Engineering Note

ACT350

EtherNet/IP Sample Code

METTLER TOLEDO

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Note: The configuration used in the example is based on the default configuration:

Studio 5000 version 24

SAI data format: 2-Block format;

IP address: 192.168.0.2;

Single network port AOP file: MT_SAI_ACT350_AOP_Rel120

Firmware version number: 1.05.0003;

1. Configure Development Environment

1.1. Confirm AOP Installation

This sample code project utilizes AOP file for the ACT350. This AOP is automatically included in newer versions of Studio 5000 and can also be found in the AOP download files on Rockwell's website.

To confirm installation of ACT350 AOP file:

1. In any Studio 5000 project, right click on "Ethernet" within the I/O Configuration folder in the controller organizer.
2. Select New Module.

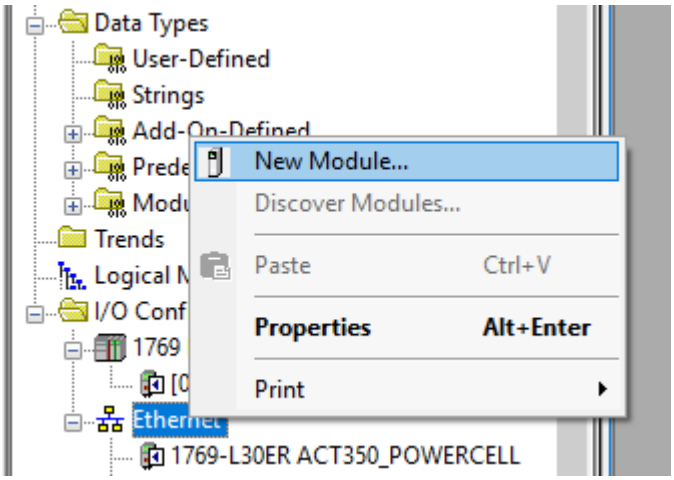


Figure 1-1: Try to add a new module to confirm AOP is installed

3. Search ACT350

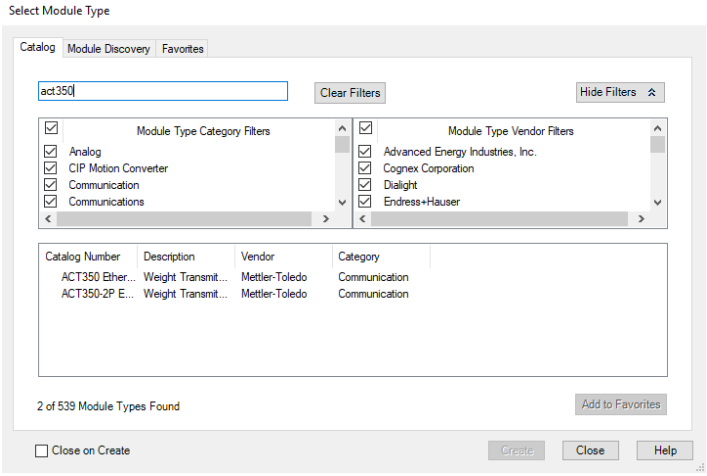


Figure 1-2: Search for ACT350

If the AOP is installed, there should be options for ACT350 and ACT350-2P. If the search returns no results, follow these steps to install the AOP:

1. Go to the ACT350 download page: www.mt.com/ind-act350-downloads
2. Click ACT350/ACT350xx Weight Transmitter Downloads

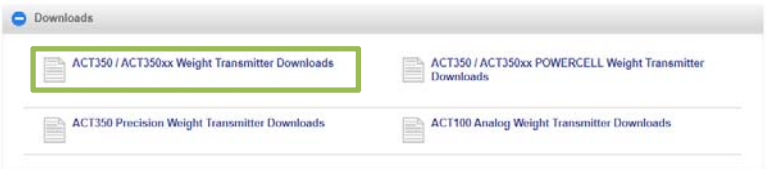


Figure 1-3: Select ACT350 downloads

3. Click AOP Rev. 120 file to begin download

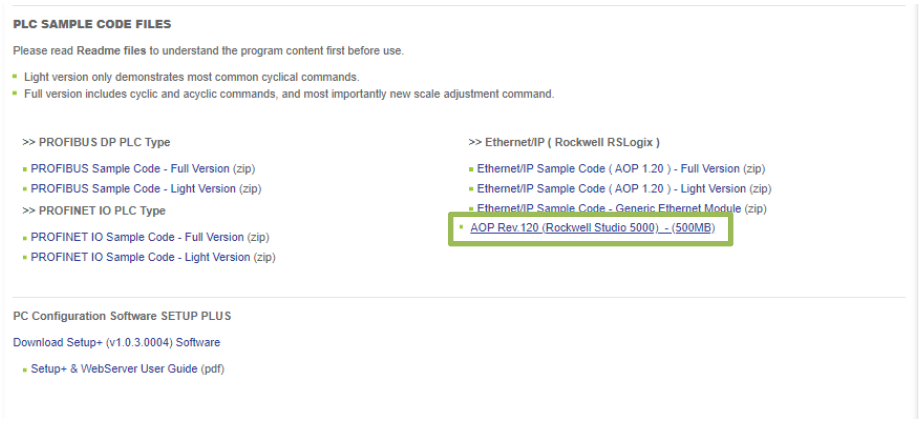


Figure 1-4: Download AOP

4. Once the download is complete, unzip the folder
5. Navigate to MPSetup.exe and double-click. The AOP files will be installed in Studio 5000

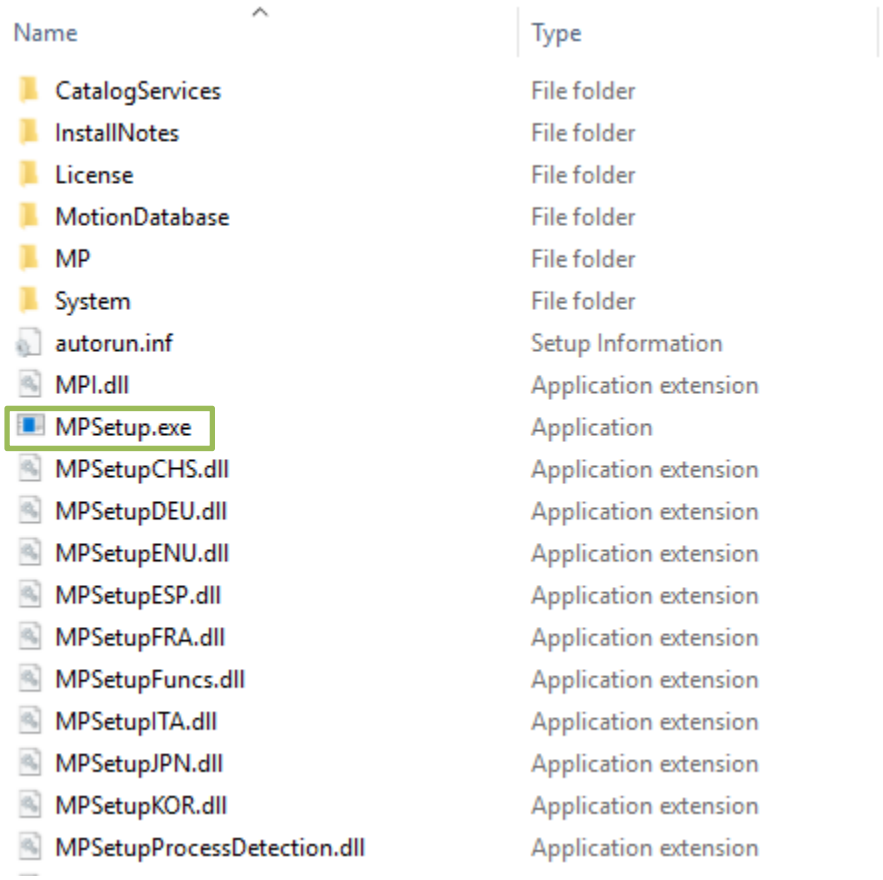


Figure 1-5: Double-Click MPSetup.exe to complete AOP installation

1.2. Update the ACT350 Firmware

Some elements of this sample code project require a minimum ACT350 firmware version of 1.05.0003. Confirm the firmware used in the transmitter by navigating to the Setup menu from the front panel of the ACT350, select Information and "S/W Version."

If the firmware on the device is below 1.05.0003, follow these steps to update the firmware:

1. Make sure to always back up the current ACT350 configuration before performing a firmware update. See the Setup+ user guide for more information on the save/load process.
2. Download the latest firmware from www.mt.com/ind-act350-downloads. Be sure to download the firmware for "ACT350/ACT350DIO Weight Transmitters" for EtherNet/IP.
3. Open the Setup+ program on your PC. If you do not have the Setup+ program, it can be found at www.mt.com/ind-act350-downloads along with the Setup+ user guide.
4. Once in Setup+, select ACT350 as the terminal.

