Accord

Model Development

AT_CIP_1T1L C1 Model Development

Document: Development of Accord Model in Designer.

System: AT CIP Set - 1 Tank 1 Line : AT_CIP_1T1L_C1

Function: Clean In Position System with One CIP Tank

Revision: Initial 16TH May 2022

R01 20th July 2025 For Accord 4

1. Introduction

This document describes the generation of a process control model for a small CIP set using Accord Designer. The reader should be familiar with Accord Designer concept and should refer to Accord Designer Manuals and accord-platform.com support for more details. The reader should have a basic understanding of the design and use of CIP Sets.
The CIP Set is a small model and is meant for illustration of Accord Designer. The model will work as a CIP Set, and can be used as a basis for other CIP Sets.

The model is a single Program, with selection choices.

The Model can also be used with Accord Recipe, for defined CIP Sequence recipes.

This is a sample application and item names and descriptions, PLC Hardware, IP Addresses and IO addresses may be easily changed. The names in this document should match with the Model, but there may be slight differences.

Contents

2. System Description

2.1 Process Description

The system provides CIP with options, which may be used for example as;

1. Rinse
2. PreRinse, Caustic Wash and Final Rinse
3. PreRinse, Caustic Wash, Middle Rinse, Sterilant Wash, Final Rinse

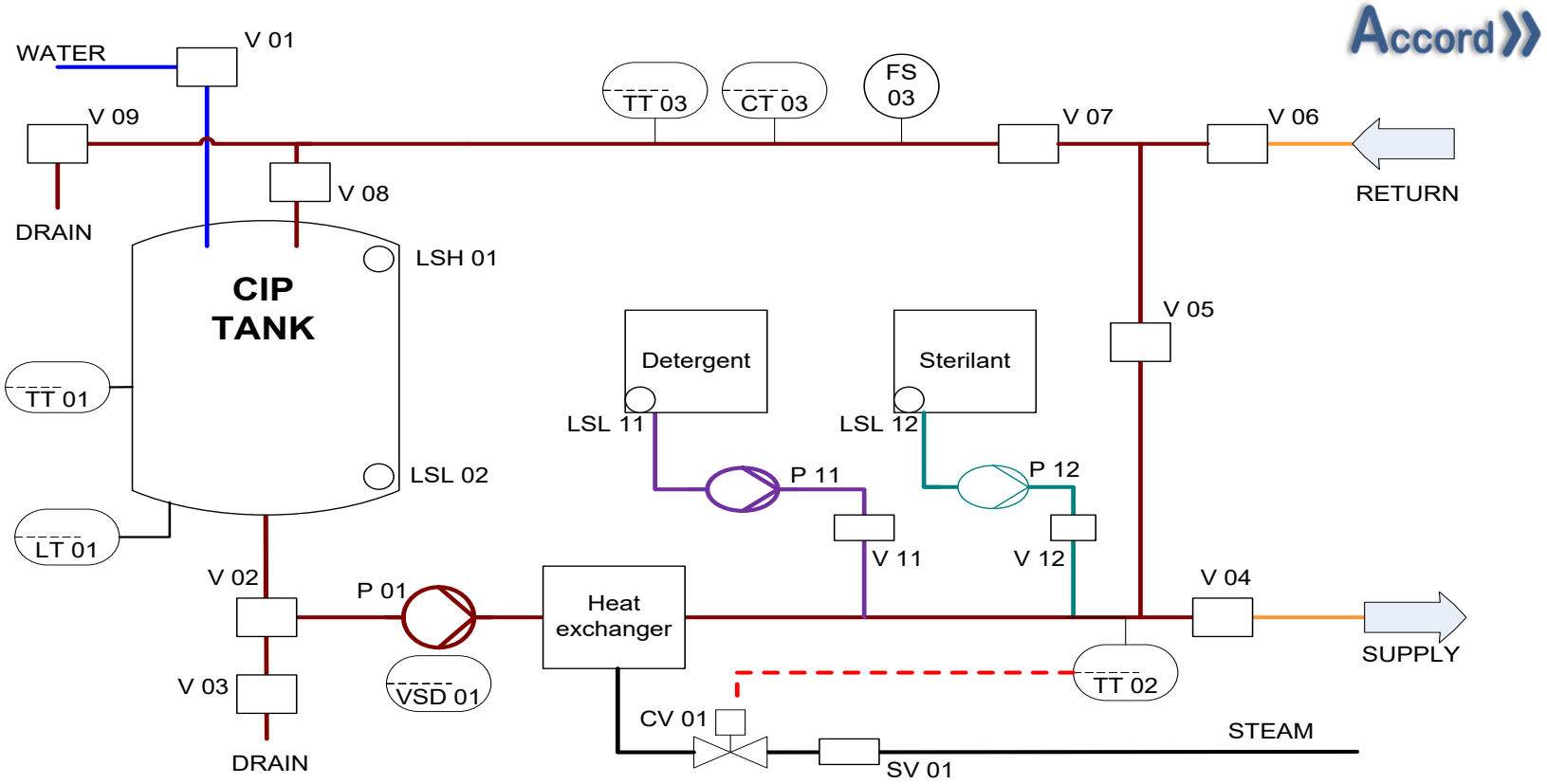
All the options are selectable on HMI

For each program the system doses and heats detergents if selected to achieve strength and temperature setpoints.
The CIP set should be flushed and drained. after each clean
The Rinses may be Hot or Cold depending on Operator Selection
The Model is configured for 1 sequence, with all setpoints contained in a common recipe
All Valves are physically normally closed, and all Feedbacks are Normally Open – Feedback True when Activated - the feedback signal is low when the valve is at rest.
There is one PID loop required, for heating of the solution at the supply side.
The CIP program to be run is selectable by the operator prior to starting, by means of Buttons on the HMI Screens.

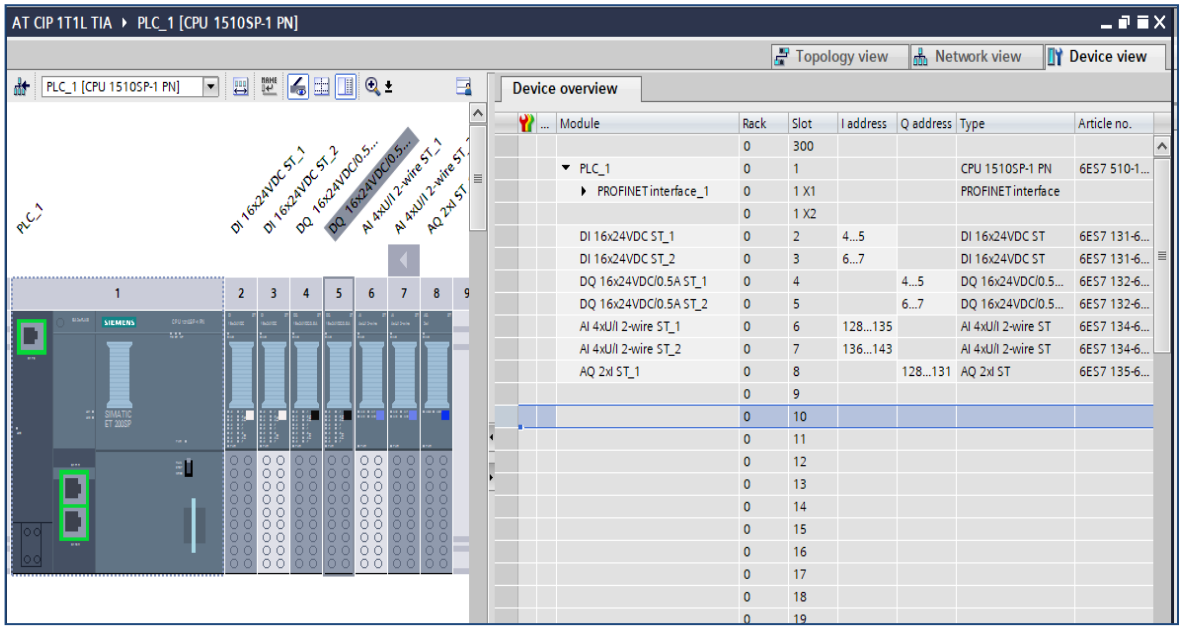
In this document the Plant being cleaned is named with generic name 'Plant' or 'Product System'

2.2 P&ID Diagram

Representation of a Single Tank CIP System.



2.3 Siemens Simatic PLC



The system may use a Siemens S7 PLC. For example a suitable S7 PLC based on ET200SP CPU is shown.

The Siemens PLC hardware is configured using TIA.

2.4 System Components and Electrical I/O Assignment.

2.4.1 Analog Instruments

Name	Description	IW
LT 01 CIP Tank Level	CIP Tank Level Transmitter	128
TT 01 CIP Tank Temperature	CIP Tank Temperature	130
TT 02 Supply Temperature	CIP Supply Line Temperature	132
TT 03 Return Temperature	CIP Return Line Temperature	134
CT 03 Return Conductivity	CIP Return Conductivity	136

2.4.2 Analog Devices

Name	Description	QW
CV 01 Steam Control	CIP Supply Heating Control Valve	128
VSD 01 CIP Supply Pump	Speed Control of CIP Supply Pump	130

2.4.3 Digital Instruments

Name	Description	I
LSL 02 CIP Low Level	CIP Tank Low Level Switch	6.0
LSH 01 CIP High Level	CIP Tank High Level Switch	6.1
LSL 11 Detergent Low Level	Detergent Tank Low Level Switch	6.2
LSL 12 Sterilant Low Level	Sterilant Tank Low Level Switch	6.3
FS 03 Return Flow	CIP Return Line Flow Switch	6.4

2.4.4 Valves

Name	Description	I	Q
V 01 Water Supply	Water Supply from Mains to CIP Tank	4.0	4.0
V 02 CIP Tank Outlet	CIP Tank Outlet to Supply line	4.1	4.1
V 03 CIP Tank Drain	CIP Tank Drain Valve	4.2	4.2
V 04 CIP Forward to Plant	CIP Forward to Product System	4.3	4.3
V 05 CIP ReCirculation	CIP from Supply to Recirculation	4.4	4.4
V 06 CIP Return from Plant	CIP Return from Product System	4.5	4.5
V 07 CIP Return to Line	CIP Return towards CIP Tank	4.6	4.6
V 08 Return to CIP Tank	CIP Return into CIP Tank	4.7	4.7
V 09 CIP Drain	CIP Return Line Drain	5.0	5.0
V 11 Detergent Supply	Detergent Dosing into CIP Supply Line	5.1	5.1
V 12 Sterilant Supply	Sterilant Dosing into CIP Supply Line	5.2	5.2
SV 01 Steam Supply	Steam for Heat Exchanger Solenoid	5.3	

2.4.5 Motors

Name	Description	I	Q
P01 CIP Supply Pump	CIP Supply Pump	5.4	5.4
P11 Detergent Dosing Pump	Detergent Dosing Pump	5.5	5.5
P12 Sterilant Dosing Pump	Sterilant Dosing Pump	5.6	5.6

2.4.6 Signals

Name	Description	Q
CIP Supply Lamp	CIP Supply Lamp	5.7

The I/O Assignment is given in Siemens format. Other PLC types will have different formats. The Model is supplied from site for use in Accord Emulator and PLC with I/O in Siemens addressing format.

3. Step 1 - Equipment Configuration

This Model contains 1 Tank equipment unit and 6 Line equipment units. Line Units are made up of items between two block valves, or between a block valve and a drain valve. The arranging of devices in units allows for device error handling in S88 style. (https://en.wikipedia.org/wiki/ISA-88).

The built-in Accord Device and Unit handling concept;

1. If an Equipment item is configured to cause Unit Error (Alarm), then the item Error will automatically put the Unit into Error. If the Unit is part of a program then the program will go into Alarm status if it is Active.

2. An Equipment item placed in Manual will also automatically put the Unit into a 'Equipment in Manual' state. This state may also be used to cause a Program Alarm.

3. An Equipment item placed in Maintenance will also automatically put the Unit into a 'Equipment in Maintenance' state. This state may also be used to cause a Program Alarm.

3.1 Representing the Equipment in terms of Units

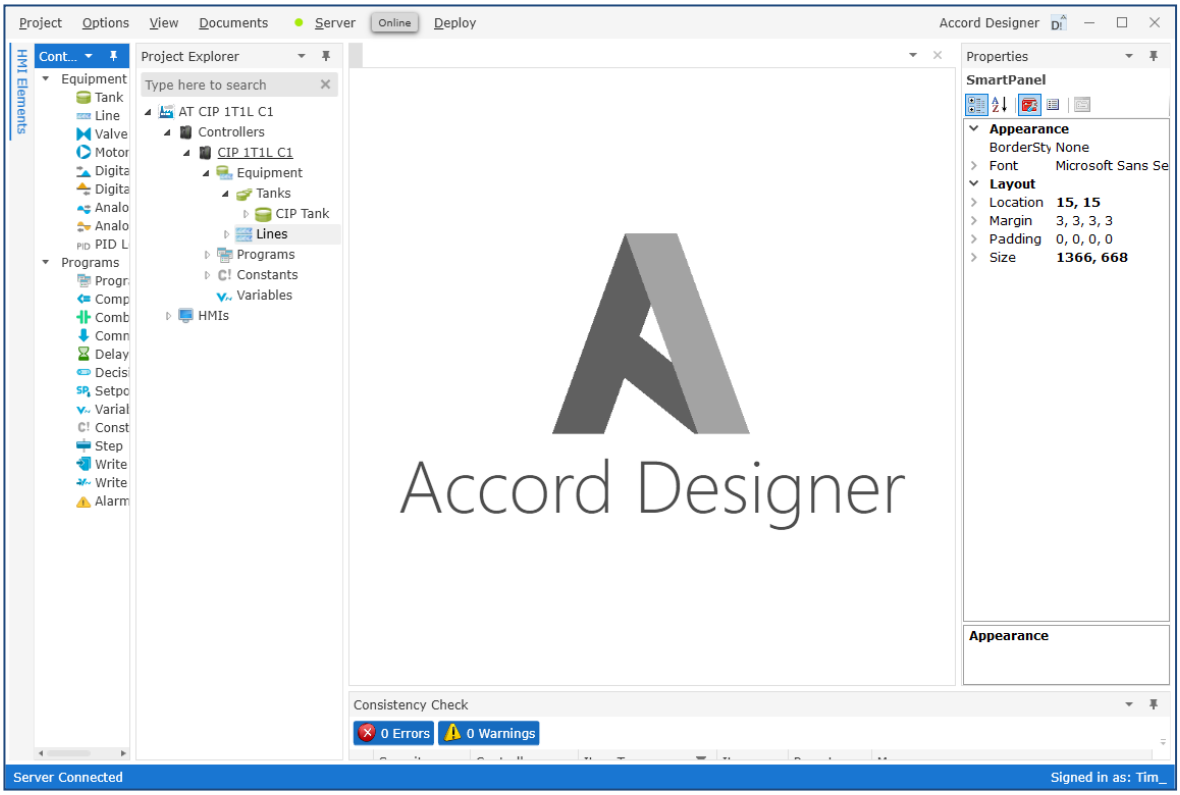
The model is considered as 6 Equipment Units,

1.	CIP Tank	a Tank Unit
2.	CIP Supply Line	a Line Unit
3.	CIP Return Line	a Line Unit
4.	Steam Supply	a Line Unit
5.	Detergent Supply	a Line Unit
6.	Sterilant Supply	a Line Unit

Procedure:
1. The CIP Tank unit is generated by dragging a Tank icon into the Tank group or by right-clicking on the Tank Group and left-clicking on Add Tank
2. CIP Supply Line unit is generated by dragging a Line icon into the Line group or by right-clicking on the Line Group and left-clicking on Add Line
3. The other lines may be generated in a similar manner or by copying an existing Line and Pasting and Renaming

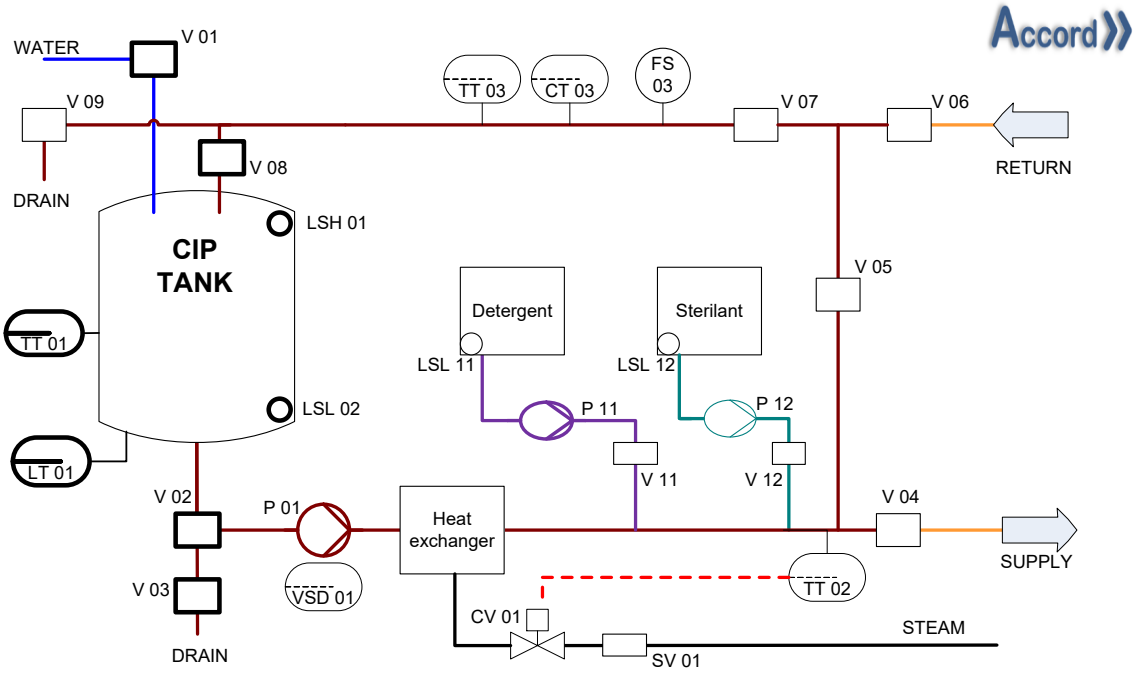
3.2 Insertion of CIP Tank Unit

The Unit is inserted by dragging in the Tank Unit Type icon into the Tank Group and naming it as CIP Tank



