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TURCK

ARGEE
Reference Manual

MA1019

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Preface

Read this preface to familiarize yourself with the rest of the manual. It provides answers to the following questions:

- Why use ARGEE?
- What are ARGEE's advantages and limitations?
- Who should use this manual?
- What is the purpose of this manual?
- What content is in the ARGEE reference manual?

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Why use ARGEE?

Imagine that a customer is trying to solve a simple application. This customer does not need a PLC, but they do need some logic. ARGEE was created specifically to solve this problem.

What are ARGEE's advantages and limitations?

ARGEE advantages

- ARGEE stands alone
  - Standalone application (No PLC needed to perform logic)
- ARGEE backs up the PLC
  - PLC back-up (If the application loses communication with the PLC, ARGEE can take over and safely shut down the process)
- ARGEE and the PLC work together
  - Local Control (ARGEE can monitor an application and send updates back to the PLC)

ARGEE limitations

- One ARGEE block cannot control another ARGEE block
- ARGEE is not suited for motion applications

Who should use this manual?

Use this manual if you are responsible for designing, installing, programming or trouble shooting a Turck multiprotocol block that is using the ARGEE programmable functionality.

You should have a basic understanding of networking knowledge, Boolean algebra, and ladder logic. If you do not possess these skills, contact your local Turck representative for proper training before using ARGEE.

What is the purpose of this manual?

This manual is a reference guide for the ARGEE Programing Environment. This manual:

- Teaches the user how to use the ARGEE Flow Chart
- Teaches the user about syntax in ARGEE PRO
- Provides code for common applications
- Defines all the tag names associated with Turck I/O cards

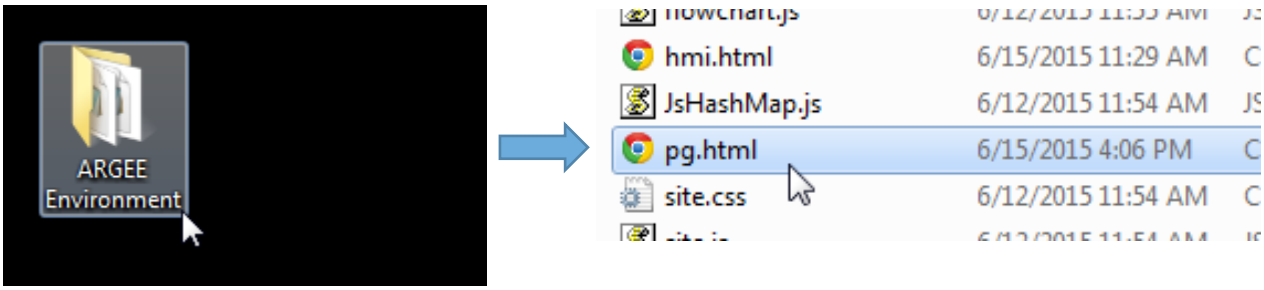
What content is in this manual?

Chapter	Title	Content
	Preface	Overview of the ARGEE Manual content
1	Logging into ARGEE	How to access the ARGEE Environment
2	ARGEE Menu Bar	An explanation of the ARGEE Menu Bar
3	Getting Familiar with Flow Chart	A general overview and walkthrough of the ARGEE Flow Chart
4	Getting Familiar with ARGEE PRO	A general overview and walkthrough of ARGEE PRO
5	Conditions & Actions	A detailed explanation of the ARGEE Condition & Action statements
6	Operations	A detailed explanation of the Operations offered in ARGEE PRO
7	ARGEE Simulation Mode	A general overview and walkthrough of the ARGEE Simulation Mode
8	ARGEE Security	A detailed explanation about ARGEE Security
9	System Performance	A general overview of ARGEE system behavior
10	Common Application	Sample code for many common applications
	Appendix	Defining I/O Variable Names

Chapter 1: Logging into ARGEE

Opening the Environment

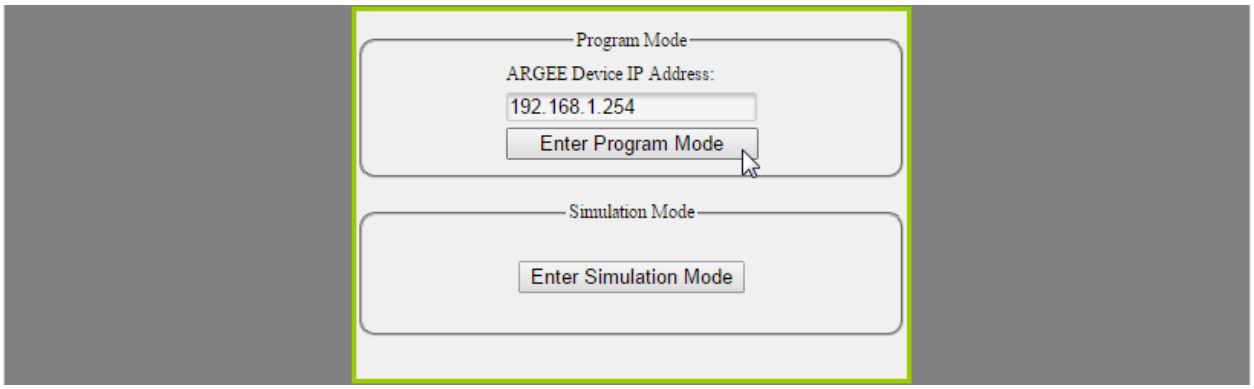
Open the ARGEE Environment and double click on pg.html.



NOTE: ARGEE only opens up in HTML 5 compliant web browsers such as Google Chrome or Firefox.

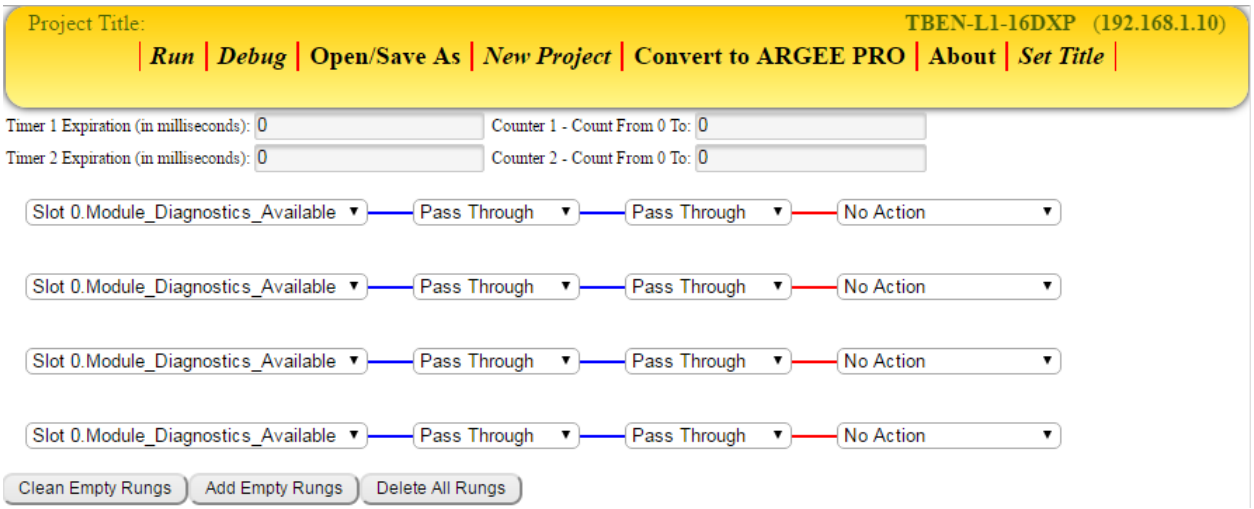
Logging into Program Mode

Type your devices IP Address into the ARGEE Device IP Address text box, and then click *Enter Program Mode*.



NOTE: Simulation Mode is explained on page 73.

Welcome to Flow Chart



Chapter 2: ARGEE Menu Bar

Run

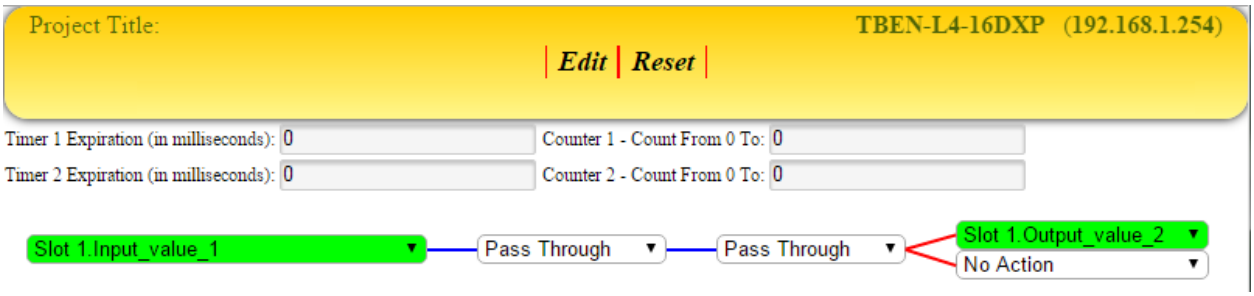
When the user clicks *Run*, several things happen. First, ARGEE checks the code for errors. If the code has no errors, ARGEE downloads the code to the block. It also calculates and displays how much memory the code has used and how much memory is still available. Next, ARGEE transitions over to the Debug screen.

If the code has errors, ARGEE will display an error message and tell the user where the error is located in the code.

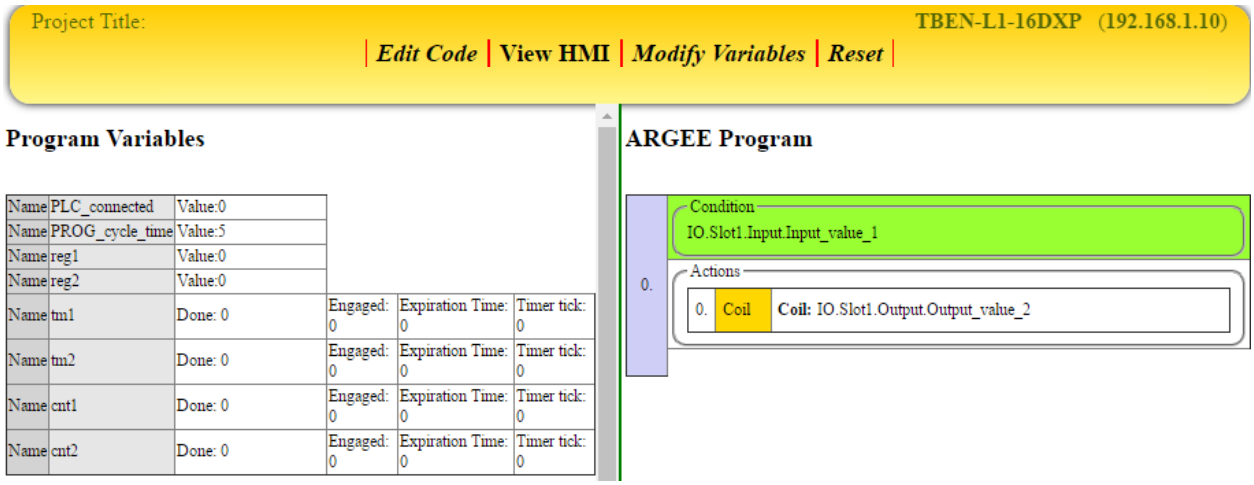
Debug

When the user clicks *Debug*, different things happen depending on whether the user is in Flow Chart or ARGEE PRO.

If the user clicks *Debug* while in Flow Chart, the first thing the user will notice is that the Flow Chart will enter *Debug* mode. As conditions become true, the user can visually observe code progression.

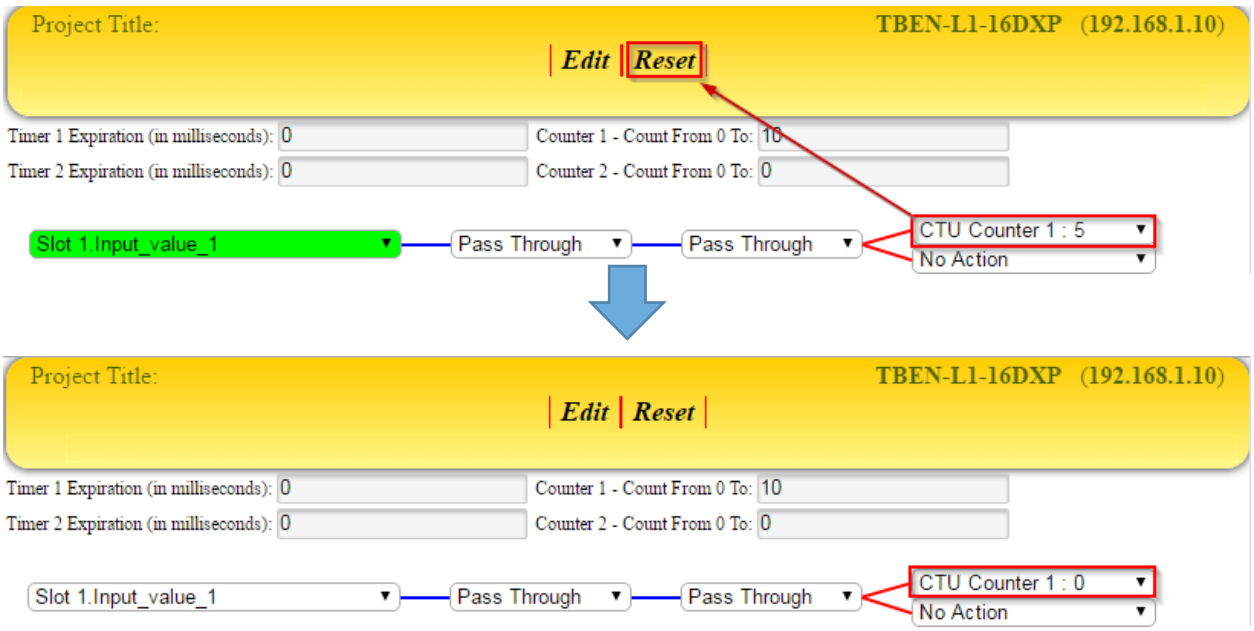


When the user clicks *Debug* while in the ARGEE PRO, the user can visually observe code progression from a more advanced screen.

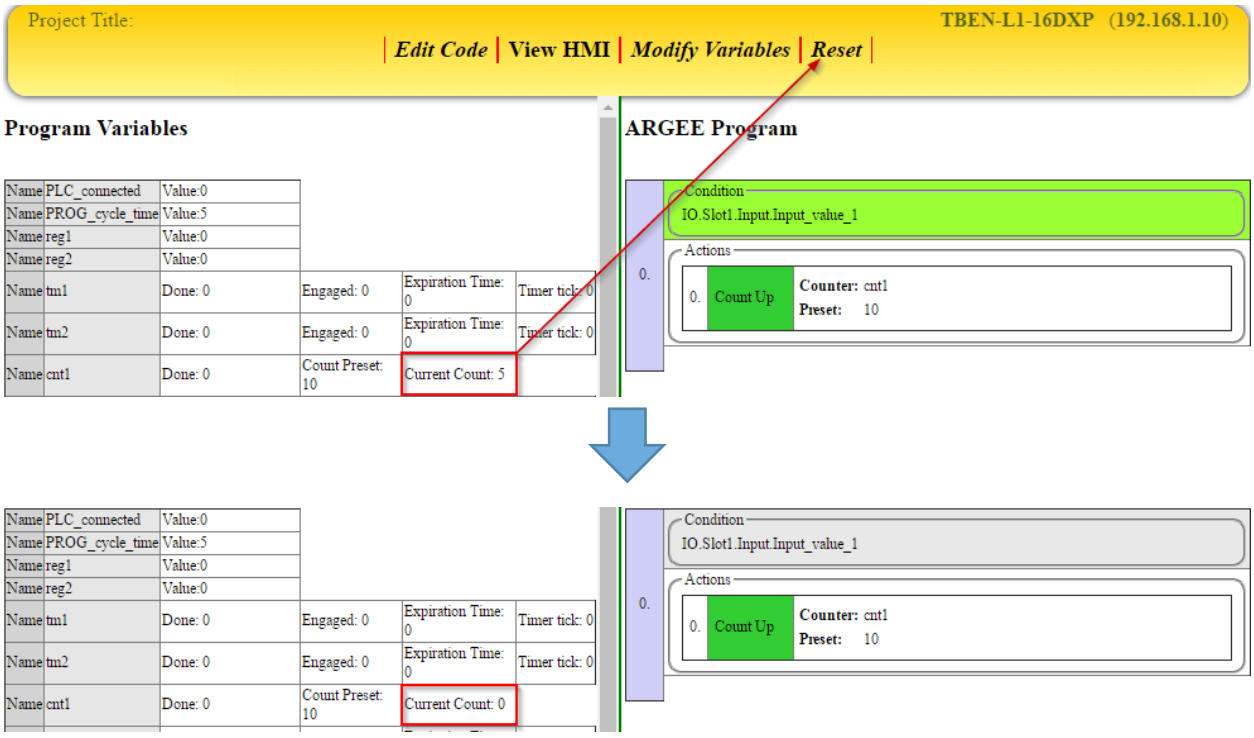


Reset

The user can view the *Reset* button while in *Debug* mode or while viewing an HMI screen. Reset sets the program's timers and counters to zero. If the user clicks Reset while in Flow Chart, the user can visually observe the timers and counters being reset.



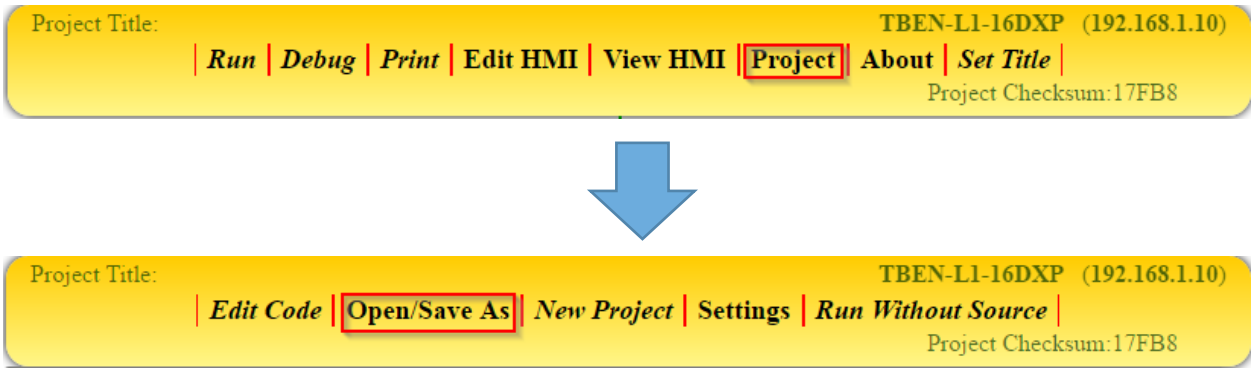
When the user clicks *Reset* while in the ARGEE PRO, the user can visually observe timers and counters resetting to zero from a more advanced screen.



Open/Save As

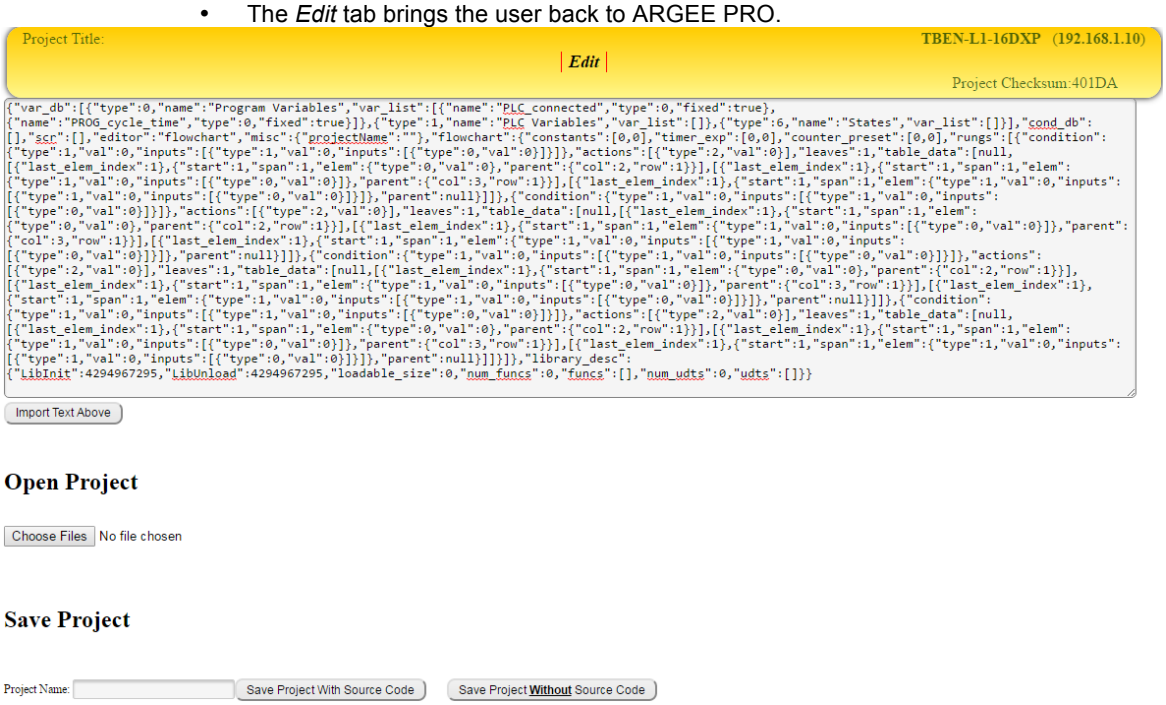
The Open/Save feature allows the user to save a current project or load a previous project. The user accesses the Open/Save As feature from different places depending on if they are in Flow Chart or ARGEE Pro. From Flow Chart, the Open/Save As tab is available in the ARGEE Menu Bar.

While in *ARGEE PRO*, the user can access the Open/Save As screen by clicking on the *Project* tab and then selecting the *Open/Save As* tab.



On the Open/Save As screen, the user can perform several actions:

- The *Import Text Above* button imports the above text into the project
- Under the *Open Project* text, the *Choose Files* button allows the user to browse their computer for a previously saved project. Once the file is selected, ARGEE will automatically load the project
- Under the *Save Project* text, the *Save Project With Source* button allows the user to save their project as an .arg file. The user also has the option to *Save Project* ***Without*** *Source Code*.
- The *Edit* tab brings the user back to ARGEE PRO.



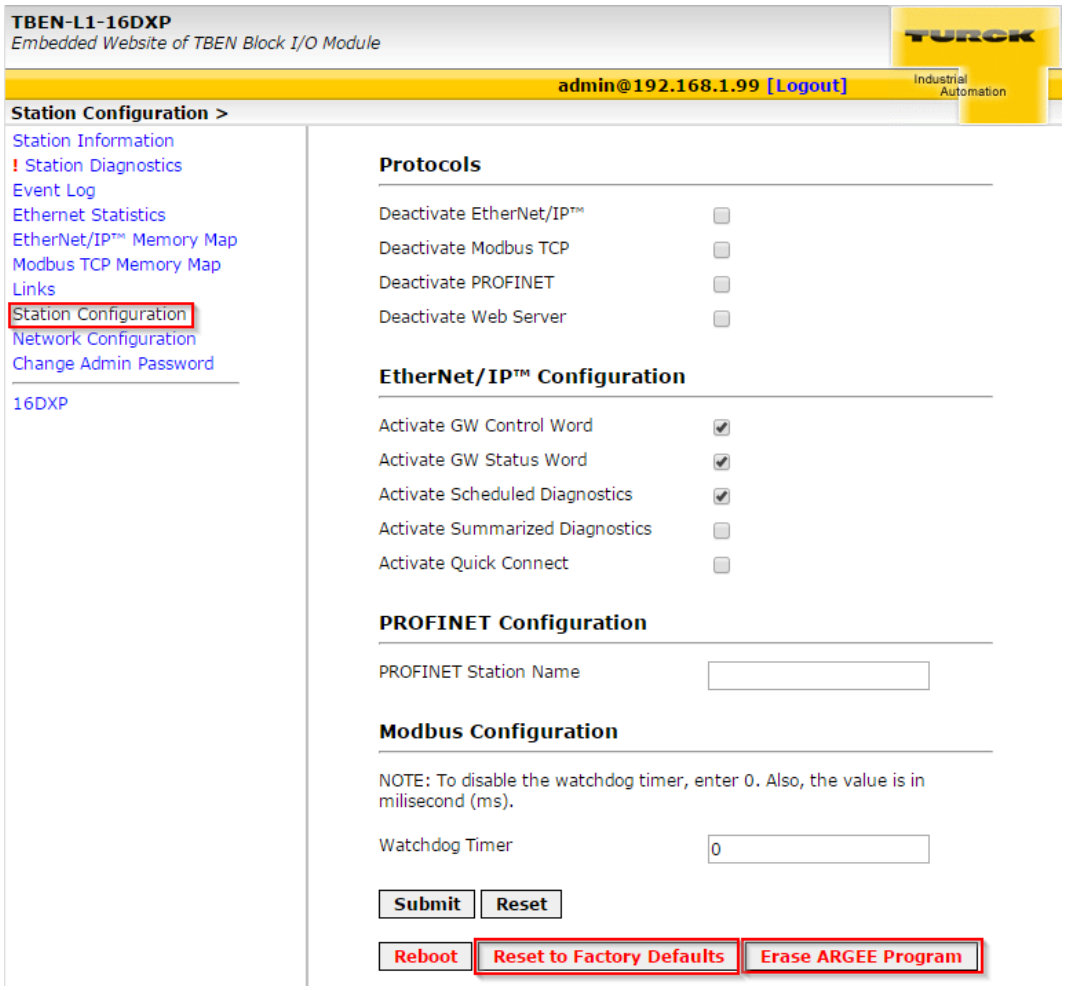
New Project

The user clicks on New Project to start a new project.

