

TULSA Water and Sewer Department

SCADA System Improvements

Valve POS Add-On Instruction

FINAL

PRESENTED TO

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Revision History

After the Add-On Instruction has been modified or updated, this document should be revised to reflect the changes. The version is broken into two parts: major (**X.0**) and minor (**1.X**). A major version is reserved for adding or removing sections of this document. A minor version is reserved for modifications to existing sections.

Version	Date	Description
1.0	July 9, 2021	AOI created in Studio 5000 Version 21.11, Draft submitted to client
1.0	April 4, 2022	Final submitted to client.

1 INTRODUCTION

The Valve POS Add-On Instruction (AOI) is used for controlling modulating position valves. The AOI provides automatic PLC control as well as remote manual control using HMI open and close buttons with a position setpoint. It includes alarms that are specific to modulating valves. The valve can be taken out of service to prevent it from moving and to disable its alarms.

Table 1-1 Embedded AOIs

Embedded AOIs
Analog Feedback Fail
Analog Input
Analog Output

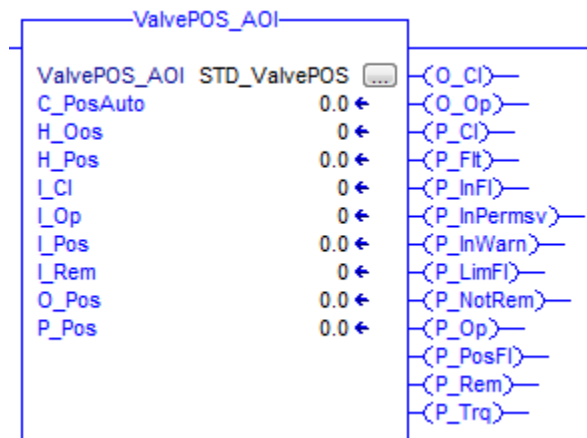


Figure 1-1 Valve POS AOI as it appears in ladder logic

2 TEMPLATE

Template logic can be found in the Unscheduled Programs/Phases task folder of the Tulsa ControlLogix Standard PLC file. Because the template task is unscheduled, the routines within it do not execute during runtime. The intention of the template routine is to provide a standard logic structure for the AOIs that can be copied into the executable tasks of the MainProgram.

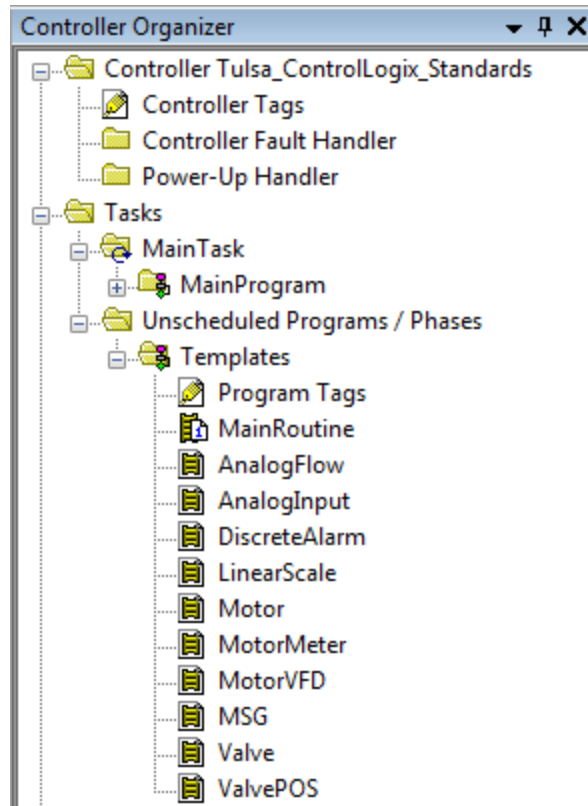


Figure 2-1 *Unscheduled Standard Logic Templates*

The Valve POS template routine displays the standard logic for using the Valve POS AOI. Rung 0 enables the valve permissive to allow the valve to operate. Programmers can include logic on this rung to control the permissive. There are 10 permissives available. Permissive descriptions should be set in rung 0 of the internal AOI logic. Rung 1 moves the raw analog input data for valve position feedback into the AOI. Rungs 3 and 4 open and close the valve by writing to digital outputs. Rung 5 moves the raw valve position command into the analog output source.