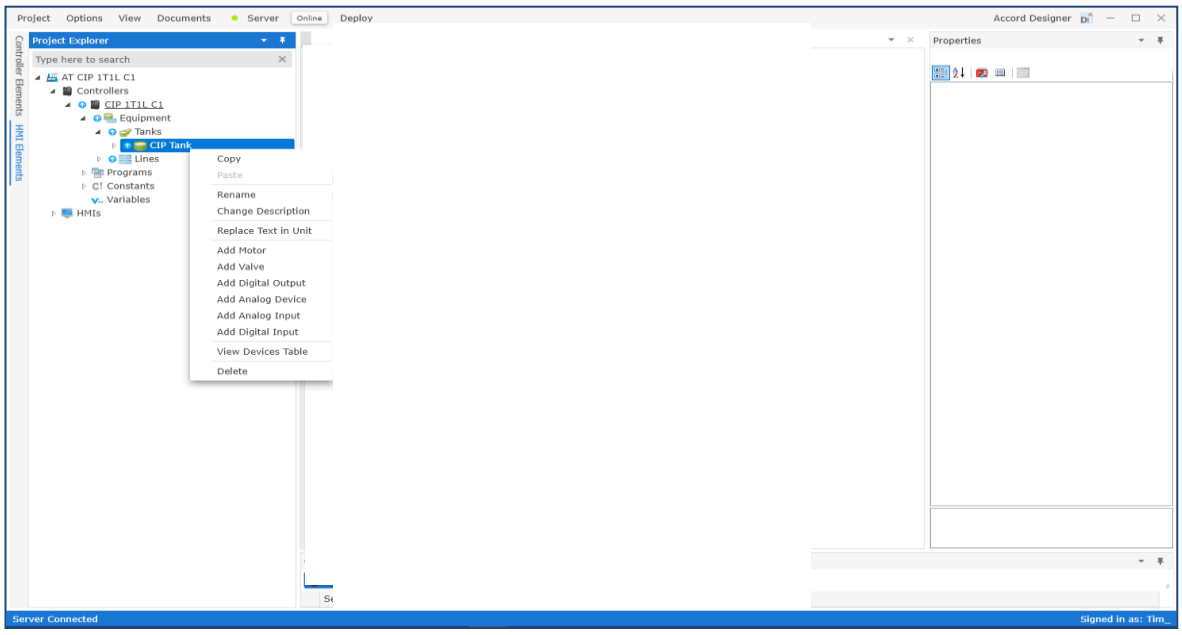
3.3 Configuration of CIP Tank Tank Unit

Unit is composed of V 01, V 08, V 02, V 03, LT 01, TT 01, LSH 01, LSL 02

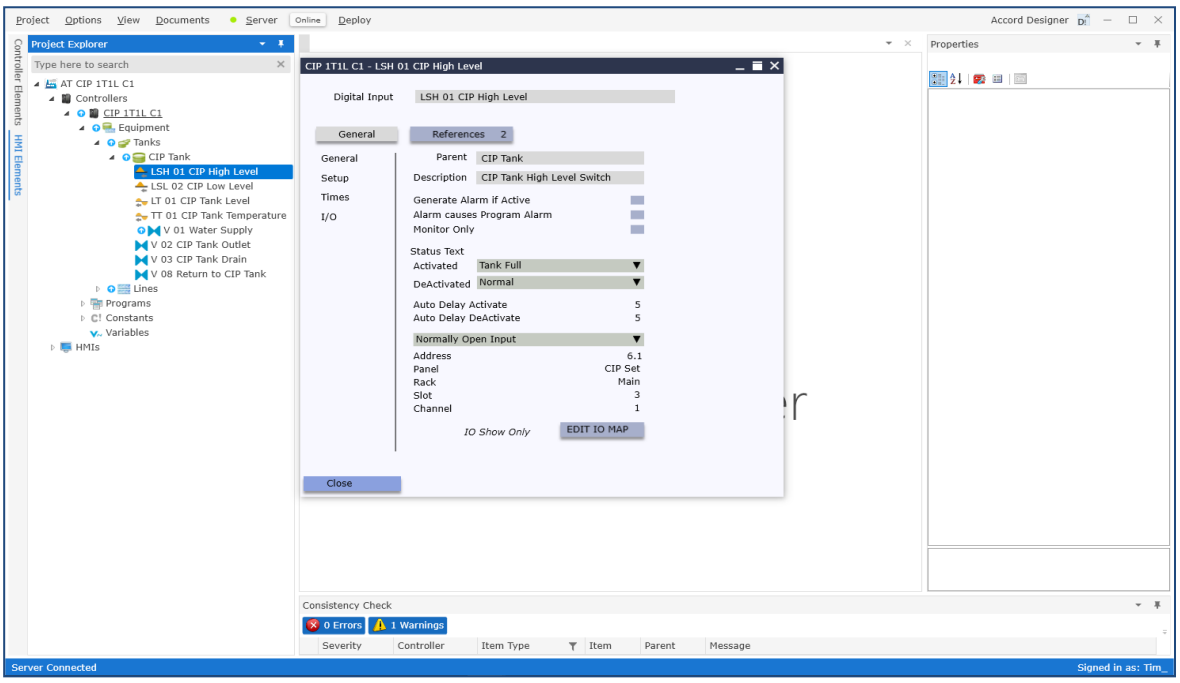


3.4 Adding an Equipment Device to CIP Tank Unit

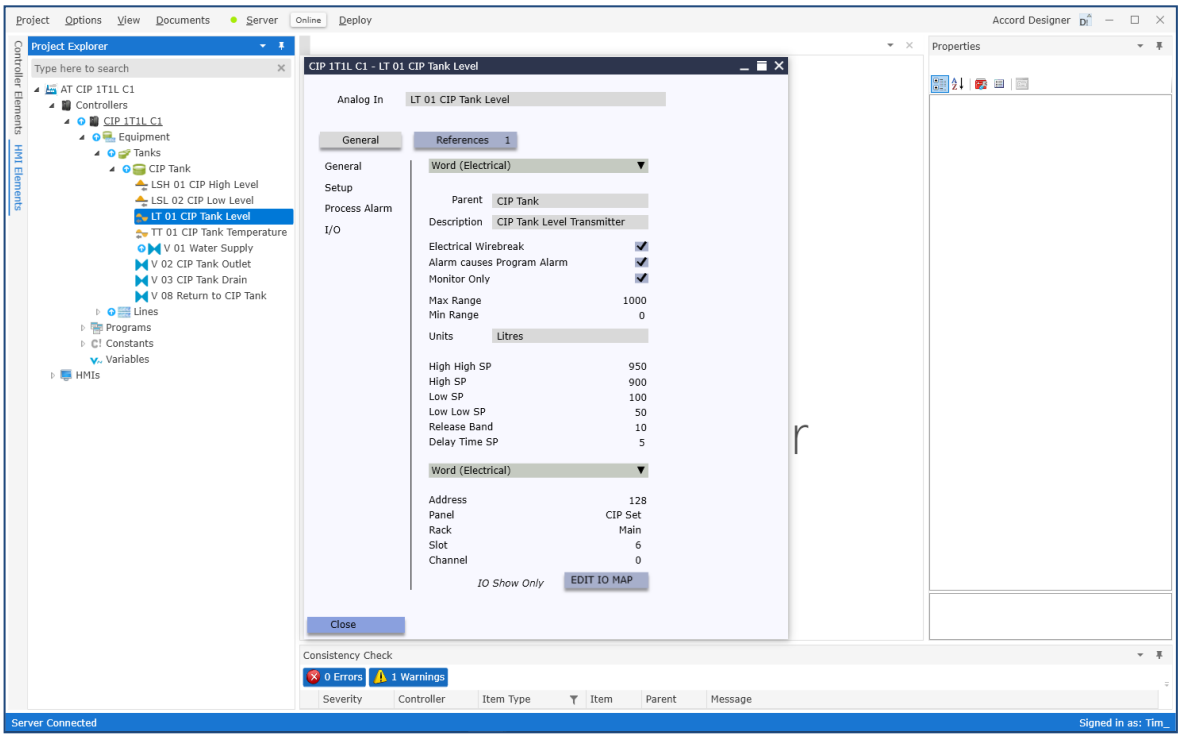
Devices can be added to Units by selecting the device type in right-click menu or selecting the Device type in the Controller Elements and dragging it in to the Unit. Devices may also be re-named, copied and deleted in the Unit.



3.5 Setup of Analog and Digital Inputs



Devices are configured after being placed in the Unit
Setup of Description, Settings, I/O Address for LSH 01 CIP Tank High Level

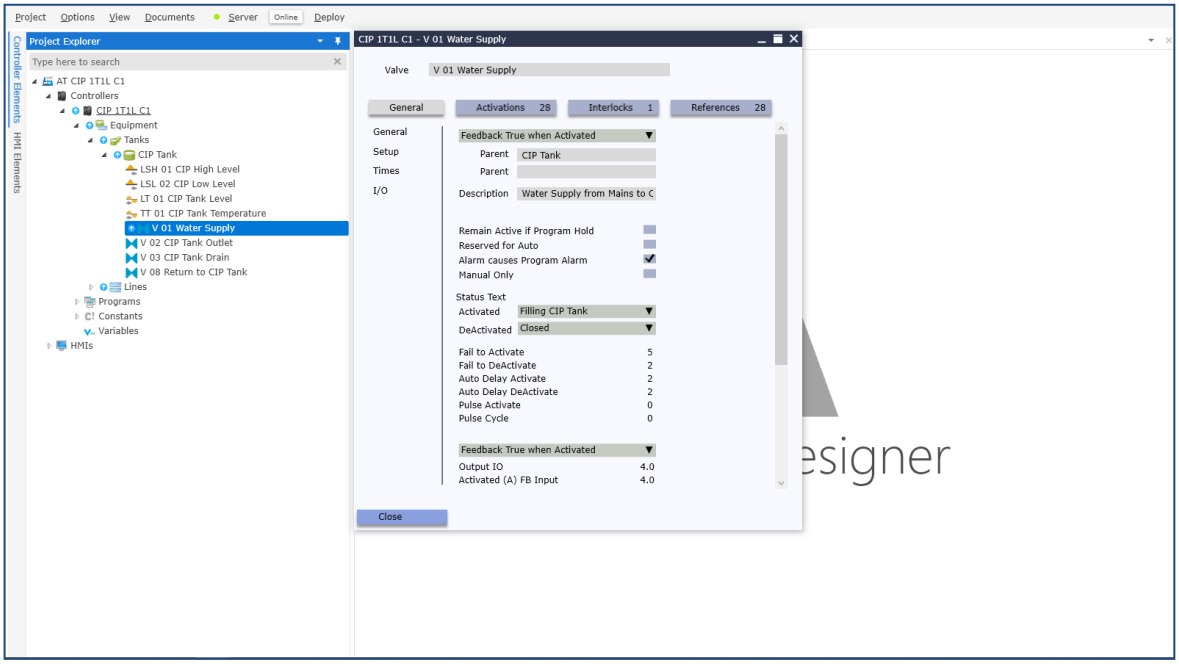


Setup of Analog Input Tank Level LT01

3.5.1 Setup of Analog Input Process Alarms

The instrument is assigned Limits, Process Alarm levels, Process Alarm Delay Timer setpoint and Hysteresis value.
the Process Alarm occurs when the Instrument value passes a Process Alarm for the number of seconds in the Delay Time SP. The Alarm is released when the Value recovers by the Hysteresis value. In the LT 01 instrument above the High Alarm is shown when Level is above 900 for 5 seconds and is released when the value is below 890 again.

3.6 Setup of a Valve.

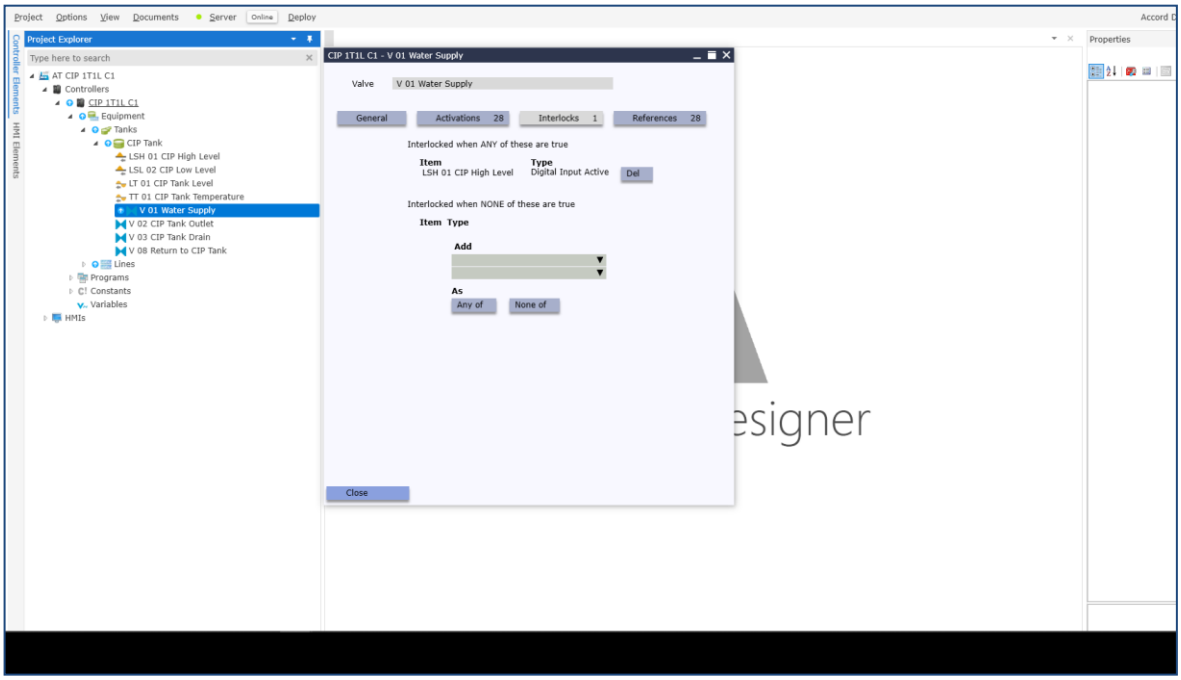


The Valve is a Single Feedback type, whose Feedback signal is True/High when the Valve is Activated. The Setpoints for Time will be used to determine valve behaviour and the 'grace' Time for the Valve to go into Alarm (Error).

The Valve will not remain Activated (Open) when the Program is in Alarm. The Valve is not configured for Pulsing based on a condition in the Program. The Valve is not Enable Reserved for Automatic, so it will be always available for Manual operation.
The Valve is not configured for Manual operation Only, so it must be referenced for Activation in a Step in a Program, for consistency.

The I/O is standard Siemens addressing.
The State Text will be used in HMI control faceplate for the valve.
A brief description may be written in the Short Description.

3.6.1 Setup of Valve Interlocks.



Interlocks are applied by selecting the type of interlock and then the particular interlocking item.

Two types of interlock are available;

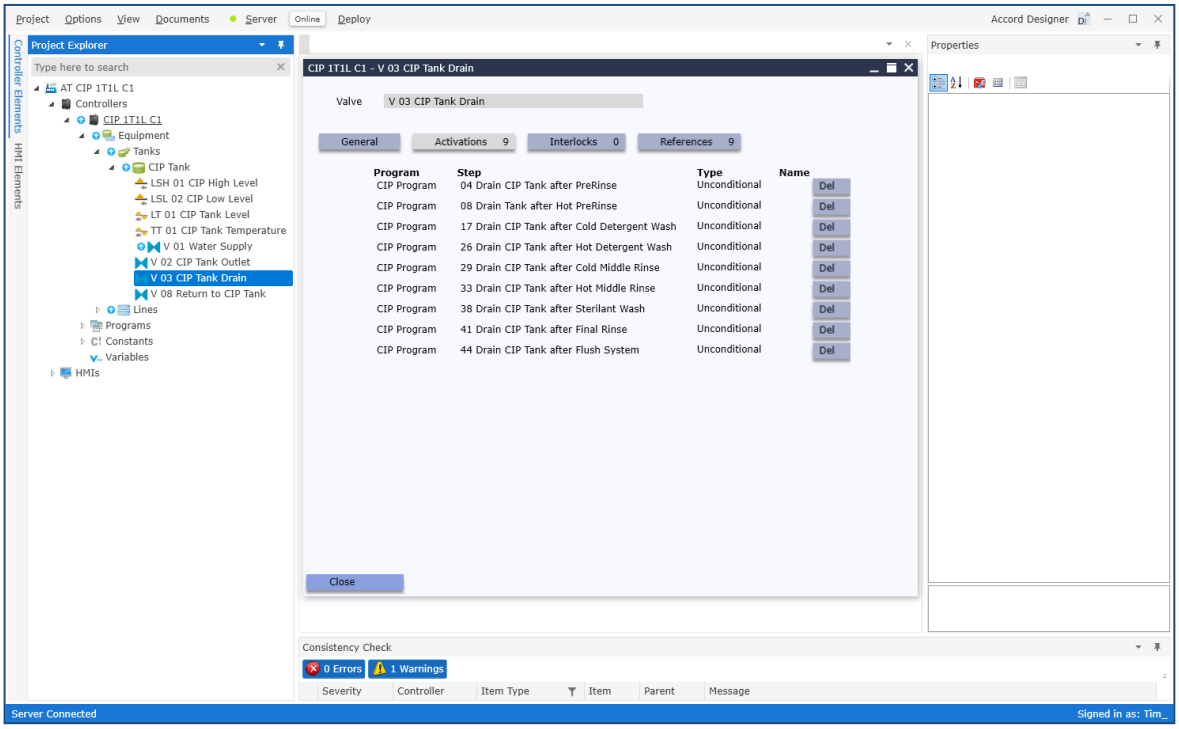
Interlocked when None; Valve is Interlocked if no item in the list is True, and / or
Interlocked when Any; Valve is Interlocked if any in the list item is True

With regard to operation then these are
Interlocked when None; One item in the list must be True for Valve to operate

Interlocked when Any; All items in the list must be False for Valve to operate

The Interlock applies to Manual and Automatic (Program / Sequenced) operation.