Erase Project

Starting a new project does not erase the code on your block. If the user wants to erase the code on the block, they need to first start a *New Project* and then click *Run*. This action will load an empty project the block.

The user can also remove the ARGEE code by selecting *Erase ARGEE Program* or *Reset to Factory Defaults* inside the webserver page.



Note: Getting to the webserver is discussed on page 29.

Convert to ARGEE PRO

The user will click *Convert to ARGEE PRO* when they want to leave the Flow Chart mode and enter the ARGEE PRO Programming Environment.

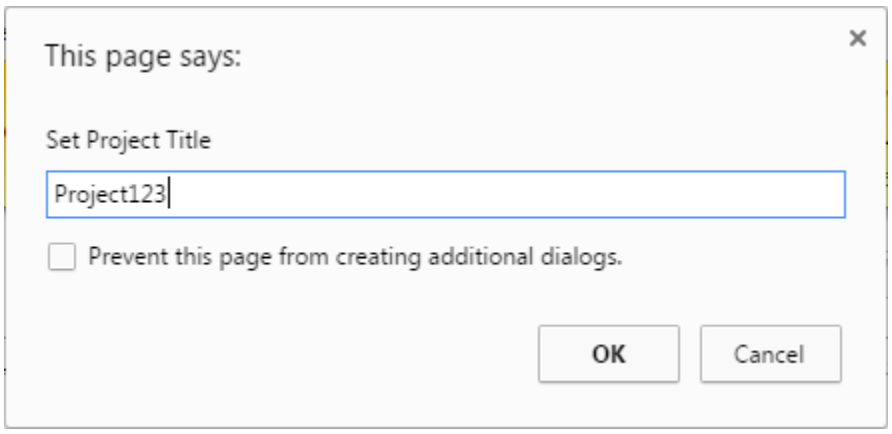
NOTE: Once the user selects *Convert to ARGEE* PRO, they cannot convert back to Flow Chart.

About

The user can click *About* if they want to view the ARGEE environment and kernel firmware revisions.

Set Title

The user can click *Set Title* to add a name to the project.

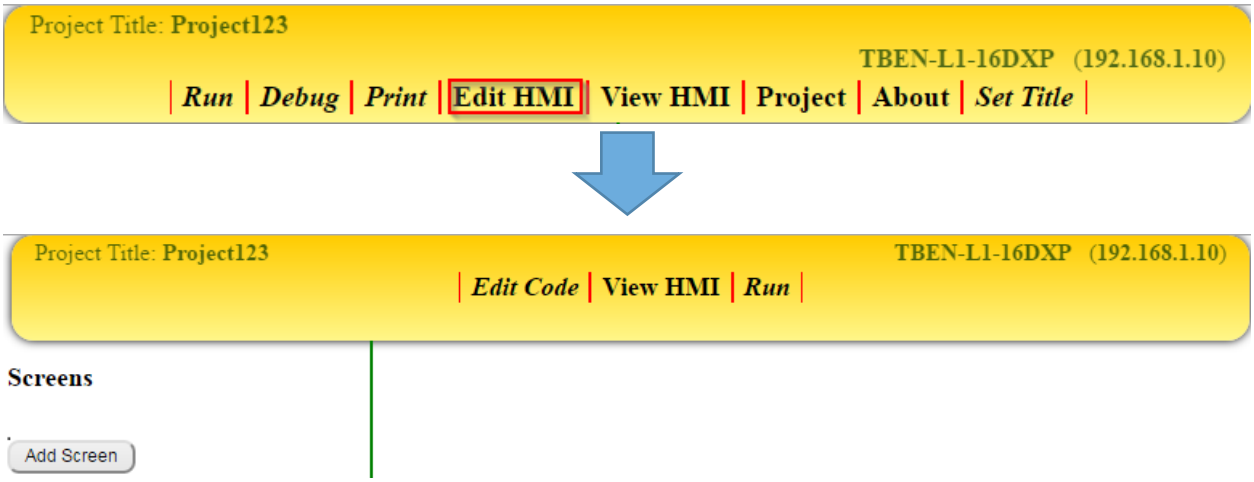


Print

The Print option is available in the ARGEE PRO menu bar. The user can click *Print* if they want to print out a copy of their project.

Edit HMI

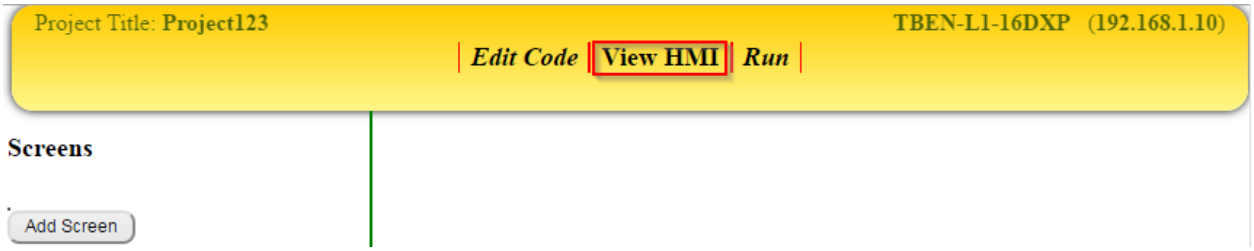
The *Edit HMI* tab brings the user to the edit HMI screen.



NOTE: Instructions for how to build an HMI are located on page 94.

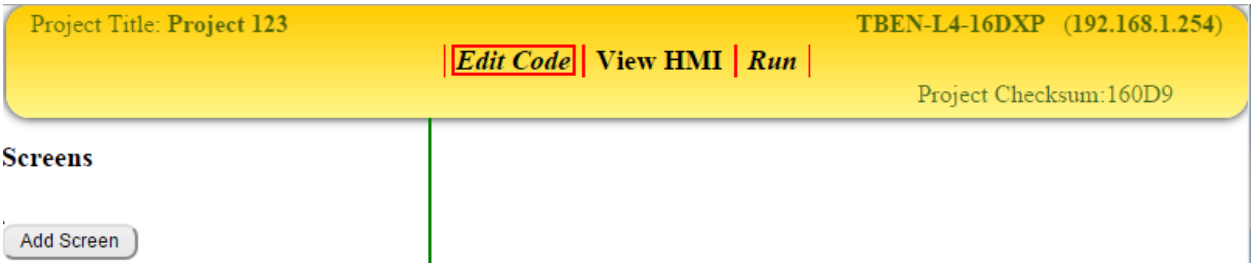
View HMI

The *View HMI* tab allows the user to view their HMI screen. This tab becomes active after the user has already built an HMI.



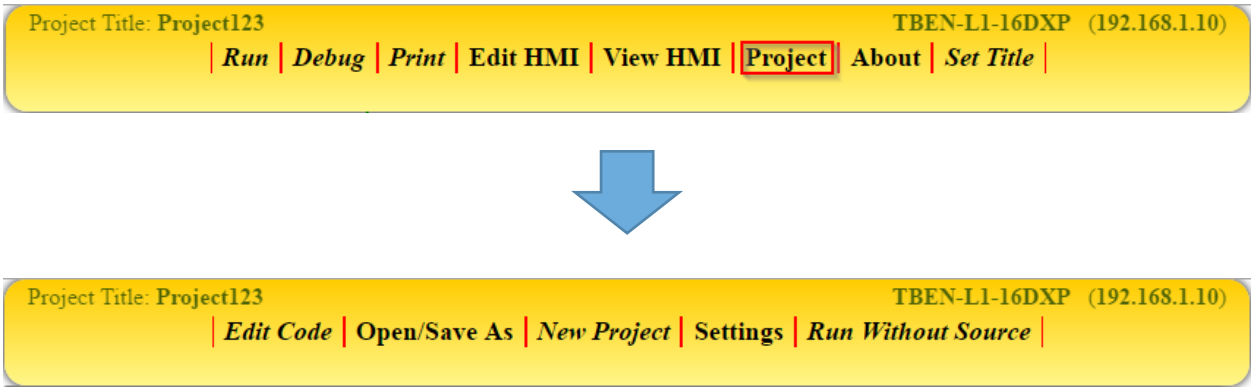
Edit Code

When the user clicks on the *Edit Code* tab they will return to the main ARGEE PRO page.



Project

When the user clicks on the *Project* tab, they will have access to a second ARGEE Menu Bar.



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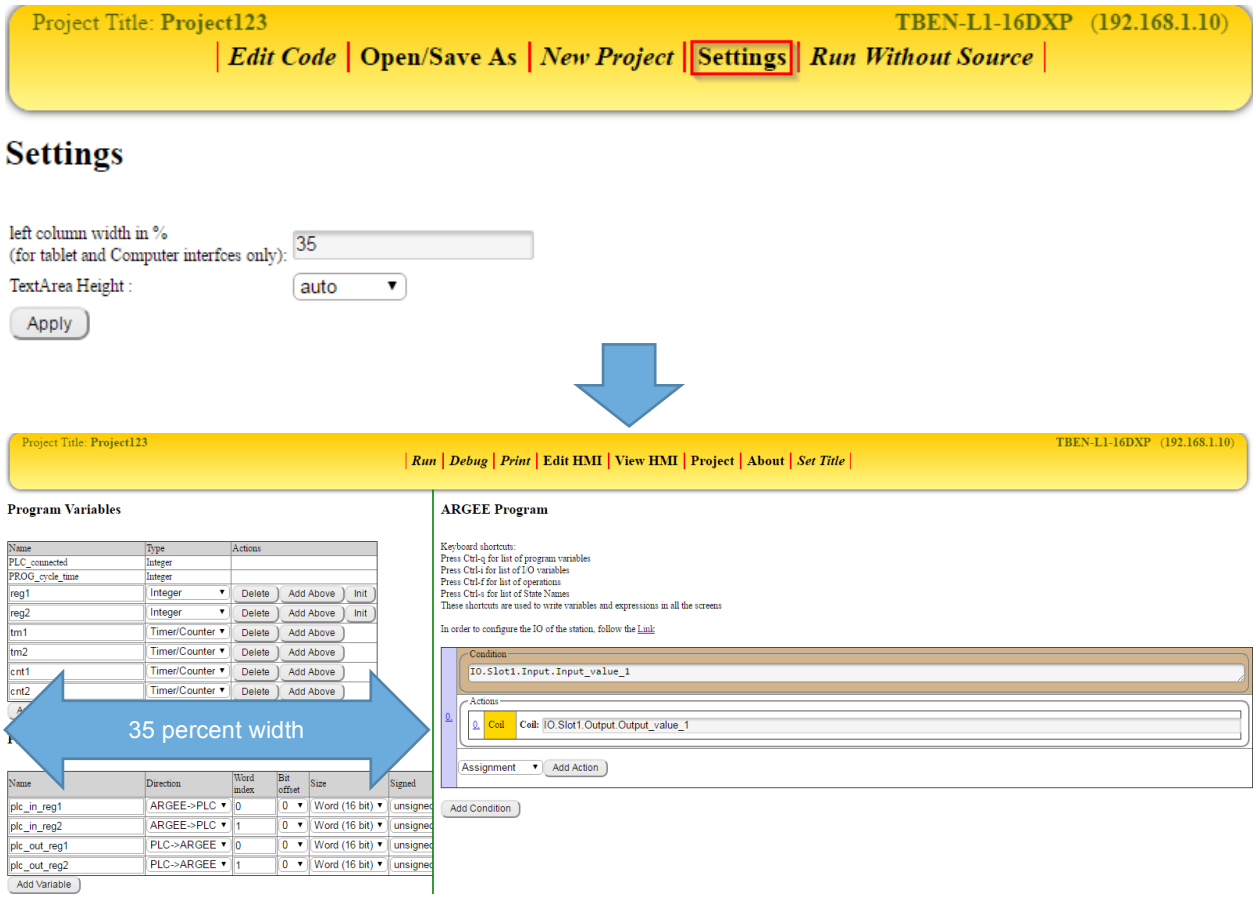
Settings

From the *Settings* screen, the user can set the “percentage” of their screen that displays their Variables and State Names. The remaining “percentage” of the screen displays the ARGEE Program.



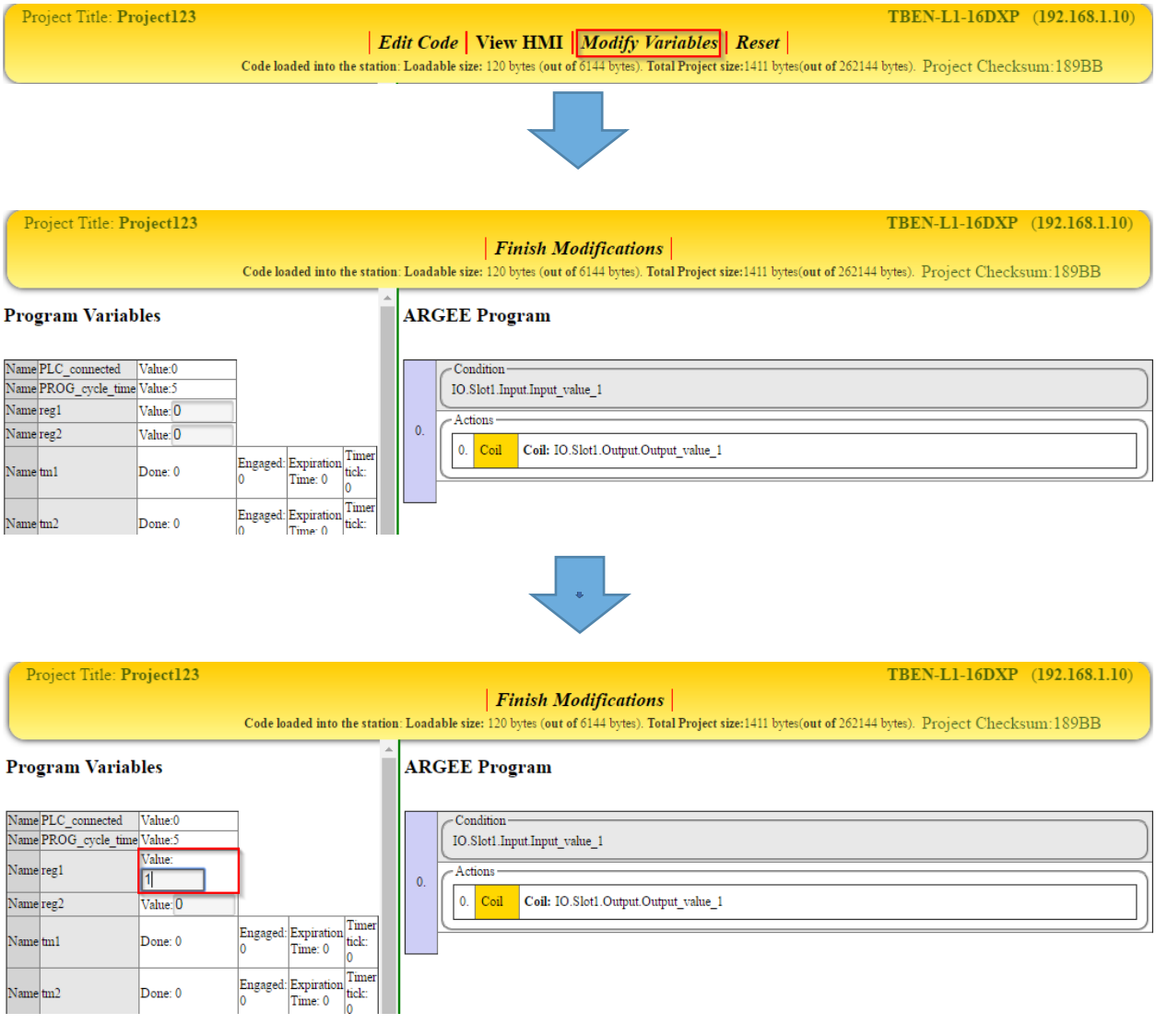
Run Without Source

Selecting *Run Without Source* will allow the user to run a program without displaying the actual code. The end user will not be able to access source code by loading the ARGEE environment. *Run Without Source* is one of ARGEE’s security protocols.

Very Important Note: The user needs to save a Master Copy of the program before the user logs out of the environment if the user wants to view/edit the code in the future. Security protocols are discussed in Chapter 8 - ARGEE Security.

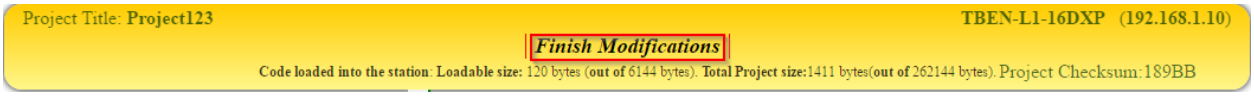
Modify Variables

The *Modify Variables* tab is available in ARGEE PRO and in the ARGEE Simulation Mode. It only becomes visible when the user is in Debug mode. From the *Modify Variables* screen, the user can manually change register and variable values.



Finish Modifications

The user can select *Finish Modification* to exit *Modify Variables* mode.



Show Trace, Stop Trace, Resume Trace

The user will use Trace when they want to measure the run-time behavior of the program. Trace allows the user to measure how long each state takes as well as which states were visited in which order. Trace is an Action that must be inserted into the code before Trace will appear in the menu bar.

The user can click on Show Trace to view the active Trace data.

The user can click on Stop Trace to easily view the programs historical run-time data.

The user can click on Resume Trace to resume tracing the programs run-time.

NOTE: More information about Trace can be found on page 52.

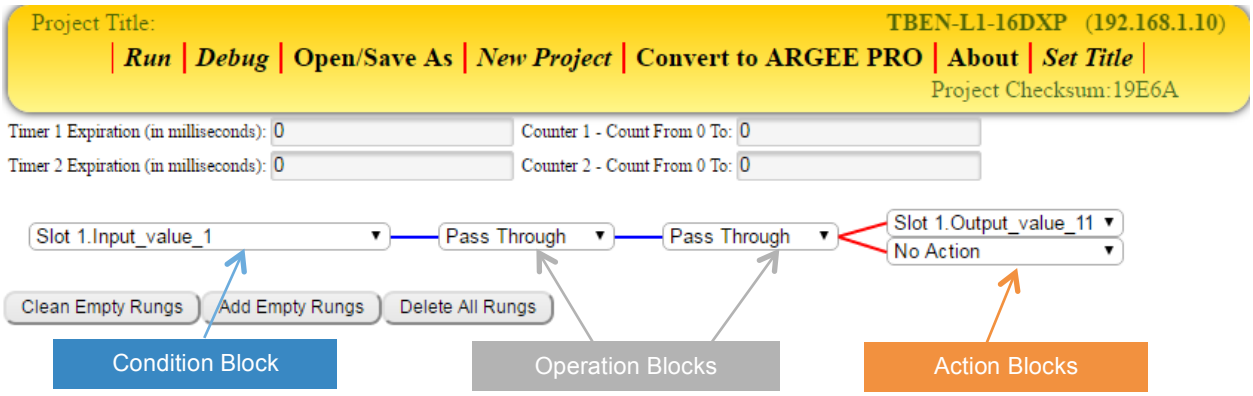
Show Variables

The user can click on *Show Variables* if the user wants to leave Trace Mode.

Chapter 3: Getting Familiar with Flow Chart

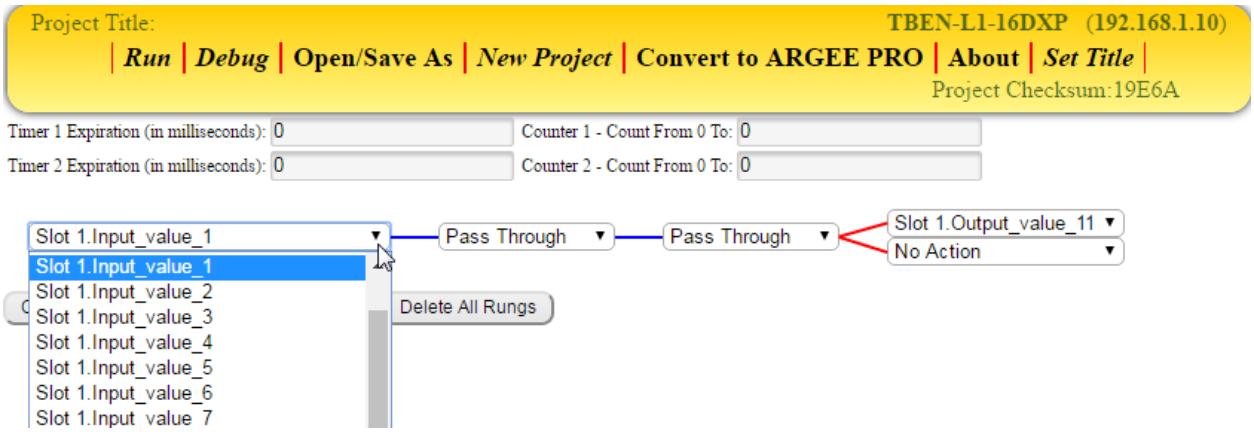
The Basics

The Flow Chart Editor is made up of Condition, Operation, and Action Blocks. Conditions, Operations and Actions are selected by clicking their respective drop down arrows. The Flow Chart Editor also provides the user with two timers and two counters.



Conditions

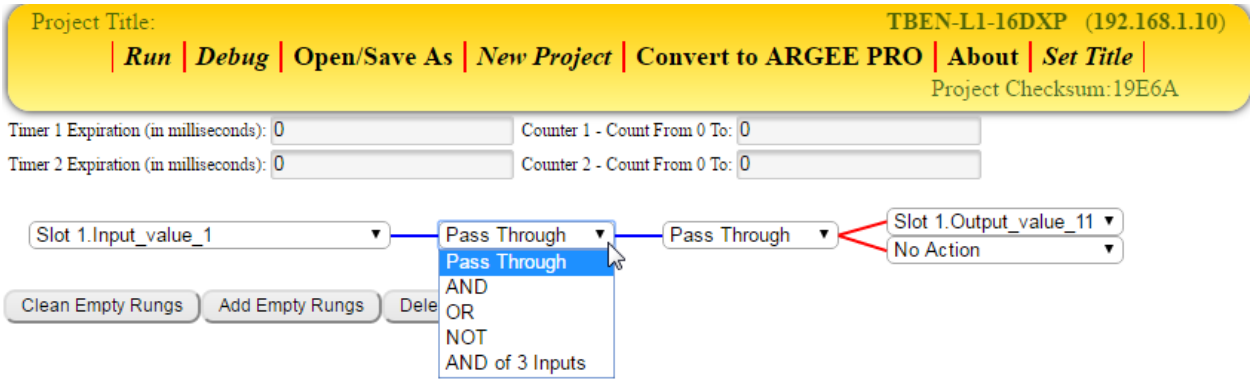
The Condition Block contains Input conditions. The input conditions the user sees corresponds to the block the user is connected to. Other included input conditions are: Timer X expired, Counter X expired, Internal Reg X, and PLC In Reg X.



NOTE: Expired functions are discussed on page 72. Internal Reg's are discussed on page 30 (Reg = Register). PLC In Reg's are discussed on page 38.