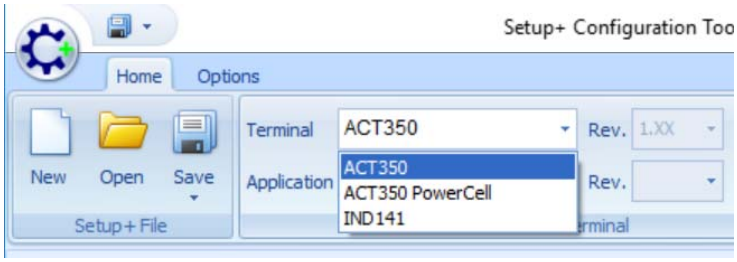


Figure 1-6: Select terminal type in Setup+

5. Select "Settings" to confirm the serial communication settings are correct and match those of the ACT350

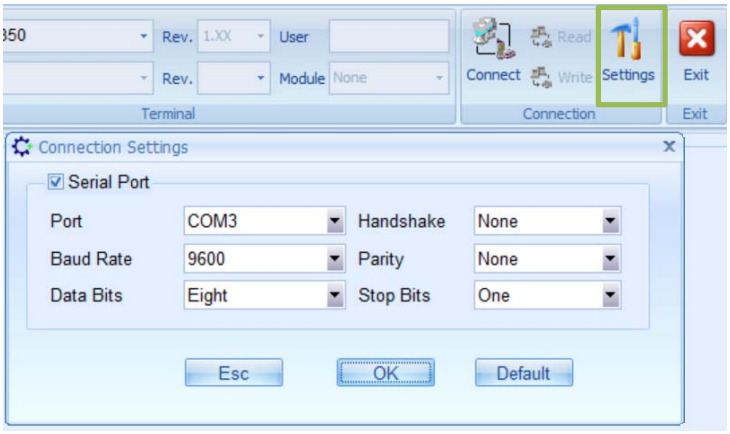


Figure 1-7: Configure Serial Communication Settings

6. Press "Connect" to test communication with the transmitter

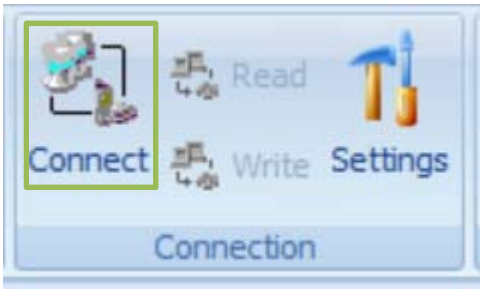


Figure 1-8: Connect to ACT350

7. If successfully connected, press "Disconnect". If not successful, adjust the connection settings and try to connect again. You must be able to connect to successfully update the firmware.

Figure 1-9: Disconnect from ACT350

8. Power down the ACT350. This is important for initiating the update.

9. Select the Options tab at the top of the Setup+ screen and click Flash Download.

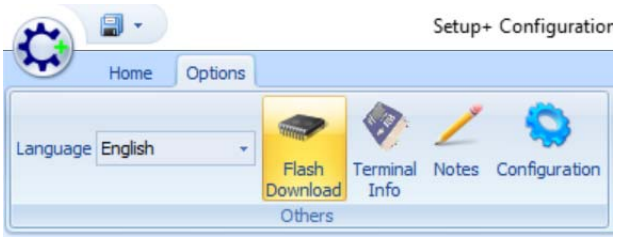


Figure 1-10: Navigate to Flash Download

10. Click the three dots next to "Flash file name and navigate to the firmware download on your PC

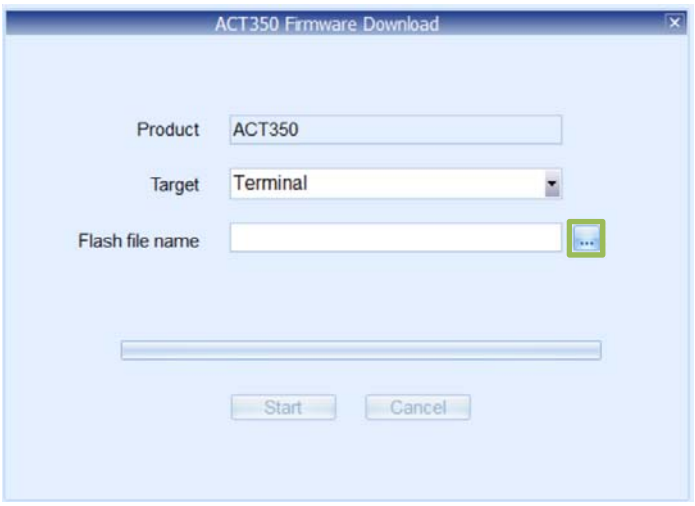


Figure 1-11: Navigate to Firmware File

11. Select Start. The process will timeout automatically because the ACT350 is powered down.

12. A pop-up will appear asking if you would like to force download. Click Yes.

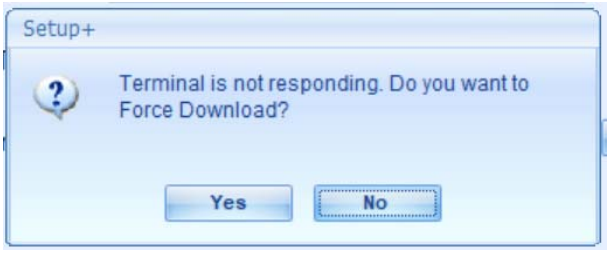


Figure 1-12: Force Download

13. Click Restart to Force Download

14. When prompted, power up the ACT350

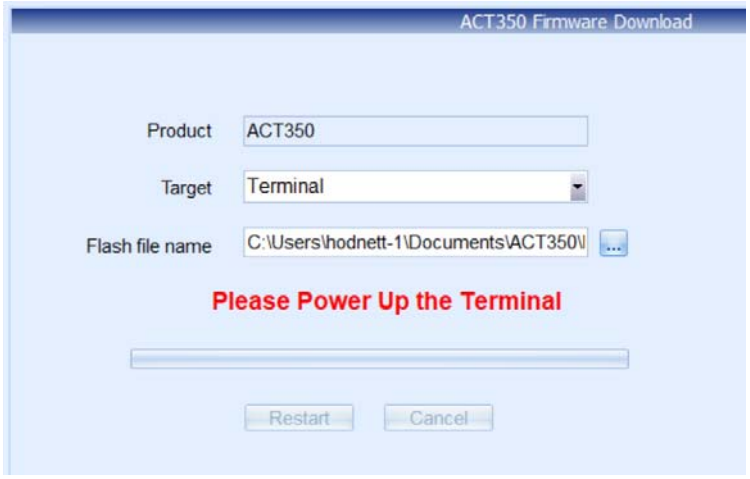


Figure 1-13: Power up the ACT350

15. Follow remaining on screen prompts to complete the update

The firmware update process can take several minutes to complete. It is important to be patient through this process and not power cycle the transmitter. A power cycle in the middle of a firmware update can potentially cause an unrecoverable error.

Once the process completes, please allow the ACT350 to automatically restart itself. Confirm the new firmware has been properly downloaded by once again going to Setup->Information->S/W Version on the front panel of the ACT350.

1.3. Import Example as a New Project

You need Studio5000 V24 or above to import the examples.

Import the project in Studio5000, click "File-> Open"

Select the .ACD file and click open. The project will load.

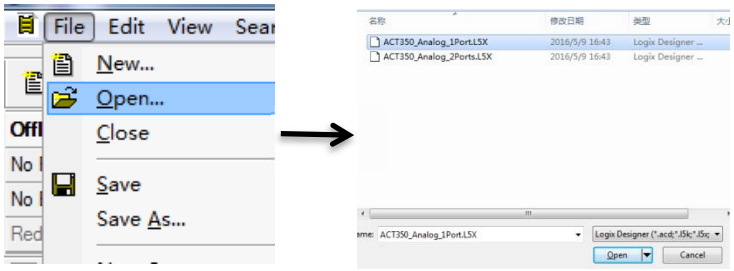


Figure 1-14: Import Project

1.4. Import Example to an Existing Project

1. Add an ACT350 (if using single port ACT350) or ACT350-2P (if usuing dual port ACT350) to the I/O Configuration in the existing project. See the first steps of Section 3 for more information on how to complete this. Using the name "ACT350" and the IP Address 192.168.0.2 will require no changes to the sample code. If a different name or IP address is required, steps explaining what changes to make are provided below.

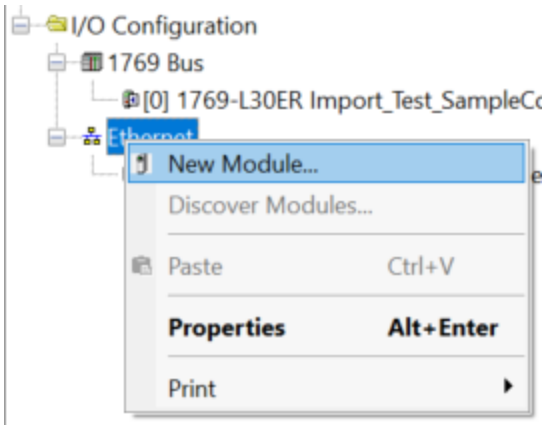


Figure 1-15: Add ACT350 to the existing project

2. Copy the Add-On Instructions from the Add-On Instructions folder in the Controller Organizer of the sample project and paste in the same location in the existing project.