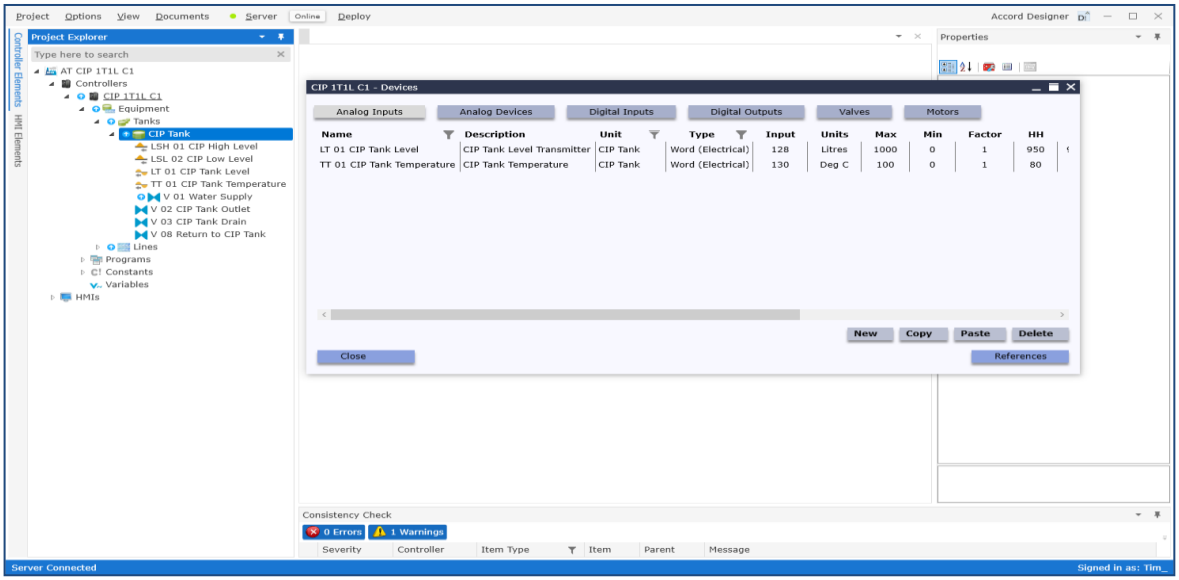
3.6.2 Valve Activations Tab



List of Valve Activations when configured in Programs.

3.7 Completion of CIP Tank configuration

Other Valves and Instruments are then added and configured.

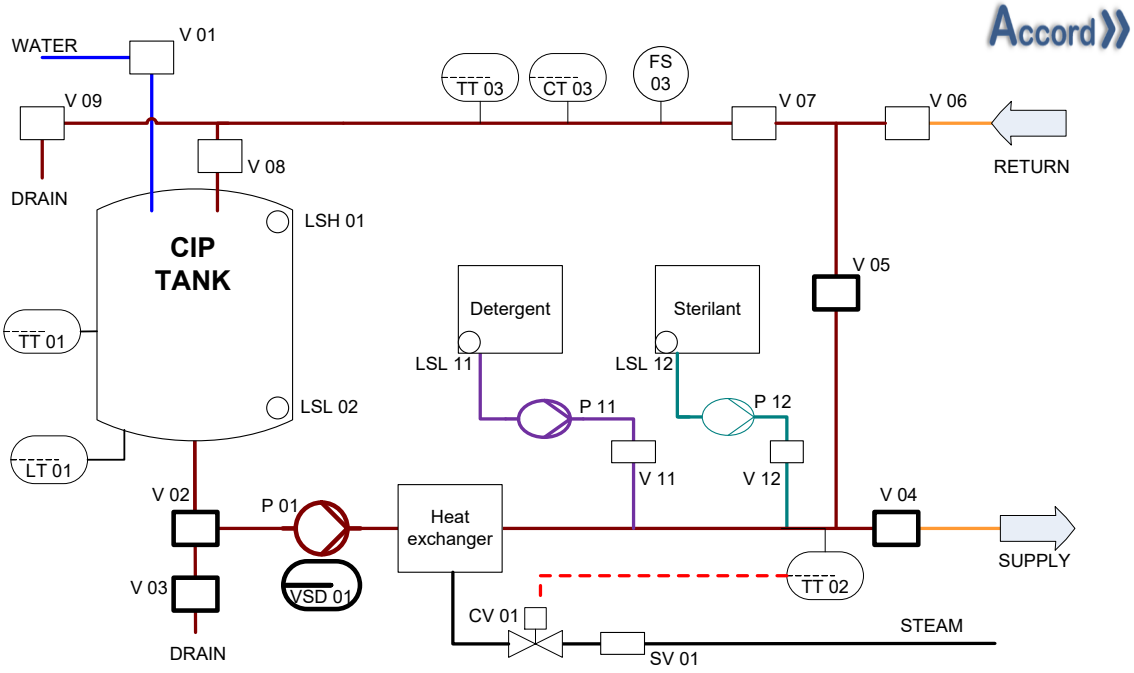


A table of Equipment in the Unit can be obtained by right clicking on the unit and selecting View Device Table.

3.8 Configuration of the Lines

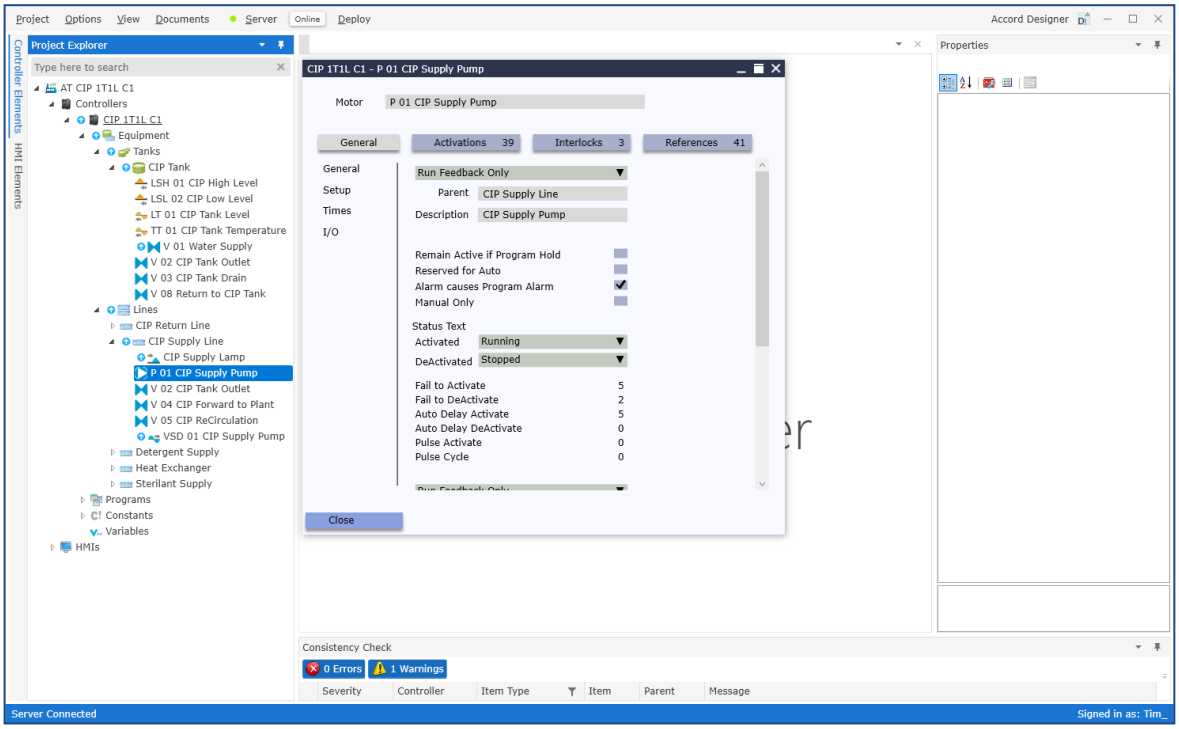
3.8.1 Supply Line Line Unit

This Unit is composed of V 02, V 03, P 01, VSD 01, V 04, V 05.



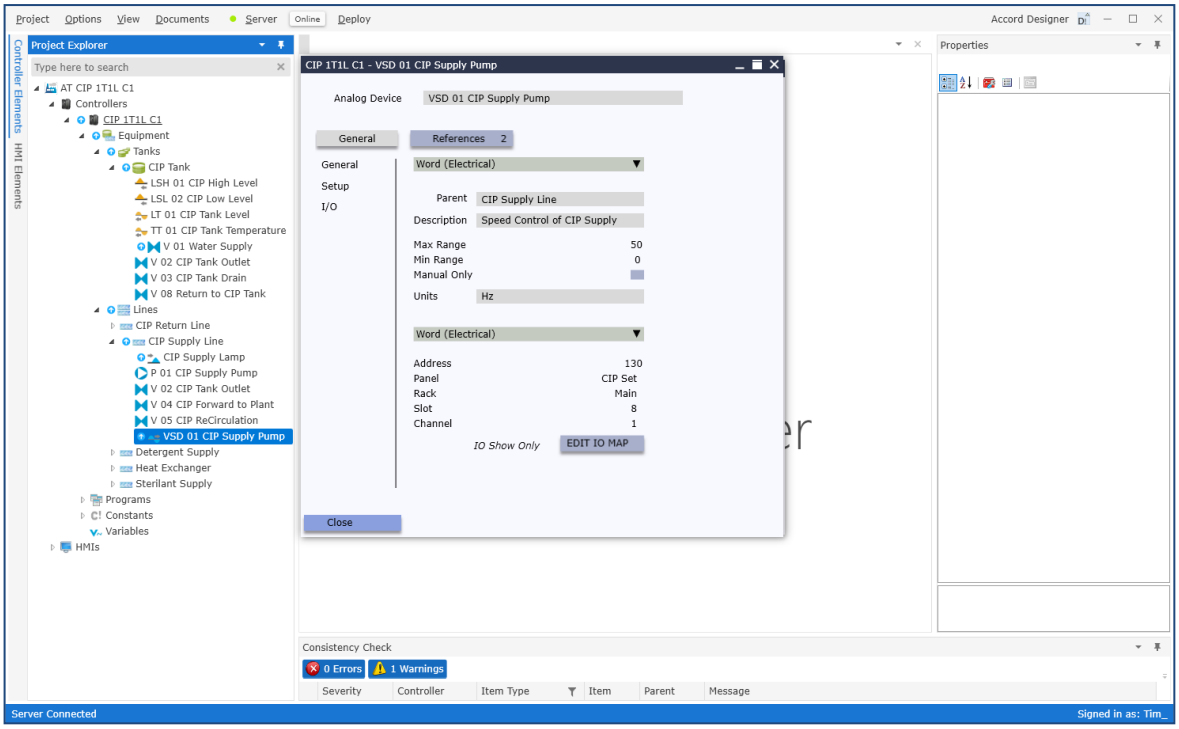
The unit is added by Right-Click and add in the Lines Group or dragging the line unit icon into the Lines Group.

3.8.2 Configuration of the CIP Supply Pump



A Motor may be added to the Unit by dragging a Motor from the toolbox into the Unit or by Right-Clicking on the Unit and adding the Motor.
The Motor is configured for a Run Feedback, which will be High/True when the Motor is running. Trip and/or Isolator Feedbacks could also be configured.
Remaining items in the configuration are set-up per Valves.

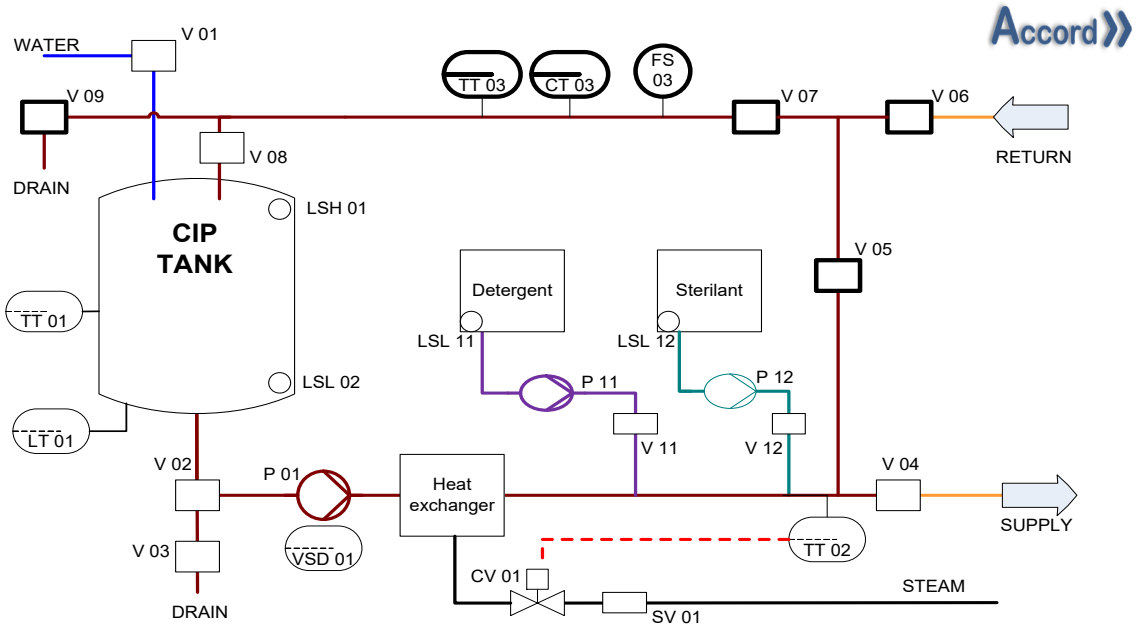
3.8.3 Variable Speed Drive Set-up.



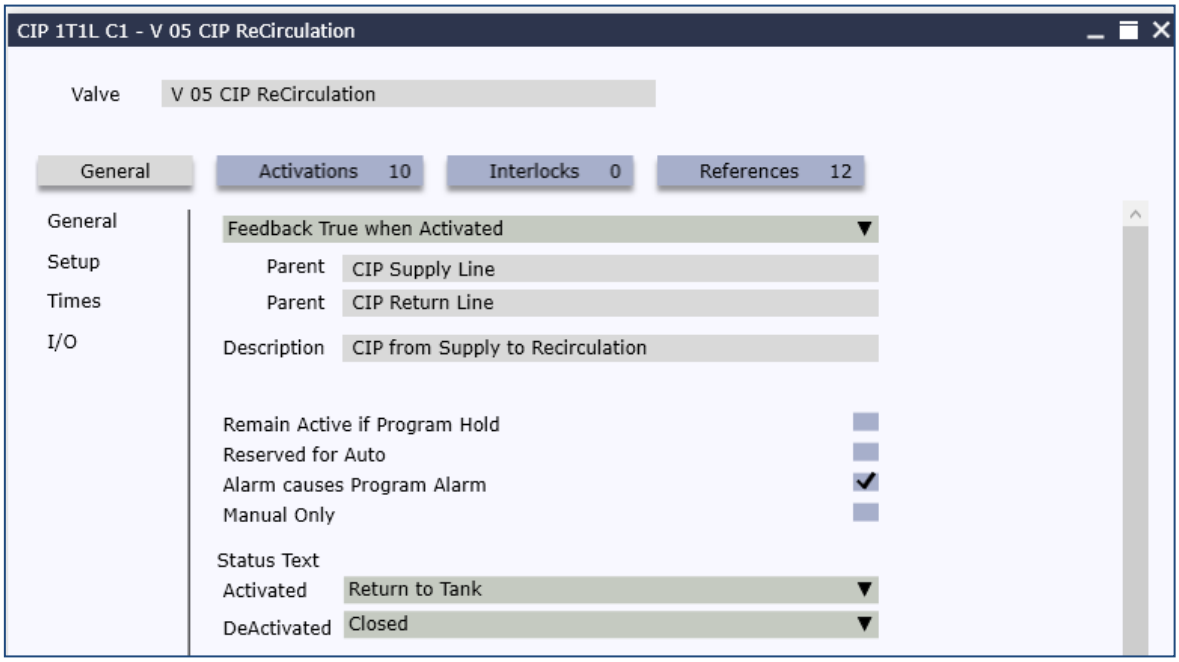
Variable Speed Drive Set-up.
The I/O address is a standard Siemens type. The item I/O address is set-up for standard Electrical item. It may also be addressed as a Bus based item which receives a scaled Integer or Real number setpoint from the PLC.
The item is given an operating range for control. These limits will be auto applied at HMI also.

3.8.4 Configuration of Return Line Line Unit

Unit is composed of V 05, V 06, V 07, V 08, V 09, TT 03, CT 03, FS 03.

