channel No 1's differential pressure level. This routine is provided as a Function Block Diagram.

- **BarScreen02** Controls the motor and manages cycle times and flow channel differential levels for the Bar Screen 2 system as described for BarScreen01.

- **GritTank01** Controls the motor and manages cycle times for the GritTank01 system, including:
  - Main routine calls the other routines in this program.
  - A01_GritTankDrive_LDR contains the code to monitor and control the Bar Screen 01 Reset Alarms, Interlocks, and Faults associated with the motor. This routine is provided as a Ladder Diagram.
– A02_GritTankDrive_FBD contains the Single Speed Motor, Permissives and Interlock AOIs that monitor and control the Grit Tank 01 motor. This routine is provided as a Function Block Diagram.

– A03_GritTankDrive_Auto contains the Cycle Timer (including the U_RepeatCycTmr AOI) code. This routine is provided as a Ladder Diagram.

– A04_GritTankFlow contains the Analog Input AOI and U_FlowTot AOI that aggregates the Grit Tank 01 flow. This routine is provided as a Function Block Diagram.

● Wet Well monitors Wet Well level and generates alarms, including:

– Main routine calls the other routines in this program.

– A01_Wellwell contains the code to monitor Wet Well level and generates alarms utilizing the Analog (P_AIn) and Discrete (P_Din) Input AOIs. This routine is provided as a Function Block Diagram.

AOI instructions are used extensively in this application. There is a collection of Process Library AOIs and a collection of other AOIs developed specifically for this application. Process Library AOIs can be identified by a prefix "P_" in their name. The other AOIs have a prefix of "U_" as shown in the AOI illustration.

AOIs

Process Description

The Raw Water Intake application consists of Screening, Influent Flow Measurement, and Grit Removal. From the inlet well, the wastewater enters
one or two preliminary treatment flow channels. Each flow channel consists of an **Inclined Bar** screen with a mechanical raking device to remove debris from the raw wastewater. The **Mechanical Bar** screens cycle periodically to rake debris from the bar rack and deposit the screenings on a belt conveyor. This conveyor runs during the screening cycle and moves the screenings to the Screenings Compactor which empties into the grit and screen hopper for subsequent disposal.

**HMI Description**

The operator controls and monitor these processes as follows:

1. Click the **WTP** button to go **Water Treatment Plant (WTP) Overview** screen.
2. Click the appropriate **Raw Water Intake & Pump Station** icon to display the **Raw Water Intake & Pump Station Overview** screen. The **Raw Water Intake & Pump Station** icons are enclosed in the large red box on the **WTP Overview** screen.
   - If you want to return to the **WWTP Overview** screen, click the **Overview** button.

**Selecting the Raw Water Intake WTP Overview Screen**
Chapter 3

Raw Water Intake Overview Screen

The status information on the Raw Water Intake & Pump Station Overview screen includes:

- **Mechanical Bar** screen Number 1
- **Grit Tank Drive Number 1**
- **Channel Numbers 1 and 2, Differential Level**
- **Channel Number 1 Flow**
Control Description

This section describes the Mechanical Bar screen Number 1 operational mode.

Hand Mode

The Mechanical Bar screen Number 1 is operated locally by selecting the Hand position on the Hand-Off-Auto selector switch, which is located at the MCC. The operator uses the Bar screen using buttons located at the equipment. In this mode, the operator is responsible for operating the conveyor, compactor, and the Bar screen.

Mechanical Bar Screen

Remote Operator Mode

The operator must place the screening equipment in the this mode to use them from the HMI. The operator can place the Mechanical Bar screen in the Remote mode by selecting Auto on the Auto-Off-Hand selector switches located at the MCC for each equipment.

In the Remote mode, the operator may select Auto or Manual mode to control the process from the HMI.

Operator Mode (Manual)

Click the screening equipment display the Single Speed Motor Faceplate.
For Manual Operator Control, select the Operator mode from the Single Speed Motor HMI Equipment Faceplate. The faceplate shown is used to control the screening equipment. The screening equipment is started and stopped remotely from the HMI Equipment Faceplate. The available Bar screen commands include:

- Press the Play button to start the Bar screen.
- Press the Stop button to stop the Bar screen.
- Click the Disable button to remove the Bar screen from service.
- Click the Enable button to place the unit back in service.

**Program Mode (Auto)**

To place the Bar screen in Program Mode (Auto) control, perform the following:

1. Select Auto on the Auto-Off-Hand selector switches located at the MCC for each equipment to place the Bar screen in the Remote mode.
2. Select Program mode from the HMI Equipment Faceplate. When in Remote Program mode, the screening will be called to start when the accumulated time is equal to the Cycle Timer pre-set or the differential level across the screen reaches setpoint.
Bar Screen Cycle Timer

The following sequence will occur when the screening system is run in Auto:

1. The system commands the Mechanical Bar screen to start.
2. The Mechanical Bar screen will run for 2 minutes before being called to stop.

Grit Removal

This section describes the Grit Removal, Hand, Remote Operator, and Program modes.

Hand Mode - Grit Tank Drive (GTD) Number 1

Operate the drive in the Local mode by selecting Hand on the Hand-Off-Auto selector switch located at the MCC. The operator uses the buttons located at the tank to start or stop each drive.

Grit Tank Drive

Remote Operator Mode

The operator must place the Grit Tank Drive in the Remote Operator mode to use it from the HMI. The Grit Tank Drive is placed in the Remote mode by selecting Auto on the Auto-Off-Hand selector switches located at the MCC for each equipment. In the Remote mode, the operator may select Auto or Manual mode to control the process from the HMI Equipment Faceplate.

Operator Mode (Manual)

Once the operator clicks on the GTD equipment, the system displays a faceplate.
Single Speed Motor (HMI Equipment Faceplate)

The operator uses this faceplate to control the GTD equipment. For Manual Operator Control, select the **Operator** mode from the **HMI Equipment** Faceplate.

The operator starts/stops the GTD equipment remotely from the **HMI Equipment** Faceplate. The available GTD screen commands include:

- Press the **Play** button to start the GTD screen.
- Press the **Stop** button to stop the GTD screen.
- Click the **Disable** button to remove the GTD screen from service.
- Click the **Enable** button to place the unit back in service.

**Program Mode (Auto)**

To place the GTD equipment in Remote Program Mode (Auto) control, perform the following:

1. Select Auto on the Auto-Off-Hand selector switches located at the MCC for each equipment to place the GTD equipment in the Remote mode.
2. Select Program mode from the **HMI Equipment** Faceplate. When in Remote Program mode, the system calls the GTD equipment to start when the accumulated time is equal to the Cycle Timer pre-set.
Bar Screen Cycle Timer

Alarms

The Supervisory Control and Data Acquisition (SCADA) system generates these two types of alarms.

- Process
- Equipment

Process Alarms

- Channel No. 1 Differential Level High alarm

Equipment Alarms

These are the two types of Equipment Alarms.
- **Start/Stop Faults** - If the system calls the Mechanical Bar screen and it is not running after 5 seconds, the system generates a Start/Stop Fail Alarm and displays it at the HMI.

- **Start/Stop Faults** - If the system calls the GTD to start and is not running after 5 seconds, the system generates a Start/Stop Fail Alarm and displays it at the HMI.
Chapter 3

Reporting Equipment Run Times

Run times are recoded for the Mechanical Bar screen mechanism by the SCADA system. Depending on the user’s security level, the total run time maybe reset by clicking on the Total Reset button next to the appropriate pump.

- Mechanical Bar Screen Number 1
- Grit Tank Drive Number 1

Single Speed Motor Run Time

![Run Time for Single Speed Motor](image)
Customization of the Raw Water Intake Application

General customization notes are included in the Lift Station Application section (page 102) of this chapter. Refer to this section before customizing any application, including the Raw Water Intake. This section describes customization specific to the Raw Water Intake application.

I/O Assignment

As in the Lift Station, I/O is mapped into this application. This is done in the following project locations:

- MainProgram - A01_DiscreteInput - as needed - this routine is provided as a template.
- MainProgram - A02_AnalogInput - as needed - this routine is provided as a template.
- MainProgram - A03_Outputs - as needed - this routine is provided as a template.

Additional Pumps/Motors (Single Speed Motor AOIs in a FBD Routine)

See the Customization of the Solids Application section for an example of how to add Single Speed Motor AOIs in a FBD routine.
**Separation Application**

The WWWAT CD contains the Separation application. Refer to the Separation System Application Controller Organization illustration to view the application's organization within the Controller.

**Separation System Application Controller Organization**

This task resides in a PLC in the main facility of the plant that contains the Separation application and it is not intended to be the only application in the Controller. A ControlLogix processor is specified for this application for that specific reason. It is assumed the processor will be running other plant systems.
Chapter 3

The organization of this application is similar to that of other applications in this toolkit. Specifically, the functionality for each program and routine is:

- **Main Program** handles general separation application and functionality.
  - Main routine calls the other routines in this program and includes a Wall Clock AOI that calculates the day of the week. It also includes a Pump Inputs simulation bit that you can use when testing the application.
  - A01_MiscDiscreteInput provides a template to map inputs that are relevant throughout the secondary. This routine is provided as a Function Block Diagram.
  - A02_MiscAnalogInput provides a template to map analog inputs that are relevant throughout the secondary. This routine is provided as a Function Block Diagram.
  - A03_MiscDiscreteOutputs provides a template to map outputs that are relevant throughout the secondary. This routine is provided as a Function Block Diagram.
  - A04_MiscAnalogOutput provides a template to map analog inputs that are relevant throughout the secondary. This routine is provided as a Function Block Diagram.

- **SedBasin01Drive** controls the Sedimentation Basin's Sludge Collection Drive motor.
  - Main routine calls the other routines in this program.
  - A01_Drive_LDR contains the code to map fault inputs, hand mode, and resets for the Sedimentation Basin's Sludge Collection Drive motor. This routine is provided as a Ladder Diagram.
  - A02_Drive_FBD contains the Single Speed Motor, Permissives, and Interlock AOIs that monitor and control the Sedimentation Basin's Sludge Collection Drive motor. (See the Using Add-On Instructions section for more information). This routine is provided as a Function Block Diagram.

- **FlocBsn01_M1202** controls the Flocculation Mixer motor.
  - Main routine calls the other routines in this program.
  - A01_Pump_LDR contains the code to configure the source of the speed reference for the VFD for the Flocculation Mixer and reset alarms, interlocks and faults associated with the mixer. This routine is provided as a Ladder Diagram.
  - A02_Pump_FBD contains the Variable Speed Drive, Permissives, and Interlock AOIs that monitor and control the Flocculation Mixer motor (See the Using Add-On Instructions section for more information). This routine is provided as a Function Block Diagram.

Add-On Instructions are used extensively in this application. There is a collection of Process Library AOIs and a collection of other AOIs developed specifically for this application. Process Library AOIs can be identified by a prefix "P_" in their name. The other AOIs have a prefix of "U_" as shown in the AOI illustration.
AOIs

Process Description

Raw water, especially river water, contains both dissolved and suspended particles. Coagulation and flocculation processes are used to enlarge and separate the suspended solids portion from the water. The Separation application process consists of:

- Rapid Mix
- Flocculation
- Sedimentation.

Rapid Mix

The Rapid Mix process destabilizes the particle’s charges. Before the raw water enters the Rapid Mix area coagulants are added to the water to neutralize the negative charges on suspended solids. Once the charge is neutralized, the small suspended particles stick together. The high-energy Rapid Mix process disperses the coagulant and promotes particle collisions, which is needed to achieve good coagulation.

Flocculation

Directly downstream of the rapid mix process is the Flocculation process. Flocculation is a gentle mixing of the raw water to increase the particle size from submicroscopic to visible suspended particles.
Sedimentation

Sedimentation basins are used to settle out the floc before going to the filters. The inlet to the basin is designed to distribute water evenly, at uniform velocities. The sludge collection drive, removes the sludge from the bottom of the basin, and allows pumps to transfer the sludge to holding tanks.