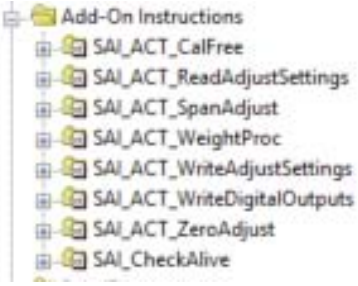


Figure 1-16: Copy/Paste AOIs

3. Copy the controller tags from the sample code project and paste in the controller tags of the existing project. Make sure not to copy the ACT350:I and ACT350:O tags since those are already present in the existing project.

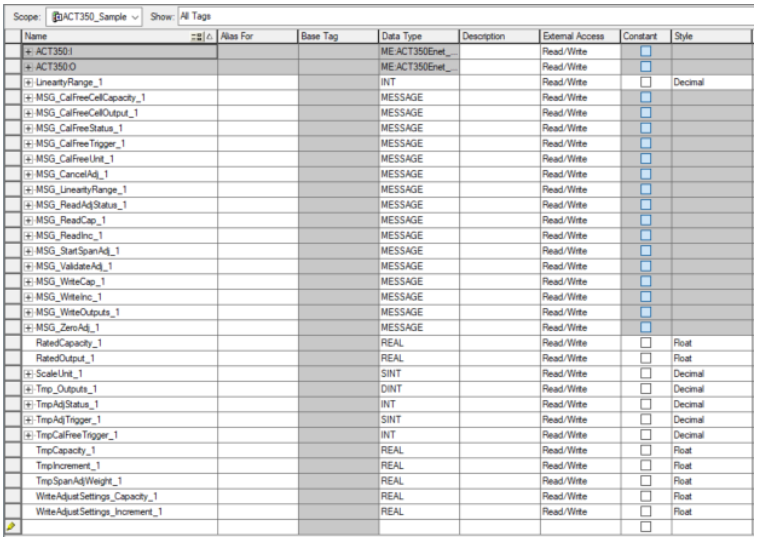


Figure 1-17: Copy/Paste Controller Tags

4. Copy the Main Program local tags from the sample project and paste in the tags for the existing project.

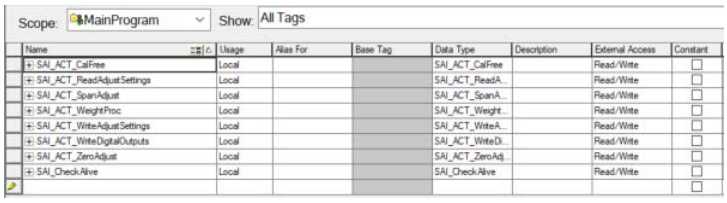


Figure 1-18: Copy/Paste Main Program Local Tags

5. Copy the "MT_ACT_Application" routine from the sample project and paste in the existing project.

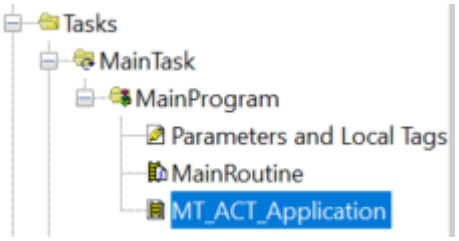


Figure 1-19: Copy/Paste the Routine

6. Make sure something in the existing project calls the MT_ACT_Application. Any AOIs that automatically monitor weight conditions will not run if nothing calls this routine.

7. If a name other than "ACT350" was used as the name of the transmitter in the project, replace every use of "ACT350" in the AOI instances with the name given to the transmitter in the project.

Figure 1-20: Example of name "ACT350_2" used in project

8. If an IP address other than 192.168.0.2 was used for the ACT350 in the project, open the message configuration for every message in every AOI instance and in the communication tab, browse to the appropriate ACT350 to set the path for the message.

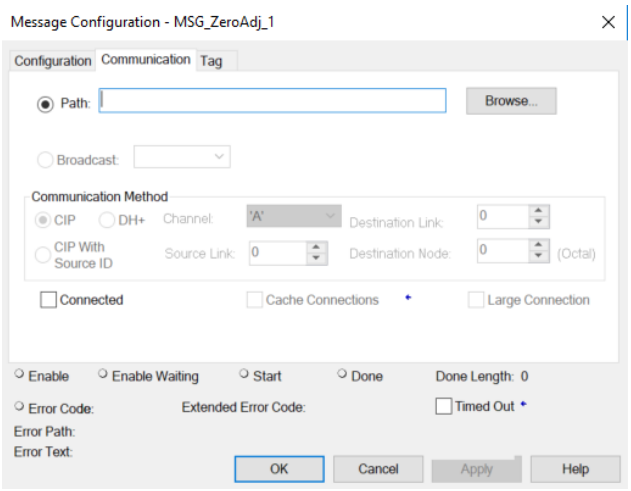


Figure 1-21: Set the Communication Path for each Message

1.5. Configure Controller Type

Please note that this is only necessary if using the sample code as the basis for the PLC project. If importing the routine and AOIs into an already existing project, this is unnecessary.

Right-click the project's controller, select Properties, and set the controller type.

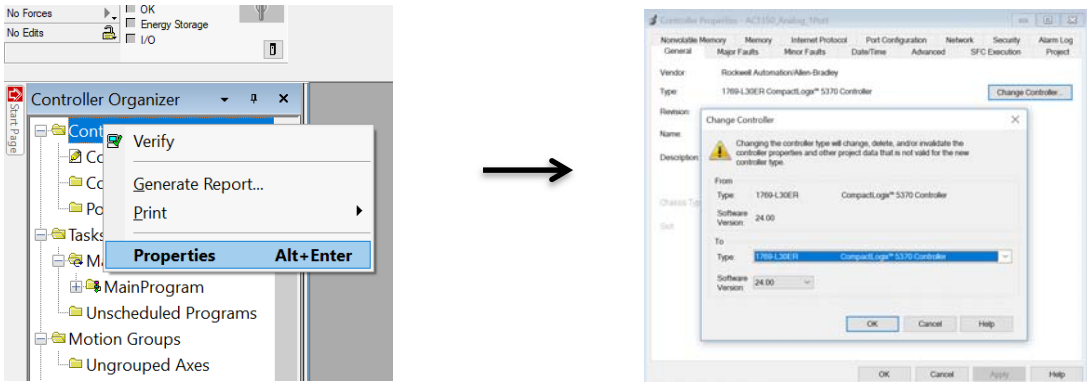


Figure 1-22: Configure controller type

Download the project to the controller and test.

1.6. Configure Transmitter Type

This project was developed with a single port ACT350. If using a dual port ACT350:

1) Delete ACT350 from controller organizer in the project.

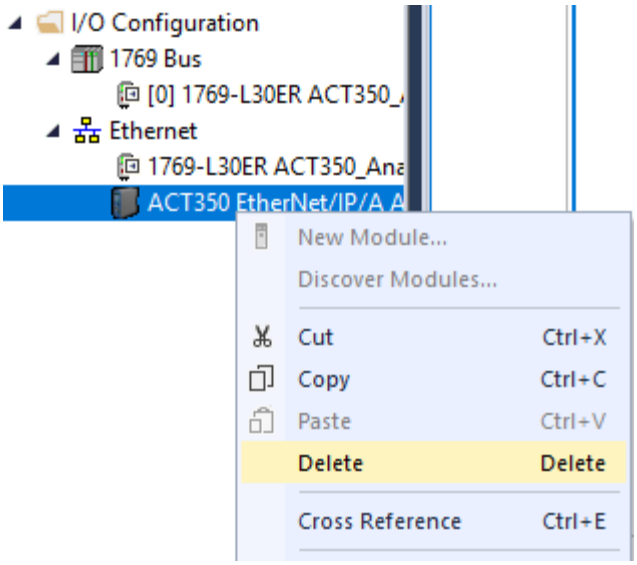


Figure 1-23 Delete single port ACT350

2) Follow steps in Section 3. Steps to Add New ACT350s. Make sure to select ACT350-2P.

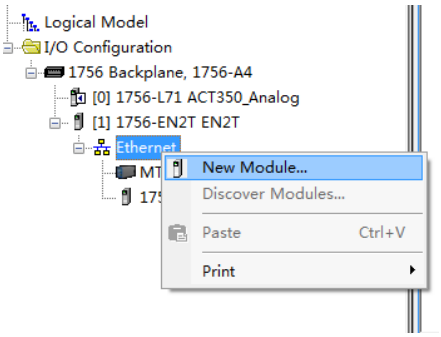


Figure 1-24: Add a device

3. When naming the device, use the same name "ACT350" to minimize work required to rename parameters in Add-On Instructions.

2. Add-On Instructions(AOI)

About the configuration of the Messages in the add-on instructions:

Add-On Instructions that use acyclic communication functions, such as zero point adjustment, span adjustment, etc. need to create and configure Message variables, set paths and indicate which

device to use for acyclic communication. The path of each device is different when multiple devices are networked.