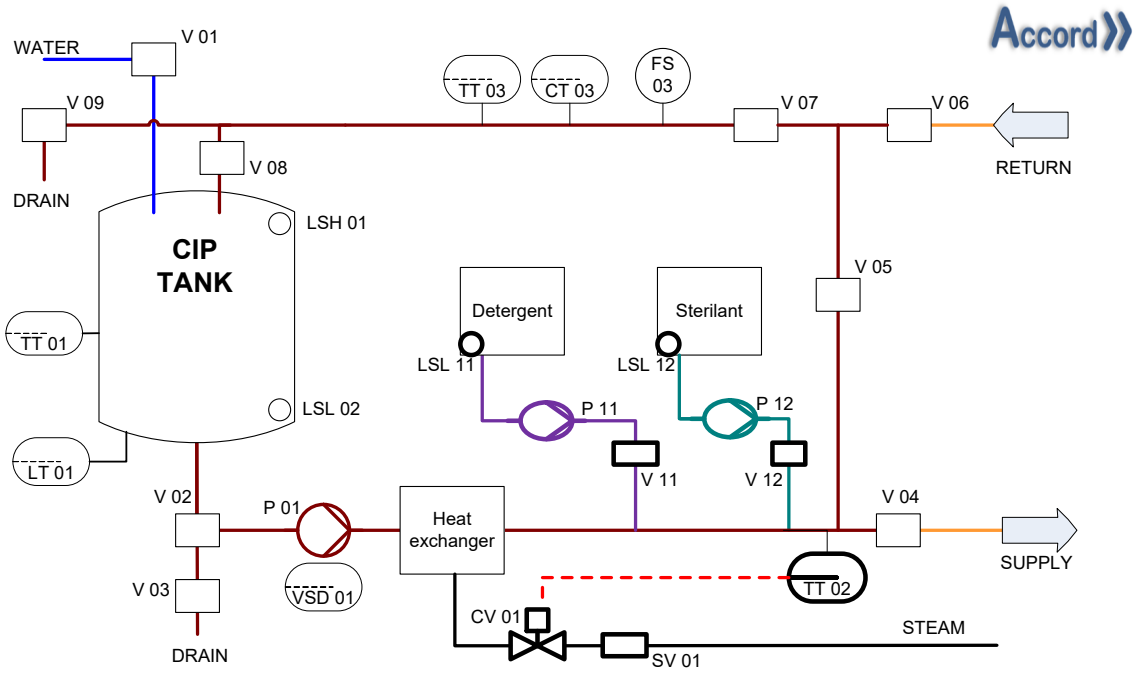


Again the unit is dragged in, or added, and the equipment items are then added and configured.
Note Valve V05 is part of the Supply and Return Lines.



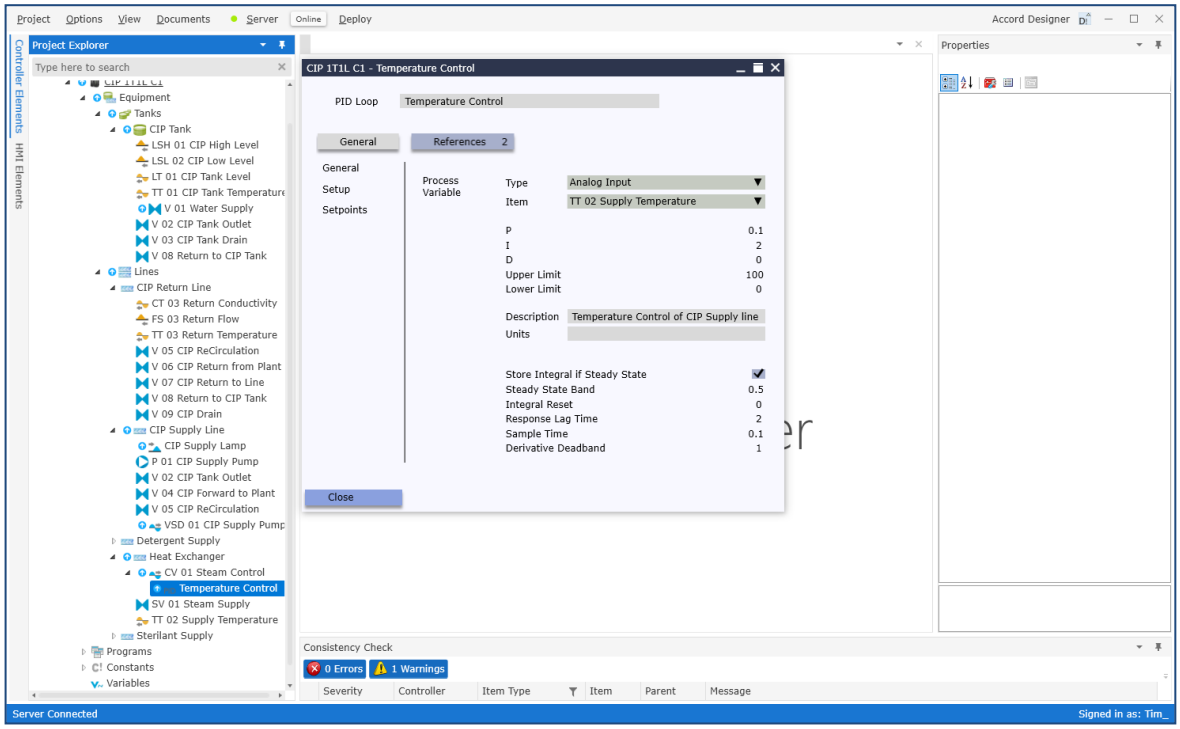
3.9 Remaining Lines

Steam Supply	Line Unit	Composed of SV 01, CV 01, TT 02
Detergent Supply	Line Unit	Composed of V 11, P 11, LSL 11
Sterilant Supply	Line Unit	Composed of V 12, P 12, LSL 12



The remaining Lines are added to the system by dragging in the line icon or by Right-Clicking and adding the Lines. The lines are then configured by adding the required Equipment Items and configuring them as required.

3.10 Configuration of the PID Loop for the Steam Supply Heat Exchanger.



The PID loop is given initial P, I and D setpoints, but these will probably change when the loop is being tuned. The selection of the process variable is selected (the Supply Line Temperature) and other settings will remain for the Loop.

3.11 Summary of Allocating Devices in the Units.

The Valves, Motors, switches etc. are allocated and configured within the respective Units.
Each item may be assigned by one of the following;

1. Drag an icon for the object type into the appropriate Unit from the object toolbox

Or

2. Right-click on the Unit and insert appropriate object

Or

3. Copy / Paste and Rename of an existing object of similar type

On insertion of an item in a unit the item is named and is allocated I/O addresses and a short description.
The other information for I/O point configuration for Rack/Slot/Channel and Descriptions is also filled in. This may be also filled in later using the Edit I/O table facility. All the short descriptions for the items in a unit may be allocated by filling in the grid which is available by left-clicking on the Unit.

3.11.1Assigning Device Objects that belong to two Units

The Valves V 02 and V 08 are both part of the Tank Unit and Line Units. V 02 is part of the Tank and the Supply Line, and V 08 is part of the Tank Unit and the Return Line. The Valves should be configured in the Tank Unit and then "Copy" and "Paste to Second Parent" in order to achieve this. Both Parent units will appear in the valve details.

In the same manner, V 05 is part of the Supply and Return Lines.

4. Step 2 - Program Configuration

When a Program is placed in a system the Program containers are automatically generated. These containers are for Steps, Comparisons, Combinations, Alarms, Delays, Decisions, Commands, Setpoints, Writes to Values and Writes to Program.

4.1 Adding a Single Program to control the system.

The Program is generated by

1. Dragging the Program icon from the Controller Elements into the Program sections in the Project tree.

Or

2. Right-click in the Program Section and select 'Add Program'.

Program sub-sections are then generated automatically.

These sub-sections are for the following components

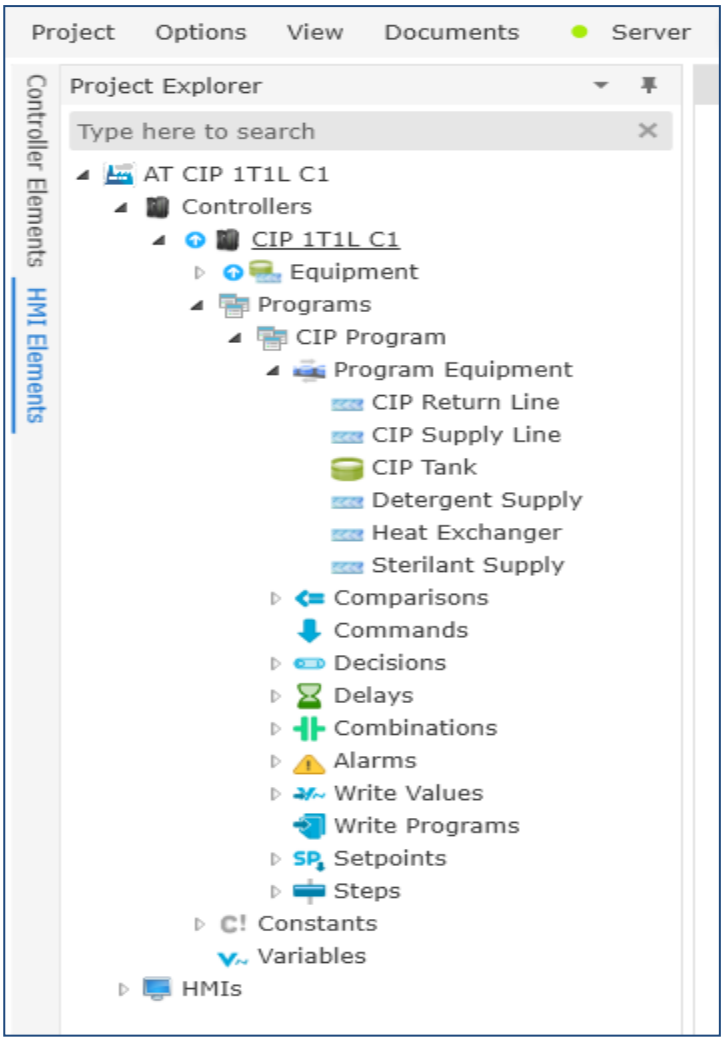
Equipment Units	Equipment Units
Comparisons	Single state checks
Combinations	Checks on multiple items; Logic functions
Alarms	Critical and non-critical Alarms and Events
Writes Values	Changing Values
Writes Values	Changing program status
Steps	Lists of Alarms, Writes, and Activations
Setpoints	Targets for Process Values
Decisions	On/Off selections for program options
Step Order	The order of processing of steps.

Recipes, configurable in Accord Recipe Manager, can consist of new settings for Setpoints, Decisions and Step Times.

4.2 Placing Units in the Program

This program will need to reserve (select) all the Equipment Units. For this program all of the Units (Tank, Supply, Return, Detergent, Sterilant, Steam) must be dragged to the Program Route Unit holder.

The Program will be operated in terms of steps, each of which has particular alarms, writes, activations and step-on functionality, and items in the steps are configured using elements such Comparisons and Combinations.



Insertion of the CIP Program and Units into the Program Equipment holder

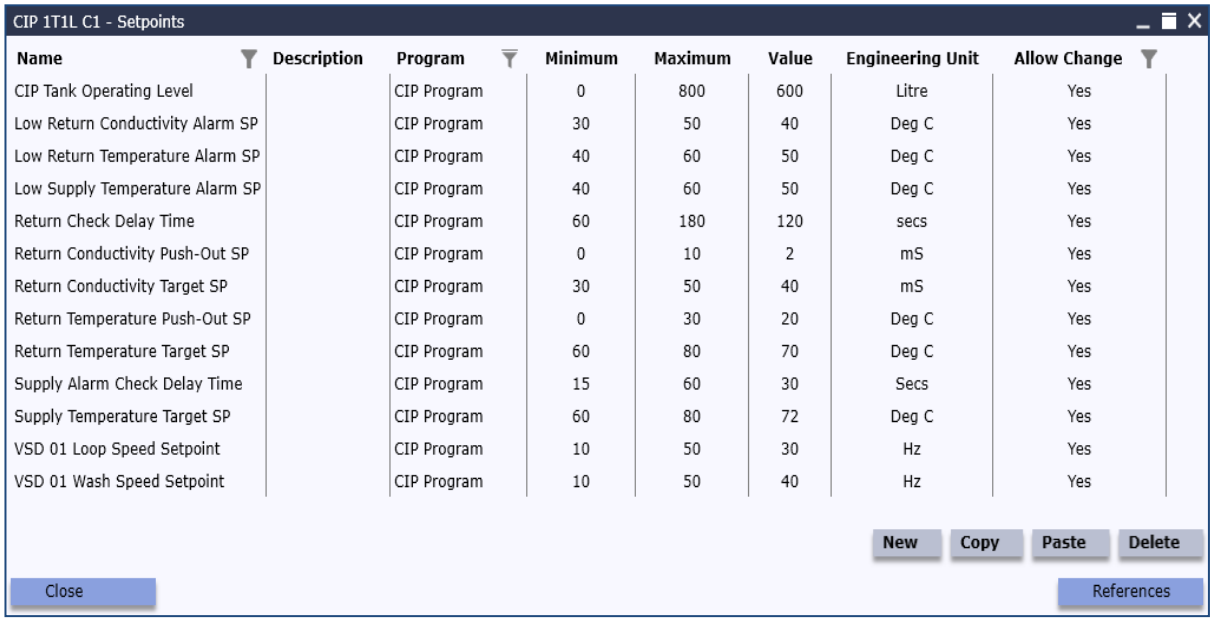
4.3 Common items in the Program

These items are evaluated or used during the program, regardless of which step the program is in.

4.3.1 Setpoints

The Setpoints are added in the Setpoints section, by Right-Click and New, or by Copy and Paste.
Each Setpoint is a 32-bit Real, Floating Pt Number, and is defined with Maximum, Minimum and Default Values and the Engineering Units associated with the Setpoint.
All Setpoints are accessible at HMI or Scada or Recipe Manager, and for HMI or Scada may be configured to be Changeable when Program is running (Yes) or to be only changeable when Inactive (before the program is started.)

Name	Min	Max	Default	Eng. Unit	Allow Change when Active
CIP Tank Operating Level	0	800	600	Litre	Yes
Low Return Conductivity Alarm SP	30	50	40	Deg C	Yes
Low Return Temperature Alarm SP	40	60	50	Deg C	Yes
Low Supply Temperature Alarm SP	40	60	50	Deg C	Yes
Return Check Delay Time	60	180	120	secs	Yes
Return Conductivity Push-Out SP	0	10	2	mS	Yes
Return Conductivity Target SP	30	50	40	mS	Yes
Return Temperature Push-Out SP	0	30	20	Deg C	Yes
Return Temperature Target SP	60	80	70	Deg C	Yes
Supply Alarm Check Delay Time	15	60	30	Secs	Yes
Supply Temperature Target SP	60	80	72	Deg C	Yes
VSD 01 Loop Speed Setpoint	10	50	30	Hz	Yes
VSD 01 Wash Speed Setpoint	10	50	40	Hz	Yes

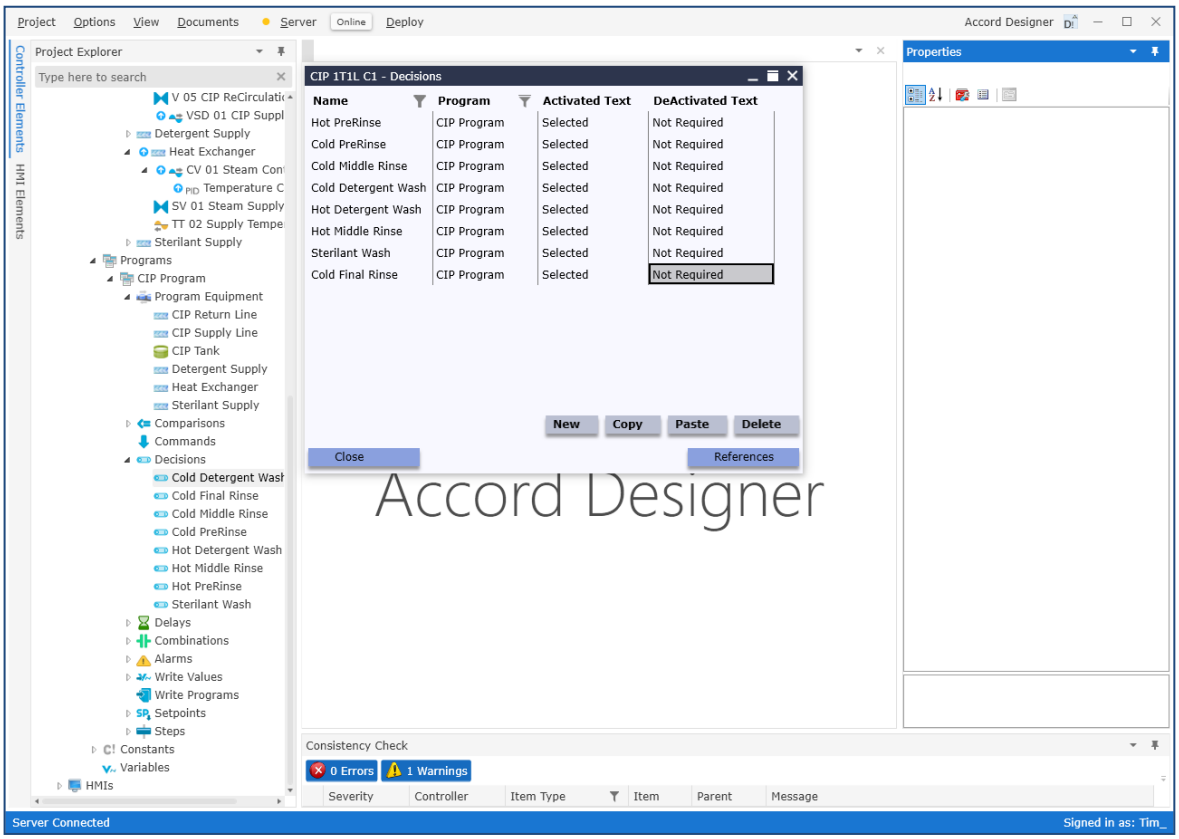


Decisions

The following Decisions are configured for program selections.