The Separation process (Flocculation and Sedimentation) is controlled by the PLC located in the Chemical Building.

HMI Description

The operator controls and monitors these processes as follows:

1. Click the WTP button to go Water Treatment Plant (WTP) Overview screen.
2. Click the appropriate Separation icon to display the Separation Overview screen. The Separation icons are enclosed in the large red box on the WTP Overview screen.
   - If you want to return to the WWTP Overview screen, click the Overview button.

Selecting the Separation WTP Overview Screen
Separation Overview Screen

The status information on the **Separation Overview** screen includes:

- Flocculation Mixer Mechanism
- Sludge Mechanism
Control Description

Flocculation Mixer Mechanism

Plant operators control the Flocculation Mixer manually. A VSD powers the mixer, which allows operators to adjust its speed.

Hand Mode

Select Hand on the Hand-Off-Auto selector switch (located at the VSD) to operate the mixer locally. The operator uses the buttons located at the VSD to operate it.

Selecting the Flocculation Basin on the Separation Overview Screen

Remote Operator Mode

Select the Auto position on the Auto-Off-Hand selector switches located at the VSD to put the mixer in the Remote mode. Select the operating state (On/Off) and set the speed on the VSD Faceplate.

Operator Mode (Manual)

Click on the Flocculation Mixer section of the Separation Overview screen. The system displays the VSD Faceplate.
VSD Faceplate

For manual Operator Control, select the Operator mode on the VSD Faceplate. The operator uses the faceplate shown to control the mixer. The operator starts/stops the mixer remotely from the VSD Faceplate. The available faceplate commands include:

- Press the Play button to start the mixer.
- Press the Stop button to close the mixer.
- Click the Disable button to remove the mixer from service.
- Click the Enable button to place the unit back in service.

Sedimentation

Plant operators control the Sludge Collection Mechanism (SCM) manually. As the sludge settles to the bottoms of the basin, a rack system collects the sludge for processing.

Sedimentation Basin Drive on the Separation WTP Overview Screen
Hand Mode

Select Hand on the Hand-Off-Auto selector switch (located at the MCC) to operate the SCM locally. The operator uses the buttons located at the MCC to operate it.

Remote Operator Mode

Select the Auto position on the Auto-Off-Hand selector switches located at the MCC to put the SCM drive in the Remote mode.

Operator Mode (Manual)

Click the SCM section of the Solids Overview screen. The system displays the Sedimentation Basin 1 Drive Faceplate.

Sedimentation Basin 1 Drive Faceplate

For manual Operator Control, select the Operator mode on the Sedimentation Basin 1 Drive Faceplate. The Operator uses this faceplate to control the SCM. The operator starts and stops the SCM remotely from the faceplate. The available faceplate commands include:

- Press the Play button to start the SCM.
- Press the Stop button to stop the SCM.
- Click the Disable button to remove the SCM from service.
- Click the Enable button to place the unit back in service.

Alarms

The Supervisory Control and Data Acquisition (SCADA) system generates these two types of alarms.
• Process
• Equipment

**Process Alarms**

There are the four types of Process Alarms.

- Sedimentation Basin LIT-1204 High Level Alarm
- Sedimentation Basin LIT-1204 Low Level Alarm
- Sedimentation Basin LIT-1204 High-High Level Alarm
- Sedimentation Basin LIT-1204 Low-Low Level Alarm

**Equipment Alarms**

These are the two types of Equipment Alarms.

- **Start/Stop Faults** - If the PLC commands the Flocculation Mixer to start and it is not running after 5 seconds, it generates a **Start/Stop Fail** alarm at the HMI.
- **Start/Stop Faults** - If the PLC commands the SCM to start and it is not running after 5 seconds, it generates a **Start/Stop Fail** alarm at the HMI.
- **SCM Fault** - this is a contact from the SCM, and once opened, the PLC generates a SCM Fault alarm at the HMI
Chapter 3

Reporting

The SCADA system records:

- Process - The system will trend common signals and record them for future viewing, including:
  - Sedimentation Basin Level LIT-1204
- Equipment Runtimes

The SCADA system records run times for the blower and SCST Drive Mechanism. Depending on the user's security level, the total runtime may be reset by clicking on the Total Reset button next to the appropriate pump.

- Flocculation Mixer
- SCM

Single Speed Motor Run Time

Customization of the Separation Application

General customization notes are included in the Lift Station Application section (page 102) of this chapter. Refer to this section before customizing any application, including the Separation. This section describes customization specific to the Separation application.
I/O Assignment

As in the Lift Station, I/O is mapped into this application. This is done in the following project locations

- MainProgram - A01_DiscreteInput - as needed - this routine is provided as a template.
- MainProgram - A02_AnalogInput - as needed - this routine is provided as a template.
- MainProgram - A03_Outputs - as needed - this routine is provided as a template.
- MainProgram - A04_AnalogOutput - as needed - this routine is provided as a template.

Additional Pumps/Motors (Single Speed Motor AOIs in a FBD Routine)

See the Customization of the Solids Application section the Solids application for an example of how to add Single Speed Motor AOIs in a FBD routine.
High Service Pump Station Application

The High Service Pump Station application is provided on the WWWAT CD. Refer to the High Service Pump Station System Application Controller Organization illustration to view the application's organization within the Controller.

High Service Pump Station System Application Controller Organization

This task should reside in a Controller in the main facility of the plant where the High Service Pump Station application is present and it is not intended to be the only application in the Controller. A ControlLogix processor is specified for this application for that specific reason. It is assumed the processor will be running other systems of the plant.
The organization of this application is similar to that of the other applications in this toolkit. Specifically, the functionality for each program and routine is:

- **Main Program** handles general High Service Pump Station application and functionality, including:
  - Main routine calls the other routines in this program and includes a Wall Clock AOI that calculates the day of the week. It also includes a Pump Inputs simulation bit that you can use when testing the application.
  - A01.MiscDiscreteInput includes a template to map inputs that are relevant throughout the High Service Pump Station system. This routine is provided as a Function Block Diagram.
  - A02.MiscAnalogInput includes a template to map analog inputs that are relevant throughout the High Service Pump Station system. This routine is provided as a Function Block Diagram.
  - A03.MiscOutputs includes a template to map outputs that are relevant throughout the High Service Application. This routine is provided as a Function Block Diagram.
  - A04.MiscAnalogOutput provides a template to map analog inputs that are relevant throughout the High Service Application. This routine is provided as a Function Block Diagram.
  - HighServicePumpP1300 controls the High Service Pump 1300.
  - A01_Pump_LDR contains the code to configure the source of the speed reference for the VFD for the High Service Pump 1300 and reset alarms, interlocks and faults associated with the pump. This routine is provided as a Ladder Diagram.
  - A02_Pump_FBD contains the Variable Speed Drive, Permissives and Interlock AOIs that monitor and control the High Service Pump 1300. (See the Using Add-On Instructions section for more information). This routine is provided as a Function Block Diagram.

- **HighServicePumpP1301** controls the High Service Pump 1301 as described for the High Service Pump 1300.

AOIs are used extensively in this application. There is a collection of Process Library AOIs and a collection of other AOIs developed specifically for this application. Process Library AOIs can be identified by a prefix "P_" in their name. The other AOIs have a prefix of "U_" as shown in the AOI illustration.
AOIs

Process Description

The High Service Pump Station process consists of a Clear Well, High Service Pumps, and Elevated Tank.

Clear Well

Clear Well Storage (CWS) should be sized, in conjunction with distribution system storage, to relieve the filters from having to follow fluctuations in water use.

High Service Pumps

The High Service Pumps (HSPs) deliver water to the Distribution System (DS). The DS is the elements of the municipal waterworks between the treatment facility and the consumer. The function of the DS is to deliver water under reasonable pressure in volumes adequate to meet peak consumer demands in the service area.

The PLC controls the High Service Pump Station process (Clear Well, High Service Pumps, and Elevated Tank) and it is located in the Operations Building.
HMI Description

The operator controls and monitors these processes as follows:

1. Click the WTP button to go Water Treatment Plant (WTP) Overview screen.
2. Click the appropriate High Service Pump Station icon to display the High Service Pump Station Overview screen. The High Service Pump Station icons are enclosed in the large red box on the WTP Overview screen.
   - If you want to return to the WWTP Overview screen, click the Overview button.

Selecting the High Service Pump Station WTP Overview Screen
The status information on the **High Service Pump Station Overview** screen includes:

- Clearwell Level LIT-1302
- Clearwell Level LIT-1303
- High Service Pump 1300
- High Service Pump 1301
- Elevated Tank Level LIT-1305
- Clearwell High-High Float
- Clearwell High Float
- Clearwell Low High Float
Control Description

High Service Pumps

The High Service pumps are variable frequency drive controlled, which allows their speed to be throttled. The flow of drinking water is controlled by varying the speed of these pumps. The system only requires one pump for peak demand, plus elevated tank filling.

Hand Mode

Select Hand on the Hand-Off-Auto selector switch (located at the VSD) to operate the pumps locally. The operator uses the buttons located at the VSD to operate it.

High Service Pump (Lit-1302)

Remote Operator Mode

The operator must place the pumps in this mode to use them from the HMI. The operator can place the pumps in the Remote mode by selecting Auto on the Auto-Off-Hand selector switches located at the VSD for each equipment. In Remote mode, the operator selects Program mode to control the process from the HMI.

Operator Mode (Manual)

Click the High Service Pump icon to display the High Service Pump #1 (M-1300) Faceplate.
For Manual Operator Control, select the **Operator** mode from the **High Service Pump #1 (M-1300)** Faceplate. Operators use this faceplate to control the pump equipment remotely. The available commands include:

- Press the **Play** button to start the pump.
- Press the **Stop** button to stop the pump.
- Click the **Disable** button to remove the pump from service.
- Click the **Enable** button to place the unit back in service.
Alarms

The Supervisory Control and Data Acquisition (SCADA) system generates these two types of alarms.

- Process
- Equipment

Process Alarms

There are the fifteen types of Process Alarms.

- Clearwell Level LIT-1302 High Alarm
- Clearwell Level LIT-1302 Low Alarm
- Clearwell Level LIT-1302 High-High Alarm
- Clearwell Level LIT-1302 Low-Low Alarm
- Clearwell Level LIT-1303 High Alarm
- Clearwell Level LIT-1303 Low Alarm
- Clearwell Level LIT-1303 High-High Alarm
- Clearwell Level LIT-1303 Low-Low Alarm
- Clearwell Level Float Low Water Cutoff
- Clearwell Level Float LSH-1307 High Alarm
- Clearwell Level Float LSHH-1308 High High Alarm
- Elevated Tank Level LIT-1305 High Alarm
- Elevated Tank Level LIT-1305 Low Alarm
- Elevated Tank Level LIT-1305 High-High Alarm
- Elevated Tank Level LIT-1305 Low-Low Alarm
Process Alarms

Equipment Alarms

These are the two types of Equipment Alarms.

- **High Service Pump #1 VFD Fault** - This is a messaged fault from the VSD drive unit. Once the PLC receives the fault message, it generates a VSD alarm at the HMI.
- **High Service Pump #2 VFD Fault** - This is a messaged fault from the VFD drive unit. Once the PLC receives the fault message, it generates a VFD alarm at the HMI.
Reporting

The SCADA system records:

- **Process** - The system will trend common signals and record them for future viewing, including:
  - High Service Pump P-1300
  - Output Frequency
  - Command Frequency
  - High Service Pump P-1301
  - Output Frequency
  - Command Frequency
- **Equipment Runtimes**
- **Runtimes** are recorded for the blower and clarifier center drive mechanism by the SCADA system. Depending on the user's security level, the total runtime may be reset by clicking on the **Total Reset** button next to the appropriate pump.
  - High Service Pump 1
  - High Service Pump 2

**Single Speed Motor Run Time**

![Image of Single Speed Motor Run Time](image-url)
Chapter 3

Customization of the High Service Pump Station Application

General customization notes are included in the Lift Station Application section (page 102) of this chapter. Refer to this section before customizing any application, including the High Service Pump Station. This section describes customization specific to the High Service Pump Station.