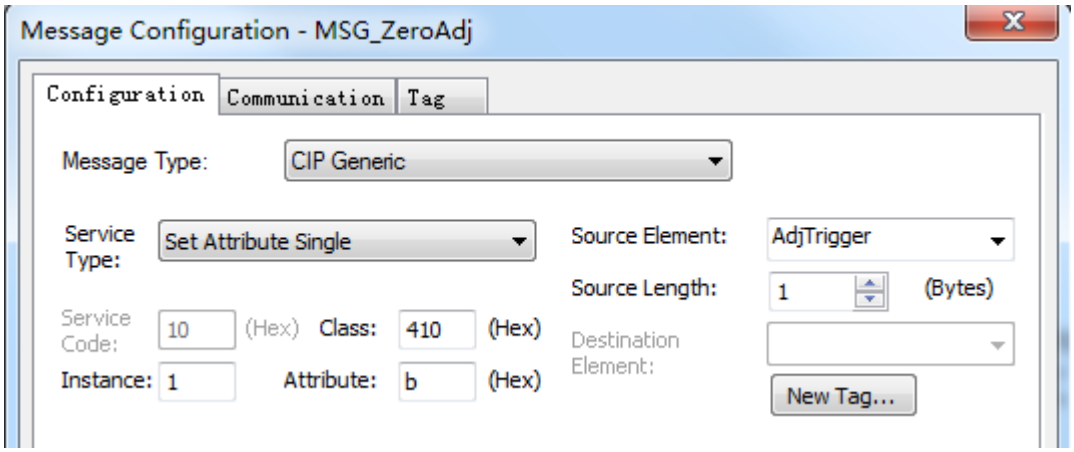


Figure 2-1: Configure Message Variable

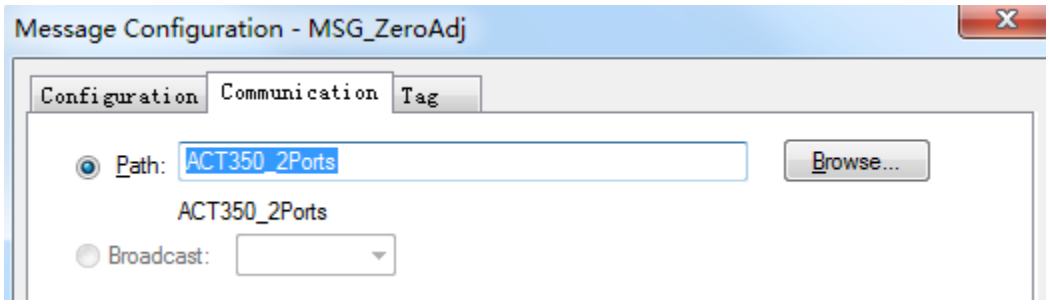


Figure 2-2: Set the path of the Message variable

Message configuration must be accessed via the AOI block in the main program. The message configuration cannot be accessed inside of the AOI logic files.

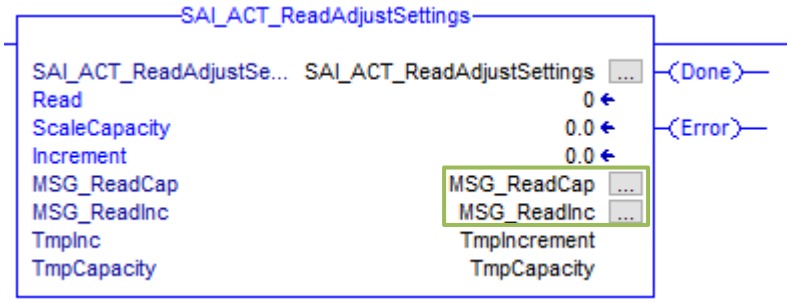


Figure 2-3: Access Message Configuration

2.1. Cyclic Weight Data

Read the real-time and stable weight from the transmitter. When performing zero and tare commands, the weight will stop updating.

Trigger execution of stable tare, stable zero, immediate tare, immediate zero and clear tare by setting that particular bit high. The response can be read, and there are flags for execution success and failure to indicate the result.

After the zero and tare commands are completed, the AOI will automatically restore whatever command is in WeightCmd and weight will be reported again. Typical values for WeightCmd are 0 (report gross weight) or 3 (report net weight). The DataOK bit is reset to 0 during overload, underload, adjustment and several other scenarios which can be used to judge abnormal conditions.

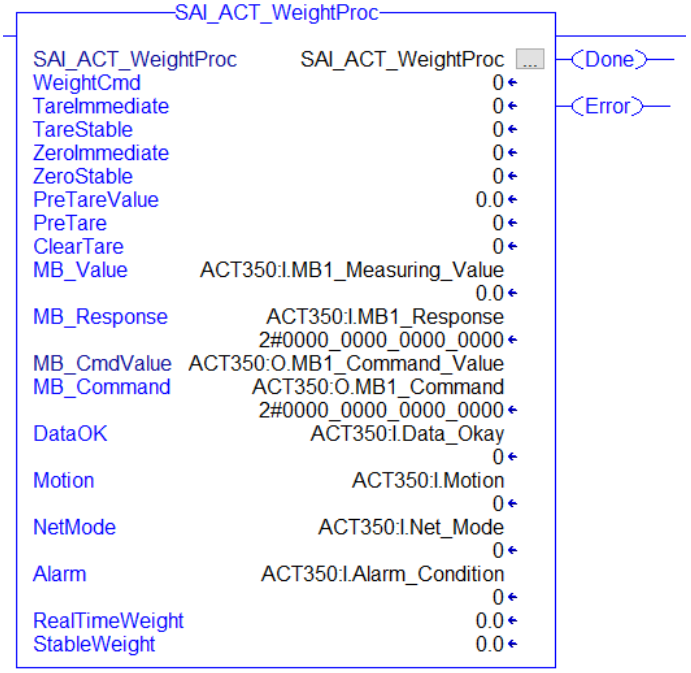


Figure 2-4: SAI_ACT_WeightProc AOI

Input Parameters	Data Type	Description
WeightCmd	INT	Use this value to request the ACT to report weight. When a zero or tare cyclic command is sent, the ACT stops reporting weight. This AOI will automatically restore this command once the zero or tare command completes. 0 or 1 = Report gross weight 2 = Report tare weight 3 = Report net weight 5 = Report gross weight value (with internal resolution) 6 = Report tare weight value (with internal resolution) 7 = Report net weight value (with internal resolution)
TareImmediate	BOOL	Set = 1 to issue tare command regardless of whether the weight value is stable or not. Net weight will not automatically be reported after tare command is issued. Recommended to use cyclic command 3 (report net weight) in WeightCmd input to receive net weight

TareStable	Bool	Set = 1 to issue tare command to ACT when weight is stable. Command will timeout if remain within the stability criteria (+/- 1d within 0.3 seconds default) for a predefined timeout range (3 seconds default). Net weight will not automatically be reported after tare command is issued. Recommended to use cyclic command 3 (report net weight) in WeightCmd input to receive net weight
ZeroImmediate	BOOL	Set = 1 to issue zero command regardless of whether the weight value is stable or not. This is only intended for minor changes to the zero point due to drifting. For a formal zero adjustment, use the SAI_ACT_ZeroAdjust AOI. Command will return an error if weight value is not within the zero range (+/- 2% default).
ZeroStable	BOOL	Set = 1 to issue zero command to ACT when ewight is stable. Command will timeout if remain within the stability criteria (+/- 1d within 0.3 seconds default) for a predefined timeout range (3 seconds default). This is only intended for minor changes to the zero point due to drifting. For a formal zero adjustment, use the SAI_ACT_ZeroAdjust AOI. Command will return an error if weight value is not within the zero range (+/- 2% default).
PreTareValue	Real	Configure with preset tare value. This value will not be sent to ACT until Pretare input is set to 1.
Pretare	BOOL	Set = 1 when ready to perform preset tare using the value from PreTareValue.
ClearTare	BOOL	Set = 1 to clear the current tare value.
MB_Value	Real	This should always be set to the MB1_Measuring_Value of the ACT. This will provide weight data for the AOI
MB_Response	INT	This should always be set to MB1_Response value of the ACT. Once a cyclic command is successfully executed, MB_Response = MB_Command. The AOI uses this information to detect if a command has been executed successfully or if an error has occurred.
DataOK	BOOL	This bit gets set to 0 when the device is still operational but the value being reported cannot be guaranteed to be valid. The following conditions cause the Data Okay bit to be set to 0: • Device is powering up • Device is in setup mode • Device is in test mode • Over capacity condition occurs - When the A/D converter is at its limit - Product dependent over capacity that occurs when the device determines it cannot trust the weight • Under capacity condition occurs - When the A/D converter is at its limit Product dependent under capacity that occurs when the device determines it cannot trust the weight
Motion	Bool	This should always be set to Motion bit of ACT. Motion bit is high when the weight value is not stable. ZeroStable and TareStable commands will not complete while the Motion bit is high.
NetMode	BOOL	This should always be set to the Net_Mode bit of the ACT. NetMode = 1 after a tare command has been executed. Just because NetMode = 1, does not mean net weight is being reported by the ACT. Net weight must be requested by the PLC (cyclic command 3).