Operations

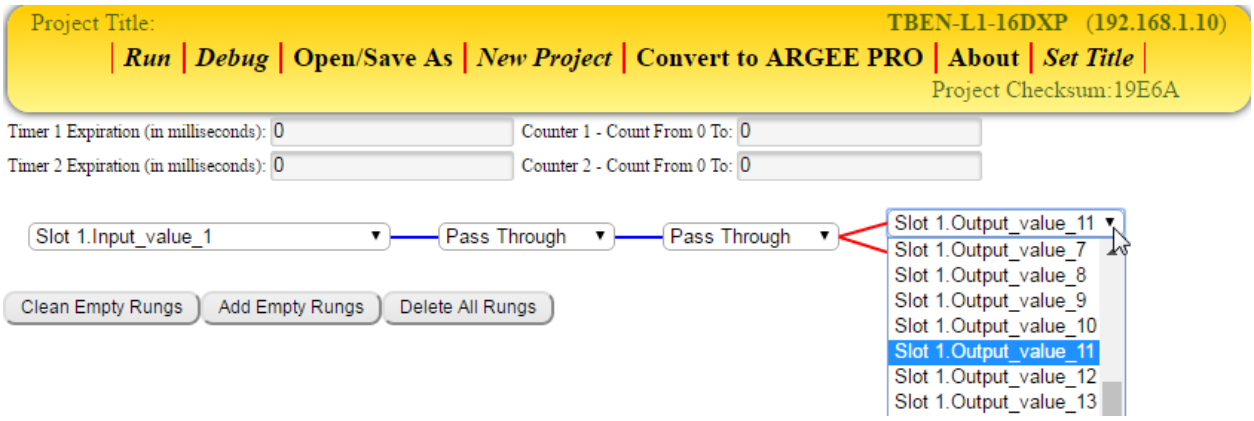
The Operation Blocks contain various Boolean operations. If no Operations are desired, select Pass Through.



NOTE: Boolean Logic is discussed on pages 63 and 64.

Actions

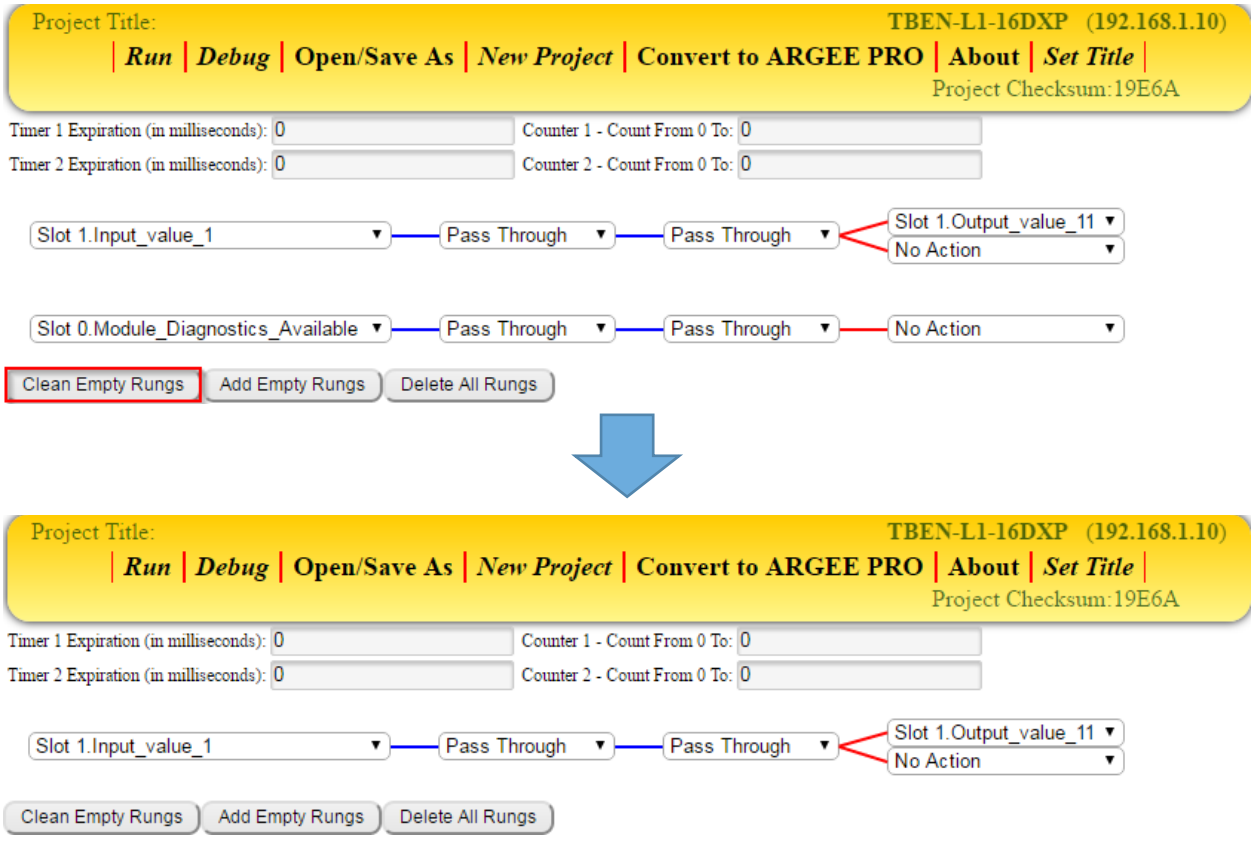
The Action Block contains Output conditions, The Output conditions the user sees corresponds to the block the user is connected to. Other included Output conditions are: TON Timer X (**T**urn **ON** Timer X), CTU Counter X (**C**oun**T** **U**p Counter X), RESET Counter X, Internal Reg X, PLC Out Reg X.



NOTE: TON is discussed on page 50. CTU is discussed on page 55. RESET is discussed on page 57. Internal Reg's are discussed on page 30 (Reg = Register). PLC Reg's are discussed on page 38.

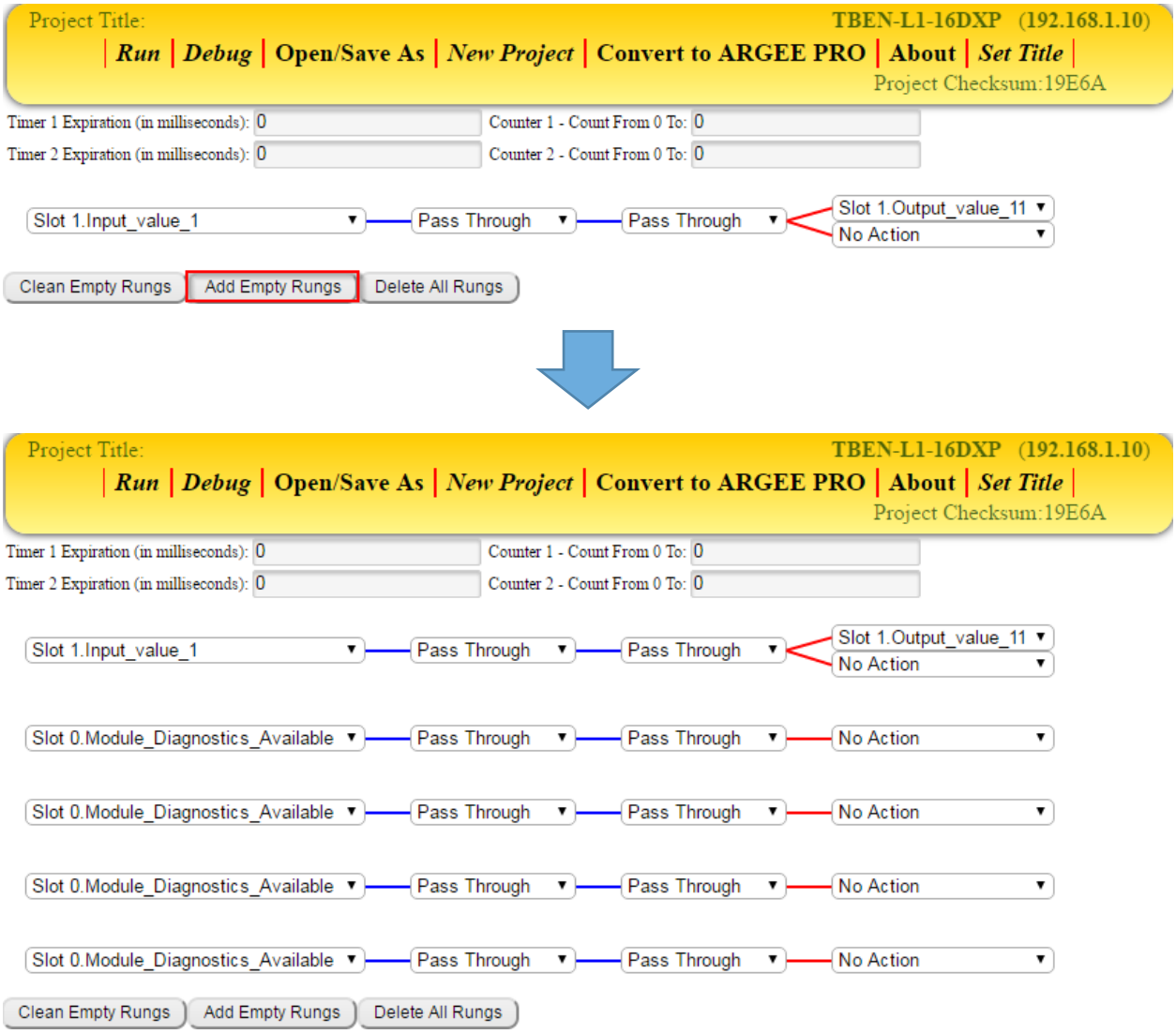
Clean Empty Rungs

The *Clean Empty Rungs* button will remove all unused rungs from the Flow Chart Editor.



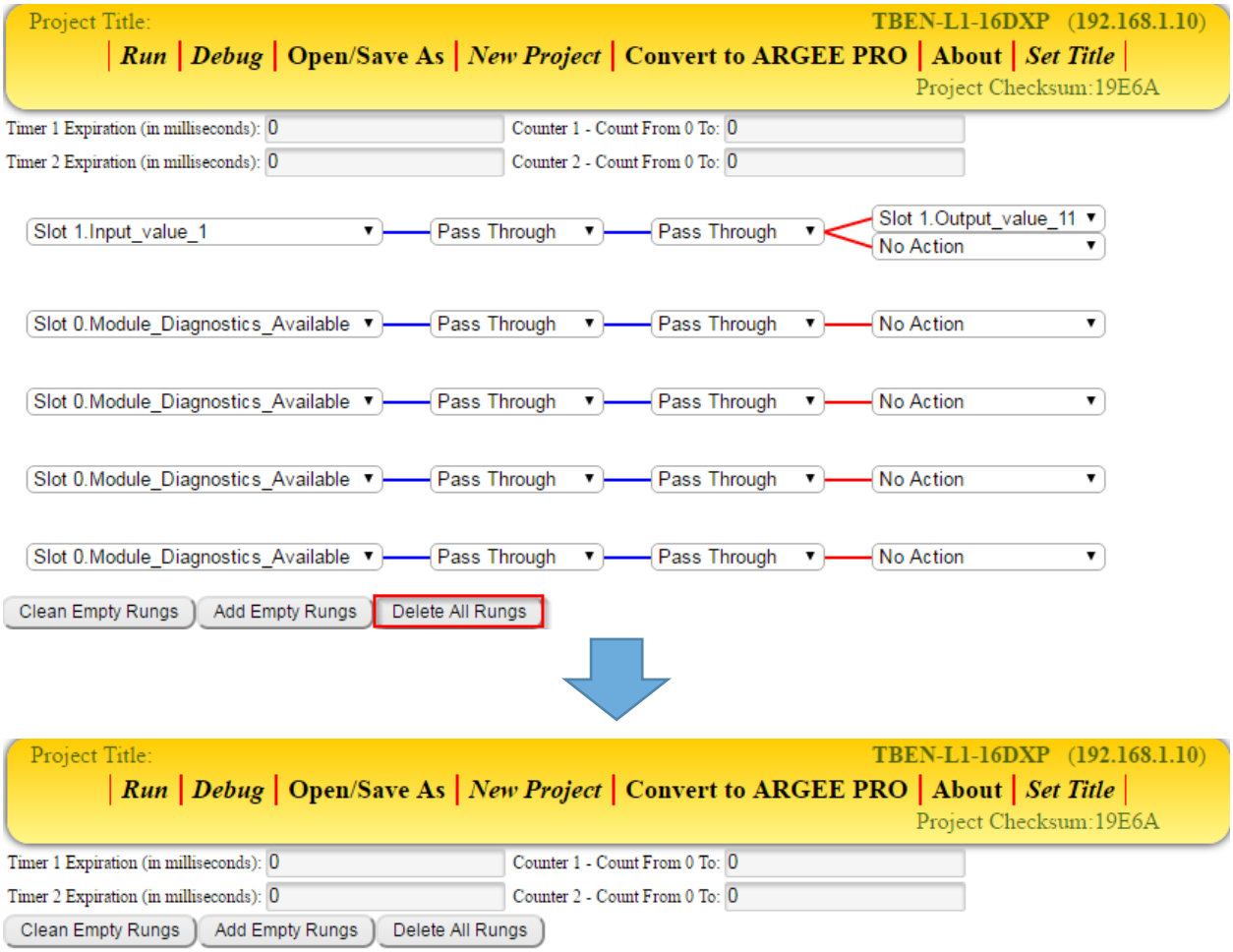
Add Empty Rungs

The *Add Empty Rungs* button will add four empty rungs to Flow Chart Editor.



Delete All Rungs

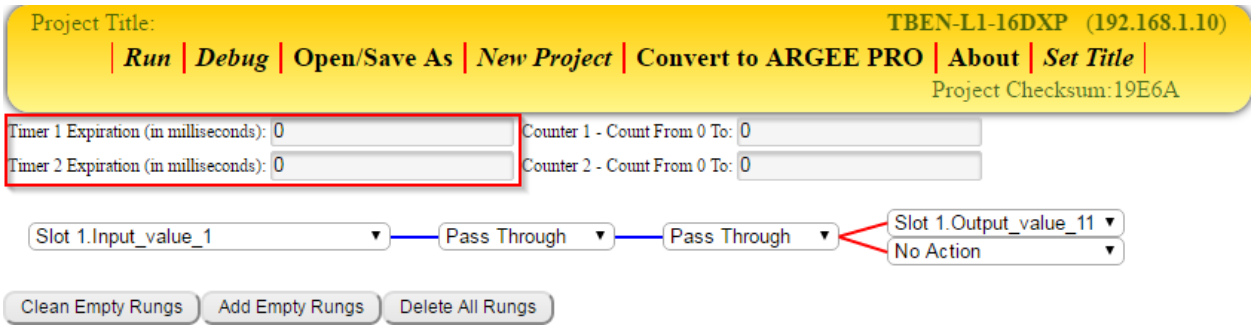
The *Delete All Rungs* button will remove all rungs from Flow Chart Editor.



Note: Used and unused rungs will both be deleted from the project.

Timers

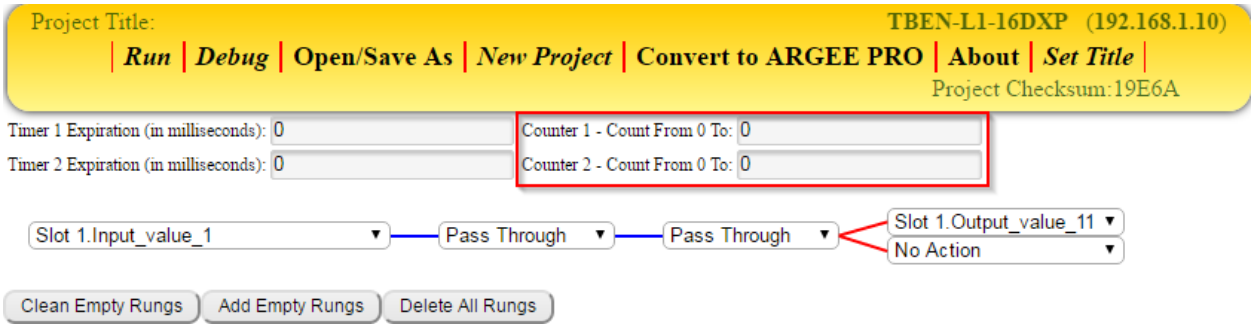
Flow Chart Editor contains two *Timers*. The user can set the Timers by typing a value into the Timer text box. Timer values are in milliseconds (1000 Milliseconds = 1 Second).



NOTE: Timer examples can be seen on page 48, 50 and 51.

Counters

Flow Chart Editor contains two *Counters*. The user can set the Counters by typing a value into the Counter text box.

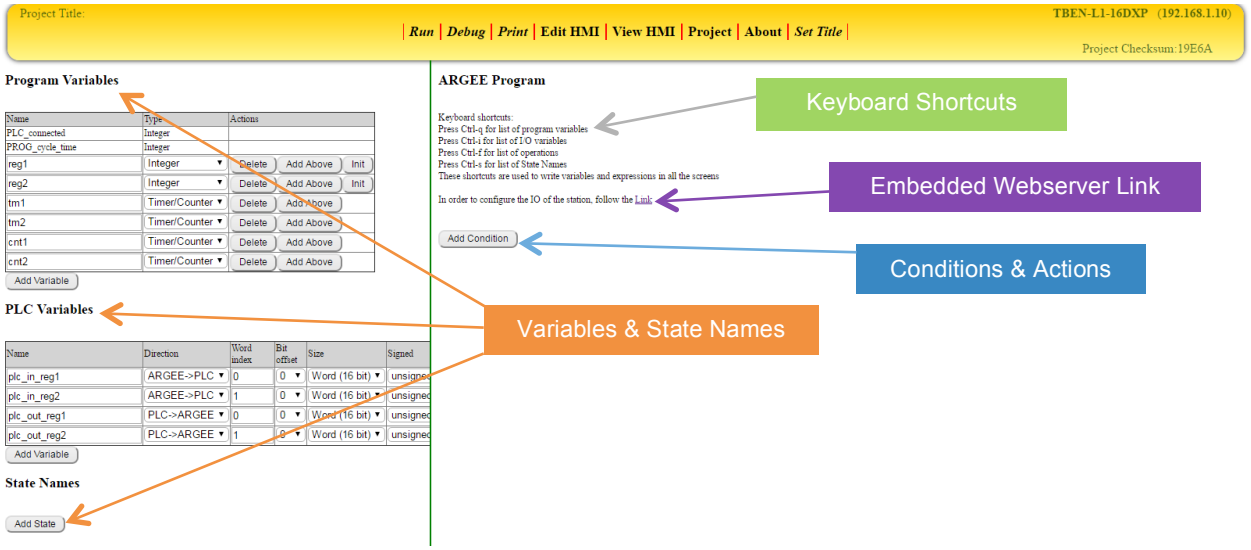


NOTE: Counter examples can be seen on page 55, 56 and 57.

Chapter 4 – Getting Familiar with the ARGEE PRO

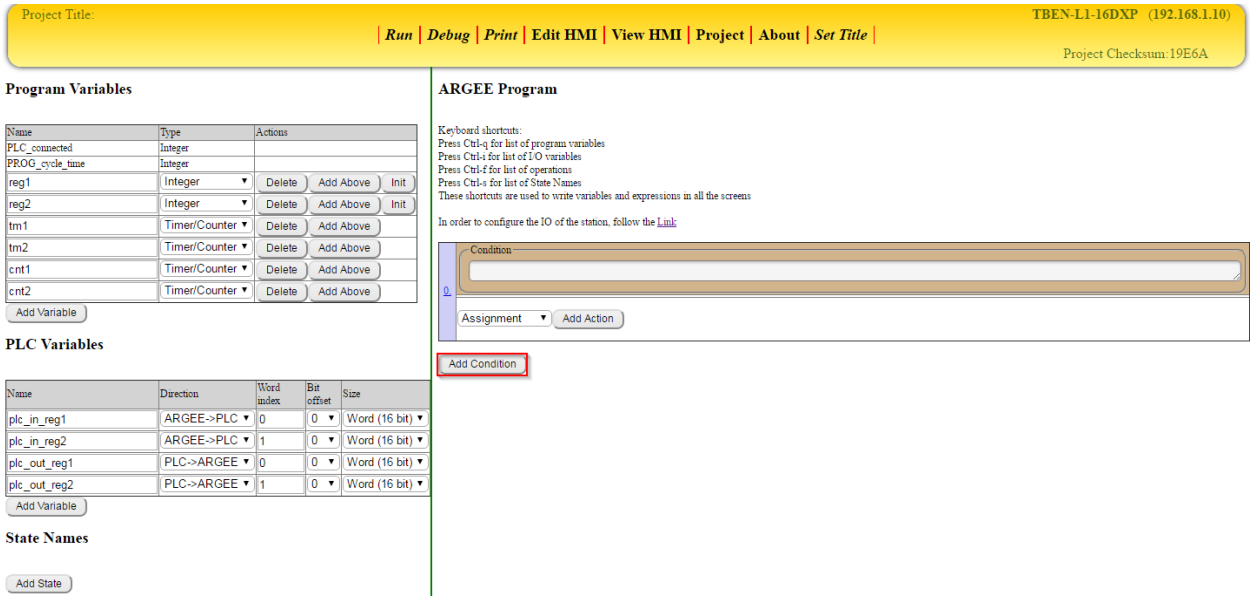
The Basics

The ARGEE PRO home page is made up of Conditions & Actions, An Embedded Webserver Link, Variables & State Names, and Keyboard Shortcuts.



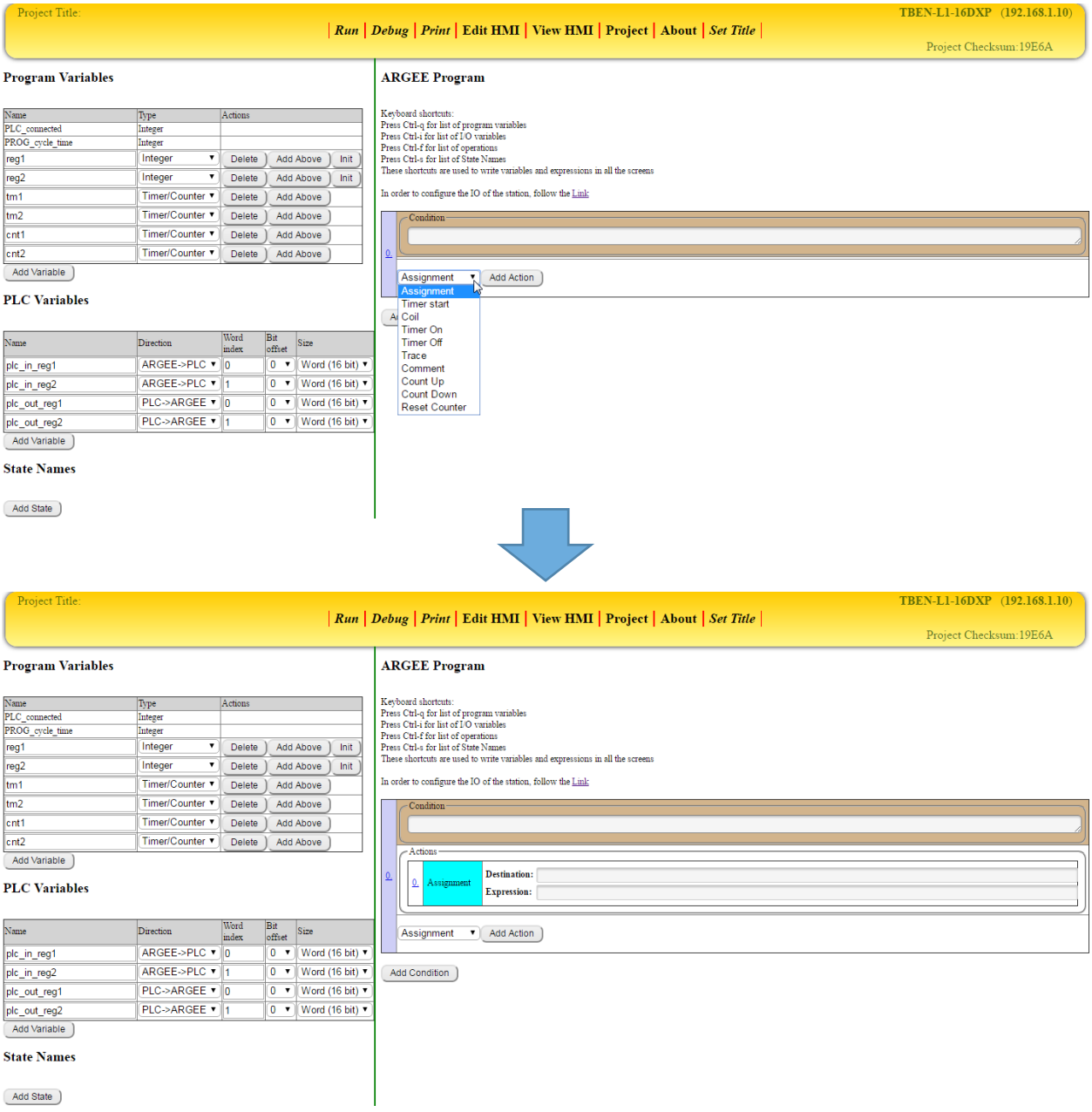
Conditions

The *Add Condition* button will add one blank condition to the ARGEE project. This environment is executed in the manner of IF / THEN statements. ARGEE calls them Conditions (IF) and Actions (THEN).