I/O Assignment

As in the Lift Station, I/O is mapped into this application. This is done in the following project locations:

- MainProgram - A01_DiscreteInput - as needed - this routine is provided as a template.
- MainProgram - A02_AnalogInput - as needed - this routine is provided as a template.
- MainProgram - A03_Outputs - as needed - this routine is provided as a template.

Additional Pumps/Motors (Single Speed Motor AOIs in a FBD Routine)

See the Solids application’s Customization of the Solids Application section for an example of how to add Single Speed Motor AOIs in a FBD routine.

Pump Controller Station

WWWAT CD

Select Pump Controller Station from the WWWAT CD Main Menu to locate this application

Introduction

The multifunction pump controller station package is designed to be a stand alone versatile control system that allows the user the ability to choose between a pump down (lift station), pump up (water tank) or a pressure follower (water distribution) control process, with just a few simple screen selections. The control combines the power and functionality of a MicroLogix 1400 PLC and the versatility of a PanelView component HMI.

Engineering cost is kept low because the user only needs to configure parameters instead of developing control programs.

Functionality includes:

- Control of up to 4 pumps
- User assignable inputs
- Use of floats, analog or a combination of both to control the process
- Control of VFD's through Modbus communication, which reduces the control wiring to the drives (PowerFlex 4/40/400 VFD's only)
- Pump control can be done with starters, PowerFlex 4 series VFD's or with another manufacturer's VFD
- Pump sequencing control
- User selectable alarms with the ability to choose which ones can be used to initiate an alarm dialer (user supplied)
- Pump statistics
- The ability to save and load VFD parameters from the HMI. (PF4 vfd's only)
- Selectable pump interlocks

Main Screen

Not visible until an application has been selected

Only visible if analog device is being used

Legend depends on if Pressure Follower® mode is selected or Level mode is selected

Legend depends on if Pressure Follower®, Level Pump Down or Level Pump Up mode is selected
The main screen displays configuration, monitoring and maintenance controls. Some control label content displays based on the current configuration.

Several of the buttons on the Main screen do not display until the application has been set up. So the first step is to go through the Application Config button.

Configuring the Application

The functions available when you select the Application Config button include:

- Select the pumps and pump modes
- Select primary and secondary measuring devices
- Select control devices for all active pumps
- Assign digital inputs and their states
- Assign backup pumps

Each of the configuration screens contains standard navigational tools:

- Press Prev or Next to navigate between screens.
- Press Up, Down, or Enter to navigate available choices on a single screen.
- Press Exit to return to the Main menu.

To use the configuration controls:

1. From the Main screen, press Application Config to display the configuration screen.

From the configuration screen you can:

- Use the Up/Down/Enter buttons to select from the three available operation modes
– Press **Enter The Number Of Pumps** to select the number of pumps (1-4) in use in the system
– View a description of the selected mode

2. Press **Next** to proceed to the **Measuring Setup** screen.

![Measuring Setup Screen](Image)

From the **Measuring Setup** screen you can:

– Use the **Up/Down** buttons to select the primary measuring device.

**TIP**

If **Pressure Follower** mode is selected then **Analog "In 0"** is the only option for the primary measuring device.

– Select a secondary measuring device

**TIP**

If the primary measuring device is an analog device, you can assign a float to be used as backup (not available if primary measuring is floats).

– Use the second analog input (IN 1) to measure flow rate from an analog transmitter or as the process variable if the default analog input (IN 0) fails.

When analog input "IN 1" (I:1.1) is set for **Flow** the flow is totalized using a calculation in the PLC. A more accurate way to totalize would be to use digital input I:0/0 as a totalized pulse.
3. Press Next to proceed to the Motor Control Setup screen. In the example shown, four pumps have been configured; the screen will only display as many pumps as you set up in the initial configuration screen.

From the Motor Control Setup screen you can use the Up/Down buttons to select the pump control device.

The Starter and Other VFD selections use physical outputs from the PLC to control the start/stop operation of the motors, while the PowerFlex 4 option uses Modbus communication to control the VFD.

4. Press Next to proceed to the first Digital Inputs Assign screen. There are four Digital Inputs Assign screens in total.

From the first Digital Inputs Assign screen you can:

- Use Digital input I:0/0 as a pulsed input to totalize flow only or to totalize flow and calculate a flow rate.
As a flow totalizer this can be very accurate. However, using it to calculate flow rate is not as accurate as using analog input I:1.1 as a flow rate input.

- Press **Enter Gallons Per Pulse** to set the appropriate gallons per input pulse

5. Press **Next** to proceed to the next **Digital Inputs Assign** screen.

![Digital Inputs Assign Screen 2](image)

From the remaining **Digital Inputs Assign** screens you can:

- Press **Normally Open** or **Normally Closed** to set the state to match the way the digital input is wired on the field device.

- Use the **Up/Down** and **End/Home** buttons to scroll through the list of selections

- Digital inputs I:0/0 – I:0/17 are assignable to any of the 27 selections listed; however, depending on the application, they may not all be applicable. For example, if you only have two pumps in your system, selection #20 Pump 3 seal fail would not apply.

<table>
<thead>
<tr>
<th>NOT USED --- (Selection 0 of 27)</th>
<th>Pump 4 Running (Selection 9 of 27)</th>
<th>Pump 1 Seal Fail (Selection 18 of 27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Level (Selection 1 of 27)</td>
<td>Pump 1 OL/Fault (Selection 10 of 27)</td>
<td>Pump 2 Seal Fail (Selection 19 of 27)</td>
</tr>
<tr>
<td>Pumps Stop (Selection 2 of 27)</td>
<td>Pump 2 OL/Fault (Selection 11 of 27)</td>
<td>Pump 3 Seal Fail (Selection 20 of 27)</td>
</tr>
<tr>
<td>Lead Start (Selection 3 of 27)</td>
<td>Pump 3 OL/Fault (Selection 12 of 27)</td>
<td>Pump 4 Seal Fail (Selection 21 of 27)</td>
</tr>
<tr>
<td>Lag Start (Selection 4 of 27)</td>
<td>Pump 4 OL/Fault (Selection 13 of 27)</td>
<td>Low Pressure (Selection 22 of 27)</td>
</tr>
<tr>
<td>High Level (Selection 5 of 27)</td>
<td>Pump 1 Motor Over Temp (Selection 14 of 27)</td>
<td>High Pressure (Selection 23 of 27)</td>
</tr>
</tbody>
</table>
Press the **Delay Between Pump Starts (Seconds)** to enter the delay before the next one starts when more than one backup pump is enabled.

<table>
<thead>
<tr>
<th>Pump 1 Running (Selection 6 of 27)</th>
<th>Pump 2 Motor Over Temp (Selection 15 of 27)</th>
<th>Power failure (Selection 24 of 27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump 2 Running (Selection 7 of 27)</td>
<td>Pump 3 Motor Over Temp (Selection 16 of 27)</td>
<td>Generator Running (Selection 25 of 27)</td>
</tr>
<tr>
<td>Pump 3 Running (Selection 8 of 27)</td>
<td>Pump 4 Motor Over Temp (Selection 17 of 27)</td>
<td>Generator Fault (Selection 26 of 27)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>General Fault (Selection 27 of 27)</td>
</tr>
</tbody>
</table>

- Press **Next** to proceed to the **Backup Pump Select** screen.

**TIP**

The **Backup Pump Selection** screen is visible only if **Float** is selected as the backup on the **Measuring Setup** screen.

If during the measuring device setup, floats are selected as secondary (backup) then these buttons will enable or disable the pumps from running in backup mode.

Press the **Delay Between Pump Starts (Seconds)** to enter the delay before the next one starts when more than one backup pump is enabled.
If on the “Measuring Setup” screen (above) the “Secondary (backup) Measuring Device” is set to “NOT USED”, then no pumps will run in backup.

**TIP**

If on the “Measuring Setup” screen (above) the “Secondary (backup) Measuring Device” is set to “Floats”, then backup pumps will start when the “Lead Start” float is activated, and continue until the “Pumps Stop” float is activated.

A “lead start” and a “pumps stop” selection must be assigned to an input on one of the “Digital Input Assign” screens.

Because this is a backup operation likely due to a failure, the pumps do not alternate.

**Setup Examples**

**Example 1**: In a pump down application. Floats are being used as backup. On the **Pump Sequence Setup** screen, the **Primary** selection for all pumps is set to **Alternate**, and the **Secondary** selections are set to **Lag1**. And on the **Backup Pump Selection** screen, lead, lag1 and lag2 pumps are all allowed to run as backup. As the level rises and activates the **Lead Start** float. The lead pump (because all are set for alternate, it could be any of the four pumps) starts. Let’s say that the **Delay Between Pump Starts** (see graphic above) is set for 60 sec. If the **Pumps Stop** float does not clear in this time, all of the pumps assigned to **Lag1** as **Secondary** will start (in this case all of them). If a pump was set to **Lag2** as the **Secondary** selection, it will start 60 sec. after the **Lag1** pump(s) start. If all of the pumps are set to **Lag2** as **Secondary**, then no pumps will start during the first 60 sec. (Lag1 time). The sequence is: lead pump --- delay --- lag1 pump(s) --- delay --- lag2 pump(s). Once a pump starts, it will continue to run until the **Pumps Stop** float clears.

**Example 2**: Same setup as above except the **Secondary** selections are now as shown. Let’s say that pump 2 is the lead pump. **Lead Start** float is activated. Pump 2 starts --- 60 sec. time delay --- pump 1 (lag1) starts --- 60 sec. time delay --- pump 3 (lag2) starts. Because pump 4 is set to **Not Used** it does not run.
Example 3: The setup is as shown, however now the Lag1 pump is not allowed to run in backup. Again, let’s say that pump 2 is the lead pump. Lead Start float is activated. Pump 2 starts --- 60 sec. time delay --- and although pumps 1 and 3 are both set for lag1, they do no run because the lag1 pumps are not allowed to run due to the selection on the Backup Pump Selection screen --- 60 sec. time delay --- pump 4 (lag2) starts.

Configuring Analog Inputs

Now that the application has been set up, you can continue through the rest of the configuration.

1. From the Main screen, press Analog Inputs Config to display the configuration screen.

   This button is not visible unless an analog device is being used (Measurement Setup screen).

   ![Analog Inputs Config Screen]

   The screen includes displays showing the raw data coming from the analog input card and mA value of the input from the calibrated (zero and span set) card.

2. Select one of the two following calibration methods:
– Apply a 4mA signal to the cards input (I:1.0), then push \textbf{Apply a 4mA Signal To Analog "In 0"} to make the zero adjustment. After making the zero adjustment, choose \textbf{Apply a 20mA Signal To Analog "In 0"} to make the span adjustment if a signal is available.

– Select \textbf{No 4-20mA Signal Available?} to calibrate the analog input using the card’s default values if no current calibrator is available.

\textbf{IMPORTANT}

You must use one of these calibration methods to ensure proper operation.

3. Enter a scaled value in the \textbf{Enter 4mA Signal Value} field. For example: 0 Ft.

4. Enter a scaled value in the \textbf{Enter 20mA Signal Value} field. For example: 10 Ft.

5. Enter a measurement unit type in the \textbf{Enter Engineering Unit} field. For example: Ft, Inch, PSI.

6. Once the scaled values have been entered, the scaled value of the analog input displays in the \textbf{Analog Input Scaled Value} area.