Alarm	BOOL	This should always be set to Alarm_Condition bit of ACT. Bit will go high when alarm conditions are present. Bit will automatically go low when no alarm conditions are present. See SAI manual for more information on what causes the Alarm_Condition to go high.
Output Parameters	Data Type	Description
MB_Command	INT	This should always be set to MB1_Command value of the ACT. Value of the last cyclic command sent to the ACT. Once successfully executed, MB_Response = MB_Command.
RealTimeWeight	Real (32 bits)	Current weight of the scale. This value is updated constantly while the AOI is enabled.
StableWeight	Real (32 bits)	Latest stable weight reading of the scale. This value does not update whenever the Motion bit is high.
Done	BOOL	Will be latched high when zero or tare command has successfully completed. When a new zero or tare command begins, bit will be unlatched until command completes successfully
Error	BOOL	Will be latched high when zero or tare command fails to complete. When a new zero or tare command begins, bit will be unlatched until a command fails to complete.

2.2. Communication Heart Beat Monitoring

Monitoring communication between the controller and ACT350. If Alive bit is set, cyclic communications between the controller and transmitter are active.

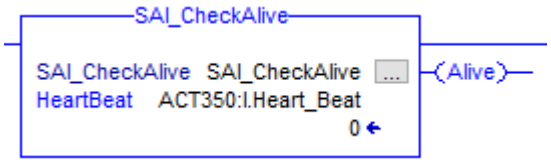


Figure 2-5: SAI_CheckAlive AOI

Input Parameters	Data Type	Description
HeartBeat	BOOL	This should always be set to Heart_Beat bit of ACT. This bit will pulse on and off each second if cyclic communications between the ACT and the controller are established
Output Parameters	Data Type	Description
Alive	BOOL	This bit = 1 if cyclic communications are established between the ACT and the controller.

2.3. Read Scale Adjustment Settings

This AOI reads the capacity and increment values used by the ACT. Set Read = 1 to read values. It is useful to know the current scale settings before performing any scale adjustment procedure.

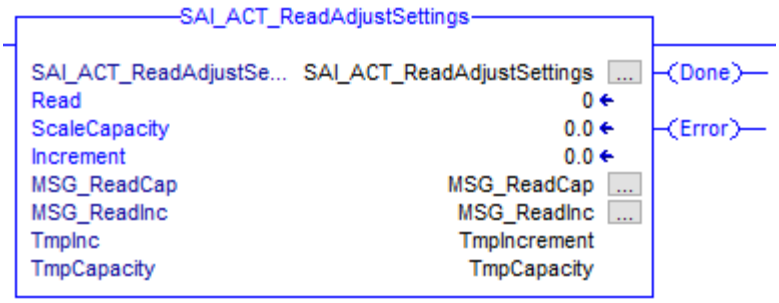


Figure 2-6: SAI_ACT_ReadAdjustSettings AOI

Input Parameters	Data Type	Description
Read	BOOL	Set = 1 to read capacity and increment values from ACT
Output Parameters	Data Type	Description
ScaleCapacity	REAL	Capacity for the scale set in ACT.
Increment	REAL	Increment size used for weight values coming from the ACT
Done	BOOL	Latched high when values are successfully read. Unlatched when Read input is set.
Error	BOOL	Latched high if an error occurred and values could not be read. Unlatched when Read input is set. Check the errors of the messages for this AOI to troubleshoot
In/Out Parameters	Data Type	Description
MSG_ReadCap	Message	**Message Type:** CIP Generic **Service Type:** Get Attribute Single **Class:** 417 (Hex) **Instance:** 1 **Attribute:** 17 (Hex) **Destination Element:** TmpCapacity_1 **Communication -> Path:** Browse for the appropriate ACT350
MSG_ReadInc	Message	**Service Type:** Get Attribute Single **Class:** 417 (Hex) **Instance:** 1 **Attribute:** 16 (Hex) **Destination Element:** TmpIncrement_1 **Communication -> Path:** Browse for the appropriate ACT350
TmpInc	Real	Temporary variable used with message
TmpCapacity	Real	Temporary variable used with message

2.4. Write Scale Adjustment Settings

Configure ScaleCapacity and Increment values and then set Write = 1 when ready to write values to ACT350POWERCELL. Capacity and Increment value parameters must satisfy 500 <= capacity / increment <= 100000

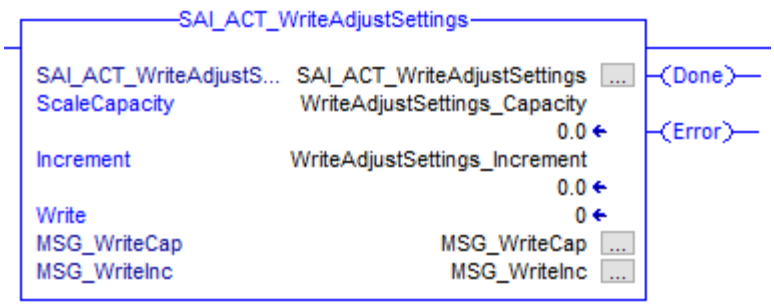


Figure 2-7: SAI_ACT_WriteAdjustSettings AOI

Input Parameters	Data Type	Description
ScaleCapacity	REAL	Configure capacity for the scale. Capacity and Increment value parameters must satisfy 500 <= capacity / increment <= 100000
Increment	REAL	Configure increment size for the scale. Capacity and Increment value parameters must satisfy 500 <= capacity / increment <= 100000
Write	BOOL	Set = 1 to write capacity and increment values to ACT
Output Parameters	Data Type	Description
Done	BOOL	Latched high when values are successfully written. Unlatched when Write input is set.
Error	BOOL	Latched high if an error occurred and values could not be written. Unlatched when Write input is set. Check the errors of the messages for this AOI to troubleshoot
In/Out Parameters	Data Type	Description
MSG_WriteCap	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 417 (Hex) **Instance:** 1 **Attribute:** 17 (Hex) **Source Element:** WriteAdjustSettings_Capacity_1 **Source Length:** 4 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
MSG_WriteInc	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 417 (Hex) **Instance:** 1 **Attribute:** 16 (Hex) **Source Element:** WriteAdjustSettings_Increment_1 **Source Length:** 4 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350

2.5. Zero Adjustment

A zero adjustment must be performed first before either a span adjustment or CalFree. Make sure the scale is empty before starting this procedure.
Set the Start bit = 1 to start the zero adjustment. The Done and Error flags will indicate the result. The DataOK bit is cleared during the adjustment process.

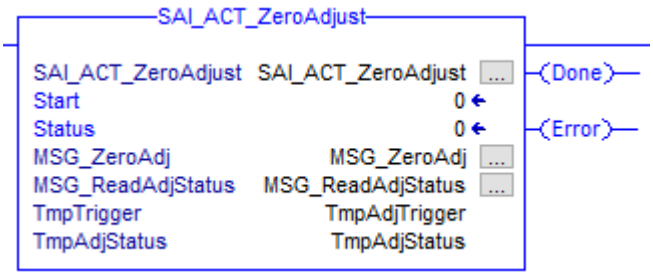


Figure 2-8: SAI_ACT_ZeroAdjust AOI

Input Parameters	Data Type	Description
Start	BOOL	Set = 1 to begin zero adjustment process
Output Parameters	Data Type	Description
Done	BOOL	Latched high when zero adjustment successfully completes. Unlatched when a new zero adjustment begins.
Error	BOOL	Latched high if an error occurred and zero adjustment could not complete. Unlatched when a new zero adjustment begins. Check the errors of the messages for this AOI to troubleshoot
Status	INT	0 = zero adjustment has not begun or has completed. 2047 = zero adjustment in process.
In/Out Parameters	Data Type	Description
MSG_ZeroAdj	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** b (Hex) **Source Element:** TmpAdjTrigger_1 **Source Length:** 1 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
MSG_ReadAdjStatus	Message	**Message Type:** CIP Generic **Service Type:** Get Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 7 (Hex) **Destination Element:** TmpAdjStatus_1 **Communication -> Path:** Browse for the appropriate ACT350
Trigger	SINT	Temporary value for use with AOI message
AdjStatus	INT	Temporary value for use with AOI message

2.6. Span Adjustment

Before executing this AOI, a zero adjustment must be completed. The zero point is the first adjustment point used for all linearity ranges.

First configure the linearity range. LinearityRange:

0 = Two point adjustment;
1 = Three point adjustment,

2 = Four point adjustment;
3 = Five point adjustment;
Note that the zero adjustment already completed was the first adjustment point.

Configure all weights to be used in the adjustment process. Start at Hi_Weight with highest weight value and proceed in descending order. An error will occur if adjustment weight values are not in correct, descending order or if a weight value of zero is used. Set Start = 1 when ready to begin adjustment.

LoadWeight will go high when the ACT350 is prepared for the next adjustment point. Place the adjustment weight on the scale that matches the value in CurrentWeight. Set ConfirmWeight = 1 to begin the adjustment step. Repeat this step for each adjustment point.

If the Done or Error flag is set, the adjustment is complete.
The adjustment process can be cancelled any time by setting Cancel = 1.
The DataOK bit is cleared during the calibration process.

