TULSA Water and Sewer Department

SCADA System Improvements

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

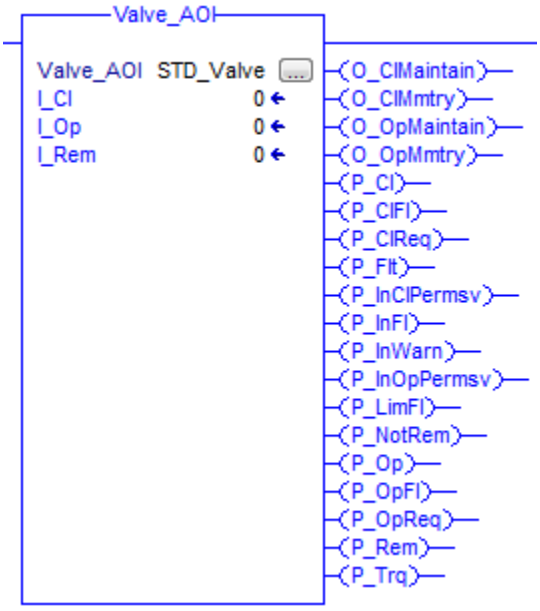

Figure 1-1 Valve AOI as it appears in ladder logic

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.

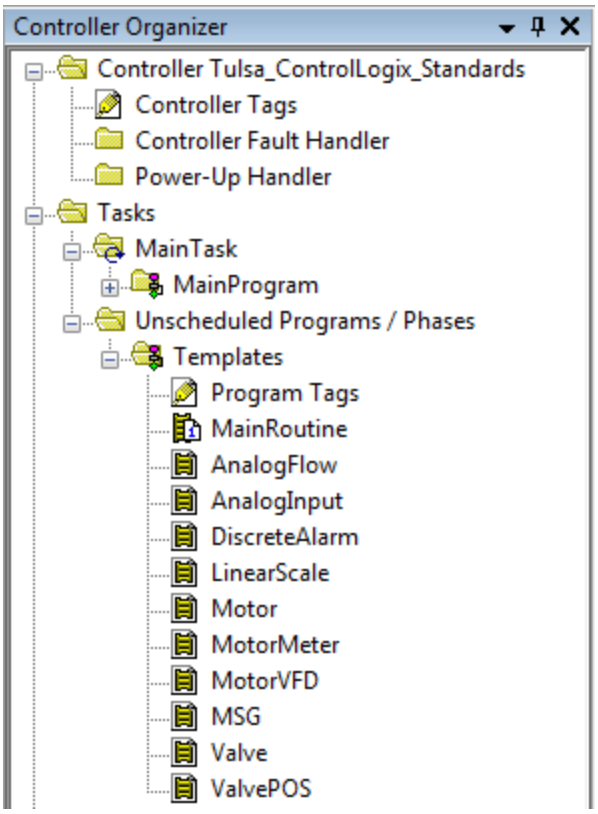

Figure 2-1 Unscheduled Standard Logic Templates

The valve template routine displays the standard logic for using the Valve AOI. Rungs 0 and 1 enable the valve open and close permissive to allow the valve to move. Programmers can include logic on these rungs to control the permissives. There are 10 permissive available for open and 10 for close. Permissive descriptions should be set in rung 0 of the internal AOI logic. Rung 2 places the valve in the default push button mode. Rungs 4 and 5 open and close the valve by writing to digital outputs.