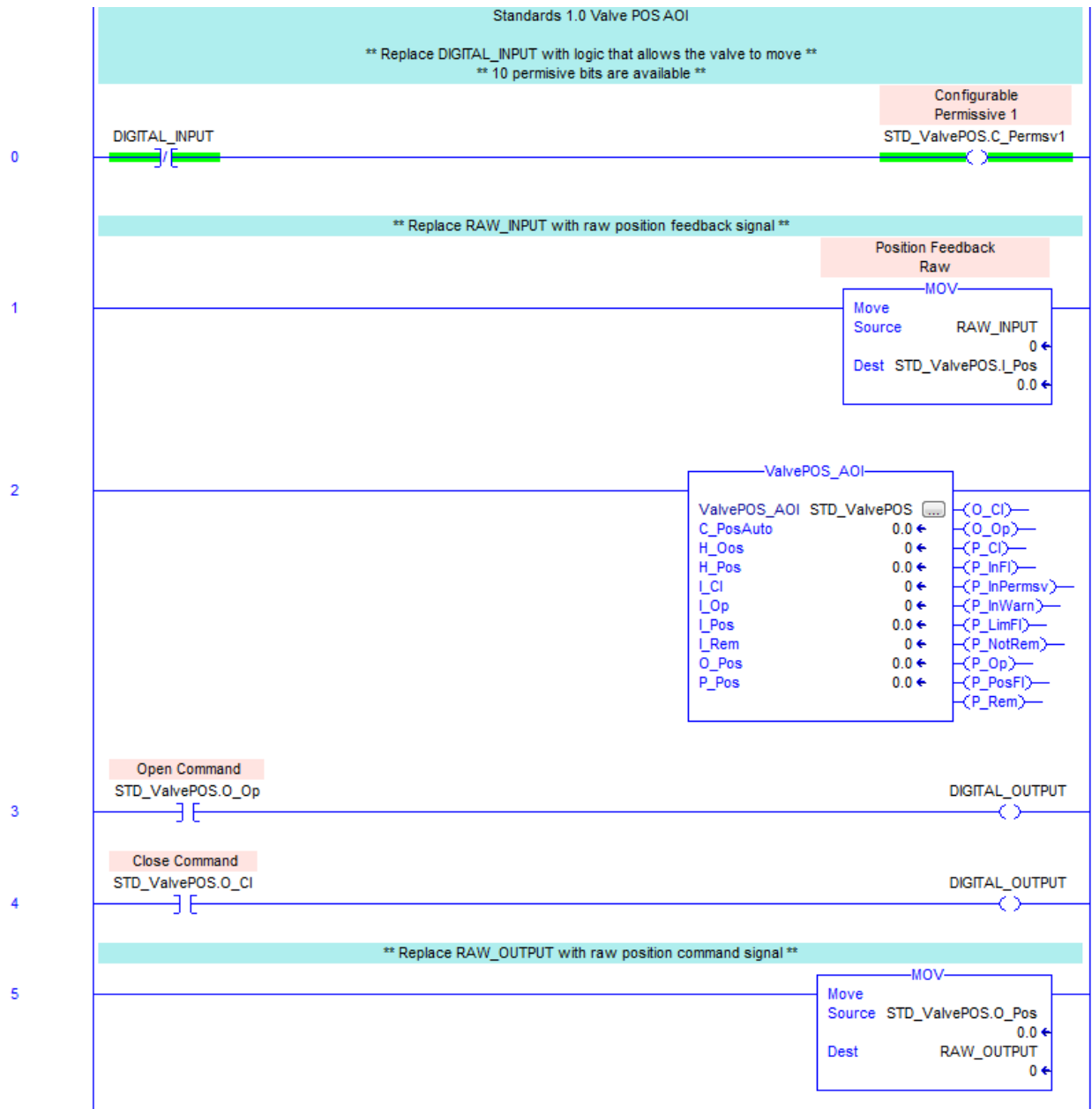


Figure 2-2 Standard Template Logic for the Valve POS AOI

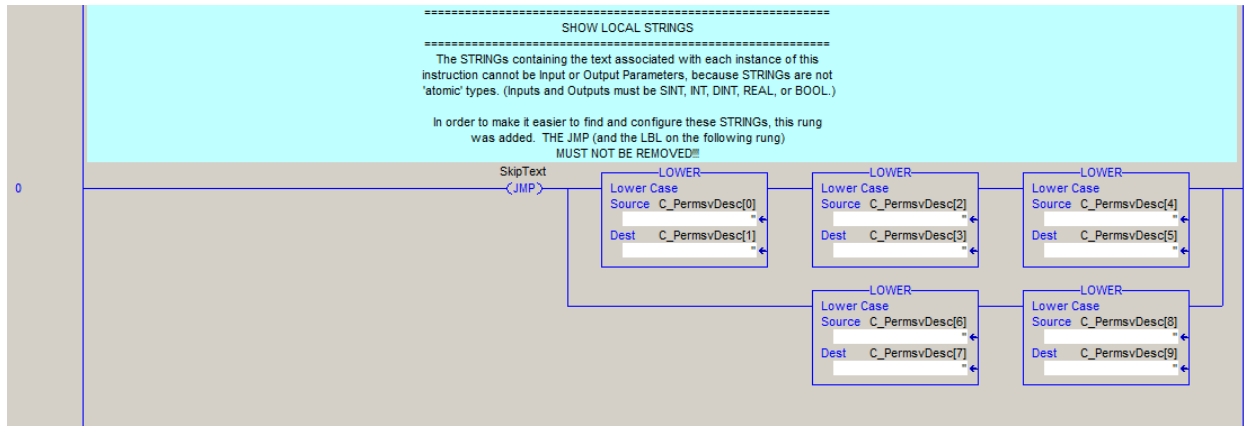


Figure 2-3 Standard Template Internal AOI Permissive Descriptions

3 FEATURES

3.1 Configuration Tags

Configuration tags are inputs to the AOI that are set by the engineer during programming and equipment start-up. A “C_” prefix is used to indicate that the tag modifies the configuration of an equipment or instrument.

Table 3-1 Configuration Tags

Parameter	Data Type	Description	Default Value
C_AutoAlm	BOOL	Configurable alarm from auto logic.	False
C_CIPctLim	REAL	Closed percent limit. Maximum valve position for the valve to be considered closed.	3
C_FltHdshDlyTm	DINT	Fault alarm handshake delay time in seconds.	0
C_FltInvlIn	BOOL	Fault invert alarm source.	False
C_FltPri	DINT	Fault alarm priority.	300
C_HasAuto	BOOL	Set if equipment has automatic control.	False
C_HasCICmd	BOOL	Set if equipment has close command signal.	False
C_HasCIFdbk	BOOL	Set if equipment has closed feedback signal.	False
C_HasOpCmd	BOOL	Set if equipment has open command signal.	False
C_HasOpFdbk	BOOL	Set if equipment has opened feedback signal.	False
C_HasPosCmd	BOOL	Set if equipment has position command signal.	False
C_HasPosFdbk	BOOL	Set if equipment had position feedback signal.	False
C_HasRem	BOOL	Set if equipment has remote signal.	False
C_InFl	BOOL	Valve in failure. Configurable from logic.	False
C_InvPos	BOOL	Invert Position. Position feedback and command are expressed as percent closed.	False
C_InWarn	BOOL	Valve in warning. Configurable from logic.	False
C_LimFIDlyTm	DINT	Limit fail alarm delay time in seconds.	90
C_LimFIPri	DINT	Limit fail alarm priority.	300
C_NotRemPri	DINT	Not in remote alarm priority.	400

C_OpCICmdDbPct	REAL	Deadband percent for position command if equipment has open/close control.	1
C_OpPctLim	REAL	Opened percent limit. Minimum valve position for the valve to be considered opened.	97