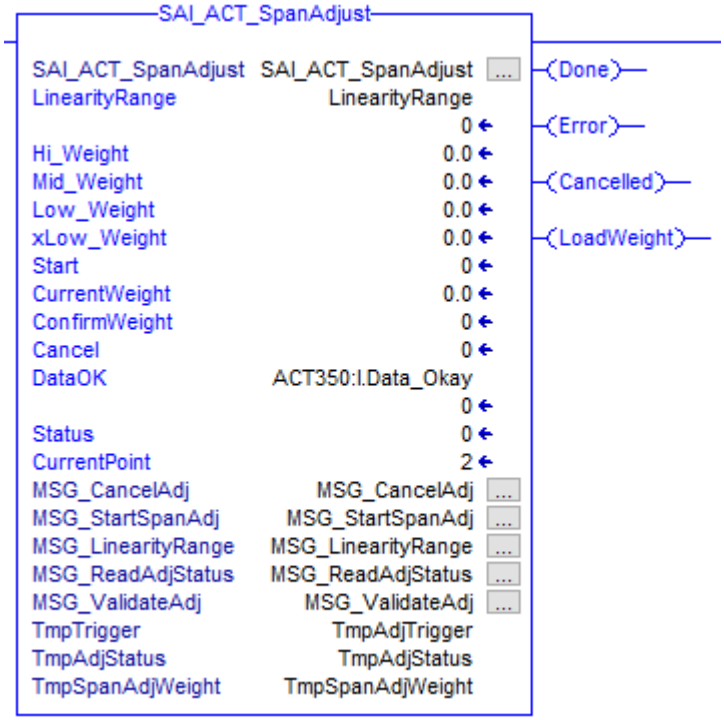
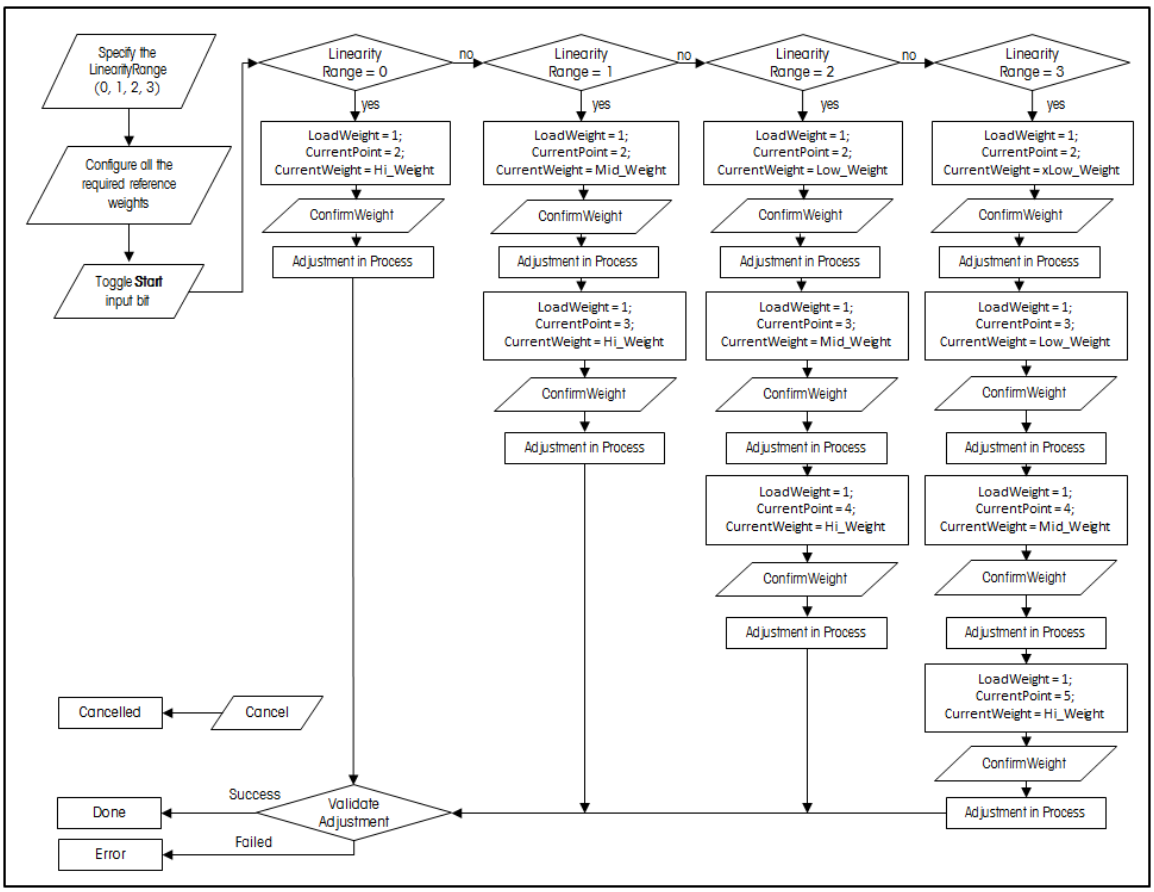


Figure 2-9: SAI_ACT_SpanAdjust AOI



Input Parameters	Data Type	Description
LinearityRange	INT	0 = 2-point adjustment; Hi_Weight 1 = 3-point adjustment; Hi_Weight, Mid_Weight 2 = 4-point adjustment; Hi_Weight, Mid_Weight, Low_Weight 3 = 5-point adjustment; Hi_Weight, Mid_Weight, Low_Weight, xLow_Weight
Hi_Weight	REAL	Highest adjustment weight used in adjustment process. Used with all linearity ranges
Mid_Weight	REAL	Middle weight used in adjustment process. Used with three point, four point and five point linearity ranges
Low_Weight	REAL	Low weight used in adjustment process. Used with four and five point linearity ranges
xLow_Weight	REAL	xLow weight used in adjustment process. Used with five point linearity range
Start	BOOL	Set = 1 once LinearityRange and adjustment weight values are configured to begin process.
ConfirmWeight	BOOL	Set = 1 when LoadWeight output = 1 and the test weight matching the value in CurrentWeight is loaded onto the scale
Cancel	BOOL	Set = 1 to cancel adjustment process
Output Parameters	Data Type	Description
CurrentWeight	REAL	The value of the test weight that should be placed on the scale
Done	BOOL	Latched high when adjustment completes successfully. Unlatched when another span adjustment begins.

Error	BOOL	Latched high if an error occurred and adjustment could not complete. Unlatched when another span adjustment begins. Check the errors of the messages for this AOI to troubleshoot
Cancelled	BOOL	Latched high if the adjustment process was cancelled. Unlatched when another span adjustment begins.
LoadWeight	BOOL	Set high when user needs to load test weight corresponding to the value CurrentWeight output.
Status	INT	Value generally only needed for troubleshooting purposes. 0 = span adjustment has not begun or has completed. 2047 = span adjustment in process. 2045 = Ready for next adjustment point.
CurrentPoint	DINT	Value = current adjustment point being calibrated
In/Out Parameters	Data Type	Description
MSG_CancelAdj	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 4 (Hex) **Source Element:** TmpAdjTrigger_1 **Source Length:** 1 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
MSG_StartSpanAdj	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 9 (Hex) **Source Element:** TMPSpanAdjWeight_1 **Source Length:** 4 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
MSG_LinearityRange	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** a (Hex) **Source Element:** LinearityRange_1 **Source Length:** 2 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
MSG_ReadAdjStatus	Message	**Message Type:** CIP Generic **Service Type:** Get Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 7 (Hex) **Destination Element:** TmpAdjStatus_1 **Communication -> Path:** Browse for the appropriate ACT350
MSG_ValidateAdj	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 10 (Hex) **Source Element:** TmpAdjTrigger_1 **Source Length:** 1 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
TmpTrigger	SINT	Temporary value for use with AOI message
TmpAdjStatus	INT	Temporary value for use with AOI message

TmpSpanAdjWeight	REAL	Temporary value for use with AOI message

2.7. CalFree

CalFree allows for electronic calibration without the use of test weights. This method can be used for initial testing of systems or when a large structure is used as the weighing vessel and it is not possible to apply test weights to the structure.

METTLER TOLEDO highly recommends that test weights or the RapidCal™ method be used whenever possible as these methods provide the most accurate adjustment results.

Configure the rated capacity first, which is the sum of the rated capacities of all sensors currently connected. Then configure the units: 0 = g; 1 = kg; 2 = lb.

Then configure the rated output (sensitivity) with the value from the sensor label. If there are multiple sensors, the average of multiple sensors.

Set Start = 1 to start CalFree. The result is displayed on the Done or Error flag.