7. The second analog Input (I:1.1) is the same as input I:1.0. If the second analog input is not being used, it does not need to be set up.

\textbf{Configuring Analog Outputs}

1. From the Main screen, press \textbf{Analog Outputs Config} to display the configuration screen.

2. Set the \textbf{Analog Output “Out 0” Usage (O:1.0)} to retransmit a 4-20mA signal from the process variable (the analog signal connected to one of the analog inputs) or to set the pump #1 VFD speed reference (4mA=0Hz, 20mA=60Hz).
3. Set the Analog Output “Out 1” Usage (O:1.1) to retransmit a 4-20mA signal from the process variable (the analog signal connected to one of the analog inputs) or to set the pump #2 VFD speed reference (4mA=0Hz, 20mA=60Hz).

**TIP**
Note: The process variable can be the signal from analog input I:1.0 or input I:1.1. The default process variable is I:1.0 but can be changed from the Measuring Setup screen under the Analog Input “In 1” Usage selection.

**TIP**
Note: In order for the analog output to transmit a VFD speed reference, the corresponding pump needs to have either PowerFlex 4 series VFD or Other VFD selected from the Motor Control Setup screen.

**Setting the Process Configuration**

1. From the Main screen, press Process Config to display the setup screen. The number of pumps shown may vary depending on how many pumps are in use.

2. From the setup screen you can:
   - Use the UP/DOWN buttons to select between Hand, Off and Auto for each configured pump.
   - Set a Primary selection for each pump. Select from Alternate, Lead, Lag 1 and Lag 2.
   - Set a Secondary selection for each pump. Select from Lag 1, Lag 2 and Not Used.
The secondary selections only come into use when the primary selection is set as **Alternate** and a second pump is required to run.

The following are three examples of sequencing:

1. **Pumping sequence example #1**: All pumps have “Alternate” selected as primary and are in “Auto”. When a pump is required to run, pump #1 starts and runs until the level is satisfied. The next time a pump is required to run, pump #2 starts; however the level gets to a point where one pump cannot keep up and a second pump is required. At that point all of the pumps with “Lag 1” selected as secondary will start. All pumps will continue to run until the level is satisfied.

2. **Pumping sequence example #2**: Same scenario as example #1 except pump #2 is “Off”. After pump #1 runs and then turns off. Pump #3 will run on the next cycle. Because even though pump #2 has “alternate” selected, it is turned “Off” and is therefore taken out of the alternation sequence.

3. **Pumping sequence example #3**: Pump #2 is set for “Lead”, pump #1 is set for “Lag 1” and pump #3 is set for “Lag2”. When the level requires a pump to run, pump #2 comes on and runs until the level is satisfied. If the level continues to change and requires another pump to run, pump #1 will start. If the level still continues to change and requires another pump, pump #3 will start. The pumps will continue to run until the stop level is satisfied. With all pumps now off, when the level requires a pump to come on, the sequence repeats itself, there is no alternation.

4. **Access other setup screens as needed from the navigation at the bottom of the Process Config screen.**
   - Press **Pump Interlocks** to open the Pump Interlocks screen. Refer to Pump Interlocks on page 246.
   - Press **Backup Pump Selection** to open the Backup Pump Selection screen. Visible only if Float is selected as backup on the Measuring Setup screen. Refer to page 240.
   - Press **Pressure Setpoints** to open the Pressure Setpoints screen. Visible only if Pressure follower mode is selected. Refer to Pressure Setpoints on page 247.
   - Press **Level Setpoints** to open the Level Setpoints screen. Visible only if an analog device is being used for measuring level. Refer to Level Setpoints on page 247.
Pump Interlocks

You can use the Pump Interlocks screen to select from a list of faults that will inhibit the pump from running.

1. Select and perform the following steps for each pump individually.

2. Select the interlock from the list, and then use the Add Interlock button to add it to the Current Interlocks or use the Remove Interlock button to remove it from the Current Interlocks.

For example: If Pump Seal Fail is in an alarm state, press Remove Interlock to allow the pump to continue running in that alarm state.

A white X in a red circle indicates an interlock that has been removed, while a blue check mark in a gray box indicates an interlock that has been added.
Level Setpoints

From the Level Setpoints screen you can:

- Press **On Setpoint** to enter the level at which you want the selected pump to turn on.
- Press **Off Setpoint** to enter the level at which you want the selected pump to turn off.
- Press **VFD # Speed Hz** to enter the desired VFD speed (in Hz) when running in Level mode. The **VFD # Speed Hz** button is not visible if Starters were selected on the Motor Control Setup screen.
- Press the **High** and **Low Alarm Setpoints** to enter the threshold values for triggering the related alarms.

Pressure Setpoints

From the first Pressure Setpoints screen you can:
– Press **Pressure Setpoint** to enter the desired system pressure.
– Press **Start Pressure** to set the pressure (combined with the time delay) at which the Lag 1 and Lag 2 pumps will come on if the desired pressure is unable to be maintained.
– View the current pressure reading (analog input must have been set up previously).
– Press **Once Below Start Pressure The Next Pump Will Start in:**
  **(Seconds)** to enter the time delay in seconds between Lag pump starts. If system pressure falls below the start set point, the Lag pump starting is delayed by this value.
– Press **Off Pressure** to set the system pressure point at which all of the pumps shut off.
– Press **More** to see the second **Pressure Setpoints** screen.

[Image showing a screen with压力设定点 and提示信息]

– Press **VFD # Manual Speed Hz** to set the speed at which the drive will run when placed into Manual.
– Press **Enter The Alternation Time In Minutes** to set the time between pump alternations. This is only used if the **Primary** selection is set to **Alternation** on the **Process Configuration** screen.

**Tip**
Lead pump alternation will only occur if the lead pump is the only pump running. If the alternation time has elapsed during high demand when more pumps are running, the alternation will happen only when all pumps other than the lead pump have turn off.
– Press **High Setpoint** to set the high pressure alarm threshold.

**Tip**
The High Pressure alarm set point is not the same as the All Pumps Off set point on the Pressure Set point 1 screen. The All Pumps Off set point is meant to turn the pumps off before it goes into High Pressure alarm.

– Press Low Setpoint to set the low pressure alarm threshold.

**Pressure Overview Screen**

From the Pressure Overview screen you can:

– View the current system pressure and set point
– View the flow rate readout, if Analog Input In 1 is assigned to Flow on the Measuring Setup screen, or if Digital Input 0 (I:0/0) on the Digital Inputs Assign 1 screen is set for Use For Pulse Counter
– View pump status, mode and sequence information, as shown below
Chapter 3

Pump Down Overview Screen

From the **Pump Down Overview** screen you can:

- View the 20mA scaled value
- View the current level scaled value
- View the 4mA scaled value
- View pump status, mode and sequence information, as on the Pressure Overview screen.

Pump Up Overview Screen

From the **Pump Up Overview** screen you can view pump status, mode, sequence and level information.
From the **Maintenance** screen you can:

- Press **Clear All Alarms** to clear all of the alarms from the alarm history. Refer to Alarms Screen on page 258.

- Press **VFD # Speed Hz** to enter the desired speed for each VFD. The **VFD # Speed Hz** button is visible only if **PowerFlex 4 VFD** or **Other VFD** is selected in the **Motor Control Setup** screen.

- Press **PowerFlex VFD Parameters** to open the PowerFlex 4 VFD Parameters screen. Refer to PowerFlex 4 VFD Parameters on page 253. The **PowerFlex VFD Parameters** button is visible only if **PowerFlex 4 VFD** is being used.

- Press **Pump Statistics** to open the Pump Statistics screen. Refer to Pump Statistics Screen on page 252. The **Pump Statistics** button is only visible after an application has been assigned.

- Press **PID Tuning** to access the PD Tuning screen. Refer to PID Tuning Screen on page 252. The **PID Tuning** button is visible only if **Pressure Follower** mode is selected.

- Press **PanelView Config** to close the running PanelView application and open the PanelView configuration screen.
Pump Statistics Screen

From the **Pump Statistics** screen you can:

- Select a pump to view the statistics for that pump. The number of pumps visible depends on how many are in use. The flow totalization is only visible if digital input I:0/0 is set to totalize or if analog input I:1.1 is set for flow
- Reset the run time and cycle count (shown in yellow)
- View the motor current and voltage if a PowerFlex series 4 VFD is in use
- View the flow totalization, if digital input I:0/0 is set to totalize or if analog input I:1.1 is set for flow

PID Tuning Screen

From the **PID Tuning** screen you can:
– Select a pump to view or change the PID values for that pump. The number of pumps visible depend on how many are in use.
– Press Enter Prop. Gain (Kc) to enter the gain value for the PID.
– Press Enter Integral Reset (Ti) to enter the reset value for the PID.
– Press Enter Derivative Rate (Td) to enter the rate value for the PID.
– Press Enter Deadband to enter the deadband value for the PID.

PowerFlex 4 VFD Parameters

From the PowerFlex 4 VFD Parameters screen you can:

– Save PowerFlex 4 series VFD parameters from the VFD to a database in the PLC
– Load saved PowerFlex 4 series VFD parameters from a database into the VFD

If a PowerFlex 4 series VFD is being used, you can save different sets of parameters under different recipe names. If you save the parameters to an existing database recipe, the previous recipe will be overwritten.

To save a recipe:
1. From the PowerFlex 4 VFD Parameters screen, press **Save PowerFlex 4 VFD Parameters Into Database** to open the **Save VFD Parameters** screen.

![Image of Save VFD Parameters screen]

2. From the **Save VFD Parameters** screen you can:
   - Use the **UP/ DOWN** buttons to select a database recipe from the list
   - Press **RENAME RECIPE** to give the selected recipe a descriptive name
   - Press **ACCEPT** or **CANCEL NEW NAME** to confirm or discard the naming of the recipe.
   - View the new recipe name, if a recipe name is being changed
   - Press **CLEAR THE SAVED RECIPE** to clear the selected database recipe.

3. Once the desired recipe is selected from the list, press **VFD (NODE) #** to select the VFD using the parameters you want to save. This option is visible only if a PowerFlex VFD is found at the appropriate node.

To load a recipe:
1. From the PowerFlex 4 VFD Parameters screen, press **Load PowerFlex 4 VFD Parameters From Database Into VFD** to open the **Load VFD Parameters** screen.

![Load VFD Parameters screen](image)

2. Press **UP/DOWN** to select a database recipe from the list.

3. Press **VFD (NODE) #** to select the VFD into which you wish to load the selected recipe. This option is visible only if a PowerFlex VFD is found at the appropriate node.

   Not all of the parameters are loaded into the VFD. The Modbus node address, comm speed and comm formate will not overwrite what is already set in the VFD. This way the VFD parameters from node #1 can be written into the VFD at node #2.

**TIP**

If the system has a combination of different PowerFlex 4 VFD's, such as one Powerflex 4 and one PowerFlex 40. Care needs to be taken to ensure that the parameters of a PF 4 VFD do not get loaded into a PF 40 VFD.

**TIP**

After the parameters are loaded into the VFD. The VFD needs to have the power cycled in order for the new parameters to take effect.
Warning Screen

From the **Warning** screen you can:

- View the current warning message.
- Press **Push to Acknowledge Warning** to scroll through each active warning if multiple warnings exist.

**TIP**

Although some of the warnings can be alarms, they are typically settings or setup issues that have conflicts.