Actions

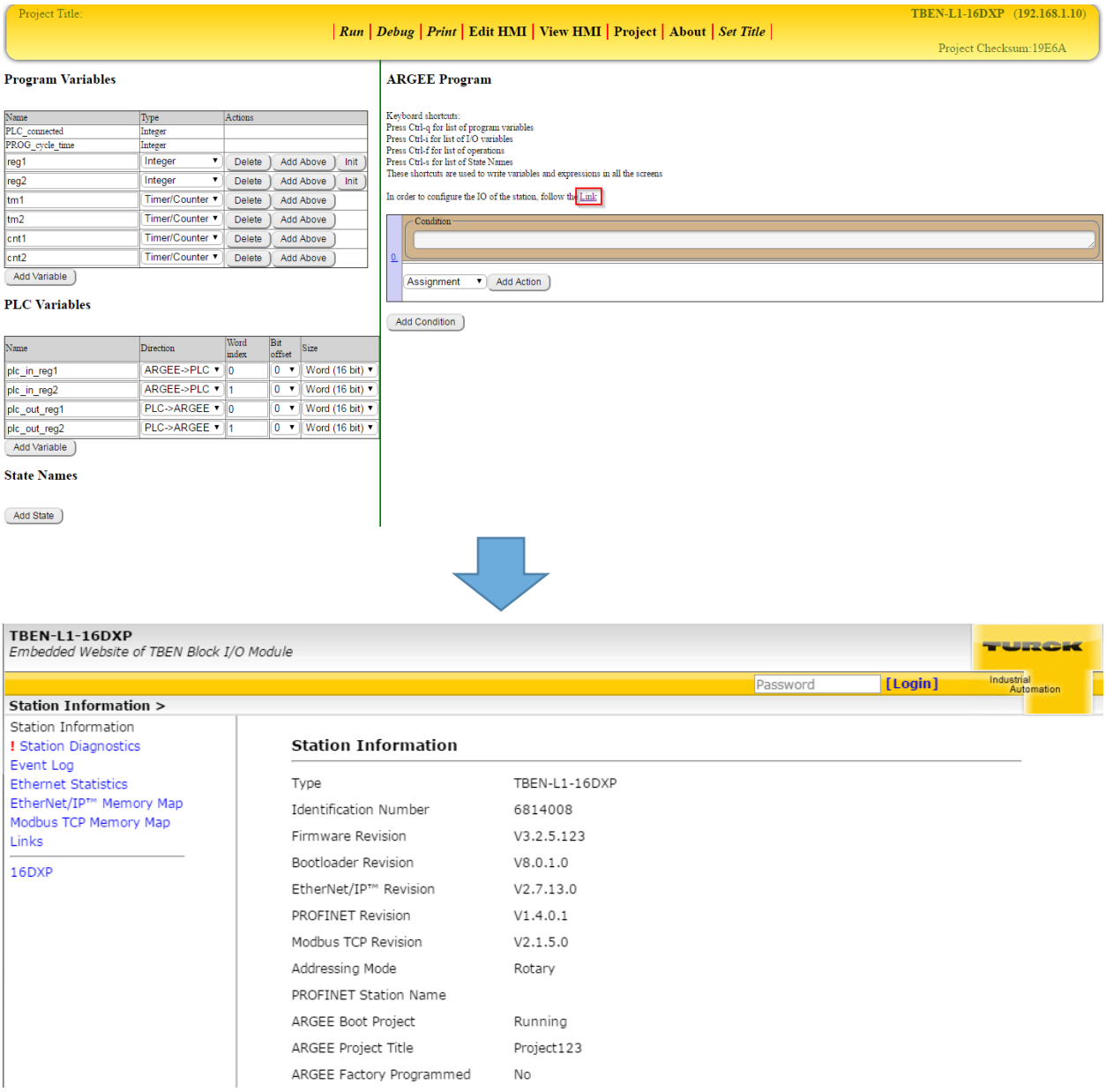
Actions are selected from a pull down menu. Users select the desired action, and then select the *Add Action* button.



Note: Some Actions are executed even if the Condition is false. See Chapter 9 – System Performance for more information in this topic.

Embedded Webserver

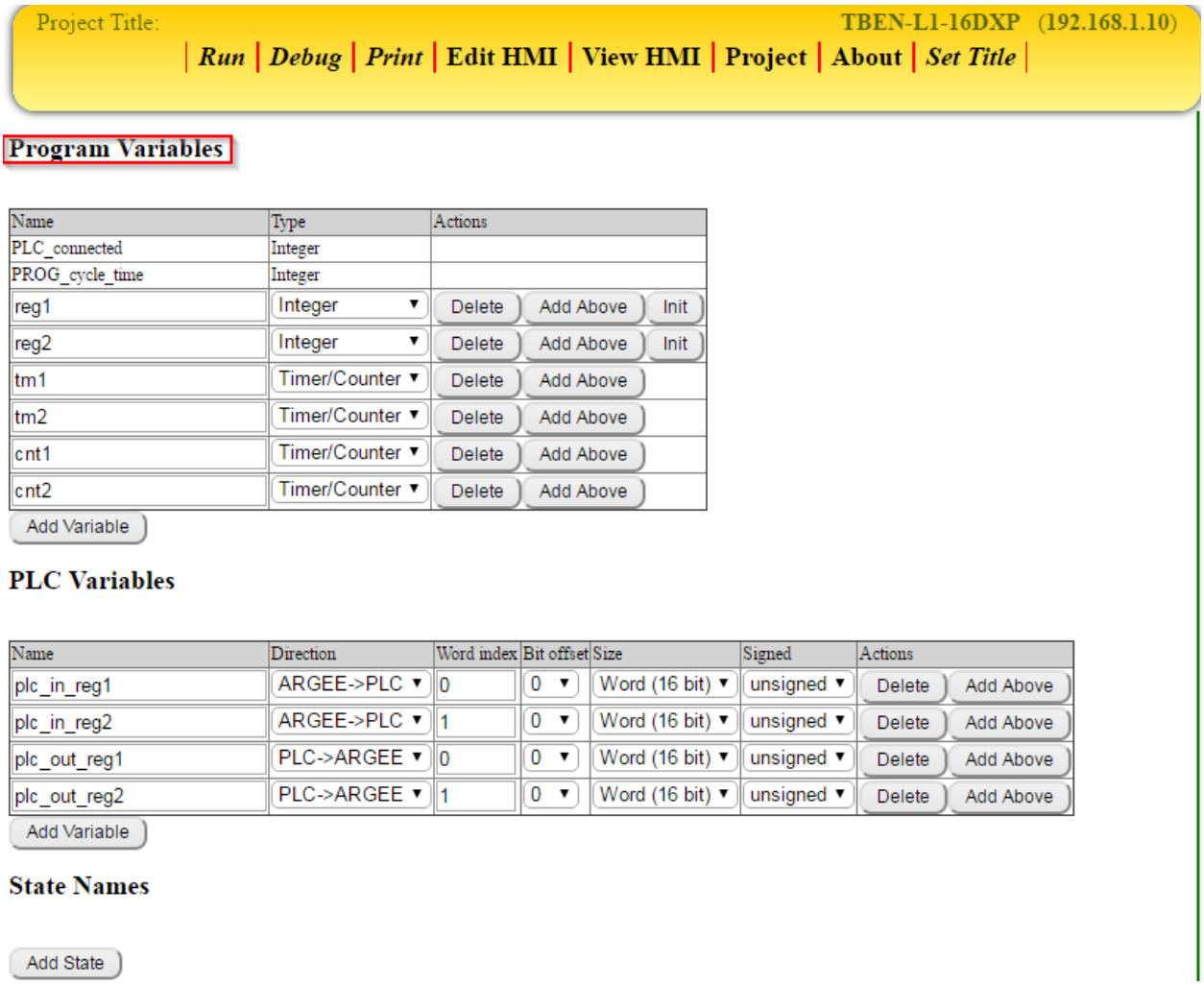
The user can click *Link* to access the connected blocks webserver. Once the user is in the webserver, they can view the device status and even set device parameters.



NOTE: The default password for the webserver is “password”.

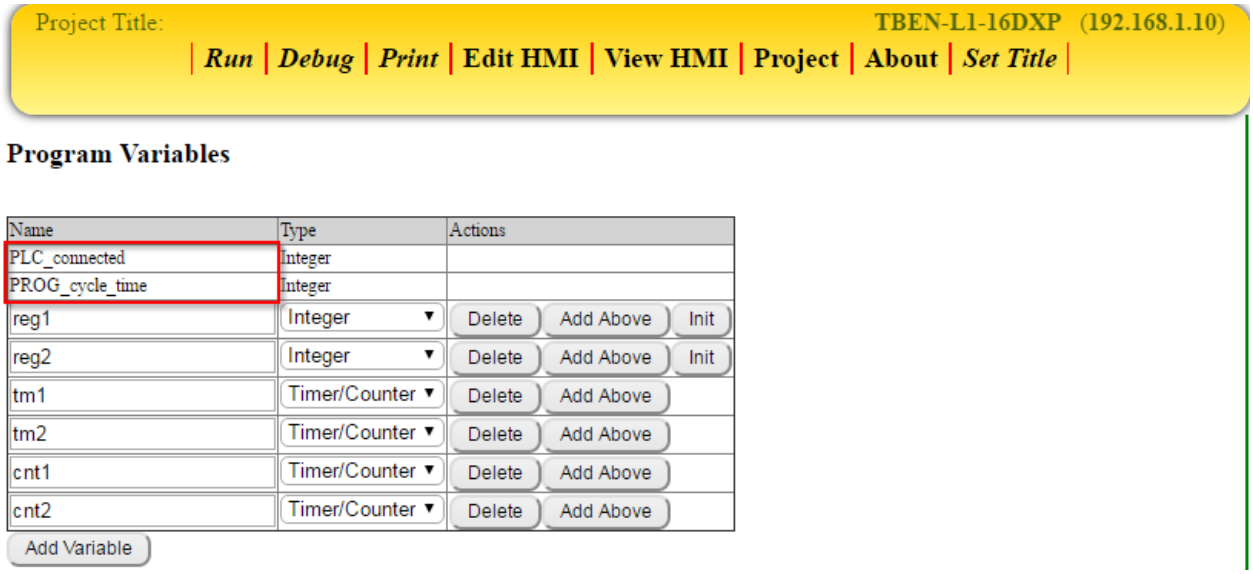
Program Variables

Program Variables can be added, deleted and renamed. The user can also change the variable type by using the drop down arrow.



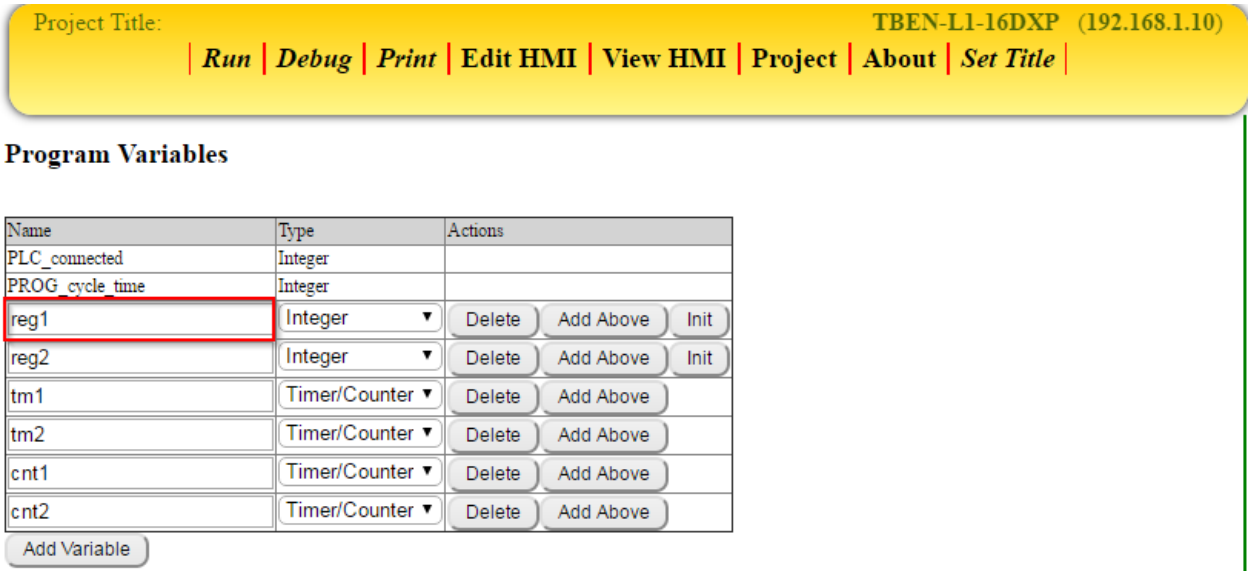
PLC_connected & PROG_cycle_time

The PLC_connected bit is true when a PLC is connected to the device. The PROG_cycle_time displays the time it takes to execute the entire program.



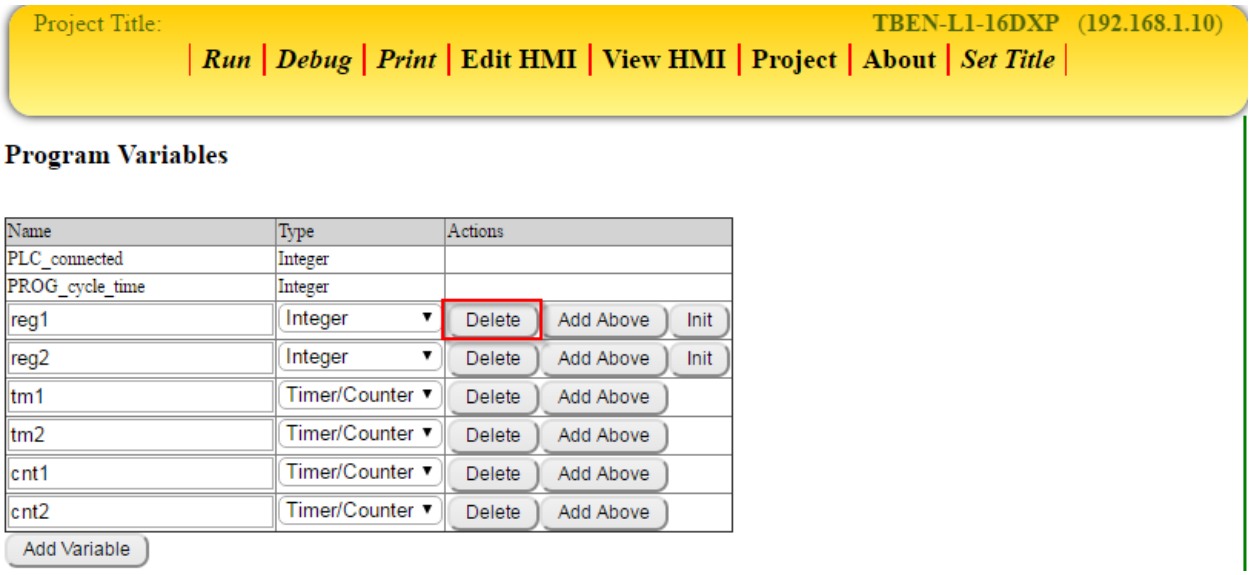
Variable Name

Variable Names are the names of variables in the users program.



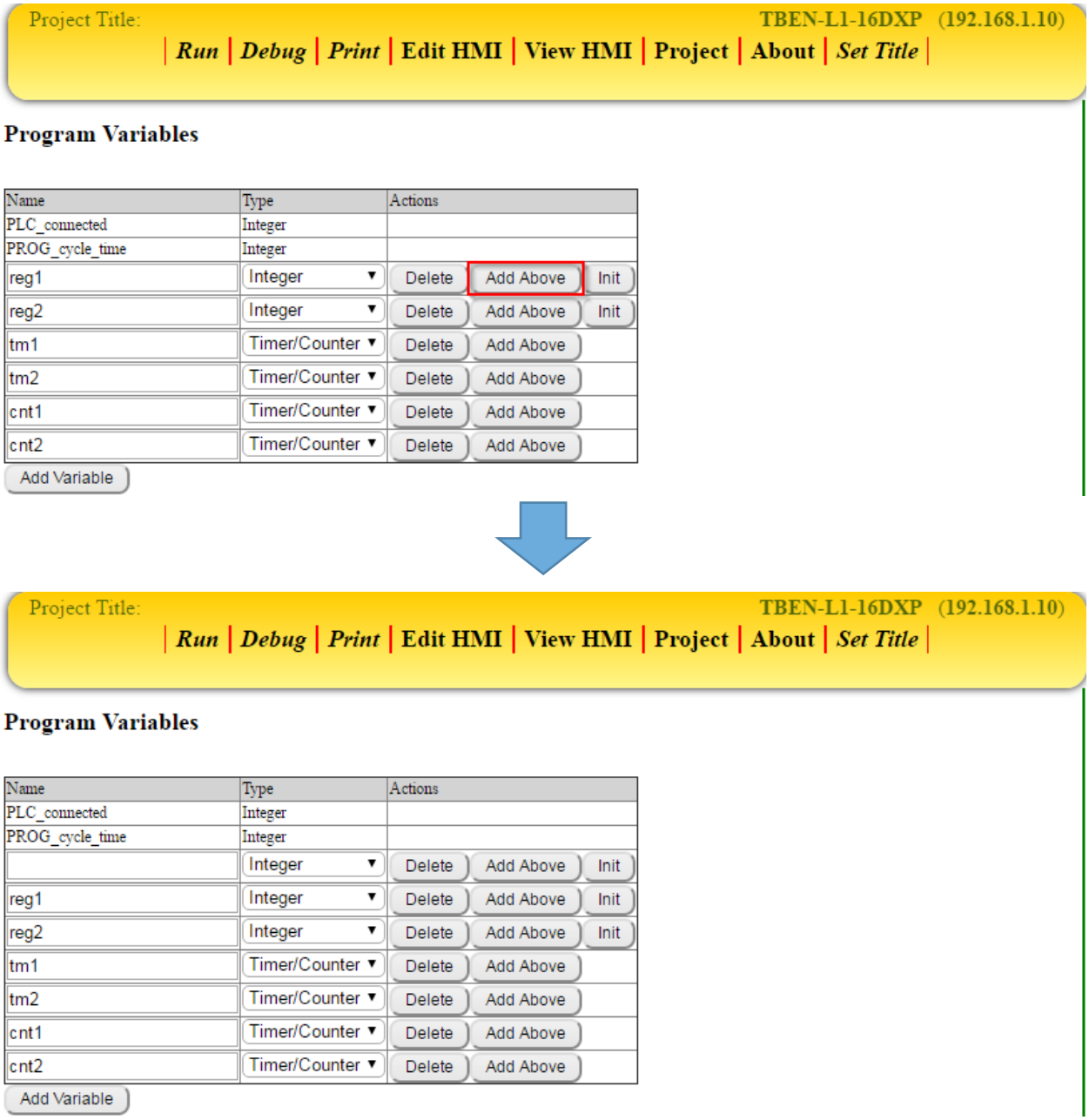
Delete

The *Delete* button will delete the program variable.



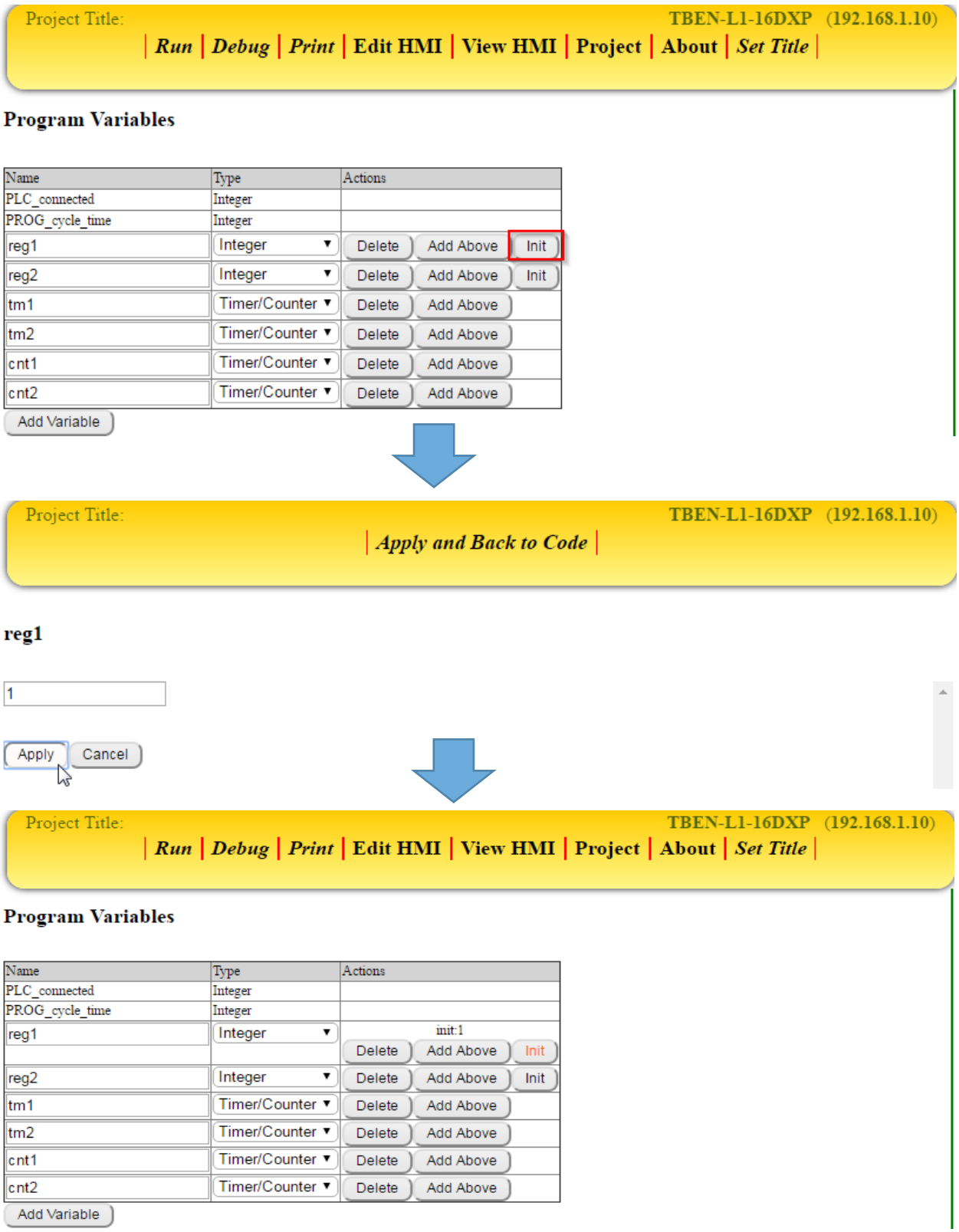
Add Above

The *Add Above* button will add a Program Variable above the selected variable.



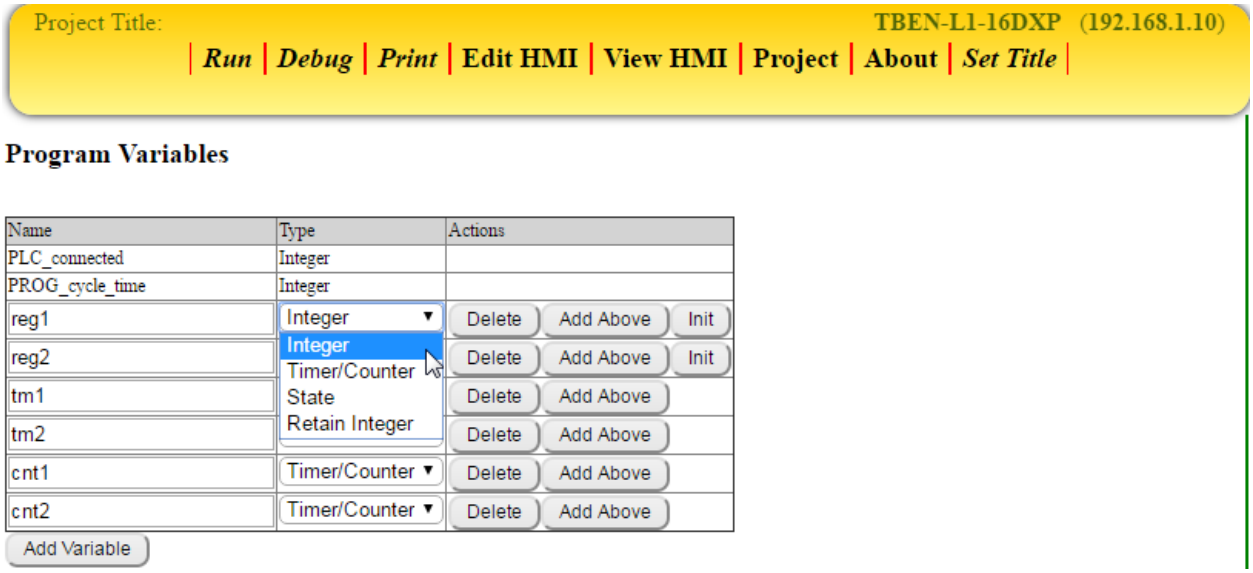
Init (Initialize)

The user will use *Initialize* if they want to pre-set the value in a Program Variable's register.



