TULSA Water and Sewer Department
SCADA System Improvements
Linear Scale 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.

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1 INTRODUCTION

The Linear Scale Add-On Instruction (AOI) converts the mapped input signal from a raw value to engineering units by using the standard linear equation y=m*x+b.

The components of the linear equation are as follows:

x = raw value

y = scaled value

$$m \text{ (slope)} = \frac{(HighEngineeringUnits - LowEngineeringUnits)}{(HighRaw - LowRaw)}$$
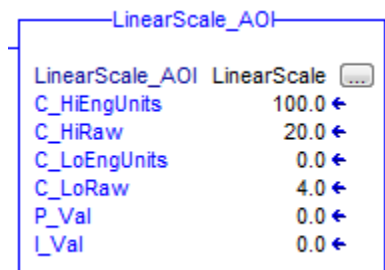
b (y intercept) = y-m*x

Figure 1-1 Linear Scale 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.
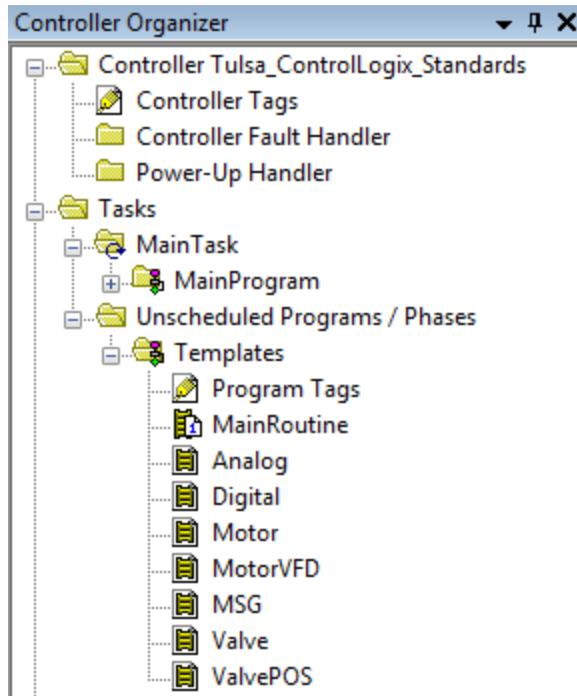
Figure 2-1 Unscheduled Standard Logic Templates

The analog template routine displays the standard logic for using the Linear Scale AOI. In the first rung, data is moved from the source into the raw value input.
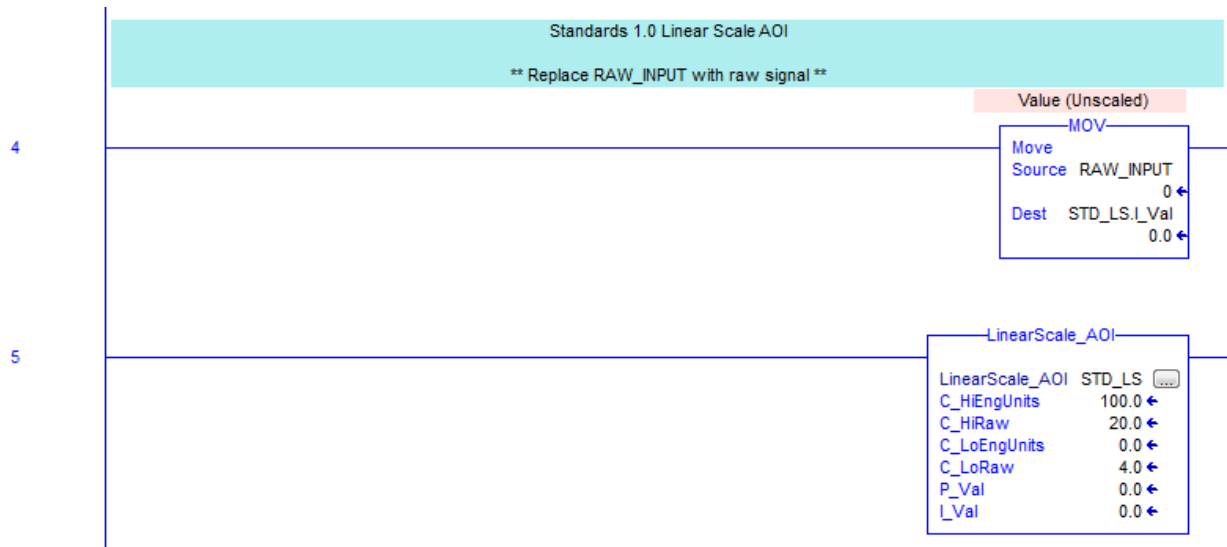

Figure 2-2 Standard Template Logic for the Linear Scale AOI

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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_HiEngUnits	REAL	The maximum value of the scaled analog signal.	0
C_HiRaw	REAL	The maximum value of the raw analog input signal.	0
C_LoEngUnits	REAL	The minimum value of the scaled analog signal.	0
C_LoRaw	REAL	The minimum value of the raw analog input signal.	0
C_ValClmpEn	BOOL	When true, the scaled value is clamped between C_LoEngUnits and C_HiEngUnits.	False

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_Val	REAL	Raw input value mapped into the AOI to be scaled.

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. The Linear Scale AOI does not contain any output tags.

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. The Linear Scale AOI does not contain any output tags.

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 3-3 PLC Logic Tags

Parameter	Data Type	Description
P_Val	REAL	Scaled value in engineering units.

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