List of available warnings:

| --- NO WARNINGS EXIST --- | --- PRIMARY MEASURING IS SET FOR FLOATS --- |
| --- AND THE MODE IS SET FOR "EMPTY (PUMP DOWN)" --- | --- AND THE MODE IS SET FOR "EMPTY (PUMP DOWN)" --- |
| A PUMP IS ASSIGNED TO "LAG2" | A PUMP IS ASSIGNED TO "LAG2"
AN INPUT NEEDS TO BE ASSIGNED TO "HIGH LEVEL" OR THE PUMP NEEDS TO BE IN "OFF" |

| --- PRIMARY MEASURING IS SET FOR FLOATS --- | --- PRIMARY MEASURING IS SET FOR FLOATS --- |
| AN INPUT NEEDS TO BE ASSIGNED TO "LEAD START" | AN INPUT NEEDS TO BE ASSIGNED TO "LEAD START"
AN INPUT NEEDS TO BE ASSIGNED TO "PUMPS STOP" AND THE PUMP NEEDS TO BE IN "OFF" |

| --- SECONDARY (BACKUP) MEASURING IS SET FOR FLOATS --- | --- SECONDARY (BACKUP) MEASURING IS SET FOR FLOATS --- |
| AN INPUT NEEDS TO BE ASSIGNED TO "LEAD START" | AN INPUT NEEDS TO BE ASSIGNED TO "LEAD START"
AN INPUT NEEDS TO BE ASSIGNED TO "PUMPS STOP" AND AT LEAST ONE PUMP NEEDS TO BE SELECTED TO RUN AS BACKUP |
<table>
<thead>
<tr>
<th>Condition</th>
<th>Action</th>
</tr>
</thead>
</table>
| The "Hand-Off-Auto" selectors for all pumps, is set to "Off" | -- Pump #1 --  
HAS ITS OVERLOAD TRIPPED/VFD FAULT INTERLOCK ENABLED  
AN INPUT NEEDS TO BE ASSIGNED TO "OL TRIPPED/VFD FAULT"  
OR THE INTERLOCK NEEDS TO BE DISABLED |
| --- Pressure Mode selected ---  
AND A "Stop Pressure" set point is set lower than a "Start Pressure" set point | -- Pump #1 --  
HAS ITS OVER TEMP INTERLOCK ENABLED  
AN INPUT NEEDS TO BE ASSIGNED TO "OVER TEMP"  
OR THE INTERLOCK NEEDS TO BE DISABLED |
| --- Pump Down mode selected ---  
The pump stop levels need to be set lower than the pump start levels | -- Pump #1 --  
HAS ITS SEAL FAIL INTERLOCK ENABLED  
AN INPUT NEEDS TO BE ASSIGNED TO "SEAL FAIL"  
OR THE INTERLOCK NEEDS TO BE DISABLED |
| --- Pump Up mode selected ---  
The pump stop levels need to be set higher than the pump start levels | -- Pump #2 --  
HAS ITS OVERLOAD TRIPPED/VFD FAULT INTERLOCK ENABLED  
AN INPUT NEEDS TO BE ASSIGNED TO "OL TRIPPED/VFD FAULT"  
OR THE INTERLOCK NEEDS TO BE DISABLED |
| --- Pressure Mode selected ---  
AND the "Stop pumps" set point is set lower than the "desired pressure" set point | -- Pump #2 --  
HAS ITS OVER TEMP INTERLOCK ENABLED  
AN INPUT NEEDS TO BE ASSIGNED TO "OVER TEMP"  
OR THE INTERLOCK NEEDS TO BE DISABLED |
| --- Primary measuring is set for floats ---  
A pump is assigned to "LAG1"  
AN input needs to be assigned to "LAG START" OR the pump needs to be in "Off" | -- Pump #2 --  
HAS ITS SEAL FAIL INTERLOCK ENABLED  
AN INPUT NEEDS TO BE ASSIGNED TO "SEAL FAIL"  
OR THE INTERLOCK NEEDS TO BE DISABLED |
| -- Pump #3 --  
HAS ITS OVERLOAD TRIPPED/VFD FAULT INTERLOCK ENABLED  
AN INPUT NEEDS TO BE ASSIGNED TO "OL TRIPPED/VFD FAULT"  
OR THE INTERLOCK NEEDS TO BE DISABLED | |
| -- Pump #3 --  
HAS ITS OVER TEMP INTERLOCK ENABLED  
AN INPUT NEEDS TO BE ASSIGNED TO "OVER TEMP"  
OR THE INTERLOCK NEEDS TO BE DISABLED | |
From the **Alarms** screen you can view a list of active and/or inactive alarms. Active alarms are shown in white against a red background, and inactive alarms are shown in blue against a white background. The newest alarms
appear at the top of the list. Alarms remain in the list until the **Clear All Alarms** button is pushed on the maintenance screen.

Because this list contains past alarms (history), use the **UP/DOWN** and **PAGE UP/PAGE DOWN** buttons to scroll through the list.

From this screen you can also:

- Press **View Warnings** to go to the Warning screen. Refer to Warning Screen on page 256.
- Press **Alarm Output Config** to go to the **Alarm Output Configuration** screen. Refer to Alarm Output Configuration on page 261.
- Press **View VFD Alarms** to view PowerFlex 4 alarms, if a PowerFlex 4 VFD is being used. Refer to VFD Faults (PowerFlex 4 VFDs only) on page 260.

**List of available alarms:**

<table>
<thead>
<tr>
<th>System Interlock I:0/19 Not Energized</th>
<th>Pump #2 Failed To Run</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Level</td>
<td>PowerFlex VFD #2 Comm Loss</td>
</tr>
<tr>
<td>Low Level</td>
<td>Pump #2 OL Tripped/VFD Fault</td>
</tr>
<tr>
<td>High Pressure</td>
<td>Pump #2 Over Temp</td>
</tr>
<tr>
<td>Low Pressure</td>
<td>Pump #2 Seal Fail</td>
</tr>
<tr>
<td>Analog Input I:1.0 Out Of Range</td>
<td>Pump #3 Failed To Run</td>
</tr>
<tr>
<td>Analog Input I:1.1 Out Of Range</td>
<td>PowerFlex VFD #3 Comm Loss</td>
</tr>
<tr>
<td>Power Failure</td>
<td>Pump #3 OL Tripped/VFD Fault</td>
</tr>
<tr>
<td>Generator Running</td>
<td>Pump #3 Over Temp</td>
</tr>
<tr>
<td>Generator Fault</td>
<td>Pump #3 Seal Fail</td>
</tr>
<tr>
<td>General Fault</td>
<td>Pump #4 Failed To Run</td>
</tr>
<tr>
<td>Pump #1 Failed To Run</td>
<td>PowerFlex VFD #4 Comm Loss</td>
</tr>
<tr>
<td>PowerFlex VFD #1 Comm Loss</td>
<td>Pump #4 OL Tripped/VFD Fault</td>
</tr>
<tr>
<td>Pump #1 OL Tripped/VFD Fault</td>
<td>Pump #4 Over Temp</td>
</tr>
<tr>
<td>Pump #1 Over Temp</td>
<td>Pump #4 Seal Fail</td>
</tr>
<tr>
<td>Pump #1 Seal Fail</td>
<td></td>
</tr>
</tbody>
</table>
**VFD Faults (PowerFlex 4 VFDs only)**

The **VFD Faults** screen shows faults for each PowerFlex 4 VFD in use (in this example four VFDs are in use). The fault information comes from the PowerFlex 4 VFD via the Modbus communication. Press **RESET VFD FAULT** or the stop button on the VFD to reset the VFD fault.

**List of available PowerFlex VFD faults:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NO FAULTS</td>
<td>39- PHASE V TO GROUND SHORT</td>
</tr>
<tr>
<td>2</td>
<td>AUXILIARY INPUT</td>
<td>40- PHASE W TO GROUND SHORT</td>
</tr>
<tr>
<td>3</td>
<td>POWER LOSS</td>
<td>41- PHASE UV SHORT</td>
</tr>
<tr>
<td>4</td>
<td>UNDervoltage</td>
<td>42- PHASE UW SHORT</td>
</tr>
<tr>
<td>5</td>
<td>OVERvoltage</td>
<td>43- PHASE VW SHORT</td>
</tr>
<tr>
<td>6</td>
<td>MOTOR STALLED</td>
<td>63- SOFTWARE OVERCURRENT</td>
</tr>
<tr>
<td>7</td>
<td>MOTOR OVERLOAD</td>
<td>64- DRIVE OVERLOAD</td>
</tr>
<tr>
<td>8</td>
<td>HEATSINK OVERTEMPERATURE</td>
<td>70- POWER UNIT FAILED</td>
</tr>
<tr>
<td>12</td>
<td>HW OVERCURRENT (300%)</td>
<td>80- AUTO TUNE FAILED</td>
</tr>
<tr>
<td>13</td>
<td>GROUND FAULT</td>
<td>81- COMMUNICATION LOSS</td>
</tr>
<tr>
<td>29</td>
<td>ANALOG INPUT LOSS</td>
<td>100- PARAMETER CHECKSUM ERROR</td>
</tr>
<tr>
<td>33</td>
<td>AUTO RESTART TRIES</td>
<td>122- I/O BOARD FAIL</td>
</tr>
<tr>
<td>38</td>
<td>PHASE U TO GROUND SHORT</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 3

**Alarm Output Configuration**

From the **Alarm Output Configuration** screen you can:

- Press UP/DOWN to select a process-specific alarm from the list
- Press Add Alarm or Remove Alarm to enable or disable the selected process-specific alarm

The alarms, when enabled, combine to turn on PLC output O:0/9. If the alarm is not enabled, even though it becomes active, it will not turn the PLC output on.

- Press MORE to add pump-specific alarms from the **Pump # Alarm Output Configuration** screen(s). Refer to Pump #1 Alarm Output Configuration on page 261.

**Pump #1 Alarm Output Configuration**

Refer to Alarm Output Configuration on page 261 for screen descriptions and functions. Add and/or remove alarms for the selected pump. Press MORE to
add or remove alarms on additional pumps, if any. The alarm output screens for pumps #2-4 are the same as pump #1.

**PowerFlex 4 series VFD set up (must have firmware version 6.0 or higher)**

If PowerFlex 4 VFD’s are being used, the following parameters need to be set on each VFD.

1. P36 (start source) = 5 (comm port)
2. P38 (speed reference) = 5 (comm port)
3. PowerFlex 4/40 - A103 (comm data rate) = 5 (38.4k), PowerFlex 400 - C103 (comm data rate) = 5 (38.4k)
4. PowerFlex 4/40 - A104 (comm node address) = 1-4, PowerFlex 400 - C104 (comm node address) = 1-4
5. PowerFlex 4/40 - A106 (comm loss time) = 10 sec., PowerFlex 400 - C106 (comm loss time) = 10 sec.

The PLC is programmed to control PowerFlex 4 VFD’s at node address 1-4. If pump #1 is a PowerFlex 4 drive, it must be set to node “1”. If pump #2 is a PowerFlex 4 drive, it must be set to node “2”, and so on with the remaining pumps.

6. PowerFlex 4/40 - A107 (comm format) = 0 (RTU 8-N-1), PowerFlex 400 – C102 (comm format) = 0 (RTU 8-N-1)

**Panel View C600 (2711C-T6T), Firmware version 1.60**

1. IP address: 192.168.1.3
2. Subnet: 255.255.255.0
3. Gateway: 0.0.0.0 (not used)
4. DHCP: Off (not used)

**PLC Micro 1400 series A (1766-L32BXB)**

1. Analog I/O module 1762-IF2OF2, 2 chnl. Input, 2 chnl. Output
2. Channel settings.
MicroLogix Memory Module.

The Multifunction Pump Control PLC program comes stored on a 1766-MM1 memory module.

To load the program from the memory module into the PLC:
Chapter 3

1. Use the up/down buttons on the directional keypad to scroll to the **Advanced Set** option on the LCD display and push **OK**.

![Directional keypad]

2. Scroll down to **Comms EEPROM** and push **OK**.
3. Scroll to **Load from MM** and push **OK**.
4. The **Run** LED will flash on/off. When loading is complete the **Run** LED will stay off. Push **OK**. To place the PLC into Run, push the **ESC** button several times until the display no longer changes. This will bring you out to the main menu.
5. Scroll down to **Mode Switch** and push **OK**.
6. Scroll down to **Run** and push **OK**. The PLC Run LED will turn on.