C_PosAuto	REAL	Position setpoint from automatic logic.	0
C_PosCmdHiEng	REAL	Position command scaling – high engineering units.	100
C_PosCmdHiRaw	REAL	Position command scaling – high raw.	20
C_PosCmdLoEng	REAL	Position command scaling – low engineering units.	0
C_PosCmdLoRaw	REAL	Position command scaling – low raw.	4
C_PosCmdValClmpEn	BOOL	When true, the position command is clamped within the high and low engineering units.	False
C_PosFdbkFIPct	DINT	Position feedback fail percent.	5
C_PosFdbkFITm	DINT	Position feedback fail delay time in seconds.	60
C_PosFdbkHiEng	REAL	Position feedback scaling – high engineering units.	100
C_PosFdbkHiRaw	REAL	Position feedback scaling – high raw.	20
C_PosFdbkLoEng	REAL	Position feedback scaling – low engineering units.	0
C_PosFdbkLoRaw	REAL	Position feedback scaling – low raw.	4
C_PosFdbkValClmpEn	BOOL	When true, the position feedback is clamped within the high and low engineering units.	False
C_PosFIPri	DINT	Position fail alarm priority.	400
C_Permsv1	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv2	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv3	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv4	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv5	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv6	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv7	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv8	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv9	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_Permsv10	BOOL	Configurable permissive. Used in the logic to allow the valve to move.	True
C_PermsvAction	BOOL	When true, hold current valve position if permissives are not met. When false, go to C_PermsvPos.	False
C_PermsvPos	REAL	When C_PermsvAction is false and permissives are not met, valve moves to this position.	0
C_TrqHdshDlyTm	DINT	Torque alarm handshake delay time in seconds.	0