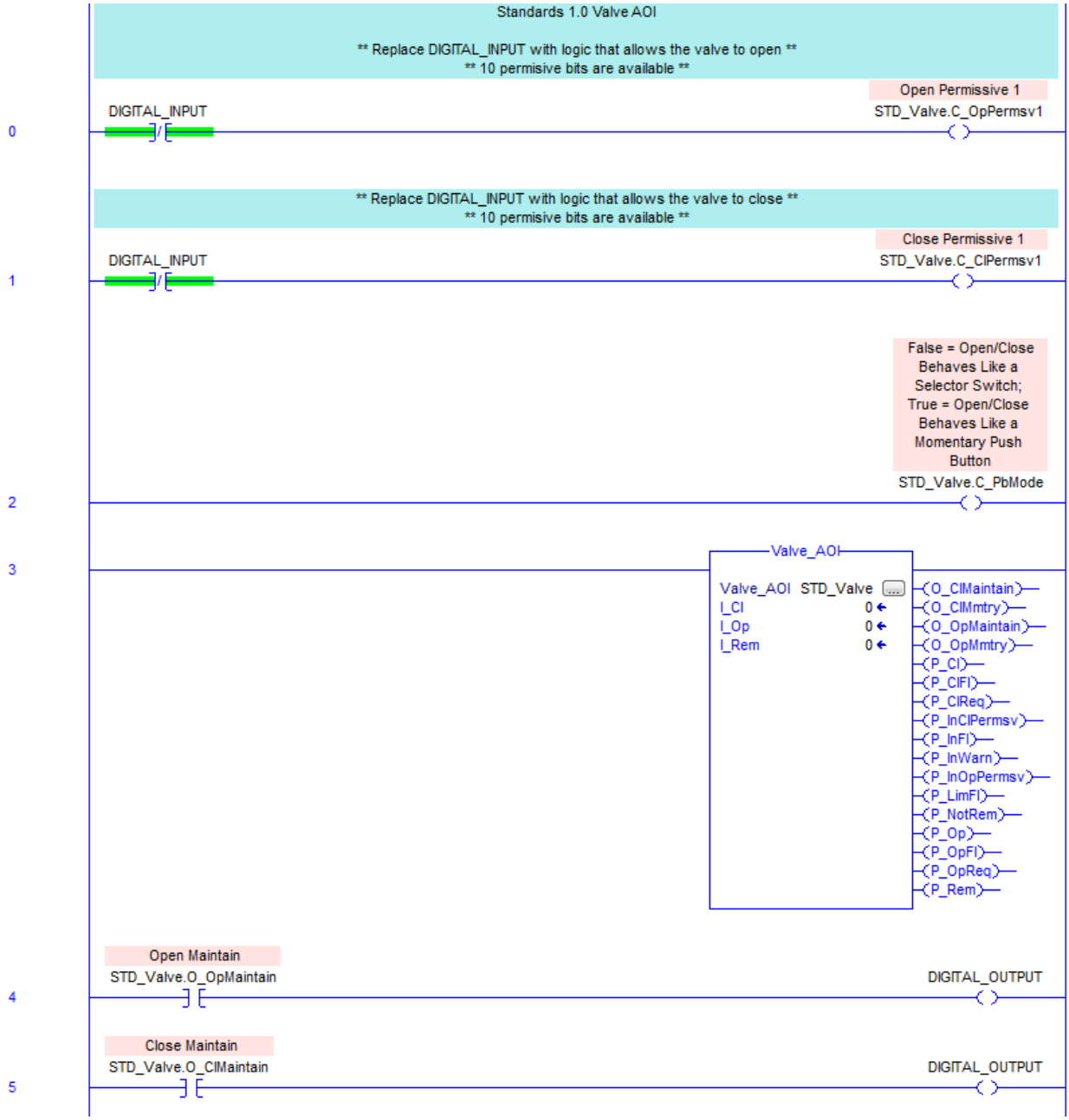

Figure 2-2 Standard Template Logic for the Valve AOI

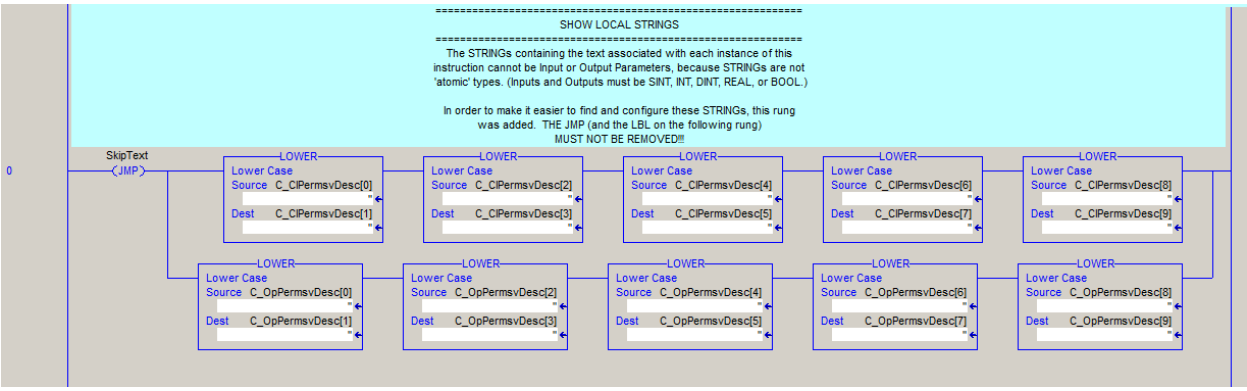

Figure 2-3 Standard Template Internal AOI Permissive Descriptions

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_ClFlDlyTm	DINT	Close fail delay time in seconds.	90
C_ClFlPri	DINT	Close fail alarm priority.	300
C_ClPermsv1	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv2	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv3	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv4	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv5	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv6	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv7	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv8	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv9	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_ClPermsv10	BOOL	Configurable close permissive. Used in the logic to allow the valve to close.	True
C_FltHdshDlyTm	DINT	Fault alarm handshake delay time in seconds.	0
C_FltInvIn	BOOL	Fault invert alarm source.	False
C_FltPri	DINT	Fault alarm priority.	300
C_HasAuto	BOOL	Set if equipment has automatic control.	False

C_HasClFdbk	BOOL	Set if equipment has closed feedback.	False
C_HasMan	BOOL	Set if equipment has manual control.	False
C_HasOpFdbk	BOOL	Set if equipment has opened feedback.	False
C_HasRem	BOOL	Set if equipment has remote signal.	False
C_InFl	BOOL	Valve in failure. Configurable from logic.	False
C_InWarn	BOOL	Valve in warning. Configurable from logic.	False
C_LimFlDlyTm	DINT	Limit fail delay time in seconds.	90
C_LimFlPri	DINT	Limit fail alarm priority.	300
C_NotRemPri	DINT	Not in remote alarm priority.	400
C_OpAuto	BOOL	Open command from the auto logic.	False
C_OpFlDlyTm	DINT	Open fail delay time in seconds.	90
C_OpFlPri	DINT	Open fail alarm priority.	300
C_OpPermsv1	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv2	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv3	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv4	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv5	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv6	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv7	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv8	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv9	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_OpPermsv10	BOOL	Configurable open permissive. Used in the logic to allow the valve to open.	True