1. Cold PreRinse
2. Hot PreRinse
3. Cold Detergent Wash
4. Hot Detergent Wash
5. Cold Middle Rinse
6. Hot Middle Rinse
7. Sterilant Wash
8. Cold Final Rinse

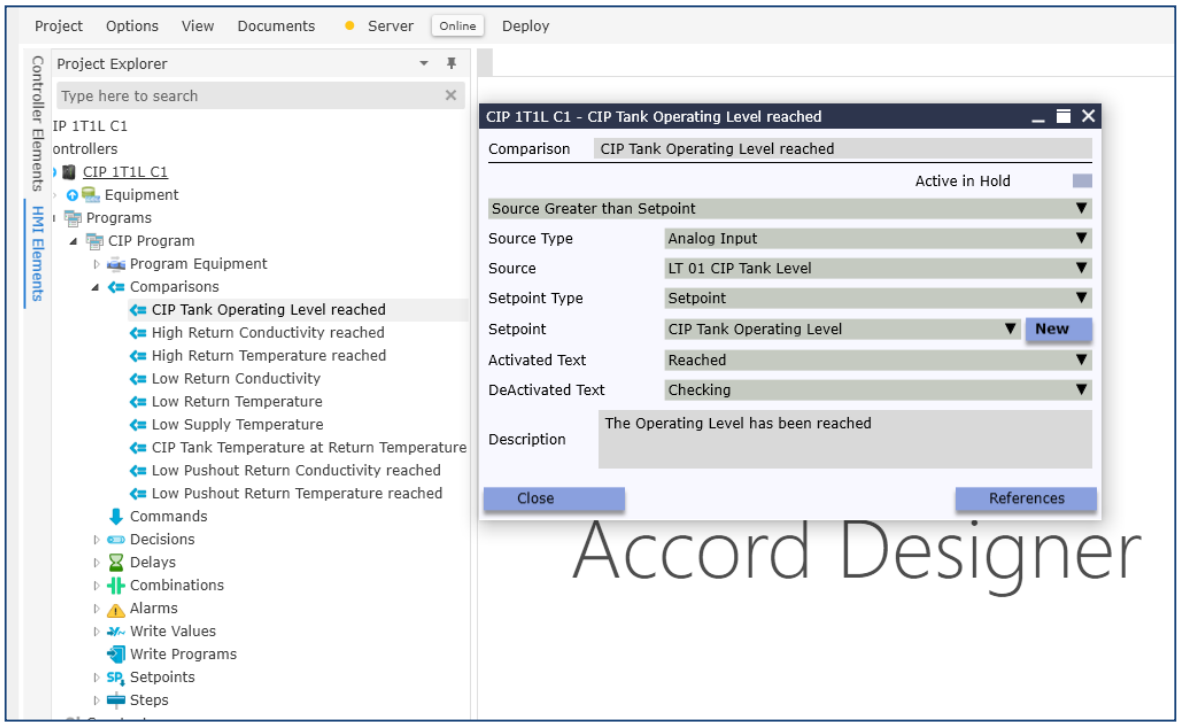
Each of these are used to enable Step Transitions and may also be examined in Combinations etc. They can be represented as a Decision on the HMI Screens and can be accessed in Recipe Manager also.



4.3.2 Comparisons

Comparisons Value Checks, that monitor values are configured by selecting setpoint type and item, source type and item. The result of the comparison is true when the condition is met.

1. High Return Temperature reached
   Return Temperature TT 03 greater than Return Temperature Setpoint
2. High Return Conductivity reached
   Return Conductivity CT 03 greater than Return Conductivity Setpoint
3. Low Pushout Return Temperature reached
   Return Temperature TT 03 less than the Return Temperature Push-Out Setpoint
4. Low Pushout Return Conductivity reached
   Return Conductivity CT 03 less than the Return Conductivity Push-Out Setpoint
5. Low Supply Temperature - Temperature not reached
   Supply Temperature TT 02 less than the Supply Temperature Setpoint
6. CIP Tank Operating Level reached
   Tank Level LT 01 greater than the CIP Tank Operating Level
7. CIP Tank Temperature reached Return Temperature SP
   Tank Temperature TT 01 greater than Return Temperature Setpoint
8. Low Return Temperature
   Return Temperature TT 03 less than Return Temperature Setpoint
9. Low Return Conductivity
   Return Conductivity CT 03 less than Return Conductivity Setpoint

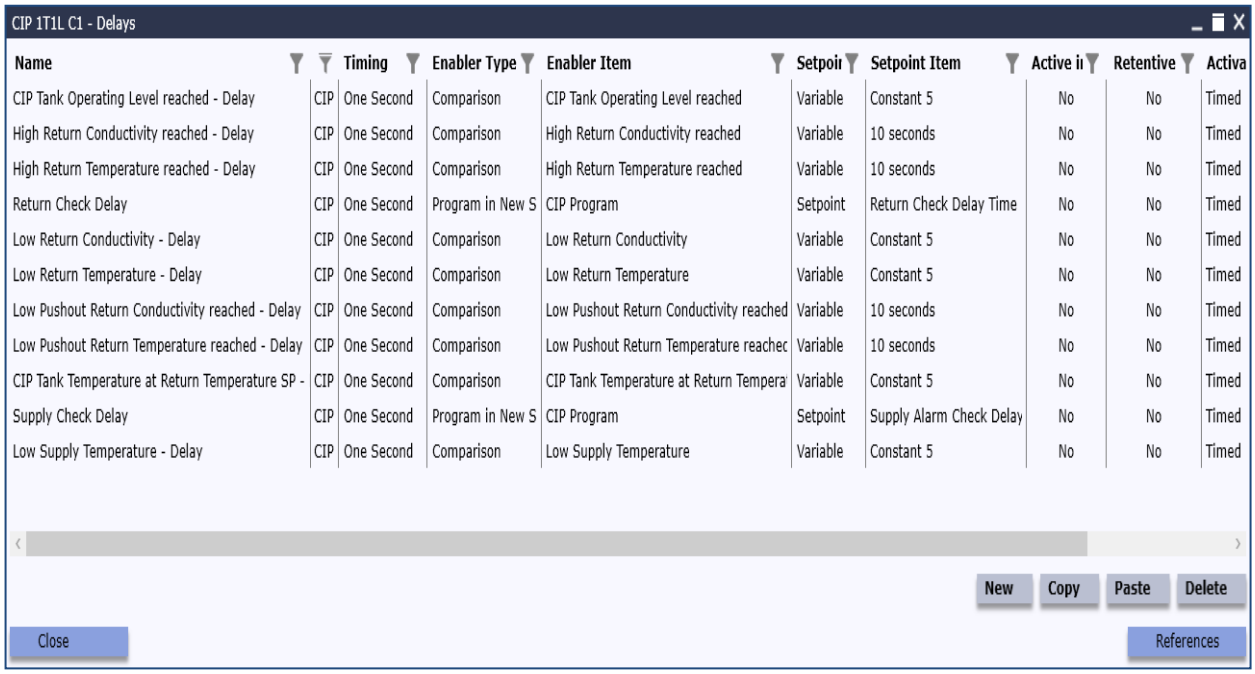


Set-up of an Analog Test Comparison.

4.3.3 Delays

These are timed events - the enabling condition must be true/present for the time setpoint in order for the result to go true.

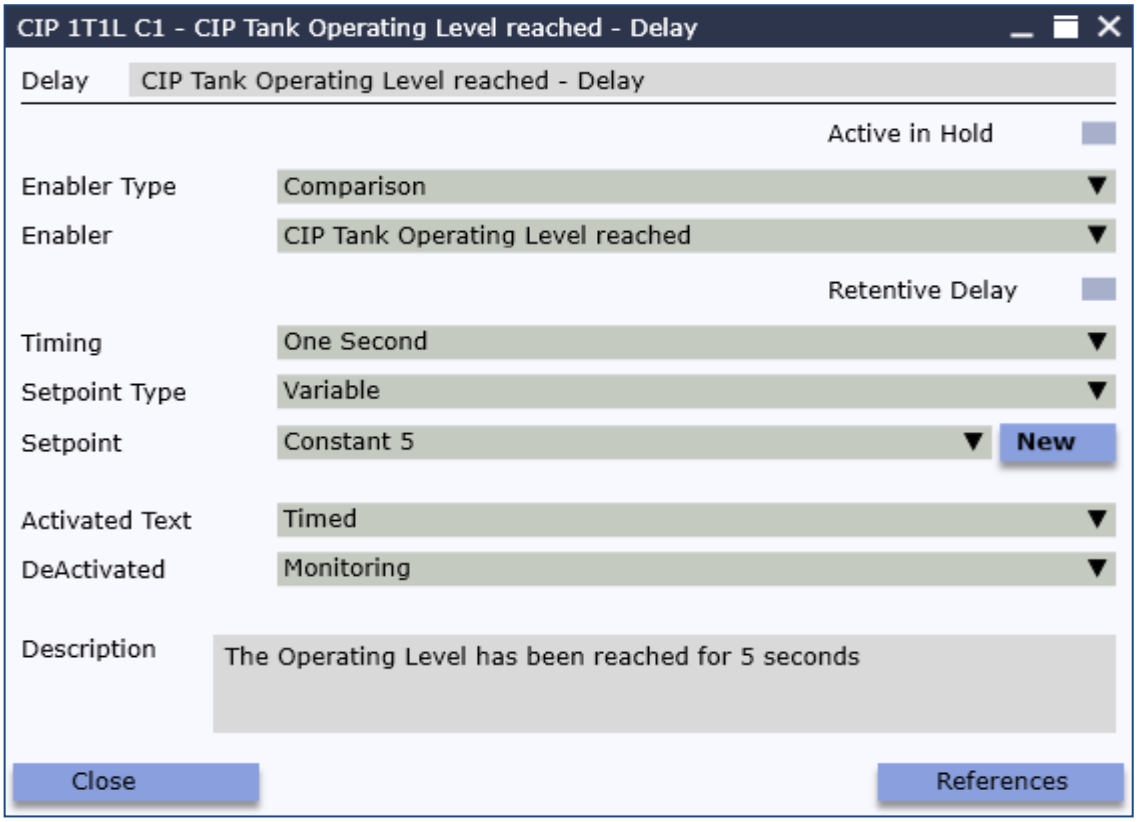
CIP Tank Operating Level reached - Delay
High Return Conductivity reached - Delay
High Return Temperature reached - Delay
Return Check Delay
Low Return Conductivity - Delay
Low Return Temperature - Delay
Low Pushout Return Conductivity reached - Delay
Low Pushout Return Temperature reached - Delay
CIP Tank Temperature at Return Temperature SP - Delay
Supply Check Delay
Low Supply Temperature - Delay



List of the Delays in the Program

The Return Check Delay and Supply Check Delay are configured after the Steps are inserted, and they represent an initial delay in the step to allow for Error checking enabling.

A delay is configured by selecting the enabler, the timebase and the setpoint.



The result will go true when the enabler is true for the time selected; this means the Delay will be true when the level is reached for 5 seconds continuously,

4.3.4 Combinations

These are logic gate type configurations for combinations of items required; For example; there is a need to check for Flow Switch FS 03 not made when Pump P 01 has been running for a time, for a Return Flow Alarm (which time would be that required to circulate to the Product System area and return).

1. No Return Flow after Check Delay
   FS 03 Low And Return Check Delay

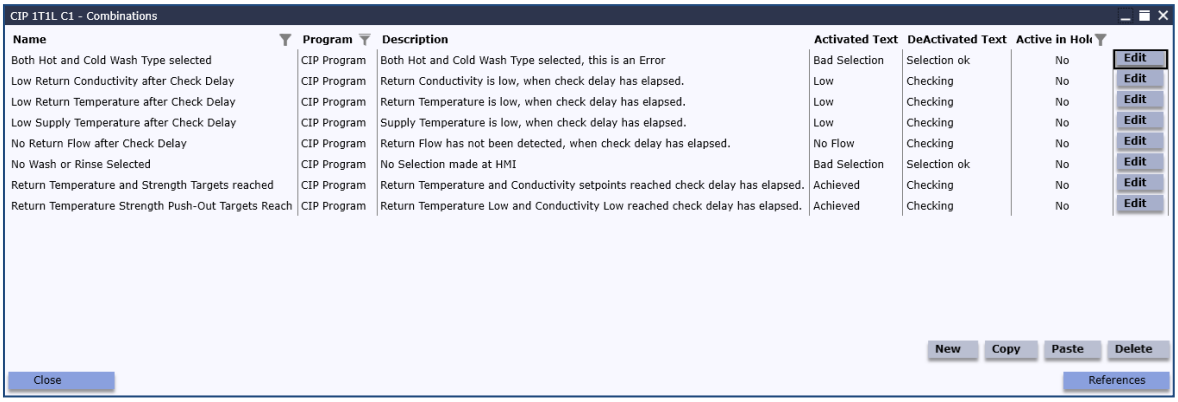
2. Low Return Temperature after Check Delay
   TT 03 below Alarm Setpoint And Return Check Delay

3. Low Return Conductivity after Check Delay
   CT 03 below Alarm Setpoint And Return Check Delay

4. Low Supply Temperature after Check Delay
   TT 02 below Alarm Setpoint And Supply Check Delay

5. Return Temperature and Conductivity Wash Targets reached
   TT 03 Return Temperature And CT 03 Conductivity setpoints reached

6. Return Temperature and Conductivity Push-Out Targets reached
   TT 03 Return Temperature Low And CT 03 Conductivity Low setpoints reached

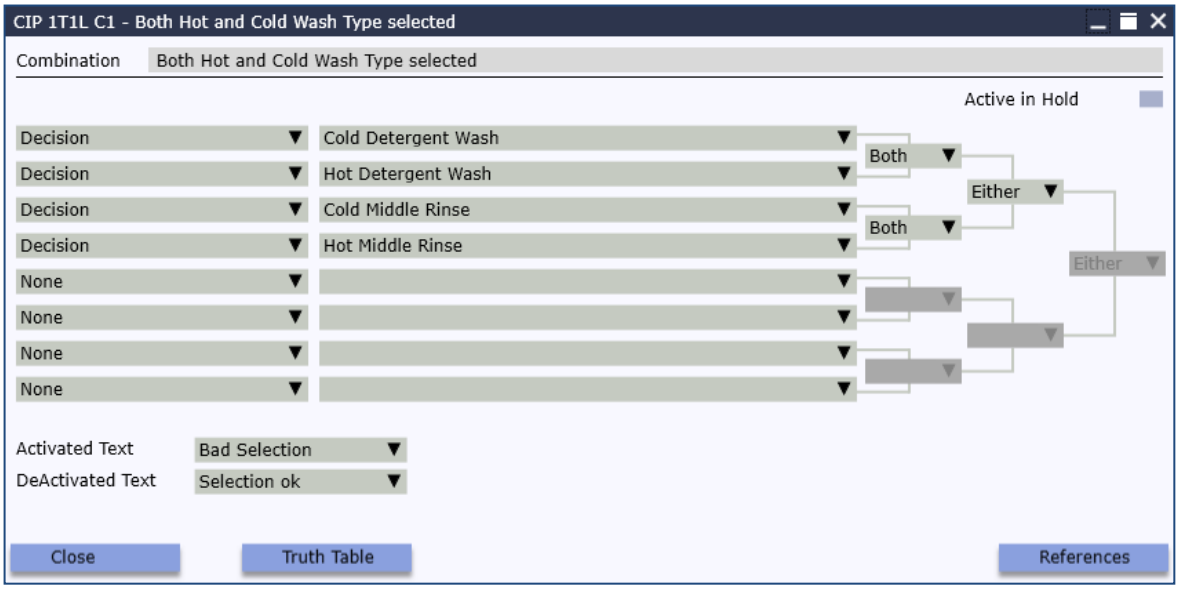


List of the Combinations in the Program.

There are also Combinations for checking for Selection Alarms.

1. No Wash or Rinse Selected
If all the following are True
Cold Pre Rinse Required Not Selected
Hot Pre Rinse Not Selected
Cold Detergent Wash Not Selected
Hot Detergent Wash Not Selected
Cold Middle Rinse Not Selected
Hot Middle Rinse Not Selected
Sterilant Wash Not Selected
Cold Final Rinse Not Selected

2. Both Hot and Cold Wash Type selected
If any of the following combinations are True
Hot Detergent Wash Selected And Cold Detergent Wash Selected
Or
Hot Middle Rinse Selected And Cold Middle Rinse Selected



Setup of the Combination for Wash Type Selection check.

4.4 Objects that are enabled in Steps

4.4.1 Write Values

The following Writes are listed in the Steps tables. In this project model all the Writes are carried out continuously in each step.