To save the program from the PLC into the memory module:

1. Use the up/down keypad to scroll to the **Advanced Set** option on the LCD display and push **OK**.
2. Scroll down to **Comms EEPROM** and push **OK**.
3. Scroll to **Store to MM** and push **OK**. The PLC will be taken out of **Run**.
4. On the next screen choose option 1 (Reuse Device). Do not choose option 2. If you choose option 2 (Write Only) you will only be able to write to the memory module one time and will not be able to save any more programs to it. Push **OK**.
5. The **Run** LED flashes on/off. When loading is complete the **Run** LED stays off.
6. Use the above procedure to put PLC back into **Run**.

**PanelView component program load**

On initial power up, the PanelView main menu displays.
1. Push File Manager.

2. Use the Up/Down buttons to scroll to USB from the Source list.

3. Use the Up/Down buttons to scroll to Internal from the To list.

4. Push Copy to transfer the application from the USB storage into PanelView.

   The message Operation Succeeded displays.

5. Press OK to clear the pop-up window.

6. From the Source list select Internal.

7. Once the source is set to Internal, push Set As Startup.
Chapter 3

The application name displays under **Startup Application**.

![File Manager](image)

8. Push **Run** to launch the application.

**PLC Program Files**

The PLC code is separated into separate program files. Each file contains the logic associated with certain operations. The **Main** file contains all of the jump to subroutine (JSR) instructions that scans all of the other files (3-20) sequentially.
Recipe Files

The parameters for the PowerFlex 4 series VFD’s are saved/recalled into/from RCP files. Because a RCP file has a max. file length of 32, there are 7 files required to hold all of the parameters.

- RCP Configuration Files
  - RCP File 0 - PARAM
  - RCP File 1 - PARAM
  - RCP File 2 - PARAM
  - RCP File 3 - PARAM
  - RCP File 4 - PARAM
  - RCP File 5 - PARAM
  - RCP File 6 - PARAM
  - RCP File 7 - PARAM
Notes:
Installation and Commissioning

This chapter contains valuable resources to help you install and begin using the Water and Wastewater system. Use the following table to locate these resources.

<table>
<thead>
<tr>
<th>To Access</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website resources for additional information, including: Rockwell Automation product and knowledge base websites Water and Wastewater industry websites</td>
<td>Website Resources on page 319</td>
</tr>
<tr>
<td>Related documentation to help you install/commission the Water and Wastewater system. This chapter lists the necessary user and quick start guides required to install/bring your system online.</td>
<td>Documentation Resources on page 320</td>
</tr>
</tbody>
</table>

Important Installation and Commissioning Drawings

Refer to the system architectural drawings for I/O check-out and system troubleshooting during installation and commissioning. These drawings reside on the Water and Wastewater Accelerator Toolkit CD. See the Introduction section in the Preface for more information.

Water and Wastewater Treatment Plant Hardware Drawings

The Water and Wastewater Treatment Plant (WWTP) Hardware documentation package contains the following system-level drawing packages:

- Lift Station System
- Dosing Pump Station System
- Primary Treatment System
- Headworks System
- Secondary Treatment System
- Solids Handling System
- Chemical Feed System
- Flushing System

The Lift Station and Dosing Pump Station drawings are included in this section for reference. These are typical of the others- all can be found on the WWWAT CD (Publication IASIMP-SP012). You can also go to the Rockwell Automation Integrated Architecture Tools Website, http://www.ab.com/go/iatools and download the drawings.
Lift Station Hardware Drawings

One of the System Architecture sub-folders on the WWWAT CD is the Lift Station folder and it contains the following drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Sheets
- Device Wiring Schematics

Title Page and Sheet Index

Lift Station Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-150</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of the drawing package for your application.</td>
</tr>
</tbody>
</table>
Process Flow Diagram

Lift Station System Process Flow Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-160</td>
<td>System Process Flow Diagram</td>
<td>The Lift Station Process Flow diagram depicts a Lift Station consisting of two pumps with particular I/O. It provides a general overview of the process controlled by the system, a quick summary of the controls involved, and the process that is being controlled.</td>
</tr>
</tbody>
</table>
Network Diagram

Lift Station Network Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-170</td>
<td>Network Diagram</td>
<td>For details, see page 12.</td>
</tr>
</tbody>
</table>
Panel I/O Sheets

Lift Station Panel I/O Sheets

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-180</td>
<td>Panel I/O Layout (Sheet 1 of 2) Panel I/O Layout (Sheet 2 of 2)</td>
<td>The Lift Station Inputs and outputs to the controller are shown on these diagrams. The format uses three cards per sheet. Inputs to the card are shown with the input device to the left of the input card. Output devices are shown to the right of the output card. For every additional input or output card, new sheets must be added. Refer to these sheets during the Commissioning process.</td>
</tr>
<tr>
<td>E-181</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Device Wiring Schematics

This sheet provides power distribution and manual (hand) selector switch wiring information. Refer to these sheets during the Commissioning process.

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-182</td>
<td>Device Wiring Schematics</td>
<td>This sheet provides power distribution and manual (hand) selector switch wiring information. Refer to these sheets during the Commissioning process.</td>
</tr>
</tbody>
</table>
Dosing Pump Hardware Drawings

One of the System Architecture sub-folders on the WWWAT CD is the Dosing Pump folder and it contains the following drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Layout Sheets

Title Page and Sheet Index

Dosing Pump Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-100</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of your application's drawing package.</td>
</tr>
</tbody>
</table>
**Process Flow Diagram**

_Dosing Pump System Process Flow Diagram_

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-110</td>
<td>System Process Flow Diagram</td>
<td>The Dosing Pump System Process Flow diagram depicts a two pump alum addition process. You make any changes to the number of pumps or I/O for this process on this drawing. For example, if you require additional pumps in an application, update this sheet with the appropriate pumps and their associated I/O information. The Dosing Pump System Process Flow diagram provides a general overview of the process controlled by the system, a quick summary of the controls involved, and the process that is being controlled.</td>
</tr>
</tbody>
</table>
**Network Diagram**

**Dosing Pump Network Diagram**

![Network Diagram Image]

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-170</td>
<td>Network Diagram</td>
<td>For details, see page 14.</td>
</tr>
</tbody>
</table>

**Panel I/O Layout Sheets**

**Dosing Pump Panel I/O Layout Sheets**

![Panel I/O Layout Sheets Image]
<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-130</td>
<td>Panel I/O Layout (Sheet 1 of 3)</td>
<td>The Dosing Pump System Panel I/O Layout Sheets show the I/O to the controller. The format uses three cards per sheet. This drawing depicts inputs to the card with the input device to the left of the input card. It also shows output devices to the right of the output card. You must add a new sheet for each additional input or output card. This drawing package was designed with space reserved for all the Controller Chassis card slots. In this example drawing package, slot 3 is empty. This empty slot is represented on sheet E-131 with an empty area on the sheet and the text &quot;Spare.&quot; If you add a card to slot three, you should show it in this spare area. If an additional chassis is required, use this same format with space reserved in the drawings for any empty slots of the chassis. This provides a pre-determined location in the drawing package for all the I/O modules. Include I/O information specific to your application on this drawing. We expect you to modify these sheets to fit your application. You use these sheets as a template for use with many applications even though the specific I/O points vary. These sheets include digital input and output modules as well as analog input and output modules. The Dosing Pump Panel I/O Layout Sheet contains one example of each type of module that will typically be used in a lift station application. Note, that these modules are 1756 style I/O modules. Different I/O modules will require changes to these sheets.</td>
</tr>
<tr>
<td>E-131</td>
<td>Panel I/O Layout (Sheet 2 of 3)</td>
<td></td>
</tr>
<tr>
<td>E-132</td>
<td>Panel I/O Layout (Sheet 3 of 3)</td>
<td></td>
</tr>
</tbody>
</table>
The Water and Wastewater Treatment Plant (WTP) Hardware documentation package contains the following system-level drawing packages:

- Raw Water Intake Pump Station System
- Separation Station System
- High Service Pump Station System

The Raw Water Intake System Pump Station drawings are included in this section for reference. These are typical of the others— all can be found on the WWWAT CD (Publication IASIMP-SP012). You can also go to the Rockwell Automation Integrated Architecture Tools Website, http://www.ab.com/go/iatools and download the drawings.

**Raw Water Intake System Hardware Drawings**

The System Architecture folder on the WWWAT CD contains the Raw Water Intake System sub-folder. Select this sub-folder to view the following Raw Water Intake System drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Layout Sheets
Title Page and Sheet Index

Raw Water Intake System Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1100</td>
<td>Title Page and Sheet</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify</td>
</tr>
<tr>
<td></td>
<td>Index</td>
<td>this sheet as necessary to match the contents of the drawing package for</td>
</tr>
<tr>
<td></td>
<td></td>
<td>your application.</td>
</tr>
</tbody>
</table>
Process Flow Diagram

Raw Water Intake System Process Flow Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1110</td>
<td>System Process Flow Diagram</td>
<td>The Run Water Intake System Flow diagram depicts a Raw Water Intake System with particular I/O. Any changes to the I/O for the Raw Water Intake System should be reflected on this diagram. For example, if additional pumps are required in an application, you should update this sheet with those pumps and their associated I/O. A diagram like the one on this sheet shows a general overview of the process controlled by the system in this drawing set. It provides a quick summary of the controls involved and of the process that is being controlled.</td>
</tr>
</tbody>
</table>
Network Diagram

Raw Water Intake System Network Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1120</td>
<td>Network Diagram</td>
<td>For details, see <a href="#">page 23</a>.</td>
</tr>
</tbody>
</table>
Panel I/O Layout Sheets

Raw Water Intake System Panel I/O Layout Sheets

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1130</td>
<td>Panel I/O Layout (Sheet 1 of 2)</td>
<td>The Run Water Intake System Panel I/O Layout Sheets depict inputs and outputs to the controller. This format uses three cards per sheet. Inputs to the card are shown with the input device to the left of the input card. Output devices are shown to the right of the output card. You must add a new drawing sheet for every additional input or output card. This drawing package reserves space for all the &quot;slots&quot; of a controller's chassis. If an additional chassis is required, use this same format with space reserved in the drawings for any empty slots of the chassis. This provides a pre-determined location in the drawing package for all the I/O modules.</td>
</tr>
<tr>
<td>E-1131</td>
<td>Panel I/O Layout (Sheet 2 of 2)</td>
<td>I/O specific to an application are shown here and it is expected that these sheets are heavily modified for each application. These sheets function as a template for many applications even if the specific I/O points vary. These sheets include digital input and output modules as well as analog input and output modules. This provides one example of each type of module that will typically be used in a Raw Water Intake System application. <strong>Note:</strong> This drawing depicts 1756 style I/O modules. If you use different I/O modules, you must also update these sheets. Refer to these sheets during the Commissioning process.</td>
</tr>
</tbody>
</table>
One of the System Architecture sub-folders on the WWWAT CD is the Pump Controller Station folder and it contains the following drawings:

- Title Page and Sheet Index
- Communications Diagram
- Panel Layout Diagram
- Power Layout Sheets
- Panel I/O Layout Sheets

Title Page and Sheet Index

Pump Controller Station Title Page and Sheet Index

ROCKWELL AUTOMATION
WATER/WASTEWATER
ACCELERATOR TOOL KIT

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of the drawing package for your application.</td>
</tr>
</tbody>
</table>
Communications Diagram

Pump Controller Station Communications Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-12</td>
<td>Pump Control Communications Diagram</td>
<td>Refer to Pump Controller Station Architecture Drawing on page 28 for details.</td>
</tr>
</tbody>
</table>
Panel Layout Diagram

Pump Controller Station Panel Layout Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Pump Controller Station Panel Layout Diagram</td>
<td>You can modify this as needed for your application requirements.</td>
</tr>
</tbody>
</table>
Chapter 4

Power Layout Sheets

Pump Controller Station Power Layout Sheets
<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3 and 5</td>
<td>Power Layout</td>
<td>Pump Control Power Distribution, 480VAC Power, and 24VDC Power Drawings.</td>
</tr>
</tbody>
</table>
Panel I/O Layout Sheets

Pump Controller Station Panel I/O Layout Sheets
<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-11</td>
<td>I/O Layout Sheets</td>
<td>Pump Control Drive and PLC I/O Drawings.</td>
</tr>
</tbody>
</table>
Notes:
Chapter 5

Maintenance and Repair

Introduction

This chapter contains valuable resources to help you install and begin to use the Water and Wastewater system. Use the following table to locate these resources.