C_TrqInvlIn	BOOL	Torque invert alarm source.	False
C_TrqPri	DINT	Torque alarm priority.	300

3.2 Input Tags

Input tags are inputs to the AOI that are set by the I/O and indicate equipment status. The “I_” prefix is used to indicate that the tag is displaying an equipment or instrument status.

Table 3-2 Input Tags

Parameter	Data Type	Description
I_CI	BOOL	Closed feedback.
I_Flt	BOOL	Fault alarm source.
I_Op	BOOL	Opened feedback.
I_Pos	REAL	Position feedback raw value.
I_Rem	BOOL	Equipment is in remote mode.
I_Trq	BOOL	Torque alarm source.

3.3 Output Tags

Output tags are outputs from the AOI that are used to control equipment. The “O_” prefix is used to indicate that the tag controls a real-world output within the PLC.

Table 3-3 Output Tags

Parameter	Data Type	Description
O_CI	BOOL	Close command.
O_Op	BOOL	Open command.
O_Pos	REAL	Position command raw value.

3.4 HMI Tags

HMI tags are inputs to the AOI that are set by the operator. The “H_” prefix is used to indicate that the tag modifies a PLC register from the operator interface.

Table 3-4 HMI Tags

Parameter	Data Type	Description	Default Value
H_Auto	BOOL	Mode selection. False=Manual, True=Auto.	False
H_CI	BOOL	Manual close button.	False
H_FltDlyTm	REAL	Fault alarm delay time in seconds.	0
H_FltEn	BOOL	Fault alarm enable.	False
H_FltHdsh	BOOL	Fault alarm HMI handshake.	False
H_FltOos	BOOL	Fault alarm out of service.	False
H_FltRst	BOOL	Fault alarm reset.	False
H_LimFIEn	BOOL	Limit fail alarm enable.	False
H_NotRemDlyTm	REAL	Not in remote alarm delay time in seconds.	5
H_NotRemEn	BOOL	Not in remote alarm enable.	False

H_Oos	BOOL	Out of service. When true, the valve cannot be called to move, and the alarms are disabled.	False
H_Op	BOOL	Manual open button.	False
H_PermsvByP	DINT	Bypass the permissives. Set the individual bits to true to bypass permissives that are not met.	0
H_Pos	REAL	Manual position setpoint.	0
H_PosFdbkFIEn	BOOL	Position feedback fail alarm enable.	False
H_Rst	BOOL	Alarm reset button.	False
H_Stp	BOOL	Manual stop button.	False
H_TrqDlyTm	REAL	Torque alarm delay time in seconds.	0
H_TrqEn	BOOL	Torque alarm enable.	False
H_TrqHdsh	BOOL	Torque alarm HMI handshake.	False
H_TrqOos	BOOL	Torque alarm out of service.	False
H_TrqRst	BOOL	Torque alarm reset.	False

3.5 PLC Logic Tags

PLC Logic tags are attributes internal to the AOI. The “P_” prefix is used to indicate that the tag is modified or calculated within the PLC.

Table 3-5 PLC Logic Tags

Parameter	Data Type	Description	Historian	Alarm
P_CI	BOOL	Closed feedback.	No	No
P_Flt	BOOL	Fault alarm.	No	Yes
P_InAlm	BOOL	Indicates that an alarm is active.	No	No
P_InFI	BOOL	Valve in failure.	No	No
P_InWarn	BOOL	Valve in warning.	No	No
P_InPermsv	BOOL	Valve is permitted to move.	No	No
P_LimFI	BOOL	Limit fail.	No	Yes
P_MaxAlmPri	DINT	Displays the highest priority of the active alarms. 100=critical, 200=high, 300=medium, 400=low.	No	No
P_NotRem	BOOL	Not in remote.	No	Yes
P_Op	BOOL	Opened feedback.	No	No
P_Permsv	DINT	Displays which permissives are active after checking for bypassing.	No	No
P_Pos	REAL	Position feedback in engineering units.	Yes	No
P_PosFI	BOOL	Position fail.	No	Yes
P_Rem	BOOL	Valve is in remote.	No	No
P_Trq	BOOL	Torque alarm.	No	Yes