1. VSD 01 to Loop Speed Setpoint
2. VSD 01 to Wash Speed Setpoint
3. CV 01 PID to Supply Temperature Target SP

1. VSD 01 to Loop Speed Setpoint

Loop Speed Setpoint is written to the Analog Device VSD 01 while the Main Pump P 01 is Activated

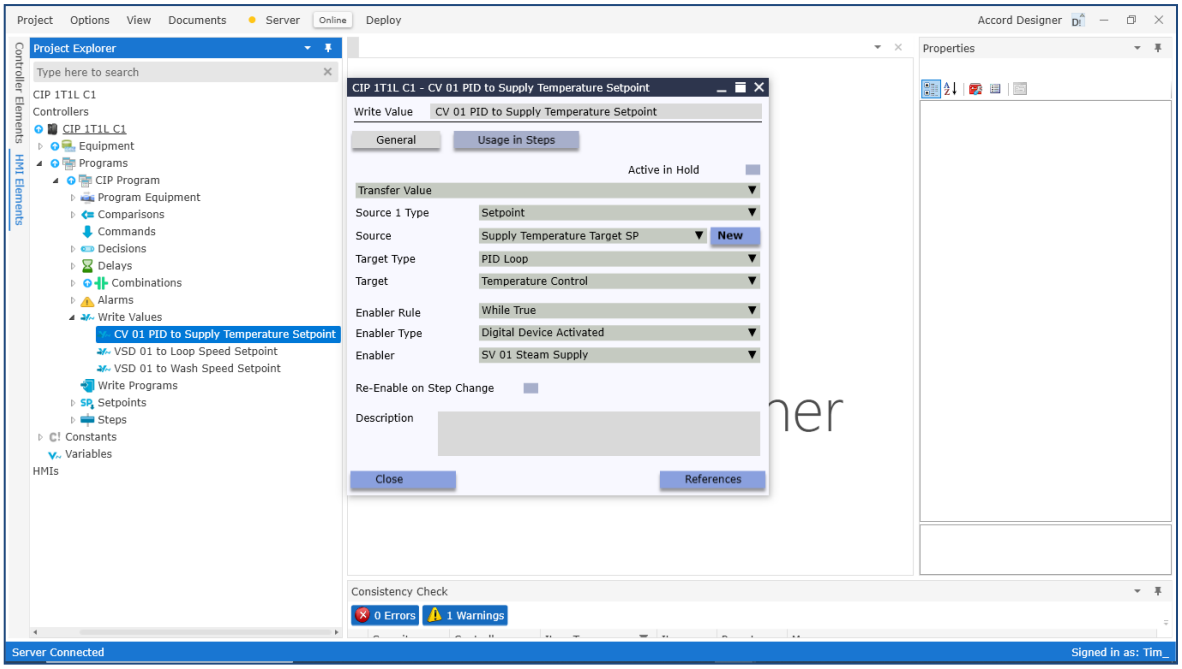
2. VSD 01 to Wash Speed Setpoint

Wash Speed Setpoint is written to the Analog Device VSD 01 while the Main Pump P 01 is Activated

3. Supply Temperature Setpoint to CV 01 PID

Supply Temperature Target SP is written to the CV 01 PID Loop and Solenoid SV 01 Steam Supply is Activated

The Accord PLC Library will automatically write Analog Devices and PID Loops to minimum value if there is no Write actively writing to them, so there is no need for Reset to Minimum type Writes.



Write the Supply Temperature Setpoint to the PID Loop for CV 01 Temperature Control

4.4.2 Alarms

The devices may be configured to be automatically monitored for Alarms. If a device is configured for 'Place Unit / Program in Alarm' then a Device Error will cause a Unit Error and then any program using the Unit will go into Alarm/Error also.

All the Alarms in this Model are placed as Critical Alarms; which will cause Program Alarm and Hold.

The following Alarms will occur when the Alarm occurs in the relevant Step.

1. CIP Return Flow not Present
   No Flow after Return Check Delay (Combination)
2. Step Watchdog Time Up
3. Low Temperature at TT 02 after Supply Check Delay (Combination)
4. Low Conductivity at CT 03 after Return Check Delay (Combination)
5. Low Temperature at TT 03 after Return Check Delay (Combination)
6. LSL 12 Sterilant at Low Level
7. LSL 11 Detergent at Low Level
8. LSL 02 CIP Tank at Low Level
9. LSL 02 CIP Tank Not at Low Level
10. LSH 01 CIP Tank at High Level
11. Hot and Cold Selection Error
12. No Wash Selected Error

The Alarms are all monitored in the Steps per the tables above, so that, for example, the Sterilant Low Level is only monitored in the Sterilant Dosing step.

Accord Designer automatically generates the following alarms, as the Units are placed into the Program Equipment component holder.

Selection Alarms are to protect against two Programs selecting (reserving) a Unit at the same time.

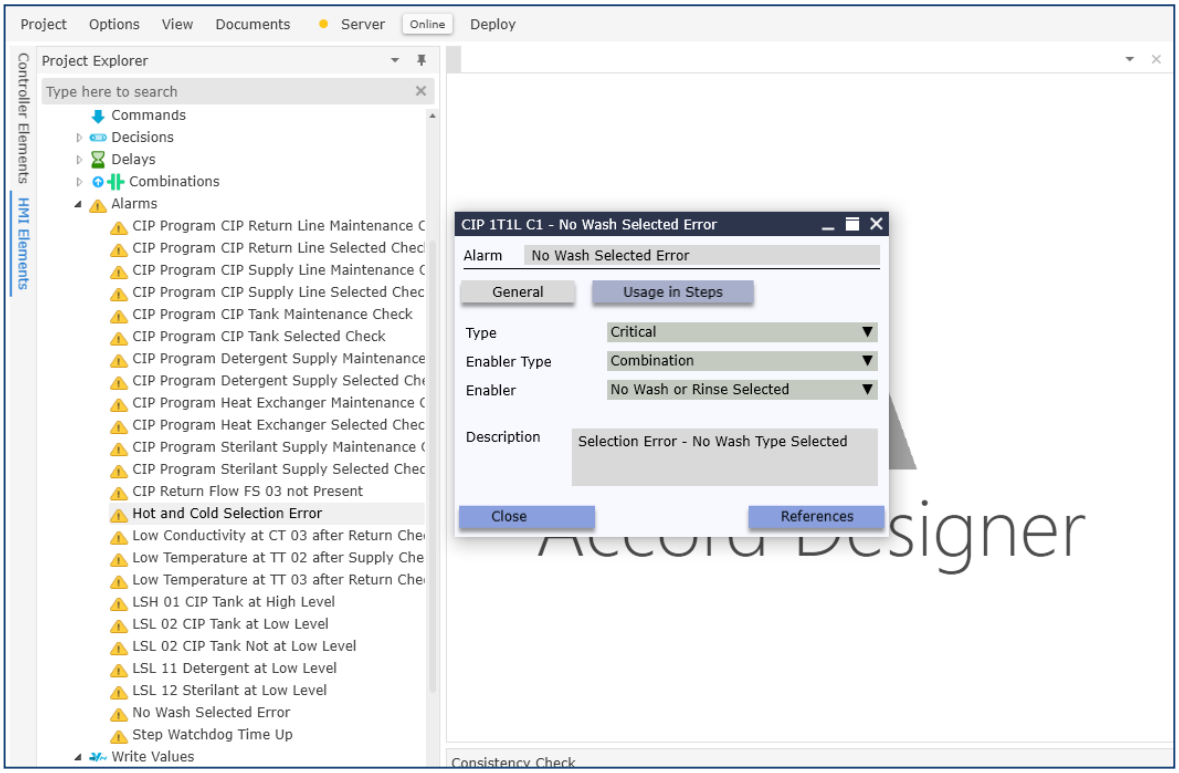
1. CIP Tank Selected Alarm
2. CIP Supply Line Selected Alarm
3. CIP Return Line Selected Alarm
4. Steam Supply Selected Alarm
5. Detergent Supply Selected Alarm
6. Sterilant Supply Selected Alarm

This system has only 1 program so these Unit selection / reserved Alarms are not necessary.

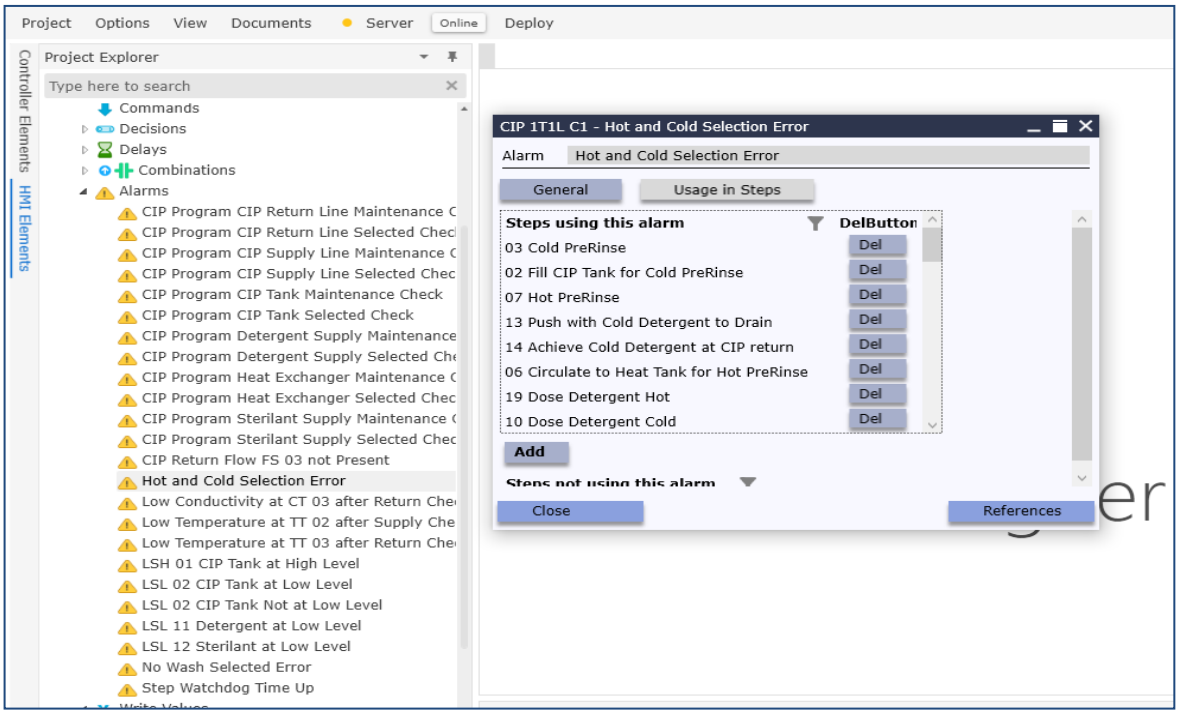
Maintenance Alarms are to protect against a Program operating while a Device is in Maintenance.

1. CIP Tank Maintenance Alarm
2. Supply Line Maintenance Alarm
3. Return Line Maintenance Alarm
4. Steam Supply Maintenance Alarm
5. Detergent Supply Maintenance Alarm
6. Sterilant Supply Maintenance Alarm

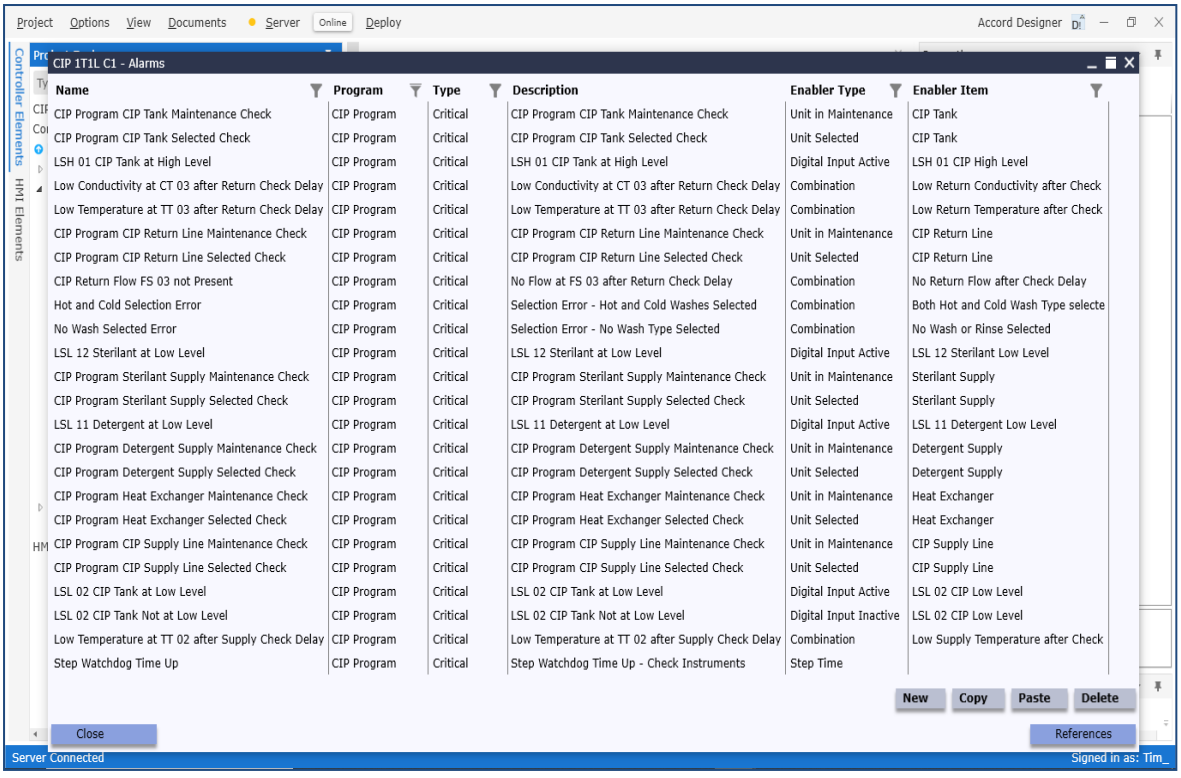
These Alarms are all added to Step 0 as Critical Alarms. The Maintenance Alarms may be added to other steps also, but the Selection Alarms should not be as the Program will select the Units and this will cause incorrect Alarms.



Set-up of an Alarm based on a Combination



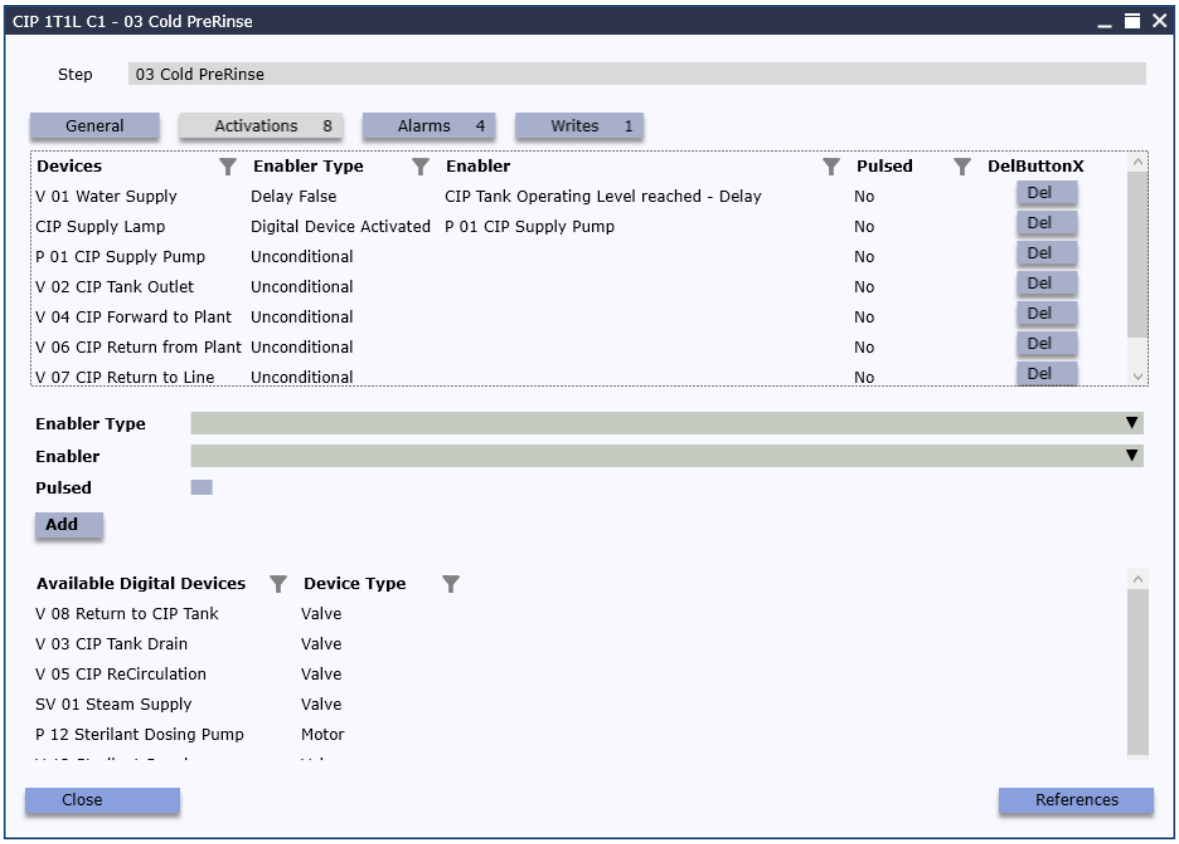
Set-up of an Alarm, showing enabling in Steps.
The Alarm can be added to or removed from Steps here. This is the same as Enabling the Alarm in steps, or disabling it in steps.



List of Alarms in the Program.

4.4.3 Activations

These are listed in the Steps rows in the detailed tables below.
The Activations in this program are all configured to be Always active, with the exception of V 01 for Water Supply in the Steps where Water Level needs to be maintained at CIP Tank Operating Level and the CIP Supply Lamp. These are set up as Conditional Activations.



Activations for step in the Program.

4.5 List of Steps in the Program;

The following steps are required in the program, listed here in sections

Initialise	0	Pre-Check
Cold PreRinse	1	Fill Tank for
	2	Cold PreRinse
	3	Drain Tank
Hot PreRinse	4	Fill Tank
	5	Heat Tank
	6	Hot PreRinse
	7	Drain Tank
Cold Detergent Wash	8	Fill Tank
	9	Dose Detergent Cold
	10	Circulate Tank
	11	Check Strength
	12	Push with Cold Detergent to Drain
	13	Achieve Detergent at CIP return
	14	Cold Detergent Wash
	15	Push Detergent to Drain
	16	Drain Tank
Hot Detergent Wash	17	Fill Tank
	18	Dose Detergent Hot
	19	Circulate Tank
	20	Check Strength
	21	Push with Hot Detergent to Drain
	22	Achieve Detergent at CIP return
	23	Hot Detergent Wash
	24	Push Detergent to Drain
	25	Drain Tank
Cold Middle Rinse	26	Fill Tank
	27	Cold Middle Rinse
	28	Drain Tank
Hot Middle Rinse	29	Fill Tank
	30	Heat Tank
	31	Hot Middle Rinse
	32	Drain Tank
Sterilant Wash	33	Fill Tank
	34	Dose Sterilant
	35	Push with Sterilant to Drain
	36	Sterilant Wash
	37	Drain Tank
Cold Final Rinse	38	Fill Tank
	39	Cold Final Rinse
	40	Drain Tank
Flush System	41	Fill Tank
	42	Flush System
	43	Drain Tank
Final Step	44	Final Step

4.6 Placing the Objects in the Steps.

The following tables show the assignment of components to the Steps.