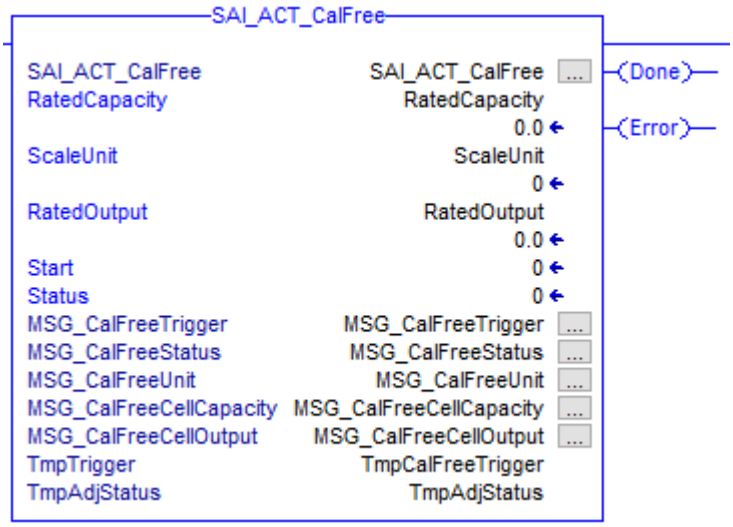


Figure 2-10: SAI_ACT_CalFree AOI

Input Parameters	Data Type	Description
RatedCapacity	REAL	Enter the sum of the rated capacity values for all load cells connected to the ACT350
Unit	DINT	Unit RatedCapacity is in. 0 = grams 1 = kilograms 2 = pounds
RatedOutput	REAL	Sensitivity value found on the load cell label. Use the average of all load cells connected to the ACT350
Start	BOOL	Set = 1 to begin CalFree process
Output Parameters	Data Type	Description

Done	BOOL	Latched high when CalFree successfully completes. Unlatched when CalFree is triggered again.
Error	BOOL	Latched high if an error occurred and CalFree could not complete. Unlatched when CalFree is triggered again. Check the errors of the messages for this AOI to troubleshoot
Status	INT	0 = CalFree has not begun or has completed. 2047 = CalFree in process.
In/Out Parameters	Data Type	Description
MSG_CalFreeTrigger	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 1a (Hex) **Source Element:** TmpCalFreeTrigger_1 **Source Length:** 2 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
MSG_CalFreeStatus	Message	**Message Type:** CIP Generic **Service Type:** Get Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 7 (Hex) **Destination Element:** TmpAdjStatus_1 **Communication -> Path:** Browse for the appropriate ACT350
MSG_CalFreeUnit	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 1c (Hex) **Source Element:** ScaleUnit_1 **Source Length:** 1 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
MSG_CalFreeCellCapacity	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 1b (Hex) **Source Element:** RatedCapacity_1 **Source Length:** 4 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
MSG_CalFreeOutput	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 410 (Hex) **Instance:** 1 **Attribute:** 1d (Hex) **Source Element:** RatedOutput_1 **Source Length:** 4 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
TmpTrigger	INT	Temporary value for use with AOI message
TmpAdjStatus	INT	Temporary value for use with AOI message

2.8. Digital Output Control

Please note that this AOI is only intended for use with the dual port version of ACT350. The single port version does not have any digital outputs. See "Configure Transmitter Type" section of this engineering note to learn how to change between the single port and dual port ACT350 in the project.

This AOI allows for manual control via the PLC for digital outputs of the transmitter. Configure Output1, Output2, Output3, Output4 and Output5 with the desired output state (1 = output on, 0 = output off).

Once output configuration is complete, set Write = 1 to write the output values. Done will = 1 when process completes. Error will = 1 if an error occurs and the process cannot complete.

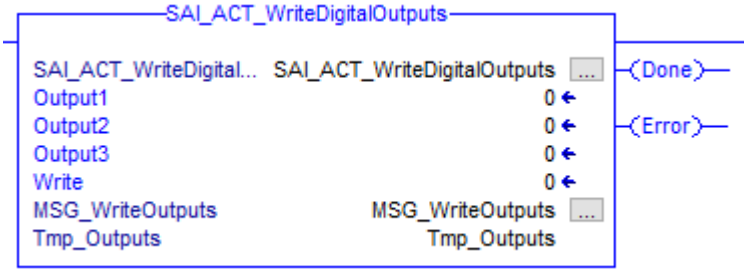


Figure 2-11 SAI_ACT_WriteDigitalOutputs AOI

Input Parameters	Data Type	Description
Output1	BOOL	Configure with desired state of Output 1 of the ACT. Value not written until Write is set to 1
Output2	BOOL	Configure with desired state of Output 2 of the ACT. Value not written until Write is set to 1
Output3	BOOL	Configure with desired state of Output 3 of the ACT. Value not written until Write is set to 1
Output4	BOOL	Configure with desired state of Output 4 of the ACT. Value not written until Write is set to 1
Output5	BOOL	Configure with desired state of Output 5 of the ACT. Value not written until Write is set to 1
Write	BOOL	Set = 1 when ready to write states of Output1, Output2, Output3, Output4 and Output5 to the corresponding outputs of the ACT
Output Parameters	**Data Type**	**Description**
Done	BOOL	Latched high when outputs successfully written. Unlatched when process is triggered again.
Error	BOOL	Latched high if an error occurred and outputs could not be written. Unlatched when process is triggered again. Check the errors of the messages for this AOI to troubleshoot
In/Out Parameters	**Data Type**	**Description**
MSG_WriteOutputs	Message	**Message Type:** CIP Generic **Service Type:** Set Attribute Single **Class:** 418 (Hex) **Instance:** 1 **Attribute:** 33 (Hex)

		Source Element: Tmp_Outputs_1 **Source Length:** 1 (Bytes) **Communication -> Path:** Browse for the appropriate ACT350
Tmp_Outputs	DINT	Temporary value for use with AOI message

3. Steps to Add New ACT350s

Because EtherNet/IP uses IP addresses to distinguish different devices, when multiple ACT350s are networked, the default IP address needs to be modified first. Each ACT350 must have a unique IP address.

1) Click "Settings-> PLC-> Ethernet / IP-> IP Address" in the ACT350 device menu in order to modify the IP address.

Figure 3-1: ACT350 IP Address Menu

2) Add an "ACT350" for single port ACT350 or "ACT350-2P" for dual port ACT350 to "I / O Configuration-> Ethernet" in Studio5000.

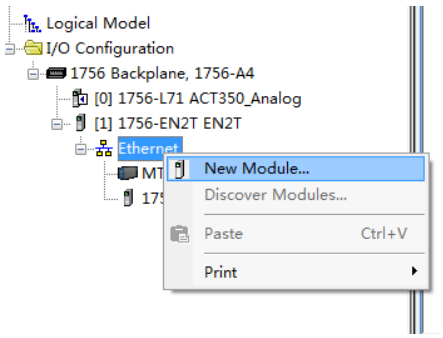


Figure 3-2: Add a device

3) Configure the name and IP address. Each device needs a unique name and IP address, and then click "Change".

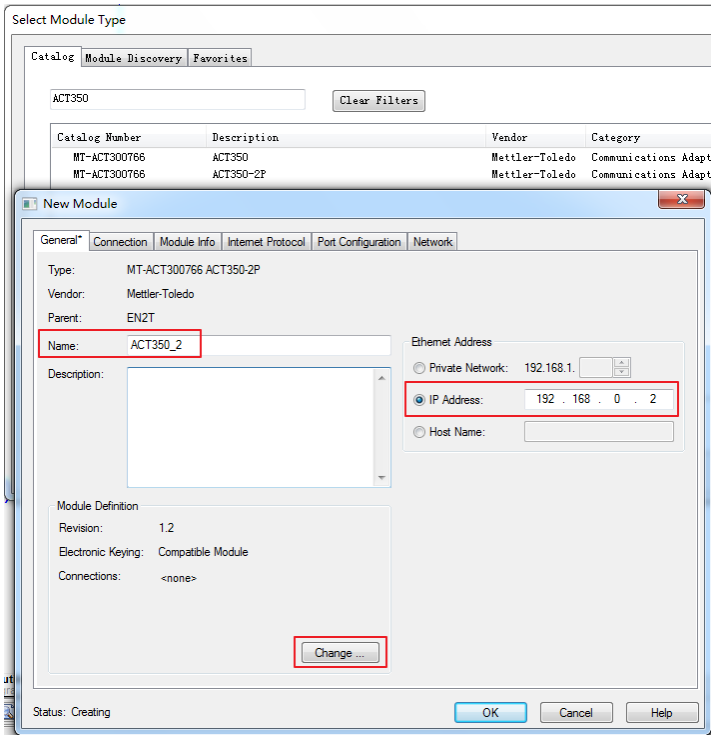


Figure 3-3: Configure name and IP address

4) Select “I/O 2 Block Format "