Integer

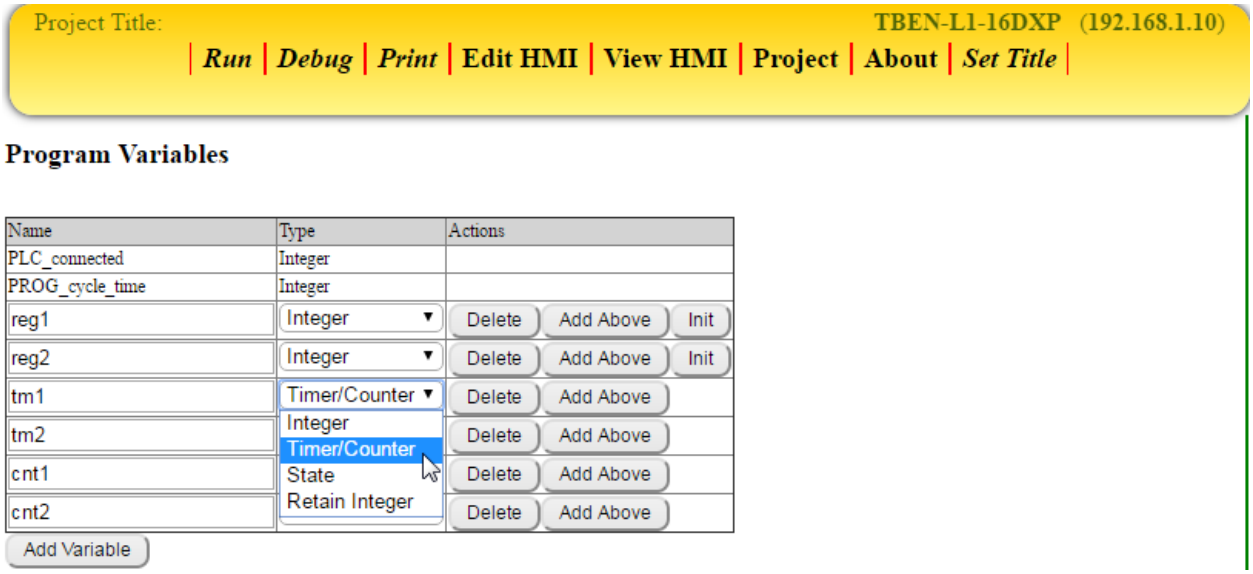
If the user selects *Integer*, the Program Variable will be stored in 32 bit signed register. This allows the user to store an Integer value between +2,147,483,647 and -2,147,483,647 in the Program Variable's register.



NOTE: Integer values are stored in four 8-bit registers.

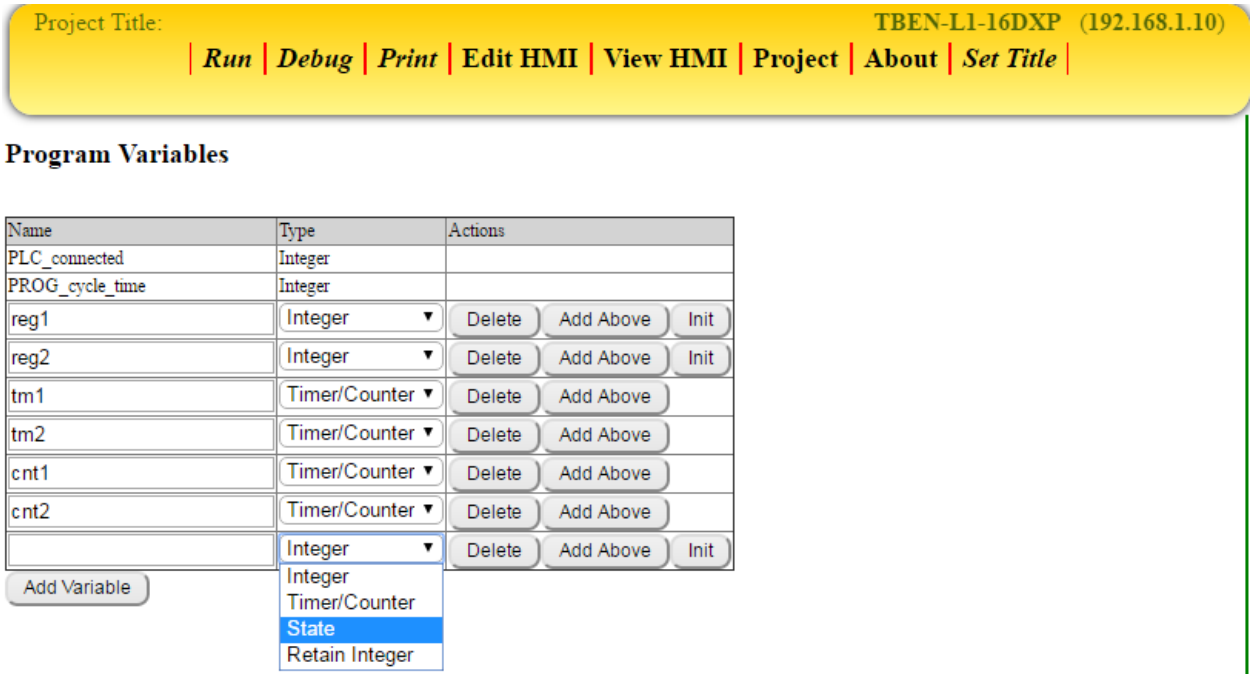
Timer/Counter

The user can select *Timer/Counter* if they want to add a Timer or Counter variable to their program.



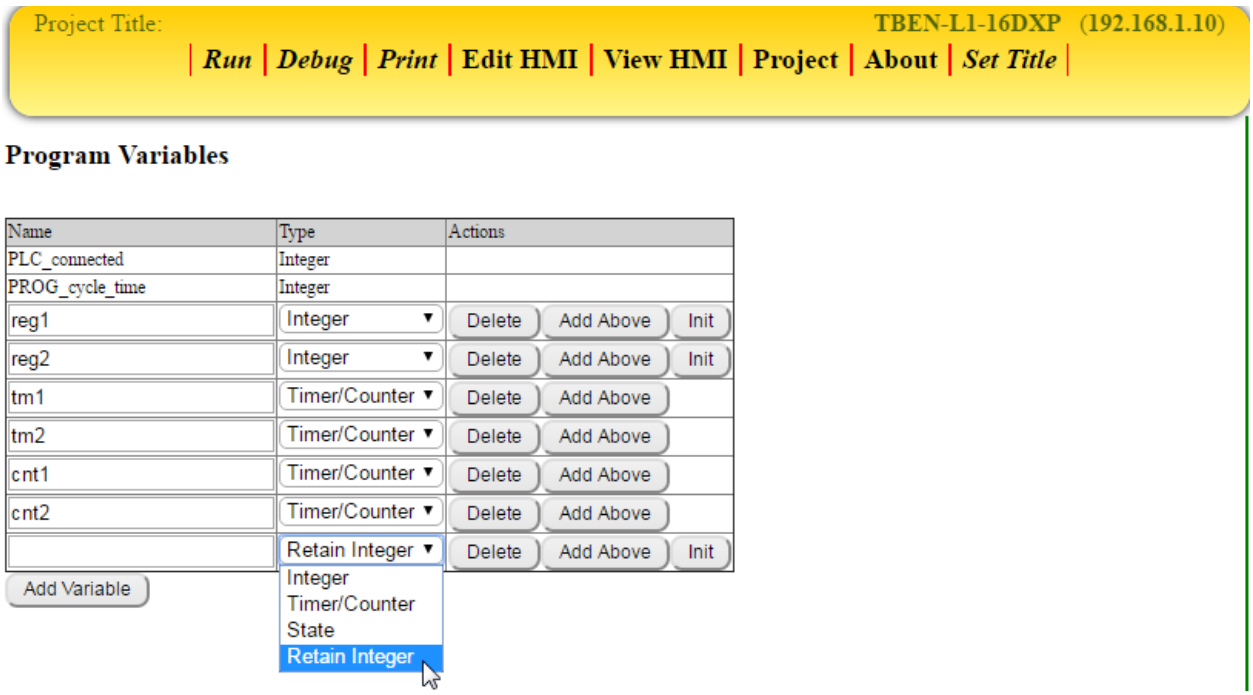
State

The user would select *State* if they wanted to create a State Variable. State Variables are used in State Machines. An example of a State Machine is shown on page 91.



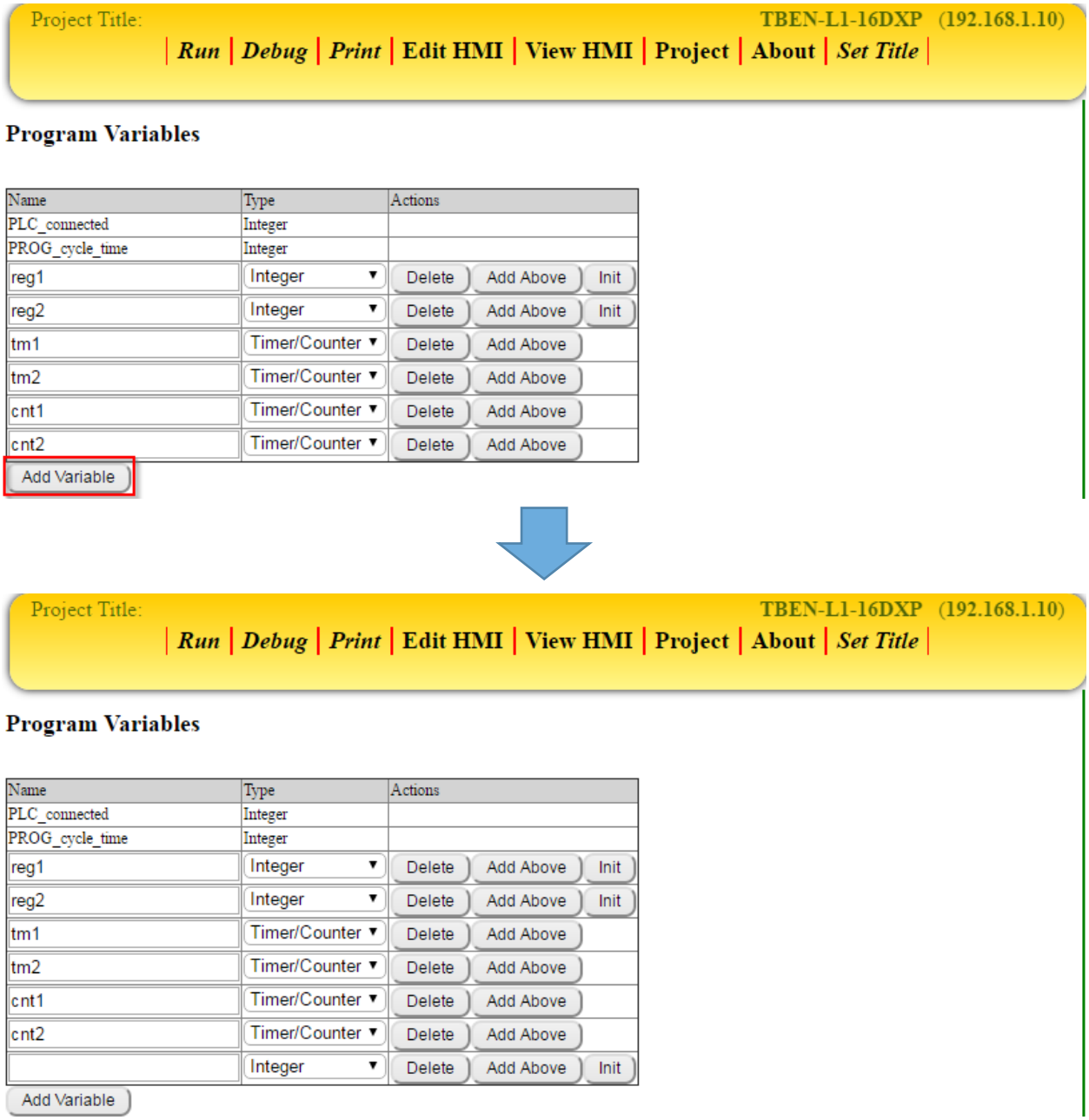
Retain Integer

The user would use *Retain Integer* if they wanted to save the value in a Program Variable through a power cycle. The value is saved into flash memory once every three minutes if the value has been changed.



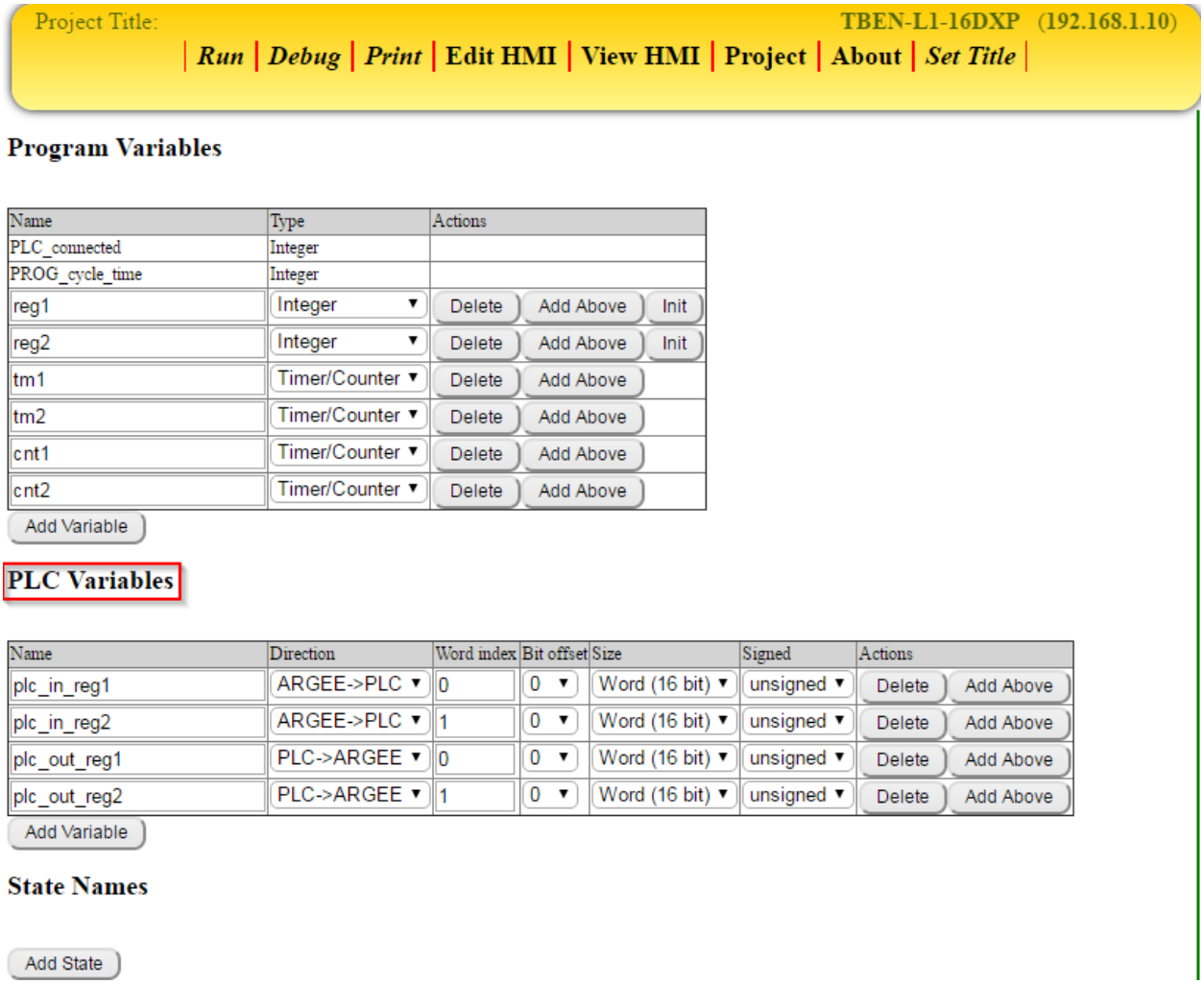
Add Variable

The *Add Variable* button will add a Program Variable to the program.



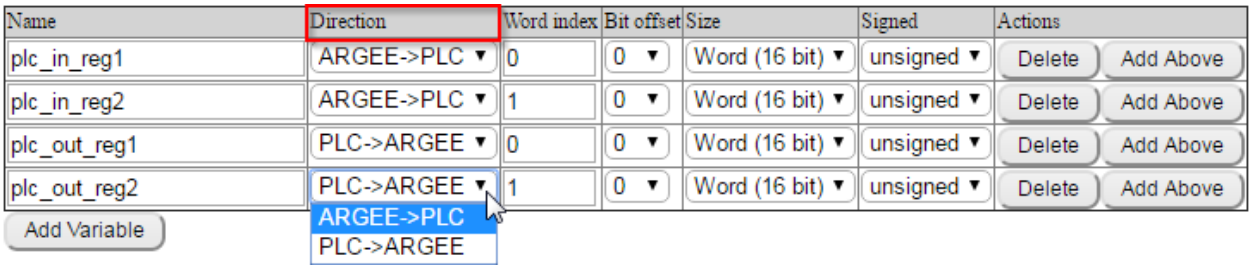
PLC Variables

PLC Variables are used to define communication between the ARGEE block and the PLC. PLC examples are shown in Chapter 10 – Common Applications.



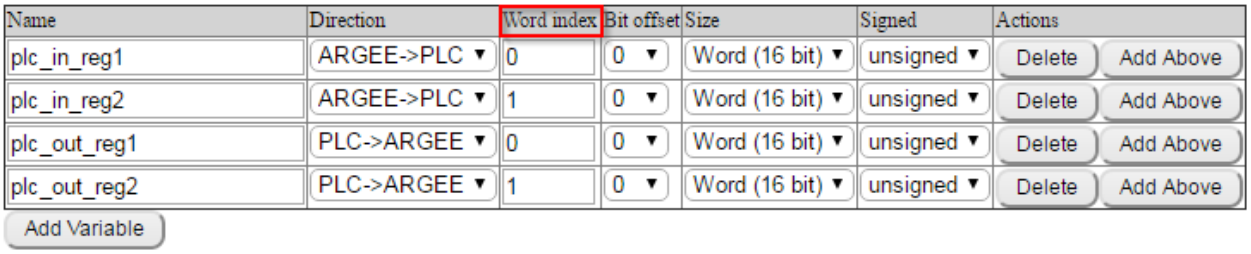
Direction

The user will use the *Direction* dropdown arrow to assign which direction the data is traveling. *ARGEE->PLC* means the data is traveling from the ARGEE block to the PLC. *PLC->ARGEE* means the data is traveling from the PLC to the ARGEE block.



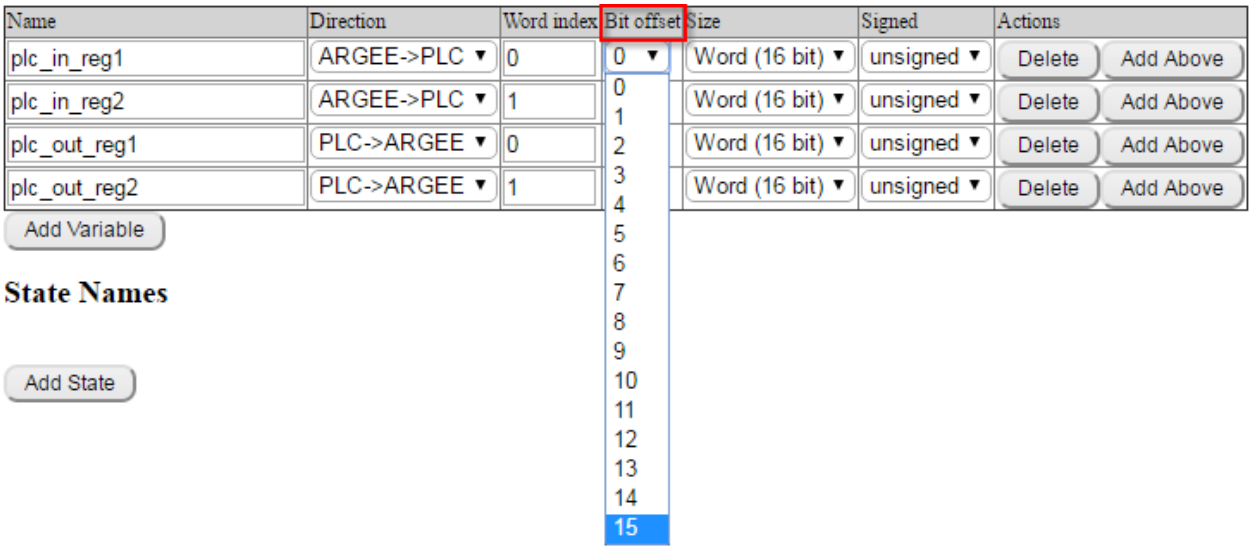
Word Index

The user will use the *Word index* to assign the data to a specific register in the PLC or the ARGEE block.



Bit Offset

The user will use the *Bit offset* to assign the data to a specific bit in a register.

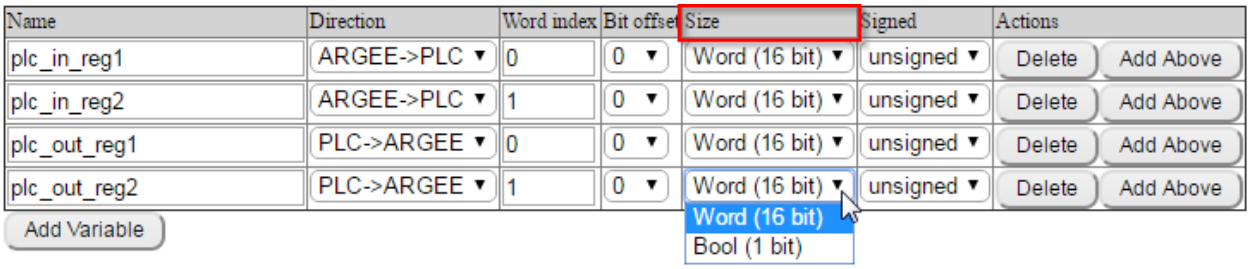


State Names

Add State

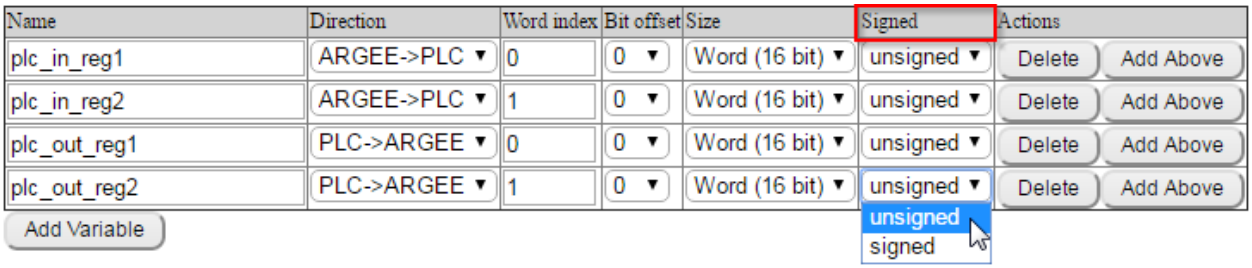
Size

The user will use the *Size* drop down to set the size of the data being transferred.