<table>
<thead>
<tr>
<th>To Access</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website resources for additional information, including:</td>
<td>Website Resources on page 319</td>
</tr>
<tr>
<td>• Rockwell Automation product and knowledge base websites</td>
<td></td>
</tr>
<tr>
<td>• Water and Wastewater industry websites</td>
<td></td>
</tr>
<tr>
<td>Related documentation to help you install/commission the Water and</td>
<td>Documentation Resources on page 320</td>
</tr>
<tr>
<td>Wastewater system. This chapter lists the necessary user and quick</td>
<td></td>
</tr>
<tr>
<td>start guides required to install/bring your system online.</td>
<td></td>
</tr>
</tbody>
</table>

Important Maintenance and Repair Drawings

Once your Water and Wastewater system is installed, it requires periodic planned maintenance and/or repair to keep it working properly. Refer to these drawings for specific technical/electrical system information when your system requires service.

Water and Wastewater Treatment Plant Hardware Drawings

The Water and Wastewater Treatment Plant Hardware documentation package contains the following system-level packages:

- Lift Station Hardware Drawings
- Dosing Pump Hardware Drawings
- Primary Treatment System Hardware Drawings
- Headworks Pump Hardware Drawings
- Secondary Treatment System Hardware Drawings
- Solids Handling System Hardware Drawings
- Chemical Feed System Hardware Drawings
- Flushing System Hardware Drawings

The Lift Station and Dosing Pump Station drawings are included in this section for reference. These are typical of the others— all can be found on the WWWAT CD (Publication IASIMP-SP012). You can also go to the Rockwell Automation Integrated Architecture Tools Website, http://www.ab.com/go/iatools and download the drawings.
Lift Station Hardware Drawings

One of the System Architecture sub-folders on the WWWAT CD is the Lift Station folder and it contains the following drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Layout Sheets
- Device Wiring Schematics

Title Page and Sheet Index

Lift Station Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-150</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of the drawing package for your application.</td>
</tr>
</tbody>
</table>
Process Flow Diagram

Lift Station System Process Flow Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-160</td>
<td>System Process Flow Diagram</td>
<td>This diagram depicts a Lift Station consisting of two pumps with particular I/O. It provides a general overview of the process controlled by the system, a quick summary of the controls involved, and the process that is being controlled.</td>
</tr>
</tbody>
</table>
### Network Diagram

#### Number Title Description

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-170</td>
<td>Network Diagram</td>
<td>For details, see page 12.</td>
</tr>
</tbody>
</table>
Panel I/O Layout Sheets

Lift Station Panel I/O Layout Sheets

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-180</td>
<td>Panel I/O Layout (Sheet 1 of 2)</td>
<td>Inputs and outputs to the controller are shown on these diagrams. The format uses three cards per sheet. Inputs to the card are shown with the input device to the left of the input card. Output devices are shown to the right of the output card. For every additional input or output card, new sheets must be added.</td>
</tr>
<tr>
<td>E-181</td>
<td>Panel I/O Layout (Sheet 2 of 2)</td>
<td></td>
</tr>
</tbody>
</table>
Device Wiring Schematics

This sheet provides power distribution and manual (hand) selector switch wiring information. Refer to these sheets during the Commissioning process.

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-182</td>
<td>Device Wiring Schematics</td>
<td>This sheet provides power distribution and manual (hand) selector switch wiring information. Refer to these sheets during the Commissioning process.</td>
</tr>
</tbody>
</table>
Dosing Pump Hardware Drawings

One of the System Architecture sub-folders on the WWWAT CD is the Dosing Pump folder and it contains the following drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Layout Sheets

Title Page and Sheet Index

Dosing Pump Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-100</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of your application’s drawing package.</td>
</tr>
</tbody>
</table>
**Process Flow Diagram**

**Dosing Pump System Process Flow Diagram**

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-110</td>
<td>System Process Flow Diagram</td>
<td>The Dosing Pump System Process Flow diagram depicts a two pump alum addition process. Make any changes to the number of pumps or I/O for this process on this drawing. For example, if you require additional pumps in an application, update this sheet with the appropriate pumps and their associated I/O information. The Dosing Pump System Process Flow diagram provides a general overview of the process controlled by the system, a quick summary of the controls involved, and the process that is being controlled.</td>
</tr>
</tbody>
</table>
Network Diagram

Dosing Pump Network Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-120</td>
<td>Network Diagram</td>
<td>For details, see page page 14.</td>
</tr>
</tbody>
</table>
### Panel I/O Layout Sheets

#### Dosing Pump Panel I/O Layout Sheets

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-130</td>
<td>E-130</td>
<td>Panel I/O Layout (Sheet 1 of 3) These diagrams show the I/O to the controller. The format uses three cards per sheet. This drawing depicts inputs to the card with the input device to the left of the input card. It also shows output devices to the right of the output card. You must add a new sheet for each additional input or output card.</td>
</tr>
<tr>
<td>E-131</td>
<td>E-131</td>
<td>Panel I/O Layout (Sheet 2 of 3)</td>
</tr>
<tr>
<td>E-132</td>
<td>E-132</td>
<td>Panel I/O Layout (Sheet 3 of 3) This drawing package was designed with space reserved for all controller chassis card slots. In this example drawing package, slot 3 is empty. This empty slot is represented on sheet E-131 with an empty area on the sheet and the text “Spare.” If you add a card to slot 3, show it in this spare area. If an additional chassis is required, use this same format with space reserved in the drawings for any empty slots of the chassis. This provides a pre-determined location in the drawing package for all the I/O modules.</td>
</tr>
</tbody>
</table>

Include I/O information specific to your application on this drawing. We expect you to modify these sheets to fit your application. Use these sheets as a template for use with many applications even though the specific I/O points vary. These sheets include digital input and output modules as well as analog input and output modules. The Dosing Pump Panel I/O Layout Sheet contains one example of each type of module that will typically be used in a lift station application. Note, that these modules are 1756 style I/O modules. Different I/O modules will require changes to these sheets.
Water Treatment Plant Hardware Drawings

The Water Treatment Plant Hardware documentation package contains the following system-level packages:

- Raw Water Intake System Hardware Drawings
- Separation Station System Hardware Drawings
- High Service Pump Station System Hardware Drawings

The Raw Water Intake System Pump Station drawings are included in this section for reference. These are typical of the others—all can be found on the WWWAT CD (Publication IASIMP-SP012). You can also go to the Rockwell Automation Integrated Architecture Tools Website, http://www.ab.com/go/iatools and download the drawings.

Raw Water Intake System Hardware Drawings

The System Architecture folder on the WWWAT CD contains the Raw Water Intake System sub-folder. Select this sub-folder to view the following Raw Water Intake System drawings:

- Title Page and Sheet Index
- Process Flow Diagram
- Network Diagram
- Panel I/O Layout Sheets
Title Page and Sheet Index

Raw Water Intake System Title Page and Sheet Index

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1100</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of the drawing package for your application.</td>
</tr>
</tbody>
</table>
### Process Flow Diagram

**Raw Water Intake System Process Flow Diagram**

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1110</td>
<td>System Process Flow Diagram</td>
<td>The flow diagram depicts a Raw Water Intake System with particular I/O. Any changes to the I/O for the Raw Water Intake System should be reflected on this diagram. For example, if additional pumps are required in an application, you should update this sheet with those pumps and their associated I/O. The Raw Water Intake System Process Flow diagram shows a general overview of the Raw Water Intake process controlled by the system in this drawing set. It provides a quick summary of the controls involved and of the process that is being controlled.</td>
</tr>
</tbody>
</table>
Network Diagram

Raw Water Intake System Network Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1120</td>
<td>Network Diagram</td>
<td>For details, see page 23.</td>
</tr>
</tbody>
</table>
Panel I/O Layout Sheets

Raw Water Intake Panel I/O Layout Sheets

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-1130</td>
<td>Panel I/O Layout (Sheet 1 of 2)</td>
<td>The Raw Water Intake Panel I/O Layout Sheets depict inputs and outputs to the controller. This format uses three cards per sheet. Inputs to the card are shown with the input device to the left of the input card. Output devices are shown to the right of the output card. You must add a new drawing sheet for every additional input or output card. This drawing package reserves space for all the &quot;slots&quot; of a controller’s chassis. If an additional chassis is required, use this same format with space reserved in the drawings for any empty slots of the chassis. This provides a pre-determined location in the drawing package for all the I/O modules. I/O specific to an application are shown here and it is expected that these sheets are heavily modified for each application. These sheets provide a template for use for many applications even if the specific I/O points vary. These sheets include digital input and output modules as well as analog input and output modules. This provides one example of each type of module that will typically be used in a Raw Water Intake System application. <strong>Note:</strong> This drawing depicts 1756 style I/O modules. If you use different I/O modules, you must also update these sheets.</td>
</tr>
<tr>
<td>E-1131</td>
<td>Panel I/O Layout (Sheet 2 of 2)</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 5

Pump Controller Station
Hardware Drawings

One of the System Architecture sub-folders on the WWWAT CD is the Pump Controller Station folder and it contains the following drawings:

- Title Page and Sheet Index
- Communications Diagram
- Panel Layout Diagram
- Power Layout Sheets
- Panel I/O Layout Sheets

Title Page and Sheet Index

ROCKWELL AUTOMATION
WATER/WASTEWATER

ACCELERATOR TOOL KIT

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>Title Page and Sheet Index</td>
<td>This is the Table of Contents/Cover Sheet for the drawing package. Modify this sheet as necessary to match the contents of the drawing package for your application.</td>
</tr>
</tbody>
</table>
Communications Diagram

Pump Controller Station Communications Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-12</td>
<td>Pump Control Communications Diagram</td>
<td>Refer to Pump Controller Station Architecture Drawing on page 28 for details.</td>
</tr>
</tbody>
</table>
Panel Layout Diagram

Pump Controller Station Panel Layout Diagram

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Pump Controller Station Panel Layout Diagram</td>
<td>You can modify this as needed for your application requirements.</td>
</tr>
</tbody>
</table>
Chapter 5

Power Layout Sheets

Pump Controller Station Power Layout Sheets

[Diagram of Pump Controller Station Power Layout Sheets]
<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3 and 5</td>
<td>Power Layout Sheets</td>
<td>Pump Control Power Distribution, 480VAC Power, and 24VDC Power Drawings.</td>
</tr>
</tbody>
</table>

Chapter 5
Panel I/O Layout Sheets

Pump Controller Station Panel I/O Layout Sheets
<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-11</td>
<td>I/O Layout Sheets</td>
<td>Pump Control Drive and PLC I/O Drawings.</td>
</tr>
</tbody>
</table>
Notes:
### Website Resources

This table describes the numerous websites where you can go to find useful and up-to-date information for all phases of a Water and Wastewater project. Each website is categorized on the WWWAT CD and contains a link to that specific website.