C_PbMode	BOOL	Push button mode. False = Start/Stop Behaves Like a Selector Switch; True = Start/Stop Behaves Like a Momentary Push Button	False
C_TrqHdshDlyTm	DINT	Torque alarm handshake delay time in seconds.	0
C_TrqInvIn	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 indicated that the tag is displaying an equipment or instrument status.

Table 3-2 Input Tags

Parameter	Data Type	Description
I_Cl	BOOL	Closed feedback.
I_Flt	BOOL	Fault alarm source.

I_Op	BOOL	Opened feedback.
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_ClMaintain	BOOL	Close command maintain.
O_ClMmtry	BOOL	Close command momentary.
O_OpMaintain	BOOL	Open command maintain.
O_OpMmtry	BOOL	Open command momentary.

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_Cl	BOOL	Manual close button.	False
H_ClFlEn	BOOL	Close fail alarm enable.	False
H_ClPermsvByp	DINT	Bypass the close permissives. Set the individual bits to true to bypass permissives that are not met.	0
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_LimFlEn	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 open or close, and the alarms and are disabled.	False
H_Op	BOOL	Manual open button.	False
H_OpFlEn	BOOL	Open fail alarm enable.	False
H_OpPermsvByp	DINT	Bypass the open permissives. Set the individual bits to true to bypass the permissives that are not met.	0
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	Alarm
P_Cl	BOOL	Closed feedback.	No
P_ClFl	BOOL	Close fail.	Yes
P_ClPermsv	DINT	Displays which close permissives are active after checking for bypassing.	No
P_ClReq	BOOL	Close requested. Valve has been called to close, but is not closed.	No
P_Flt	BOOL	Fault alarm.	Yes
P_InAlm	BOOL	Indicates that an alarm is active.	No
P_InClPermsv	BOOL	Valve is permitted to close.	No
P_InFl	BOOL	Valve in failure.	No
P_InOpPermsv	BOOL	Valve is permitted to open.	No
P_InWarn	BOOL	Valve in warning.	No
P_LimFl	BOOL	Limit fail.	Yes
P_MaxAlmPri	DINT	Displays the highest priority of the active alarms. 100=critical, 200=high, 300=medium, 400=low.	No
P_NotRem	BOOL	Not in remote.	Yes
P_Op	BOOL	Opened feedback.	No
P_OpFl	BOOL	Open fail.	Yes
P_OpPermsv	DINT	Displays which open permissives are active after checking for bypassing.	No
P_OpReq	BOOL	Open requested. Valve has been called to open, but is not opened.	No
P_Rem	BOOL	Valve is in remote.	No
P_Trq	BOOL	Torque alarm.	Yes