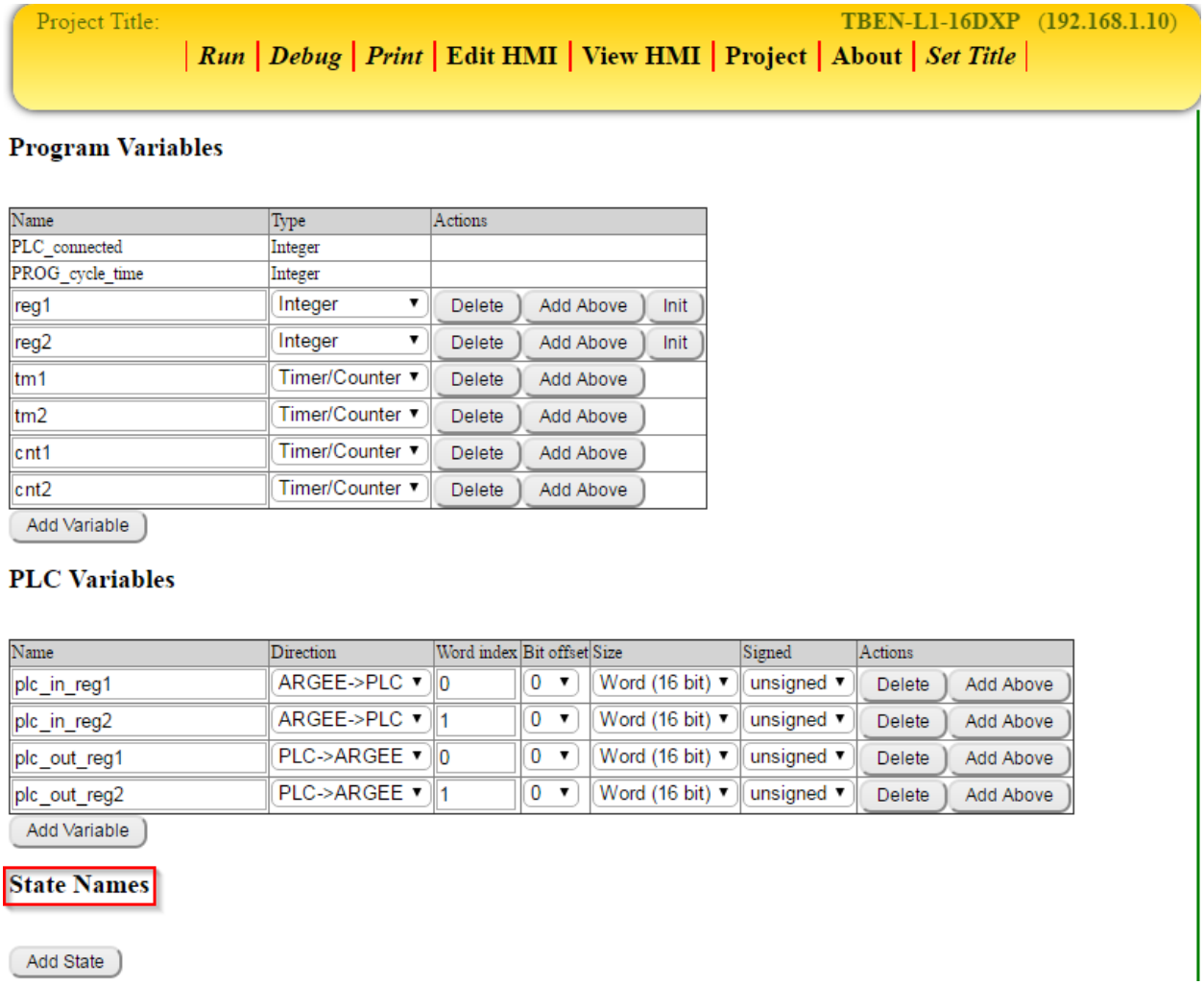
Signed

The user will use the *Signed* drop down to indicate whether the data being transferred is a signed or unsigned integer.



State Names

State Names are used to make it easier to identify which State the users program is in. “State” is the term used to identify a specific program operation at a specific moment.



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Add State

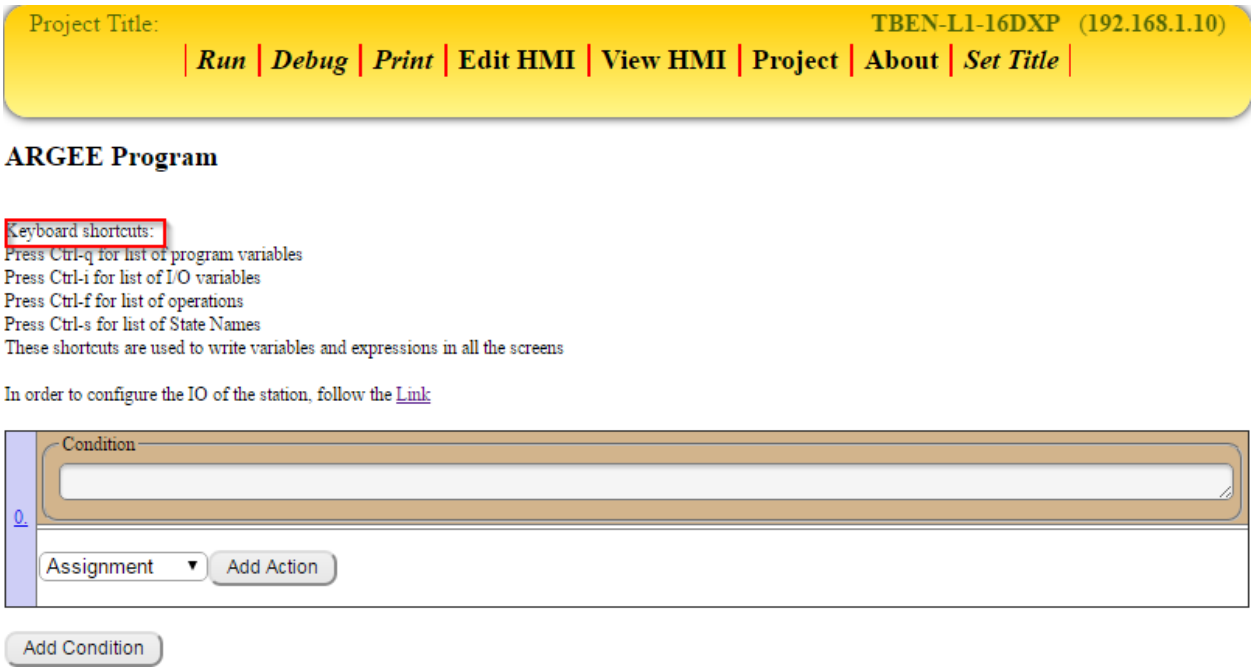
The user would click *Add State* if they wanted to add State Names to their program.

Note: An example that uses State Names is shown on page 91 and page 116.

Keyboard Shortcuts

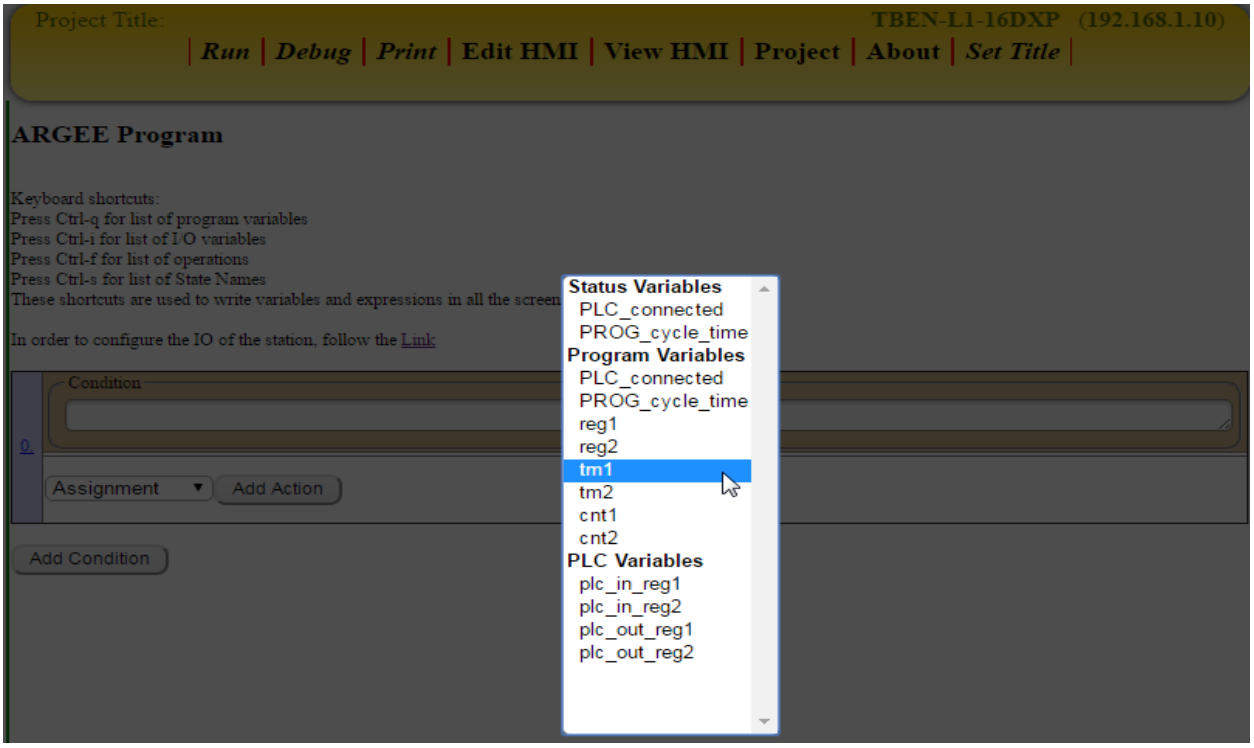
Keyboard shortcuts provide the user with a quick way to access Program Variables, I/O Variables, Operations and State Names.

- Ctrl-q, Program Variables.
- Ctrl-i, I/O Variables.
- Ctrl-f, Operations
- Ctrl-s, State names



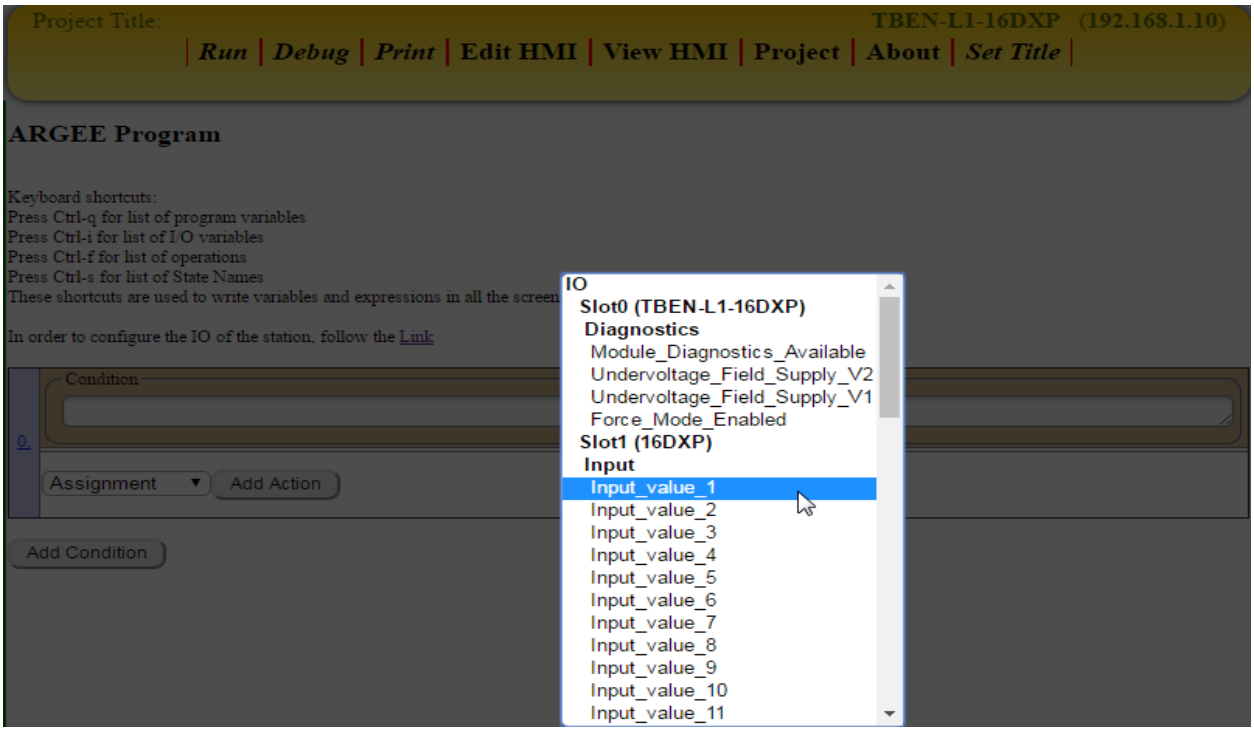
Program Variables (Control + Q)

If the user presses *Ctrl + q* while in a Condition or Action box, the Program Variable List will pop up. The user can select their desired variable and it will be added to their respective Condition or Action box.



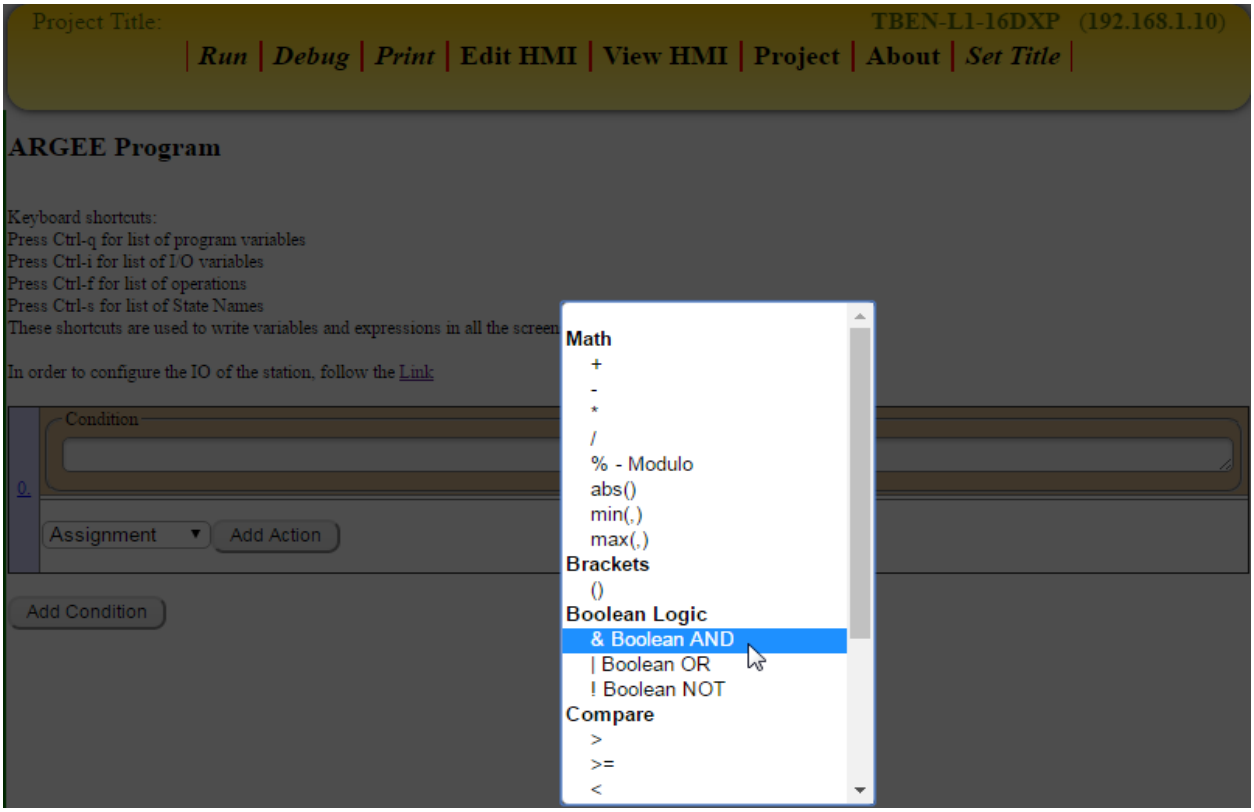
I/O Variables (Control + I)

If the user presses *Ctrl + i* while in a Condition or Action box, the I/O Variable List will pop up. The user can select their desired variable and it will be added to their respective Condition or Action box.



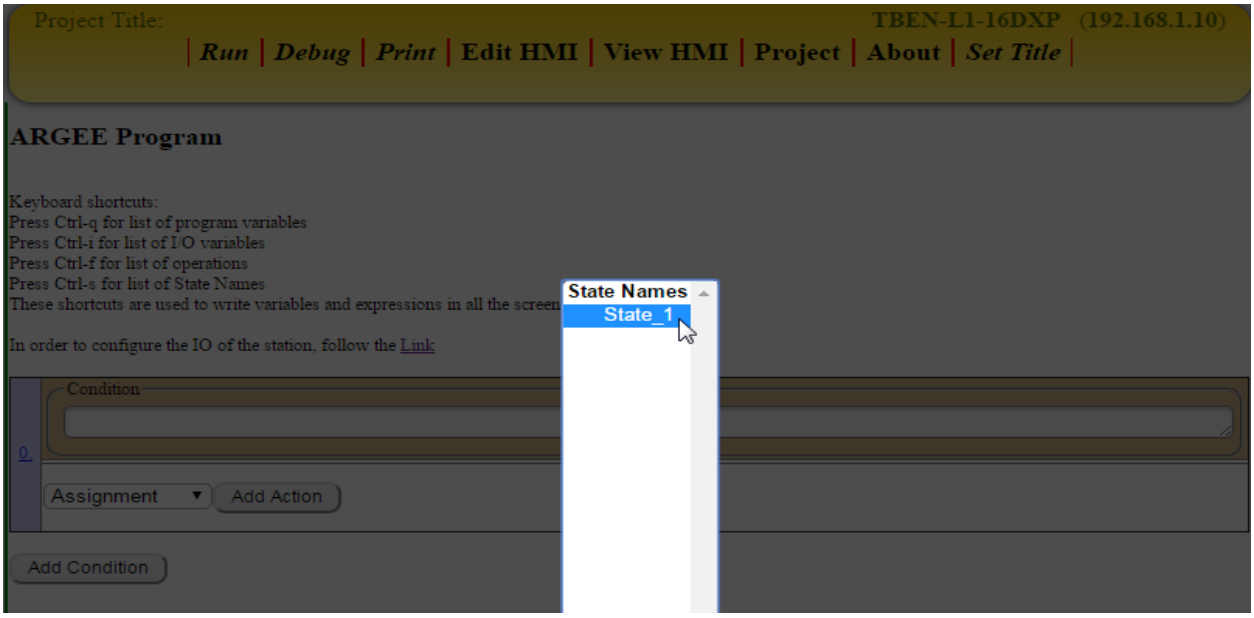
Operations (Control + F)

If the user presses *Ctrl + f* while in a Condition or Action box, the Operations List will pop up. The user can select their desired operation and it will be added to their respective Condition or Action box.



State Names (Control + S)

If the user presses *Ctrl + s* while in a Condition or Action box, the State Name List will pop up. The user can select their desired State Name and it will be added to their respective Condition or Action box.



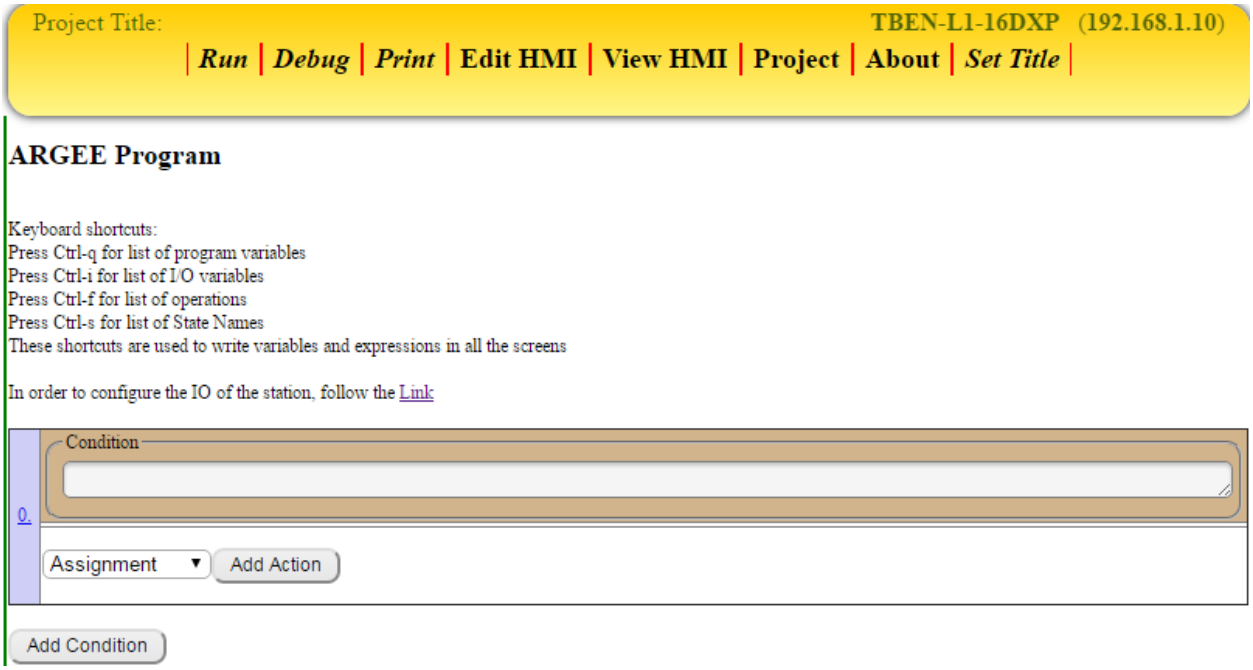
NOTE: If the user has not added a State Name to their project, the State Name List will be empty.

Chapter 5: Conditions & Actions

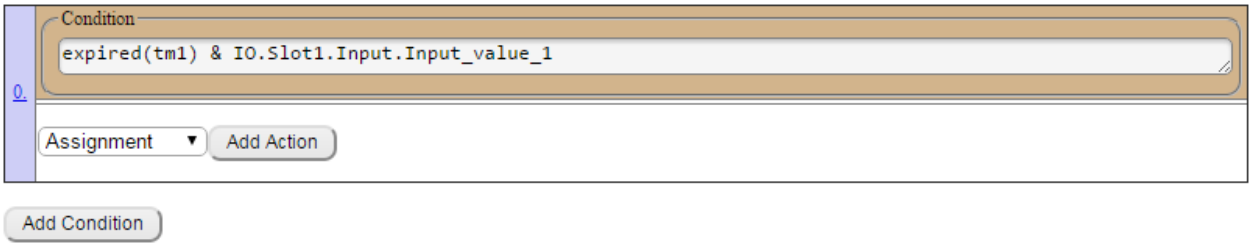
Conditions

The Condition box is where the user puts their input conditions. An example of an Input condition could be:

- A Timer expiring
- A Counter reaching a specific value
- A Counter expiring
- A register value changing from 0 to 1
- A register value changing from 1 to 0
- An Input from a sensor becoming true
- …many other things can also be used as an input condition



The Condition box also allows the user to combine different types of Inputs.



Explaining the Screenshot: The above Condition will only become true when timer 1 expires and Input_value_1 goes true.

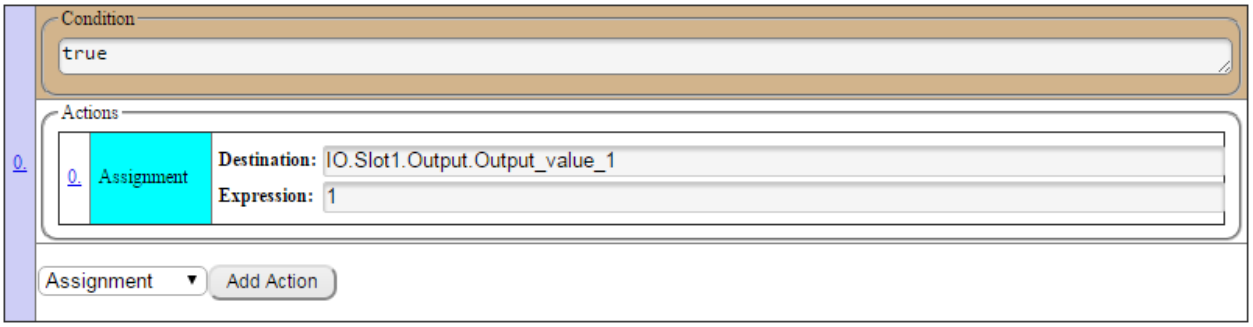
Actions

The Actions box is where the user puts their Output conditions. The user can execute several Actions under a single Condition statement. An Action could be:

- Loading a value into a register
- Stating a Timer
- Stopping a Timer
- Signal Tracing
- Incrementing a Counter
- Decrementing a Counter
- Resetting a Counter

Assignment

The user would use the *Assignment* action if they want to load a value into a register.



Explaining the Example: The Condition in the above statement is always “true”. The value “1” is loaded into register Output_value_1. In other words, this means that the user’s Output 1 will always be on.