	Steps	Normal / Alternate Step On	Next Steps Alternate Step On	Activations	Conditional Activations	Writes	Alarms
							All Steps to Check for Unit Alarms – Devices in Alarm in Unit
0	Pre-Check	No Alarms Present					Selection Alarms Maintenance Alarms LSL 02 CIP Tank not at Low Level LSH 01 CIP Tank at High Level

Cold PreRinse							
1	Fill Tank	LT 01 > CIP Tank Operating Level		V 01			Step Watchdog Time Up
		Cold PreRinse Not Selected (C)	Step 4				LSH 01 CIP Tank at High Level
2	Cold PreRinse	Step Time Reached		V 02, P 01, V 04, V 06, V 07, V 09	V 01 if CIP Tank Operating Level not reached	VSD 01 to Wash Speed Setpoint	CIP Return Flow FS 03 not Present
							LSL 02 CIP Tank at Low Level
3	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

Hot PreRinse							
	Steps	**Normal / Alternate Step On**	**Next Steps Alternate Step On**	**Activations**	**Conditional Activations**	**Writes**	**Alarms**
4	Fill Tank	LT 01 > CIP Tank Operating Level		V 01			Step Watchdog Time Up
		Hot PreRinse Not Selected (C)	Step 8				LSH 01 CIP Tank at High Level
5	Heat Tank	CIP Tank Temperature reached Return Temperature SP		V 02, P 01, V 05, V 07, V 08, SV 01		CV 01 PID to Supply Temperature Target SP	Step Watchdog Time Up
						VSD 01 to Loop Speed Setpoint	
6	Hot PreRinse	Step Time Reached		V 02, P 01, V 04, V 06, V 08, SV 01	V 01 if CIP Tank Operating Level not reached	CV 01 PID to Supply Temperature Target SP	CIP Return Flow FS 03 not Present
						VSD 01 to Wash Speed Setpoint	Low Temperature at TT 03 after Return Check Delay (CC)
							LSL 02 CIP Tank at Low Level
7	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

Cold Detergent Wash							
	Steps	**Normal / Alternate Step On**	**Next Steps Alternate Step On**	**Activations**	**Conditional Activations**	**Writes**	**Alarms**
8	Fill Tank	LT 01 > CIP Tank Operating Level		V 01			Step Watchdog Time Up
		Cold Detergent Wash Not Selected (C)	Step 16				LSH 01 CIP Tank at High Level
9	Dose Detergent Cold	Step Time Reached		V 02, P 01, V 05, V 07, V 08, V 11, P 11	V 01 if CIP Tank Operating Level not reached	VSD 01 to Loop Speed Setpoint	LSL 11 Detergent at Low Level
10	Circulate Tank	Step Time Reached		V 02, P 01, V 05, V 07, V 08		VSD 01 to Loop Speed Setpoint	
11	Check Strength	Detergent Strength Achieved	Push with Cold Detergent to Drain	V 02, P 01, V 05, V 07, V 08		VSD 01 to Loop Speed Setpoint	
		Step Time Reached	Dose Detergent Cold				
12	Push with Cold Detergent to Drain	Step Time Reached		V 02, P 01, V 05, V 06, V 07, V 09		VSD 01 to Wash Speed Setpoint	CIP Return Flow FS 03 not Present
13	Achieve Detergent at CIP return	High Return Conductivity reached		V 02, P 01, V 05, V 06, V 07, V 09		VSD 01 to Wash Speed Setpoint	CIP Return Flow FS 03 not Present
							Step Watchdog Time Up

14	Cold Detergent Wash	Step Time Reached		V 02, P 01, V 05, V 06, V 07, V 08		VSD 01 to Wash Speed Setpoint	CIP Return Flow FS 03 not Present
							LSL 02 CIP Tank at Low Level
15	Push Detergent to Drain	Low Return Conductivity reached		V 02, P 01, V 05, V 06, V 07, V 09	V 01 if CIP Tank Operating Level not reached	VSD 01 to Wash Speed Setpoint	LSL 02 CIP Tank at Low Level
							Step Watchdog Time Up
16	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

Hot Detergent Wash							
	Steps	**Normal / Alternate Step On**	**Next Steps Alternate Step On**	**Activations**	**Conditional Activations**	**Writes**	**Alarms**
17	Fill Tank	LT 01 > CIP Tank Operating Level		V 01			Step Watchdog Time Up
		Hot Detergent Wash Not Selected (C)	Step 24				LSH 01 CIP Tank at High Level
18	Dose Detergent Hot	Step Time Reached		V 02, P 01, V 05, V 07, V 08, SV 01, V 11, P 11	V 01 if CIP Tank Operating Level not reached	CV 01 PID to Hot Wash Temperature Setpoint	LSL 11 Detergent at Low Level
						VSD 01 to Loop Speed Setpoint	Low Temperature at TT 02 After Supply Check Delay (CC)
19	Circulate Tank	Step Time Reached		V 02, P 01, V 05, V 07, V 08, SV 01,		CV 01 PID to Hot Wash Temperature Setpoint	
						VSD 01 to Loop Speed Setpoint	
20	Check Strength	Return Strength and Temperature Achieved	Push with Hot Detergent to Drain	V 02, P 01, V 05, V 07, V 08		CV 01 PID to Hot Wash Temperature Setpoint	
		Step Time Reached	Dose Detergent Hot			VSD 01 to Wash Speed Setpoint	

21	Push with Hot Detergent to Drain	Step Time Reached		V 02, P 01, V 04, V 06, V 09, SV 01		CV 01 PID to Hot Wash Temperature Setpoint	CIP Return Flow FS 03 not Present
						VSD 01 to Wash Speed Setpoint	Step Watchdog Time Up
							Low Temperature at TT 02 After Supply Check Delay (CC)
22	Achieve Detergent at CIP return	Return Strength and Temperature Achieved		V 02, P 01, V 04, V 06, V 09		CV 01 PID to Hot Wash Temperature Setpoint	CIP Return Flow FS 03 not Present
						VSD 01 to Wash Speed Setpoint	
23	Hot Detergent Wash	Step Time Reached		V 02, P 01, V 04, V 06, V 07, V 08		CV 01 PID to Hot Wash Temperature Setpoint	CIP Return Flow FS 03 not Present
						VSD 01 to Wash Speed Setpoint	Low Conductivity at CT 03 after Return Check Delay (CC)
							Low Temperature at TT 03 after Return Check Delay (CC)
							Low Temperature at TT 02 After Supply Check Delay (CC)
							LSL CIP Tank 01 at Low Level

24	Push Detergent to Drain	Low Return Conductivity and Temperature reached		V 02, P 01, V 04, V 06, V 09	V 01 if CIP Tank Operating Level not reached		CIP Return Flow FS 03 not Present
							LSL CIP Tank 01 at Low Level
25	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

Cold Middle Rinse							
	Steps	**Normal / Alternate Step On**	**Next Steps Alternate Step On**	**Activations**	**Conditional Activations**	**Writes**	**Alarms**
26	Fill Tank	LT 01 > CIP Tank Operating Level		V 01			Step Watchdog Time Up
		Cold Middle Rinse Not Selected (C)	Step 27				LSH 01 CIP Tank at High Level
27	Cold Middle Rinse	Step Time Reached		V 02, P 01, V 04, V 06, V 09	V 01 if CIP Tank Operating Level not reached	VSD 01 to Wash Speed Setpoint	CIP Return Flow FS 03 not Present
							LSL CIP Tank 01 at Low Level
28	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

Hot Middle Rinse							
	Steps	**Normal / Alternate Step On**	**Next Steps Alternate Step On**	**Activations**	**Conditional Activations**	**Writes**	**Alarms**
29	Fill Tank	LT 01 > CIP Tank Operating Level		V 01			Step Watchdog Time Up
		Hot Middle Rinse Not Selected (C)	Step 31				LSH 01 CIP Tank at High Level
30	Heat Tank	CIP Tank Temperature reached Return Temperature SP		V 02, P 01, V 05, V 07, V 08, SV 01,		CV 01 PID to Supply Temperature Target SP	
						VSD 01 to Loop Speed Setpoint	
31	Hot Middle Rinse	Step Time Reached		V 02, P 01, V 04, V 06, V 08, SV 01	V 01 if CIP Tank Operating Level not reached	CV 01 PID to Supply Temperature Target SP	CIP Return Flow FS 03 not Present
						VSD 01 to Wash Speed Setpoint	Low Temperature at TT 03 after Return Check Delay (CC)
							Low Temperature at TT 01 after Supply Check Delay (CC)
							LSL CIP Tank 01 at Low Level
32	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

Sterilant Wash							
	Steps	**Normal / Alternate Step On**	**Next Steps Alternate Step On**	**Activations**	**Conditional Activations**	**Writes**	**Alarms**
33	Fill Tank	LT 01 > CIP Tank Operating Level		V 01,			Step Watchdog Time Up
		Cold Detergent Wash Not Selected (C)	Step 36				LSH 01 CIP Tank at High Level
34	Dose Sterilant	Step Time Reached		V 02, P 01, V 05, V 07, V 08, V 12, P 12		VSD 01 to Loop Speed Setpoint	LSL 12 Sterilant at Low Level
35	Push with Sterilant to Drain	Step Time Reached		V 02, P 01, V 04, V 06, V 07, V 09		VSD 01 to Wash Speed Setpoint	CIP Return Flow FS 03 not Present
36	Sterilant Wash	Step Time Reached		V 02, P 01, V 04, V 06, V 08		VSD 01 to Wash Speed Setpoint	CIP Return Flow FS 03 not Present
							LSL 02 CIP Tank at Low Level
37	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

Cold Final Rinse							
	Steps	**Normal / Alternate Step On**	**Next Steps Alternate Step On**	**Activations**	**Conditional Activations**	**Writes**	**Alarms**
38	Fill Tank	LT 01 > CIP Tank Operating Level		V 01			Step Watchdog Time Up
		Cold Final Rinse Not Selected (C)	Step 36				LSH 01 CIP Tank at High Level
39	Cold Final Rinse	Step Time Reached		V 02, P 01, V 04, V 06, V 09	V 01 if CIP Tank Operating Level not reached	VSD 01 to Wash Speed Setpoint	CIP Return Flow FS 03 not Present
							LSL 02 CIP Tank at Low Level
40	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

Flush System							
41	Fill Tank	LT 01 > CIP Tank Operating Level		V 01			Step Watchdog Time Up
							LSH 01 CIP Tank at High Level
42	Flush System	Step Time Reached		V 01, P 01, V 05, V 07, V 09,		VSD 01 to Loop Speed Setpoint	
43	Drain Tank	LSL 02 For Time		V 03			Step Watchdog Time Up

5. Adding and Configuring the Steps

In this section the configured objects are allocated to Steps and the Activations are added to the Steps.

5.1 Creating Step - CIP Program Startup Step

Accord Designer automatically generates a 'Step 0' for every program. Initial Alarms for Unit Selection and Unit Maintenance are checked in this step. Other Alarms may be added to this Step also. There are no Writes or Activations in this Step. The Alarms for incorrect operator selection should be listed in this Step. In this program the 'Step 0' has been renamed to '01 CIP Program Startup Step'.

Short Description	Checks to ensure Program can Start.
Long Description	This step is used to make sure that there are no Equipment Alarms or Operator Selection Alarms before the program begins automatically. Maintenance of Equipment Items is checked for in this step also.
Activation	None allowed
Alarms	LSH 01 CIP Tank High Level LSL 02 CIP Tank not at Low Level
	Following Alarms are automatically generated CIP Tank Selected Alarm Supply Line Selected Alarm Return Line Selected Alarm Steam Supply Selected Alarm Detergent Supply Selected Alarm Sterilant Supply Selected Alarm CIP Tank Maintenance Alarm Supply Line Maintenance Alarm Return Line Maintenance Alarm Steam Supply Maintenance Alarm Detergent Supply Maintenance Alarm Sterilant Supply Maintenance Alarm
Step On	No Alarms present

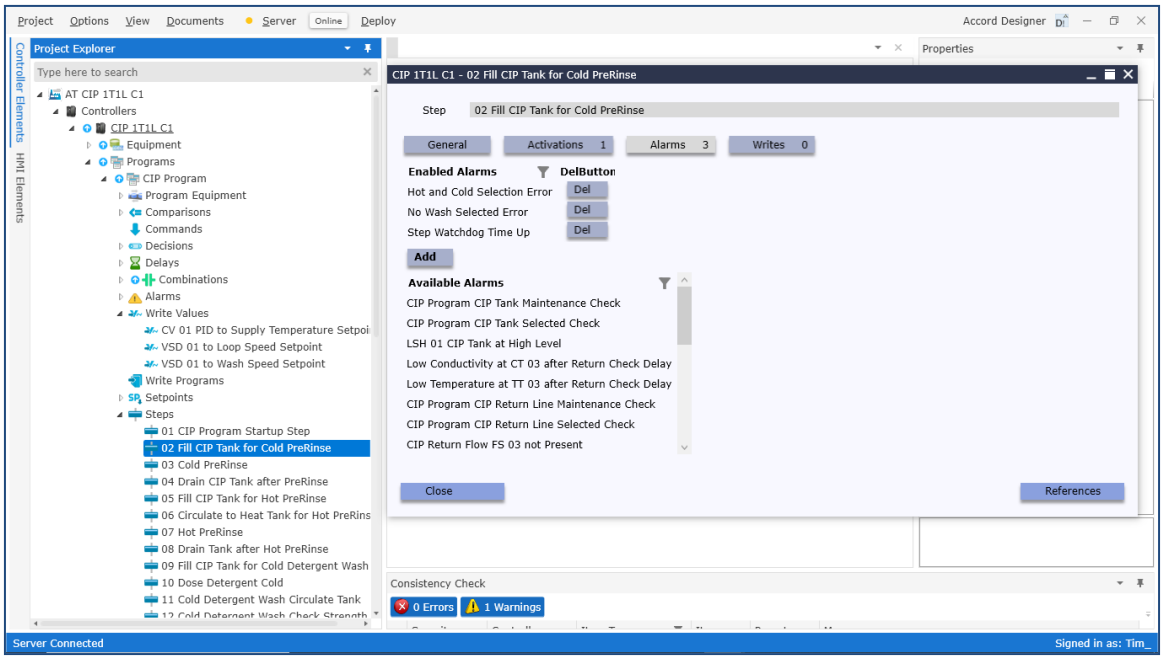
5.2 Creating Step - Fill Tank for Cold PreRinse

The Step is added by
1. Dragging the Step Element from the Controller Elements to the Program
Or
2. Right-Clicking on the Steps container and Selecting 'New'

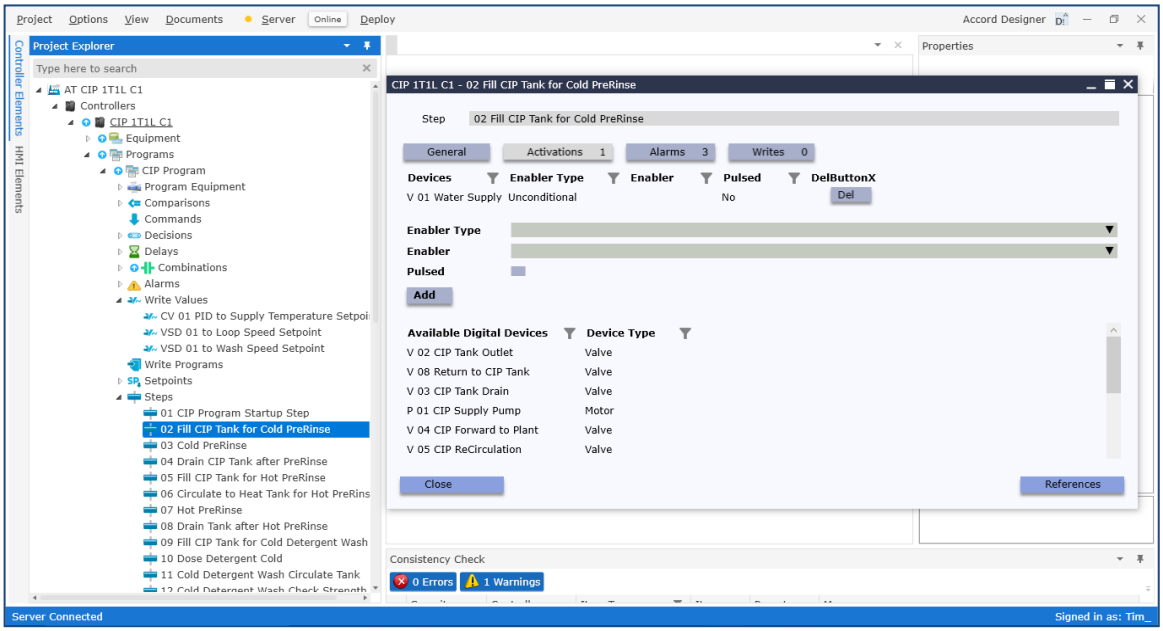
After the Step is added to the Program the Step is renamed to the name '02 Fill CIP Tank for Cold PreRinse'

The following are then added to the Step;