<table>
<thead>
<tr>
<th>For</th>
<th>See</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Integrated Architecture</strong></td>
<td></td>
</tr>
<tr>
<td>Productivity tools to help you save time in the development of your</td>
<td><a href="http://rockwellautomation.com/solutions/integratedarchitecture/resources.html">http://rockwellautomation.com/solutions/integratedarchitecture/resources.html</a></td>
</tr>
<tr>
<td>water or wastewater system.</td>
<td></td>
</tr>
<tr>
<td>water and wastewater industries.</td>
<td></td>
</tr>
<tr>
<td><strong>Components</strong></td>
<td></td>
</tr>
<tr>
<td>Time-saving accelerators centered around Rockwell Automation</td>
<td><a href="http://rockwellautomation.com/components/connected">http://rockwellautomation.com/components/connected</a></td>
</tr>
<tr>
<td>components.</td>
<td></td>
</tr>
<tr>
<td>Technical information about component-level products from Rockwell</td>
<td><a href="http://rockwellautomation.com/components/connected">http://rockwellautomation.com/components/connected</a></td>
</tr>
<tr>
<td>Automation.</td>
<td></td>
</tr>
<tr>
<td><strong>Literature</strong></td>
<td></td>
</tr>
<tr>
<td>Rockwell Automation manuals and publications.</td>
<td><a href="http://www.rockwellautomation.com/literature">http://www.rockwellautomation.com/literature</a></td>
</tr>
<tr>
<td><strong>Selection, Configuration, and Support Information</strong></td>
<td></td>
</tr>
<tr>
<td>generation.</td>
<td></td>
</tr>
<tr>
<td>the correct Rockwell Automation product for your application.</td>
<td></td>
</tr>
<tr>
<td>Answers to technical questions and solutions to problems.</td>
<td><a href="http://support.rockwellautomation.com/">http://support.rockwellautomation.com/</a></td>
</tr>
<tr>
<td>General technical support.</td>
<td><a href="http://support.rockwellautomation.com/">http://support.rockwellautomation.com/</a></td>
</tr>
<tr>
<td><strong>Product Information</strong></td>
<td></td>
</tr>
<tr>
<td>Allen-Bradley product information.</td>
<td><a href="http://www.ab.com">http://www.ab.com</a></td>
</tr>
<tr>
<td>PanelView product information.</td>
<td><a href="http://www.ab.com/eoi/graphicterminals">http://www.ab.com/eoi/graphicterminals</a></td>
</tr>
<tr>
<td>PowerFlex drives product information.</td>
<td><a href="http://www.ab.com/drives">http://www.ab.com/drives</a></td>
</tr>
<tr>
<td>Power supply information.</td>
<td><a href="http://www.ab.com/industrialcontrols/products/power_supplies">http://www.ab.com/industrialcontrols/products/power_supplies</a></td>
</tr>
</tbody>
</table>
## Documentation Resources

The WWWAT CD contains Rockwell Automation user manuals and installation instructions that you can refer to while designing your application. This table lists each document's publication number, folder location, and describes its content, so you can quickly locate the required information. The publications can be found on the CD in the folder WWWAT Common Tools>Product Information.

### Documentation Stored On the WWWAT CD

<table>
<thead>
<tr>
<th>Document Name</th>
<th>Publication Number</th>
<th>WWWAT CD Folder</th>
<th>Document Contents</th>
<th>Reference For</th>
</tr>
</thead>
</table>
| CompactLogix Packaged Controller       | 1769-IN082         | L2X Controller        | • Installation Checklist  
• Controller Dimensions  
• How to Install the Battery  
• How to Connect Expansion Modules  
• Minimum Spacing Requirements  
• How to Panel Mount  
• How to DIN Rail Mount  
• Grounding Considerations  
• Wiring Power to the System  
• Wire the I/O Removable Terminal Blocks  
• Expansion Module Wiring  
• Selecting Operating Mode  
• Status Indicators | Hardware Selection  
Installation and Start-up |
| PanelView Plus Installation Manual     | 2711P-IN002        | PanelView Plus        | • Environmental Information  
• Mounting Clearances  
• Cutout Dimensions  
• Panel Mounting Instructions  
• Product Dimensions  
• Removing and Installing the Power Terminal Block  
• DC Power Connections  
• AC Power Connections  
• Troubleshooting  
• Battery Removal  
• System Specifications  
• Certifications | Hardware Selection |
| PowerFlex 70 User Manual               | 20A-UM001          | PowerFlex 70          | • Installation / Wiring  
• Mounting  
• AC Supply  
• Grounding  
• Fusing  
• Power Wiring  
• IP66 (Nema 4X/12) Installations  
• Input/Output Contactors  
• MOVs and CM Capacitors  
• I/O Wiring  
• Speed Reference Control  
• Auto / Manual Examples  
• EMC Instructions  
• Appendix A - Supplemental Drive Information  
• Appendix B - HMI Overview  
• Appendix C - Application Notes | Hardware Selection  
Installation and Start-up  
Maintenance |
## Documentation Stored On the WWWAT CD

<table>
<thead>
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</table>
| E3 and E3 Plus Overload Relays User Manual        | 193-UM002          | E3 Overload Information | • Product Overview  
• Installation and Wiring  
• Protective Trip and Warning Functions  
• DeviceNet Node Commissioning  
• Programmable Parameters  
• Current Monitoring Parameters  
• Diagnostic Parameters  
• Logic Controller Application Example with Explicit Messaging  
• Troubleshooting  
• Appendix A - Specifications  
• Appendix B - DeviceNet Information  
• Appendix C - PTB Compliance  
• Appendix D - CD Compliance  
• Appendix E - Accessories | Hardware Selection  
Installation and Start-up  
Maintenance |
| ControlLogix System User Manual                   | 1756-UM001         | ControlLogix    | • System Overview  
• Manage Controller Communication  
• Place, Configure, and Monitor I/O Modules  
• Configure Redundancy  
• SIL2 Certification  
• Maintain Non-volatile Memory  
• Maintain the Battery  
• Status Indicators | Hardware Selection  
Installation and Start-up  
Maintenance |
| ControlLogix Controller and Memory Board Installation Instructions | 1756-IN101         | ControlLogix    | • Replacing a Suspected Failed Controller  
• Preparing the Chassis  
• Removing the Controller from the Chassis  
• Installing a Memory Board  
• Installing a Compact Flash Card  
• Connecting a Battery  
• Installing a Controller into a Chassis  
• Check the BAT Status Indicator  
• Check the OK Status Indicator  
• Updating Controller Firmware  
• Connecting via a Serial Cable  
• Interpreting the Status Indicators  
• Clearing a Major Fault  
• Clearing a Non-recoverable Fault  
• Choosing the Operating Mode of the Controller  
• Specifications | Hardware Selection  
Installation and Start-up |
| CompactLogix Selection Guide                      | 1769-SG001         | L2x Controller Information | This document contains the necessary information to specify the exact components required to build a CompactLogix based system, including:  
• CompactLogix Controller Comparison Table  
• What’s new in Version 17  
• Example Configurations:  
  - L1X  
  - L2X  
  - L3X  
  - L4X | System Specification  
Hardware Selection |
### Documentation Stored On the WWWAT CD

<table>
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<tr>
<th>Document Name</th>
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<th>WWWAT CD Folder</th>
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<th>Reference For</th>
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</thead>
</table>
| 1769 CompactLogix Packaged Controller  | IASIMP-QS010       | PowerFlex 70 Information  | This document contains information on how to deploy a CompactLogix Packaged Controller. This step by step guide includes the following:  
  - How to Assemble the Hardware  
  - Hardware Setups for Communicating between your PC and the Controller  
  - Installing RSLogix 5000 and RSLinx software  
  - Software Configuration for Serial and Ethernet Communications From Your PC to the Controller  
  - Software Setups for Communicating between your PC and the Controller  
  - Loading Controller Firmware  
  - Creating an RSLogix 5000 project  
  - Downloading to the Controller  
  - Adding Point I/O to the Project  
  - Including a PowerFlex 40 in your application and establishing communications  
  - Creating a simple PanelView Plus Application and Establishing Communications with your CompactLogix packaged controller  
  - Interfacing your CompactLogix packaged controller with a DeviceNet Network  
  - 1769 CompactLogix Packaged Controller User Manual | System Specification Hardware Selection |
| Visualization Platforms Selection Guide| VIEW-SG001         | PanelView Plus Information| This document contains the necessary information to specify the visualization components required for your application.  
  **Select a Visualization Platform**  
  Determine platform style you want to use:  
  - Dedicated platform (optimized for machine level interface)  
  - Open platform (a device with a preloaded operating system)?  
  **Select a Visualization Product**  
  Choose one of the following visualization products for your application:  
  - PanelView/ PanelView Plus terminals  
  - Industrial Computers  
  - InView Message Displays.  
  Once you have decided on a Visualization product, choose the specific product and software for your application. This section includes the necessary system specification and part number information required to select the correct visualization solution. | System Specification Hardware Selection |
## Appendix A

### Point I/O Selection Guide

Select the Communications Interface
- Identify part numbers for specific I/O Modules. You can choose between analog, digital and specialty modules. Module specifications and part numbers are listed.
- Select a Terminal Base Assembly.
- Select a Power Supply Unit.
- Select Point I/O Accessories.
- Determine mounting requirements. This section provides information on the spacing requirements for your Point I/O. This information will vary based on the selections you have made in the prior steps.

### ControlLogix Selection Guide

- Select I/O Devices
- Select Motion Control and Drives Requirements
- Select Communications Modules
- Select Controllers
- Select Chassis
- Select Power Supplies
- Select View Products
- Select Software

### Documentation Stored On the WWWAT CD

<table>
<thead>
<tr>
<th>Document Name</th>
<th>Publication Number</th>
<th>WWWAT CD Folder</th>
<th>Document Contents</th>
<th>Reference For</th>
</tr>
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<tbody>
<tr>
<td>Point I/O Selection Guide</td>
<td>1734-SG001</td>
<td>Point I/O</td>
<td>A step by step guide for selecting Point I/O Hardware, including:</td>
<td>System Specification</td>
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<td></td>
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<td>- Select the Communications Interface</td>
<td>Hardware Selection</td>
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<td></td>
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<td></td>
<td>- Identify part numbers for specific I/O Modules. You can choose between analog, digital and specialty modules. Module specifications and part numbers are listed.</td>
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<td></td>
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<td>- Select a Terminal Base Assembly.</td>
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<td>- Select a Power Supply Unit.</td>
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<tr>
<td>ControlLogix Selection Guide</td>
<td>1756-SG001</td>
<td>Point I/O</td>
<td>This document contains the necessary information to specify the components required to build a:</td>
<td>System Specification</td>
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<td></td>
<td></td>
<td></td>
<td>- ControlLogix- based system.</td>
<td>Hardware Selection</td>
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<td>- ControlLogix Controller Comparison Table</td>
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<td>It also includes detailed step by step procedures to select ControlLogix System components:</td>
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<td>- Select I/O Devices</td>
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<td></td>
<td></td>
<td>- Select Motion Control and Drives Requirements</td>
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<td></td>
<td>- Select Communications Modules</td>
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<td>- Select Software</td>
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</table>
Notes:
Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support/, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience an anomaly within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

<table>
<thead>
<tr>
<th>United States or Canada</th>
<th>1.440.646.3434</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside United States or Canada</td>
<td>Use the Worldwide Locator at <a href="http://www.rockwellautomation.com/support/americas/phone_en.html">http://www.rockwellautomation.com/support/americas/phone_en.html</a>, or contact your local Rockwell Automation representative.</td>
</tr>
</tbody>
</table>

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

<table>
<thead>
<tr>
<th>United States</th>
<th>Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside United States</td>
<td>Please contact your local Rockwell Automation representative for the return procedure.</td>
</tr>
</tbody>
</table>

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication RA-DU002, available at http://www.rockwellautomation.com/literature/.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

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Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tél: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tél: (852) 2887 4788, Fax: (852) 2508 1846

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