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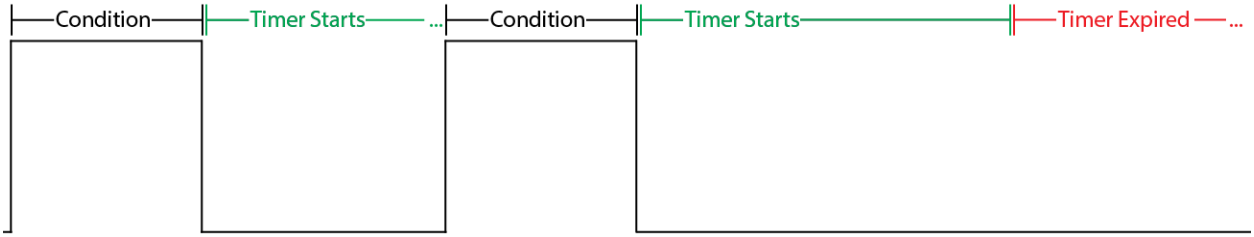
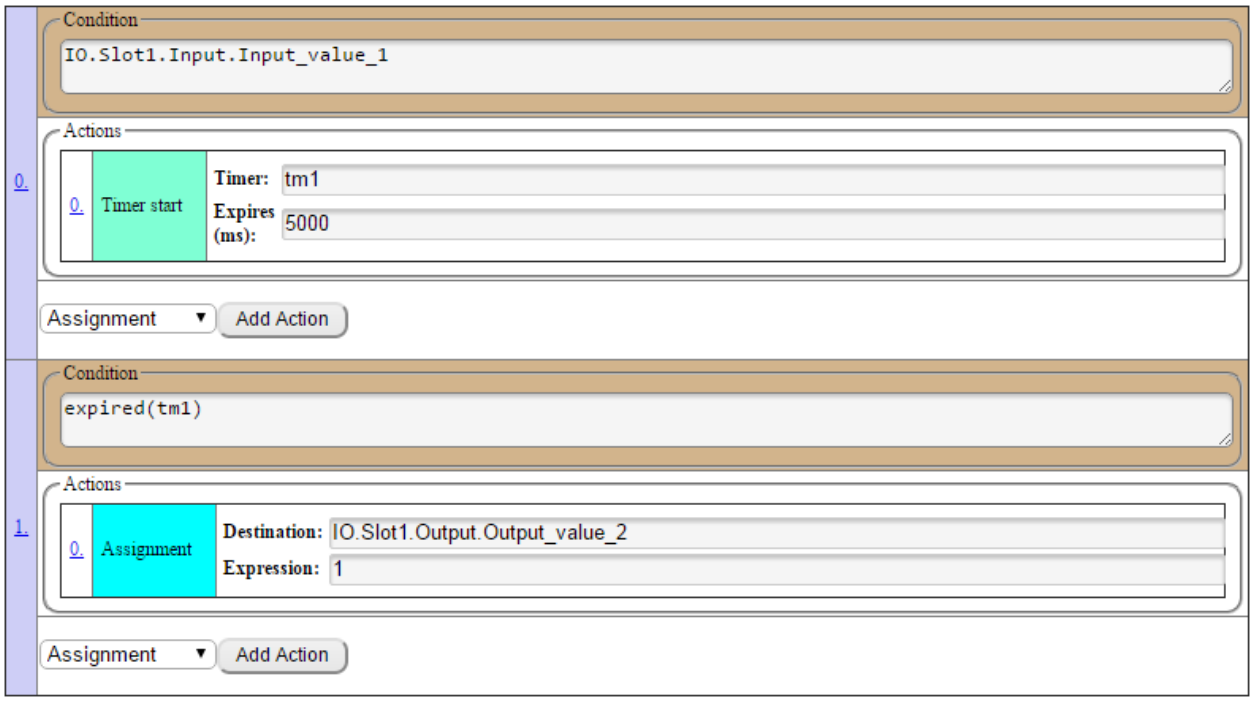
Timer Start

The user will use the *Timer Start* action if they want to start a timer after the Condition has occurred.

If the Condition occurs again before the timer expires, the timer will restart.



Example of Timer Start

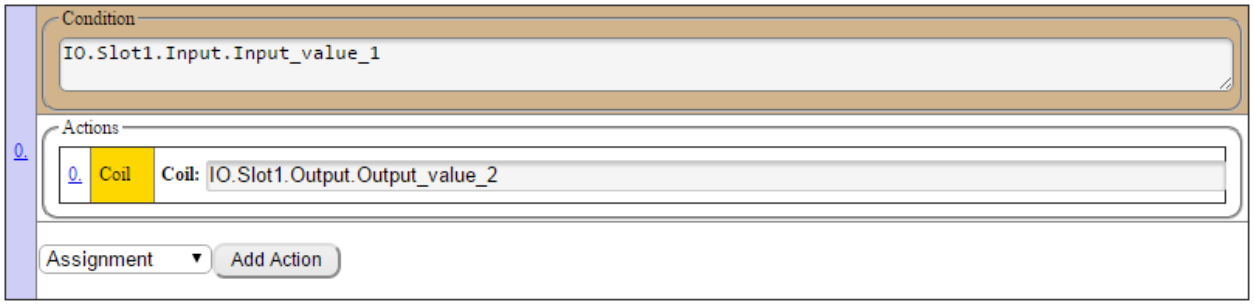


Explaining the Example: When Input_value_1 goes true and then false, start timer 1. When timer 1 expires, load the value “1” into register Output_value_2 (or turn on Output 2).

Coil

The user will use the *Coil* action if they want an Output to be “set” if the Condition is true and “cleared” when the Condition is false.

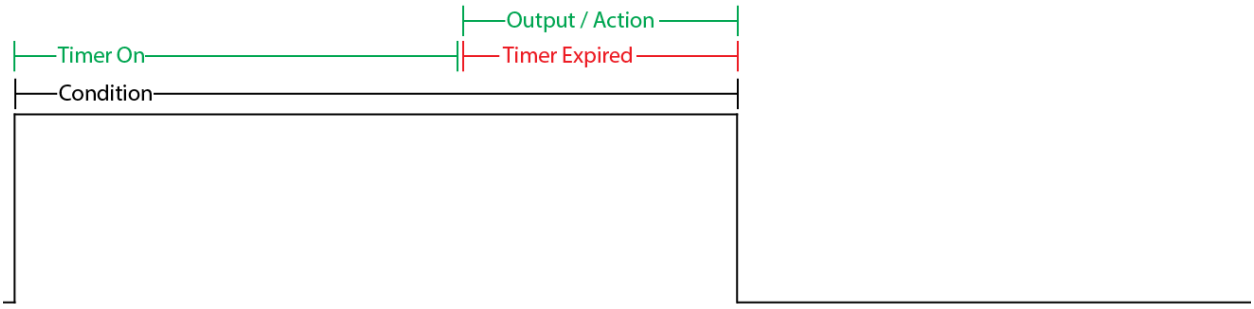
Example of Coil



Explaining the Example: When Input_value_1 is true, Output_value_2 is true. When Input_value_1 is false, Output_value_2 is false.

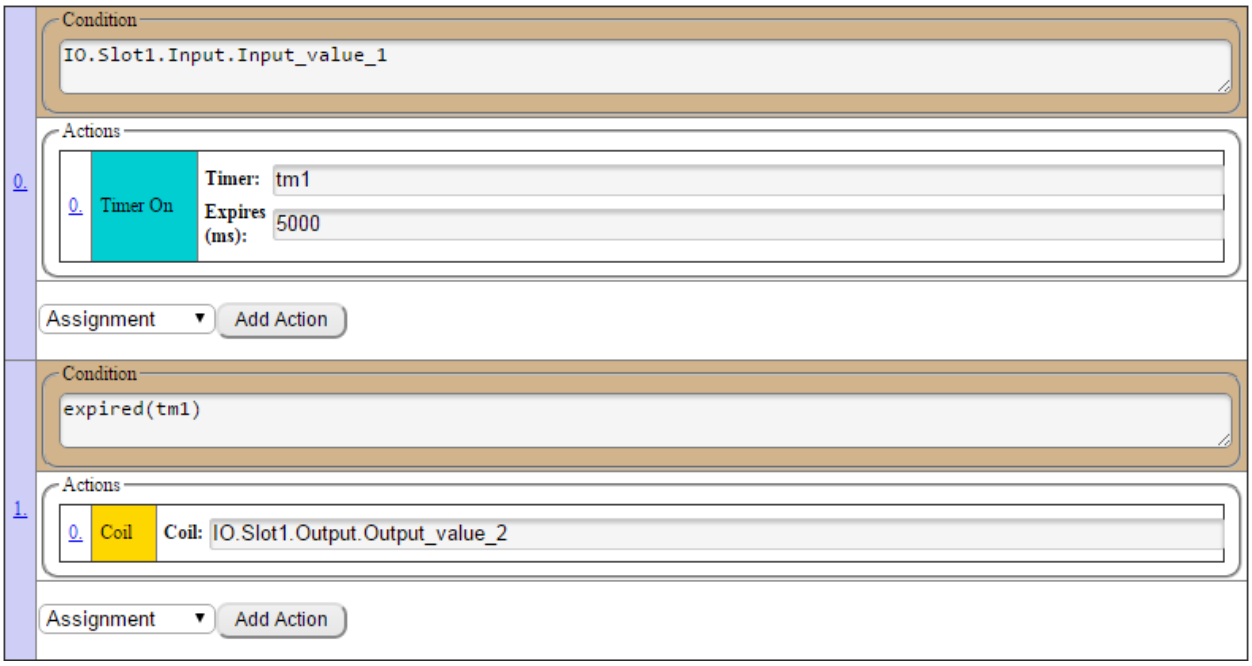
Timer On

The user will use the Timer On action if they want a timer to run while a Condition is true. The user will normally tie an additional Action or Output to the timer expired Condition.



If the Condition ends before the timer expires, the Action tied to the expired timer will not occur.

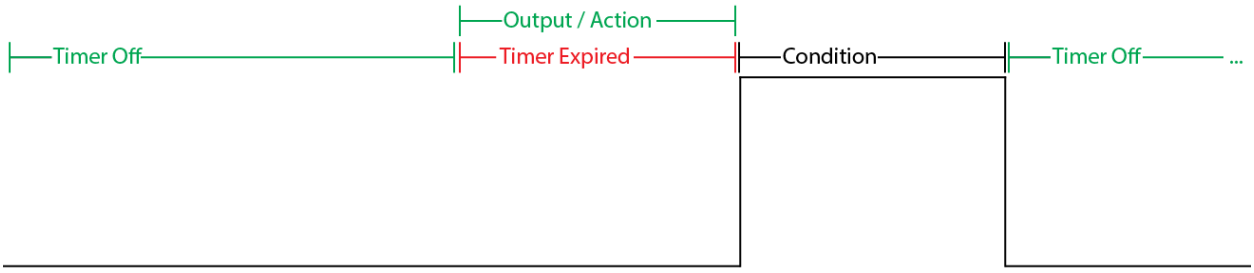
Example of Timer On



Explaining the Example: When Input_value_1 is true, start timer 1. When timer 1 expires, coil Output_value_2. When Input_value_1 is false, Output_value_2 will be false.

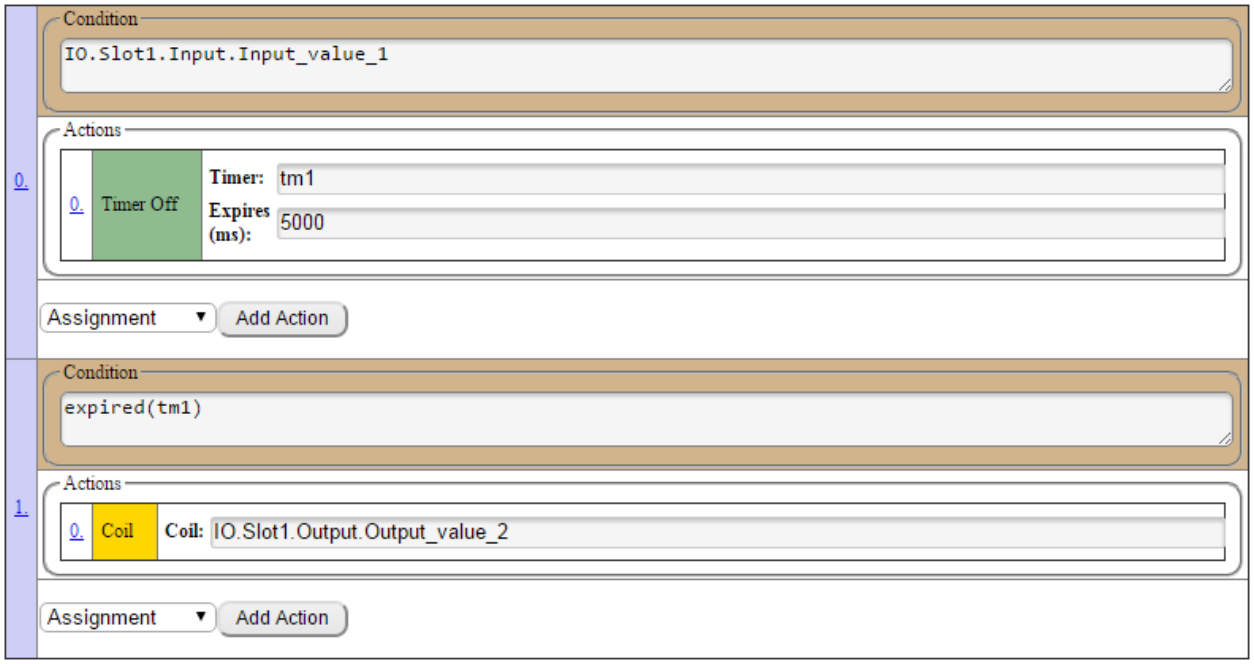
Timer Off

The user will use the Timer Off action if they want a timer to run while a Condition is false. The user will normally tie an additional Action or Output to the timer expired Condition.



If the Condition starts before the timer expires, the Action tied to the expired timer will not occur.

Example of Timer Off



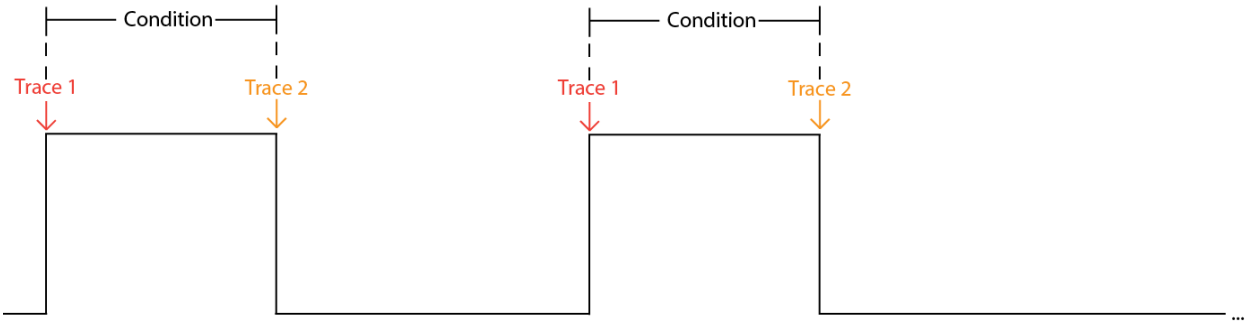
Explaining the Example: Timer 1 starts counting as soon as the program starts. When timer 1 expires, Output_value_2 is coiled on. When Input_value_1 is true, timer 1 is reset to zero and Output_value_2 goes false. When Input_value_1 is false, timer 1 starts counting again.

Trace

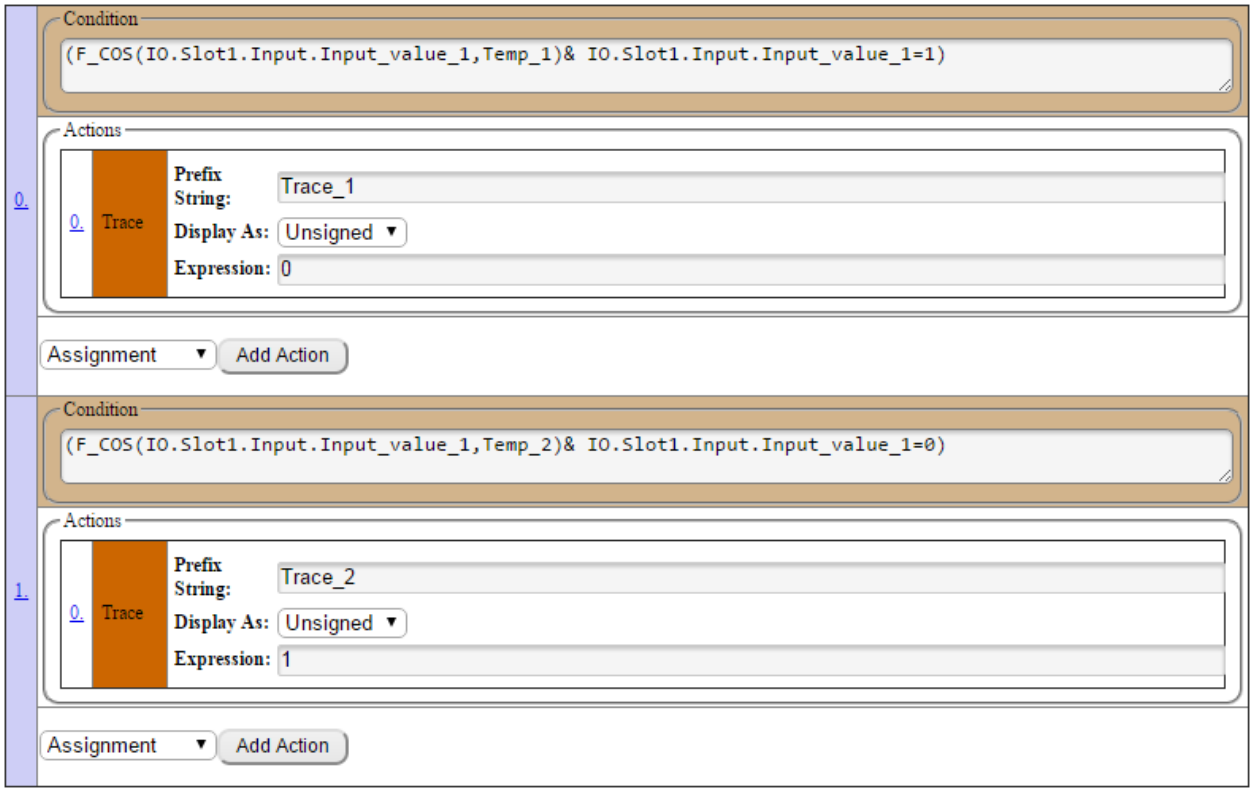
The user will use the Trace function if they want to time stamp exactly when an event occurred. Trace can be used to measure a programs run-time behavior, how long each state takes and even which states were visited in which order.

Example of Trace

The user wants to use Trace to measure how long the condition is true.



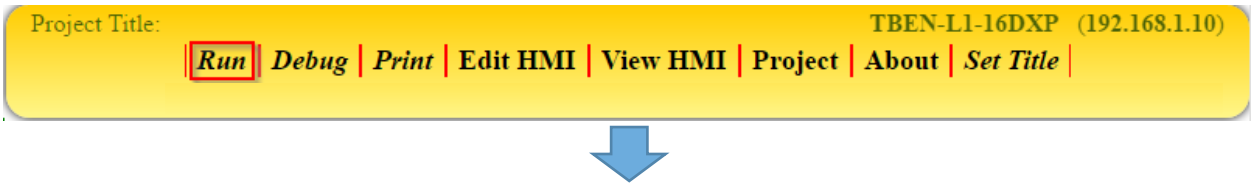
Note: The below example uses the Change of State Operation (F_COS) in the Condition block. The Change of State Operation is discussed on page 69.



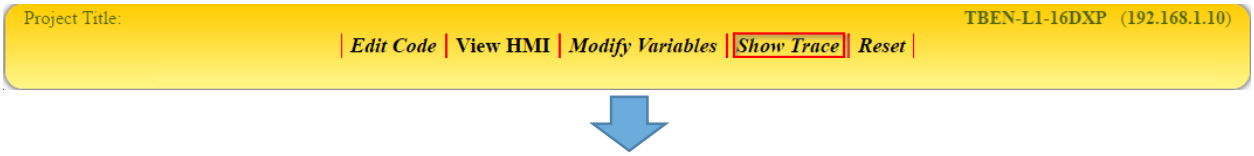
Explaining the Example: When Input_value_1 is true, Trace_1 time stamps that event. When Input_value_1 goes false, Trace_2 time stamps that event. The Prefix String is a name that makes sense to the user. The Expression can be any value or even another variable name that makes sense to the user.

The Trace example is continued on the next page.

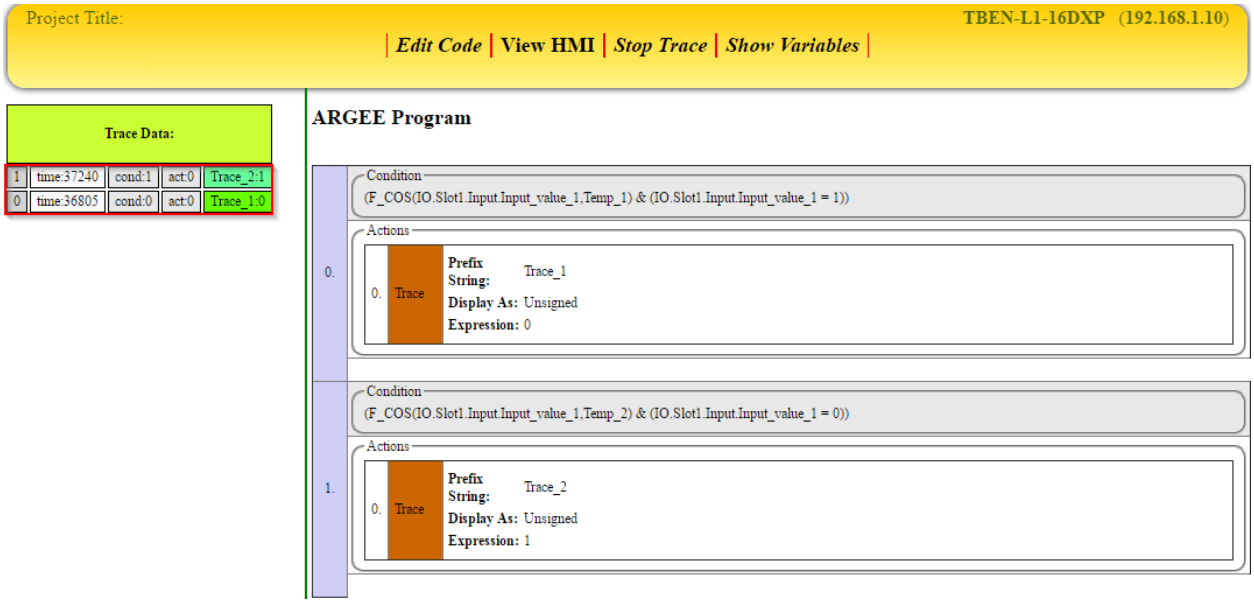
Trace Example (Continued): Once the user has written the code the user will click *Run*.



To view the Trace, the user will click *Show Trace*.



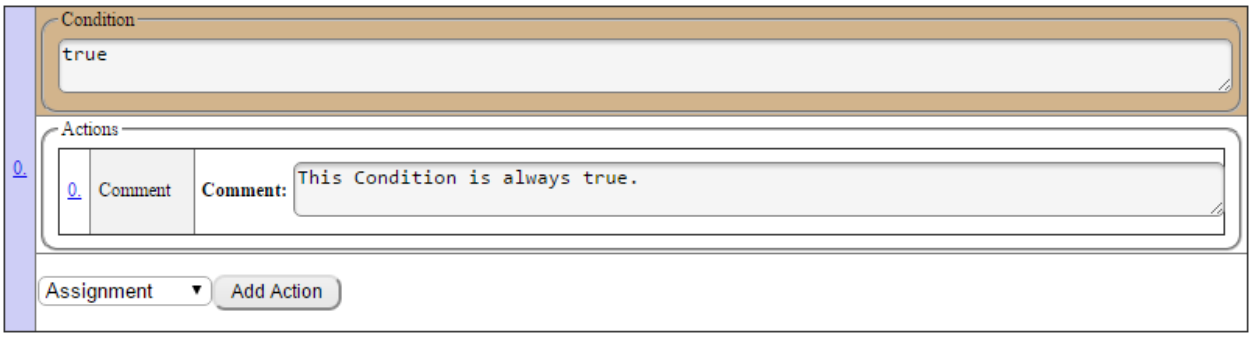
The user will trigger their Condition true then false to show a transition in the Trace data.



To calculate how long the users Condition is true, the user must subtract the two time stamps from one another: 37240 - 36805 = 435ms.