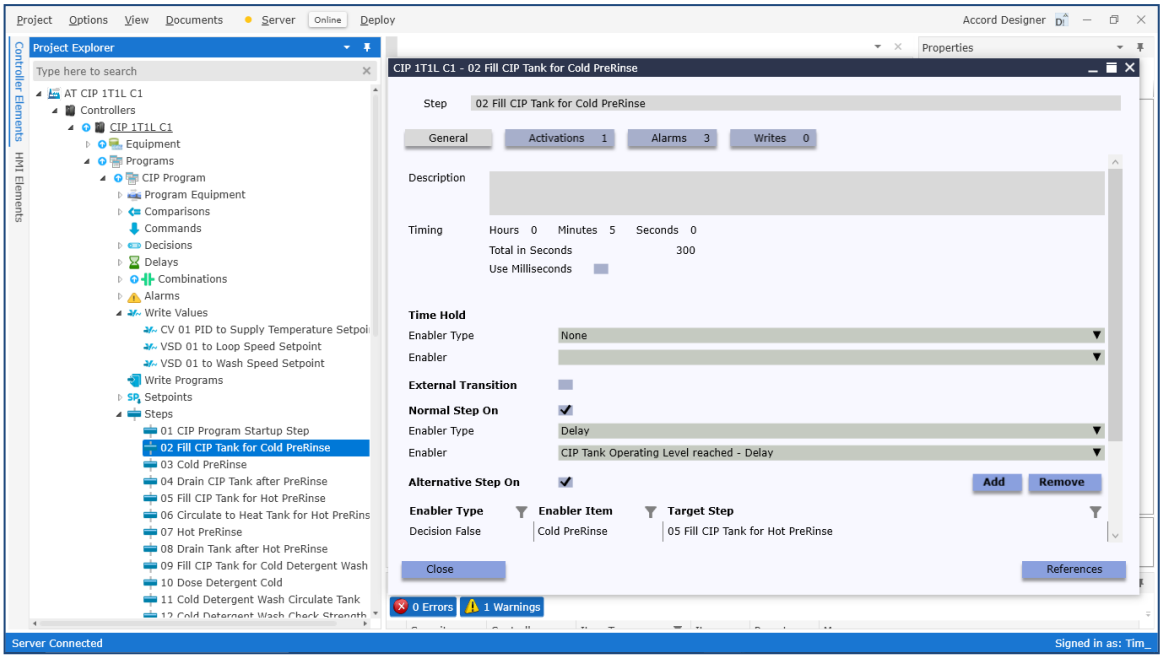
Short Description	Fill the CIP Tank with Water for Cold PreRinse
Long Description	This Step is used to Fill the Tank with Water to an Initial Level before starting the Rinse. The Step ends when the Initial Level is reached. There is a check for High Level switch to ensure that the Level transmitter is working.
Activation	V 01
Writes	None
Alarms	LSH 01 CIP Tank High Level Step Timeout (Step time is used as a Watchdog Timer, this is used to check on the Level Transmitter
Step On	Comparison - CIP Tank Operating Level Reached
Alternate Step On	Decision False - Cold Rinse Selected
Alternate Step	Hot Rinse Fill Tank (Step 4)



Alarms for 'Fill Tank for Cold PreRinse'



Activations for 'Fill Tank for Cold PreRinse'



Step On Transition for 'Fill Tank for Cold PreRinse'
The Step On Transition is configured by selecting the type of the Step On Enabler and then the particular enabler. The Normal Step On brings the Program to the next Step and the Alternative Step On brings the Program to the selected Step. In the case above the Program will move to the step Fill CIP Tank for Hot PreRinse if the Cold PreRinse Required Decision is not selected. A full list of types of enablers is provided.
The Step selected for the Alternative Step On must be in the Step Order.

5.3 Creating Step - Cold PreRinse

The Step is added by
1. Dragging the Step Icon from the Toolbox to the Program
Or
2. Right-Clicking on the Program and Selecting 'New'
Or
3. Copy Step 1 and Rename to Cold PreRinse

After the Step is added to the Program the following are added to the Step;

Short Description	Rinse the plant to be cleaned with Cold Water
Long Description	None
Activation	V 02, P 01, V 04, V 06, V 07, V 09, Conditional - V 01 if CIP Tank Operating Level not reached
Writes	VSD 01 to Wash Speed Setpoint
Alarms	CIP Return Flow FS 03 not Present LSL CIP Tank 01 at Low Level
Step On	Step Time Reached
Alternate Step On	None

5.4 Creating Step - Drain Tank after PreRinse

After the Step is added to the Program the following are added to the Step;

Short Description	Drain the CIP Tank following Cold PreRinse.
Long Description	None
Activation	V 03
Write	None
Alarms	Step Timeout
Step On	LSL CIP Tank 01 at Low Level
Alternate Step On	None

5.5 Creating Step - Fill Tank for Hot PreRinse

The Step is added by Copy the Step Fill Tank for Cold PreRinse and Rename to Fill Tank for Hot Rinse

The following are then changed in the Step;

Short Description	Fill the CIP Tank with Water for **Hot** PreRinse
Activation	V 01
Write	None
Alarms	LSH 01 CIP Tank High Level
Step On	Comparison CIP Tank Operating Level Reached
Alternate Step On	Decision False - Hot Rinse Selected
Alternate Step	Cold Detergent Wash Fill Tank (Step 8)

Note: As Step 8 has not been created yet, the Alternate Step on will not be possible at this time. It will be configured later.

5.6 Creating Step – Circulate to Heat Tank for Hot PreRinse

After the Step is added to the Program the following are added to the Step;

Short Description	Heat the Tank for Hot Rinse
Long Description	None
Activations	V 02, P 01, V 05, V 07, V 08, SV 01
Writes	VSD 01 to Loop Speed Setpoint CV 01 PID to Supply Temperature Target SP
Alarms	CIP Return Flow FS 03 not Present LSL CIP Tank 01 at Low Level
Step On	CIP Tank Temperature reached Return Temperature SP
Alternate Step On	None
Alternate Step	None

5.7 Creating Step – Hot PreRinse

The easiest way to create this Step is to copy Step 3 (Cold PreRinse) and Rename to Hot PreRinse, and then to add the items in **bold** below

After the Step is added to the Program the following are added to the Step;

Short Description	Rinse the plant to be cleaned with Hot Water
Long Description	None
Activation	V 02, P 01, V 04, V 06, V 07, V 08, **SV 01** Conditional - V 01 if CIP Tank Operating Level not reached
Writes	VSD 01 to Wash Speed Setpoint **CV 01 PID to Supply Temperature Target SP**
Alarms	CIP Return Flow FS 03 not Present LSL CIP Tank 01 at Low Level **Low Temperature at TT 01 Alarm Check Delay (CC)**
Step On	Step Time Reached
Alternate Step On	None
Alternate Step	None

5.8 Creating Step – Drain Tank after Hot PreRinse

As this step is identical to Step 3, it is copied and renamed

Noted the step does not have to be recreated, it could be simply be called again in the Step Order.

5.9 Creating Step - Fill Tank for Cold Detergent Wash

The Step is added by
Copy the Step 'Fill Tank for Cold PreRinse' and Rename to 'Fill Tank for Cold Detergent Wash'

The following are then changed in the Step;

Short Description	Fill CIP Tank with Water for **Cold Detergent wash**
Activation	V 01
Write	None
Alarms	LSH 01 CIP Tank High Level
Step On	Comparison CIP Tank Operating Level Reached
Alternate Step On	Decision False - Cold Detergent Wash Selected
Alternate Step	Hot Detergent Wash Fill Tank (Step 16)

Note: As Step Hot Detergent Wash Fill Tank has not been created yet, the Alternate Step on will not be possible at this time. It will be configured later.

5.10 Creating Step – Dose Detergent Cold

The Step is added by Copy Step 'Heat the Tank for Hot Rinse' and rename to 'Dose Detergent Cold'

After the Step is added to the Program the following items in **bold** below are changed in the Step;

Short Description	**Dose Detergent for Cold Detergent Wash**
Long Description	None
Activations	V 02, P 01, V 05, V 07, V 08, **V 11, P11**
Writes	VSD 01 to Loop Speed Setpoint
Alarms	CIP Return Flow FS 03 not Present LSL CIP Tank 01 at Low Level **LSL 11 Detergent at Low Level**
Step On	Step Time Reached
Alternate Step On	None
Alternate Step	None

5.11 Creating Step – Circulate Tank

The Step is added by Copy Step 'Heat the Tank for Hot Rinse' and rename to 'Circulate Tank'

Short Description		Circulate the Tank to mix the Detergent
Long Description		None
Activations		V 02, P 01, V 05, V 07, V 08,
	Remove	SV 01
Writes		VSD 01 to Loop Speed Setpoint
	Remove	CV 01 PID to Supply Temperature Target SP
Alarms		CIP Return Flow FS 03 not Present LSL CIP Tank 01 at Low Level
Step On		Step Time
	Remove	CIP Tank Temperature reached Return Temperature SP
Alternate Step On		None
Alternate Step		None

5.12 Creating Step – Check Detergent Strength

The Step is added by Copy Step 'Circulate Tank' and rename to 'Check Detergent Strength'. The items in **bold** are then added or changed in the Step

Short Description	Check the Detergent Strength for Cold Wash
Long Description	The Step is used to check if the Detergent strength has been reached. If it has been reached the program will step forward to the next Step 12. If the step time is reached the program will step back to begin a new dose in Step 10.
Activations	V 02, P 01, V 05, V 07, V 08, (Same)
Writes	VSD 01 to Loop Speed Setpoint
Alarms	CIP Return Flow FS 03 not Present LSL CIP Tank 01 at Low Level
Step On	**CT 03 > Detergent Setpoint**
Alternate Step On	**Step Time**
Alternate Step	**Dose Detergent Cold**

5.13 Creating Step – Push with Cold Detergent to Drain

The Step is added by Copy Step 'Cold Rinse' and rename to 'Push with Cold Detergent to Drain'. The items in **bold** are then added changed in the Step.

Short Description	**Push the Water in the System to Drain with Cold Detergent**
Long Description	This step is used to provide a minimum time for the Detergent Push, in order to make sure that the line is filled with Detergent solution before beginning the Wash.
Activations	V 02, P 01, V 04, V 05, V 07, **V 09**,
Writes	**VSD 01 to Wash Speed Setpoint**
Alarms	CIP Return Flow FS 03 not Present LSL CIP Tank 01 at Low Level
Step On	**Step Time Reached**
Alternate Step On	**None**
Alternate Step	

5.14 Creating Step – Achieve Detergent Strength at CIP Return

The Step is added by Copy Step 'Push with Cold Detergent to Drain' and rename to 'Achieve Detergent strength at CIP Return'. The items in **bold** are then added changed in the Step.

Short Description	Achieve required Detergent Strength at CIP Return Line
Long Description	This step is used to check that the line is filled with Detergent before beginning the Wash.
Activations	V 02, P 01, V 05, V 07, V 09.
Writes	VSD 01 to Wash Speed Setpoint
Alarms	CIP Return Flow FS 03 not Present Step Watchdog time Up
Step On	**High Return Conductivity reached**
Alternate Step On	**None**
Alternate Step	

5.15 Creating Step – Cold Detergent Wash

The Step is added by Copy Step 'Cold Rinse' and rename to 'Cold Detergent Wash'. The items in **bold** are then added changed in the Step.

Short Description	Wash the System with cold Detergent Solution for the Step Time
Long Description	None
Activations	V 02, P 01, V 05, V 06, V 07, V 09.
Writes	VSD 01 to Wash Speed Setpoint
Alarms	CIP Return Flow FS 03 not Present LSL 02 CIP Tank at Low Level
Step On	Step Time Reached
Alternate Step On	None
Alternate Step	

5.16 Creating Step - Drain CIP Tank after Cold Detergent Wash

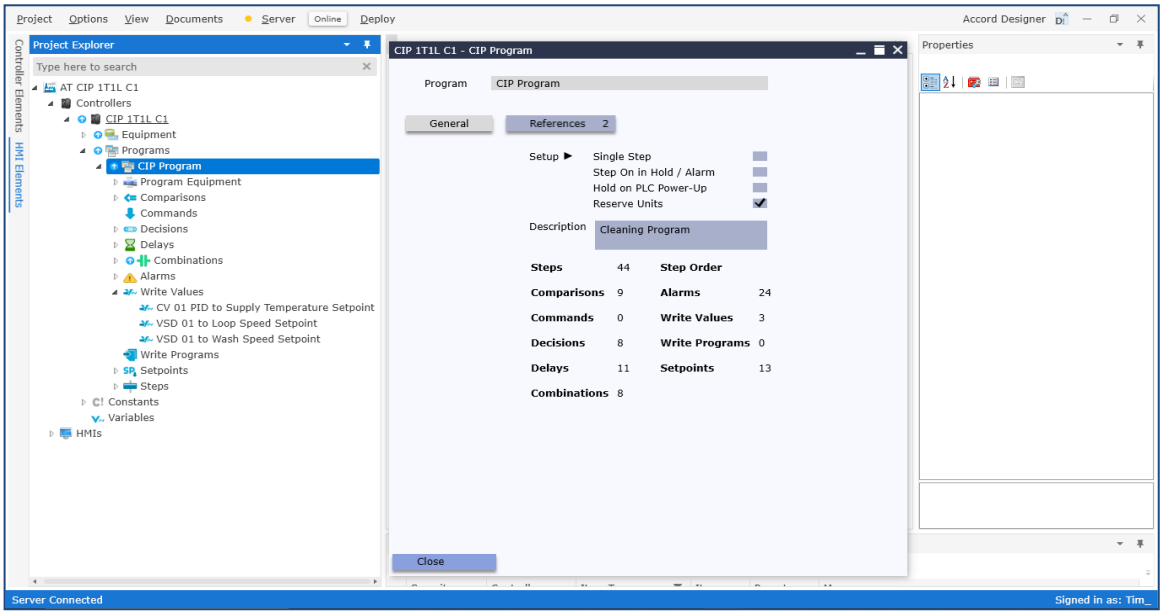
The Step is added by Copy Step 'Drain CIP Tank after PreRinse'

5.17 Creating Steps 16-42 for Other Washes.

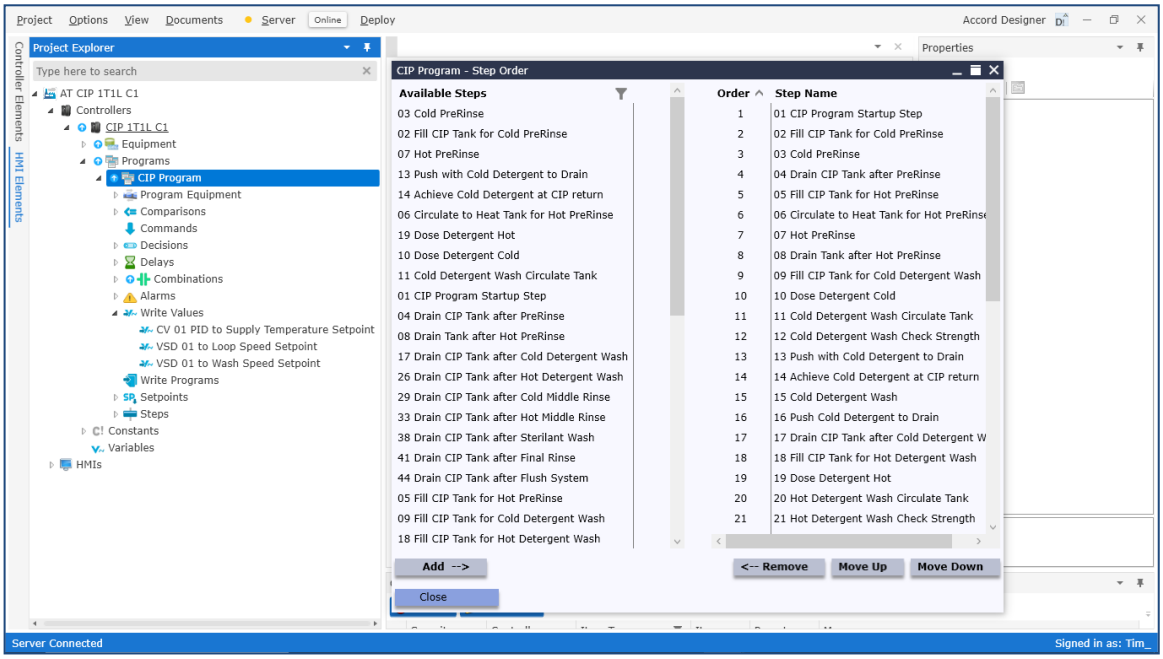
The Steps created so far cover the functionality required for Generation of the single Program. Repeating the above Copy and Rename and making simple changes will allow the rest of the Program to be created quickly. It is important to remember to put in the Alternate Step-On if any Stage is not required.

6. Step Order in Recipe

When all the Steps are configured the program Step Order may be set up. This is found in Program properties.



Program Properties Panel, by double clicking on the Program Name.



Configured Step Order.

All the Steps are listed on the left and are added to the required list on the right using Add->. Steps are then arranged in required order using the Move Up and Move Down buttons.

6.1 Configuring Alternate Step On transitions

As the Steps are all configured and placed in the Step Order list it is possible to now configure the Alternate Step On aspects that were left earlier.
These are

Step	Decision False	Alternate Step
Cold PreRinse Fill Tank	Cold PreRinse Required	Hot PreRinse Fill Tank
Hot PreRinse Fill Tank	Hot PreRinse Required	Cold Det Wash Fill Tank
Detergent Wash Fill Tank	Cold Det Wash Required	Hot Det Wash Fill Tank
Hot Det Wash Fill Tank	Hot Det Wash Required	Cold Middle Rinse Fill Tank
Cold Middle Rinse Fill Tank	Hot Middle Rinse Required	Sterilant Wash Fill Tank
Sterilant Wash Fill Tank	Sterilant Wash Required	Final Rinse Fill Tank

7. Inserting the Program in the Program Order.

The finished Program must be placed in the Program Order. This is the order that programs are processed in the PLC and it is usually not important. The order is found by right-clicking on the Programs icon. In this case there is only one Program in the system. If other programs are added then the order of processing can be changed using Move Up and Move Down.