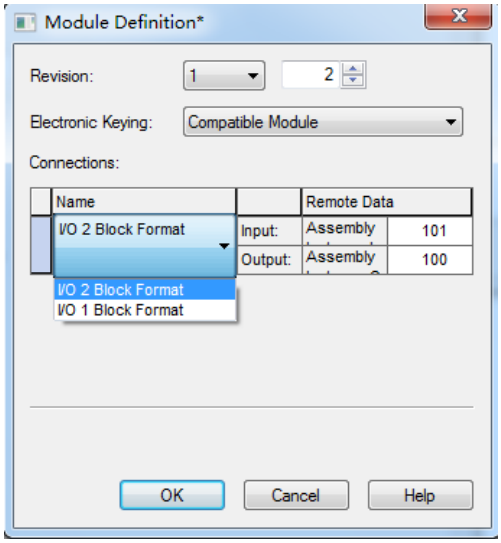
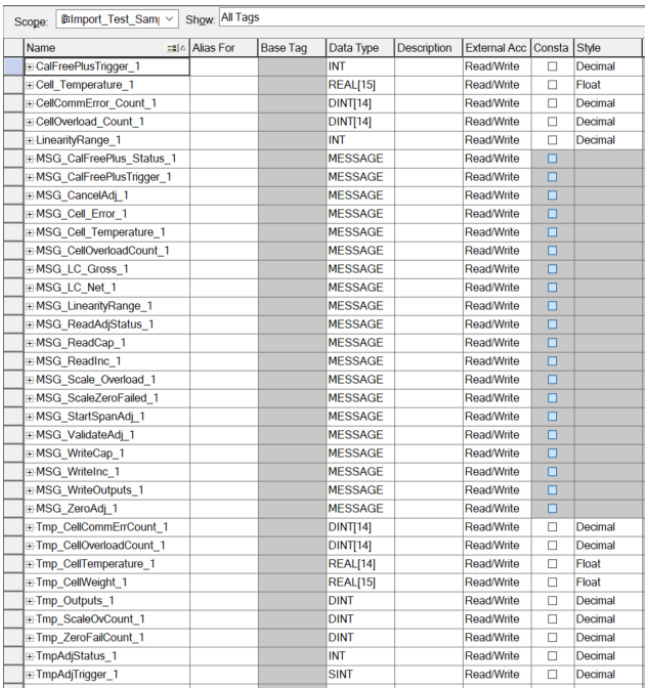


Figure 3-4: Module Definition Configuration

5) Copy the controller tags relating to the sample code and paste in the same location in order to create a duplicate set of tags. Please note that since all tags end with "_1", Studio 5000 will create duplicates that all end with "_2" instead.



Scope: Import_Test_Sam Show: All Tags

Name	Alias For	Base Tag	Data Type	Description	External Acc	Consta	Style
CalFreePlusTrigger_1			INT		Read/Write		Decimal
Cell_Temperature_1			REAL[15]		Read/Write		Float
CellCommError_Count_1			DINT[14]		Read/Write		Decimal
CellOverload_Count_1			DINT[14]		Read/Write		Decimal
LinearityRange_1			INT		Read/Write		Decimal
MSG_CalFreePlus_Status_1			MESSAGE		Read/Write		
MSG_CalFreePlusTrigger_1			MESSAGE		Read/Write		
MSG_CancelAdj_1			MESSAGE		Read/Write		
MSG_Cell_Error_1			MESSAGE		Read/Write		
MSG_Cell_Temperature_1			MESSAGE		Read/Write		
MSG_CellOverloadCount_1			MESSAGE		Read/Write		
MSG_LC_Gross_1			MESSAGE		Read/Write		
MSG_LC_Net_1			MESSAGE		Read/Write		
MSG_LinearityRange_1			MESSAGE		Read/Write		
MSG_ReadAdjStatus_1			MESSAGE		Read/Write		
MSG_ReadCap_1			MESSAGE		Read/Write		
MSG_ReadInc_1			MESSAGE		Read/Write		
MSG_Scale_Overload_1			MESSAGE		Read/Write		
MSG_ScaleZeroFailed_1			MESSAGE		Read/Write		
MSG_StartSpanAdj_1			MESSAGE		Read/Write		
MSG_ValidateAdj_1			MESSAGE		Read/Write		
MSG_WriteCap_1			MESSAGE		Read/Write		
MSG_WriteInc_1			MESSAGE		Read/Write		
MSG_WriteOutputs_1			MESSAGE		Read/Write		
MSG_ZeroAdj_1			MESSAGE		Read/Write		
Tmp_CellCommErrCount_1			DINT[14]		Read/Write		Decimal
Tmp_CellOverloadCount_1			DINT[14]		Read/Write		Decimal
Tmp_CellTemperature_1			REAL[14]		Read/Write		Float
Tmp_CellWeight_1			REAL[15]		Read/Write		Float
Tmp_Outputs_1			DINT		Read/Write		Decimal
Tmp_ScaleOvCount_1			DINT		Read/Write		Decimal
Tmp_ZeroFailCount_1			DINT		Read/Write		Decimal
TmpAdjStatus_1			INT		Read/Write		Decimal
TmpAdjTrigger_1			SINT		Read/Write		Decimal

Figure 3-5: Copy/Paste Tags to Create Duplicates

6) Copy and paste the Add-On Instructions and configure the instance name along with the input and output parameters. Refer to Section 2 for additional instructions for configuring the Message parameters. Each device must correspond to a unique instance of the AOI. As shown in the figure below, both devices call the AOI SAI_CheckAlive, but the corresponding instances are SAI_CheckAlive and SAI_CheckAlive_1. Notice that the Heartbeat parameter is also configured with different devices for these two instances. See the Add-On Instructions section of this note for information on configuring parameters for a particular AOI. Make sure that all tags for the second device for instance now end in "_2" as opposed to "_1" for the first device.

Figure 3-6: Two instances of the SAI_CheckAlive AOI for two ACT350s

7) Repeat steps 1 to 6 until the configuration of all devices is completed.

4. Frequently Asked Questions

1. Q: How do I access the parameters in the AOI variables within my PLC program?

A: You can use the format "instance_name.parameter" to access parameters in your PLC program. For example, if we create an instance of the SAI_CheckAlive AOI and name the instance "ACT350_Comm", we can monitor the alive bit by looking at "ACT350_Comm.Alive"

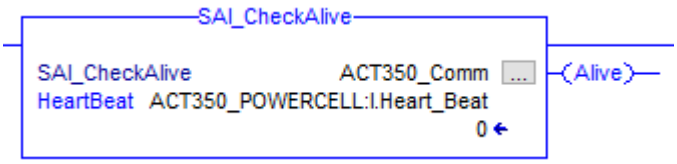


Figure 4-1: SAI_CheckAlive AOI with different instance name

2. Q: Does my AOI instance always have to match the name of the AOI?

   A: No, the AOI instance can be named anything as long as the name is unique. They must be unique so that if we are using multiple of the same AOI, we can distinguish between them in the code. See Figure 4-1 for an example of an AOI instance name that does not match the AOI name but is still valid.

3. Q: How do I read gross, tare or net weight?

   A: Use the WeightCmd parameter of the SAI_ACT_WeightProc AOI to issue different weight commands. A value of 0 = report gross weight, 2 = report tare weight and 3 = report net weight. The weight will be updated in StableWeight if the weight value is stable. StableWeight will freeze with the last reported stable weight while the scale is in motion. RealTimeWeight will constantly update the weight value regardless of whether the scale is in motion.

4. Q: How do I know the source of the error in the SAI_ACT_WeightProc AOI?

   A: Typical errors in this AOI include:

   - Pushbutton zero failure -> tried to zero when the weight value is outside of the pushbutton zero range (+/- 2% by default). If a substantial zero adjustment needs to be made, use the SAI_ACT_ZeroAdjust AOI instead.
   - Tare failure -> Typically seen if trying to tare a negative gross weight value. Try to tare again with a positive gross weight.
   - Stability failure -> Can occur with either the ZeroStable or Tare Stable command. The weight value must meet the stability criteria (no more than 1 division of change occurring in a 0.3 second period by default) at some point before a timeout occurs (3 seconds by default).

5. Q: An AOI is very close to what I want to do in my PLC logic, but I need to make a few changes. How can I do that?

   A: If necessary to view or modify the logic of an AOI, simply use the Controller Organizer view in Studio 5000 to navigate to Add-On Instructions, expand the AOI you are interested in viewing and double-click "Logic". This will show you the ladder logic used in the AOI and can be changed as necessary for your particular application.

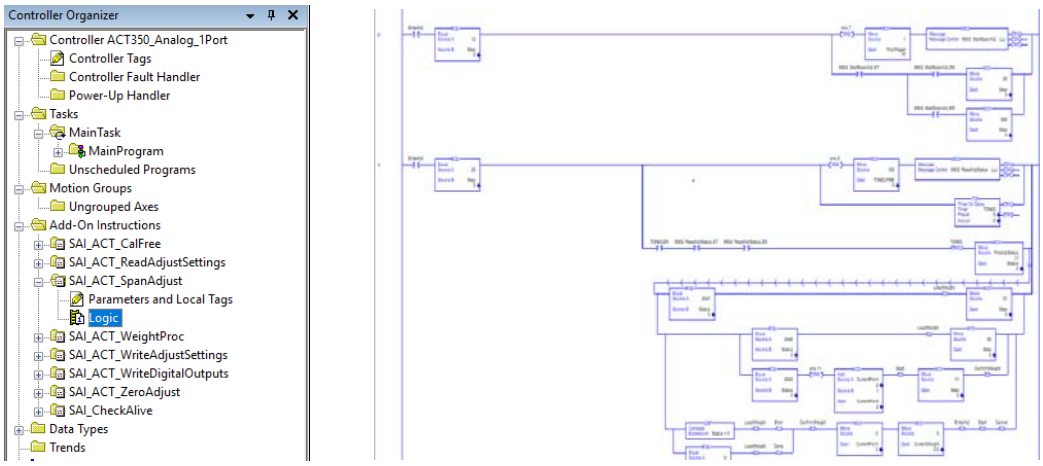


Figure 4-2: Example of AOI ladder logic