Comment

The user can use a Comment to explain the Condition and Action statements.

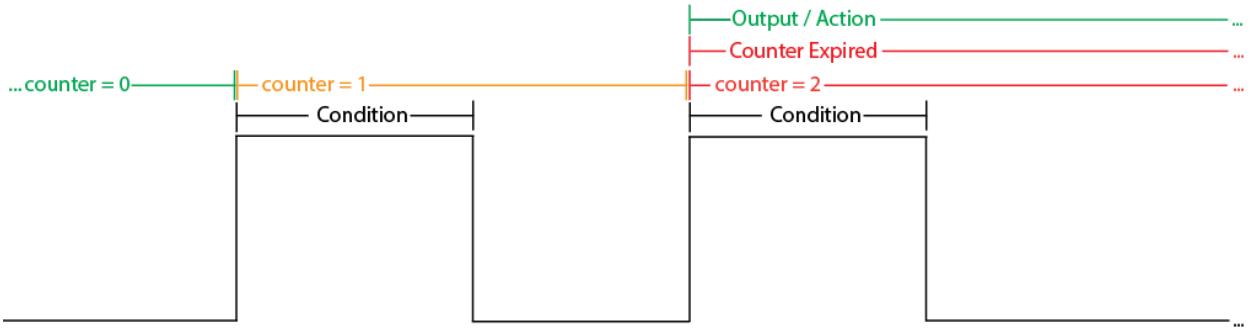


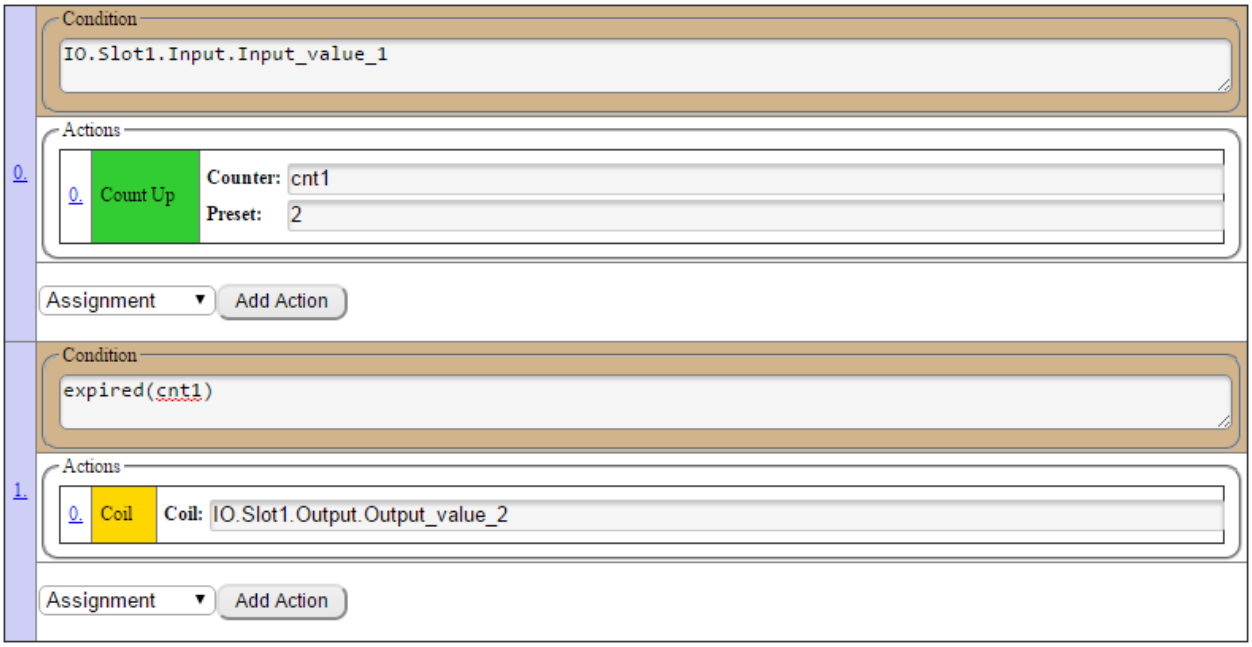
Count Up

The user will use *Count Up* if they want to count the number of times their condition is true. The user will normally tie an additional Action or Output to the counter expired Condition.

Example of Count Up

The user wants to do an Action after the same Condition has occurred two times.





Explaining the Example: Each time Input_value_1 is true, counter 1 counts up one time. Counter 1 expires after two counts. When counter 1 expires, Output_value_2 is coiled on.

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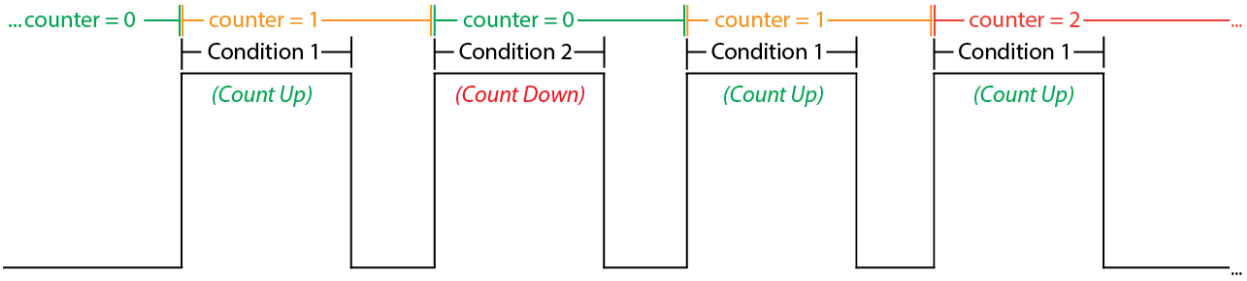
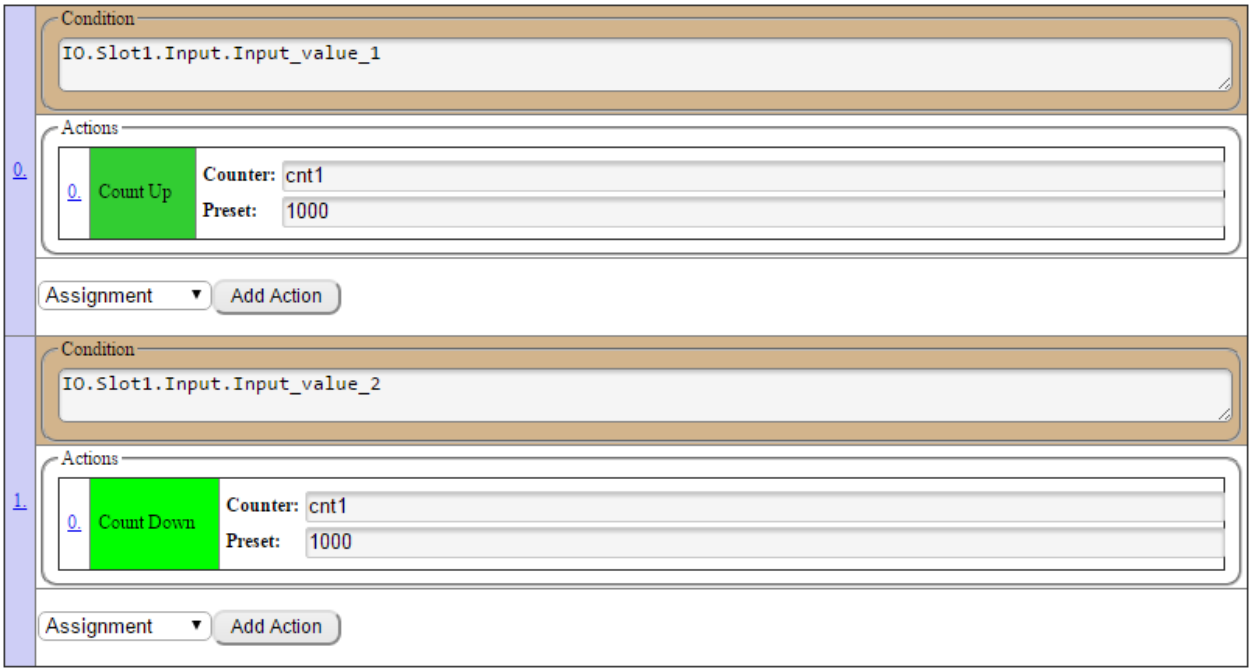
Count Down

The user will use *Count Down* if they want to count down when a condition is true. Count Down is normally used to counter the *Count Up* Action.



Example of Count Down

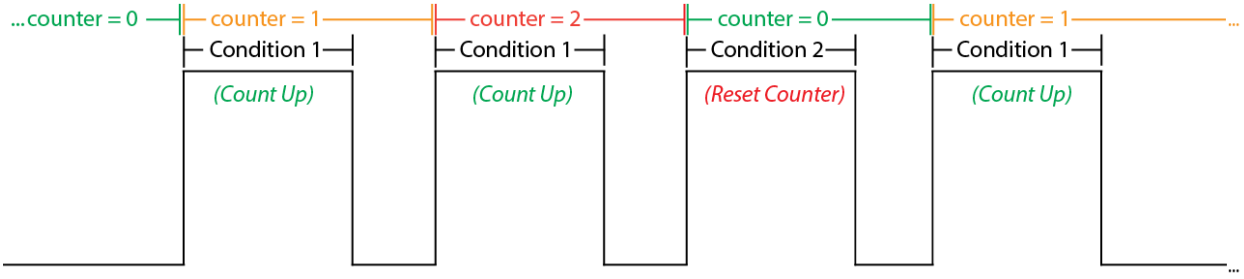
The user wants to keep track of the number of guests in the store. When a guest walks in the store the counter goes up, but when a guest walks out of the store the counter goes down.



Explaining the Example: Each time Input_value_1 is true (or a guest walks in the store), counter 1 counts up one time. Each time Input_value_2 is true (or a guest walks out of the store), counter 1 counts down one time.

Reset Counter

The user will use *Reset Counter* if they want to reset a counter to zero.



Example of Reset Counter

The user wants the ability to reset the counter at any time.

Explaining the Example: Each time Input_value_1 is true, counter 1 counts up one time. Each time Input_value_2 is true, counter 1 resets to zero.

Chapter 6 - Operations

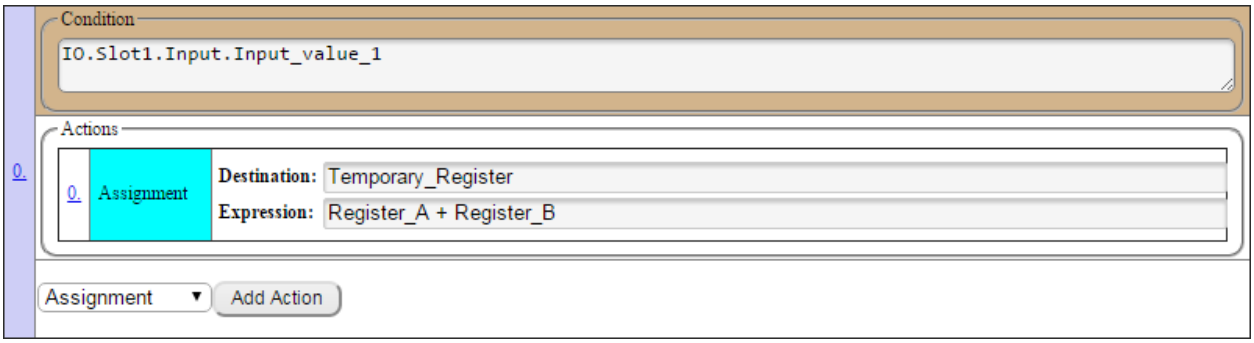
Math

The user will use Math Operations if they want to monitor, compare or combine data from different registers. Math Operations can be used in both Condition and Action expressions.

Addition

The user will use the Add Operation (+) to add one value to another value.

Example of Add Operation



Explaining the Example: When Input_value_1 is true, the value in Register_A will be added to the value in Register_B. The result is placed in Temporary_Register.

Subtraction

The user will use the Subtraction Operation (-) to subtract one value from another value.

Example of Subtraction Operation

Explaining the Example: The user is subtracting the value in Register_A from the value in Register_B. When Register A minus Register B is greater than 1, the user Coils on Output_value_1.

Multiplication

The user will use the Multiplication Operation (*) to multiply one value with another value.

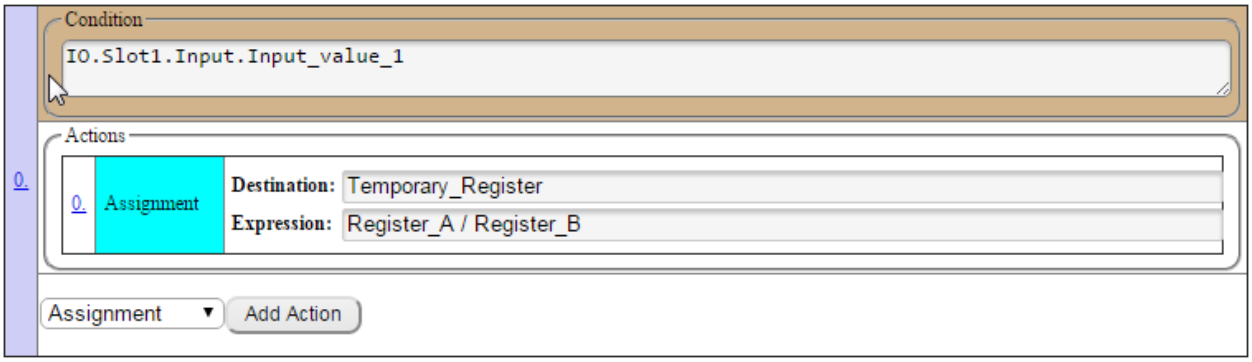
Example of Multiplication Operation

Explaining the Example: The user is multiplying the value in Register_A with the value in Register_B. If Register A times Register B is less than 1000, the user Coils on Output_value_1.

Division

The user will use the Division Operation (/) to divide one value into another value.

Example of Division Operation



Explaining the Example: When Input_value_1 is true, the value in Register_A will be divided by the value in Register_B. The result is placed in Temporary_Register.

VERY IMPORTANT NOTE: ARGEE does not currently support floating point math (or fractions). If the result has a fraction in it, AGREE will drop the fraction and just display the whole number.

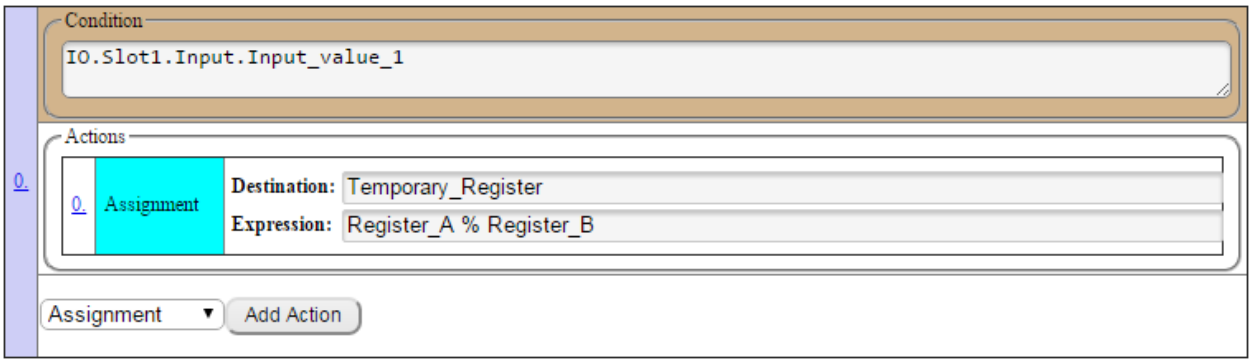
For example:

36 / 6 = 6 ---> ARGEE displays "6"
34 / 6 = $5\frac{4}{6}$ ---> ARGEE displays "5"
6 / 36 = $\frac{1}{6}$ ---> ARGEE displays "0"

Modulo

The user will use the Modulo Operation (%) if they want to capture the “remainder” after a Division Operation has occurred.

Example of Modulo Operation



Explaining the Example: When Input_value_1 is true, the value in Register_A will be divided by the value in Register_B. The “remainder” from the Division Operation is placed in Temporary_Register.

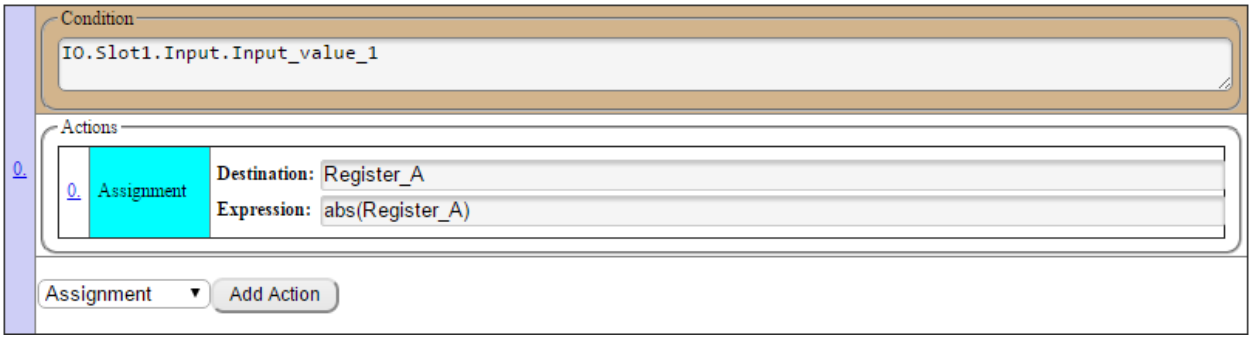
For example:

36 / 6 = “6” with a remainder of “0” ---> ARGEE displays “0”
34 / 6 = “5” with a remainder of “4” ---> ARGEE displays “4”
6 / 36 = “0” with a remainder of “6” ---> ARGEE displays “6”

Absolute Value

The user will use the Absolute Value Operation (abs) to capture the magnitude of a real number without regard to its sign.

Example of Absolute Value Operation

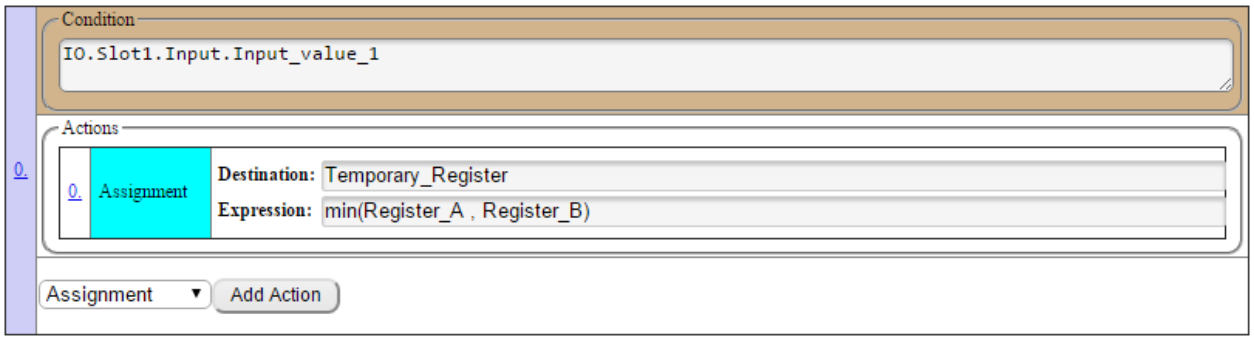


Explaining the Example: When Input_value_1 is true, ARGEE will take the value in Register_A, find its Absolute Value, and place that value back in Register_A.

Minimum Value

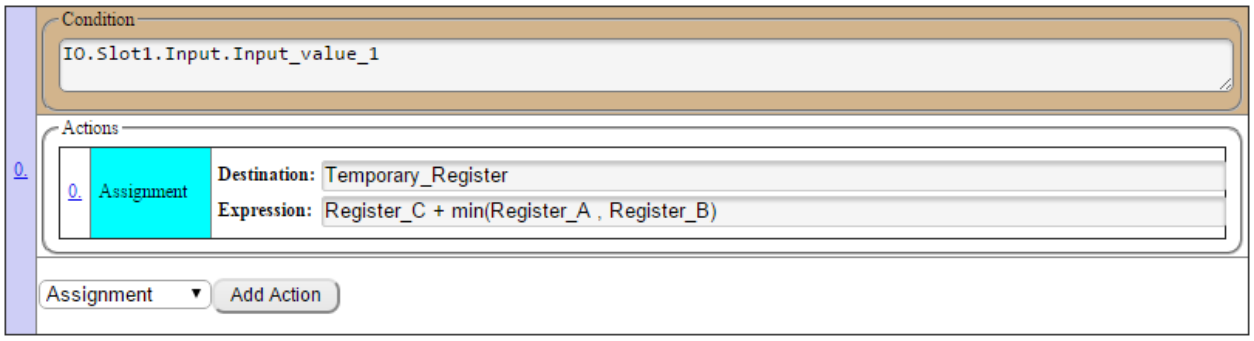
The user will use the Minimum Value Operation (min) to compare multiple registers and place the smallest value in to the Destination Register. The user can also use the Minimum Value Operation (min) to compare multiple registers and use the smallest value in a Math Operation.

Example of Minimum Value Operation



Explaining the Example: When Input_value_1 is true, ARGEE will take the smallest value between Register_A and Register_B and place that value into Temporary_Register

OR

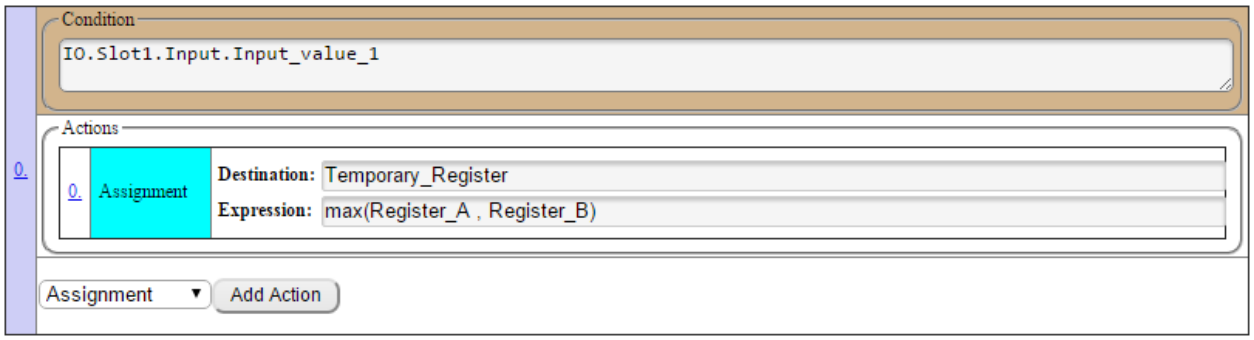


Explaining the Example: When Input_value_1 is true, ARGEE will take the smallest value between Register_A and Register_B and place that value into the Math Operation. The result will be stored in Temporary_Register.

Maximum Value

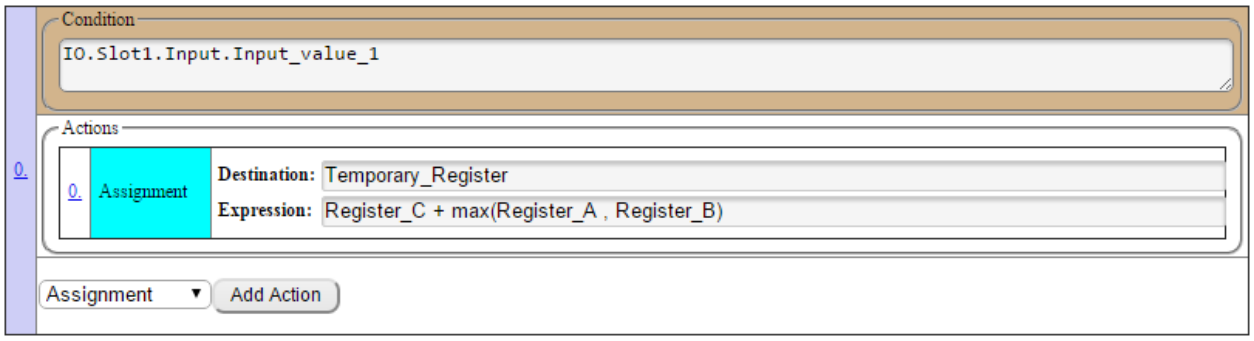
The user will use the Maximum Value Operation (max) to compare multiple registers and place the largest value in to the Destination Register. The user can also use the Maximum Value Operation (max) to compare multiple registers and use the largest value in a Math Operation.

Example of Maximum Value Operation



Explaining the Example: When Input_value_1 is true, ARGEE will take the largest value between Register_A and Register_B and place that value into Temporary_Register

OR

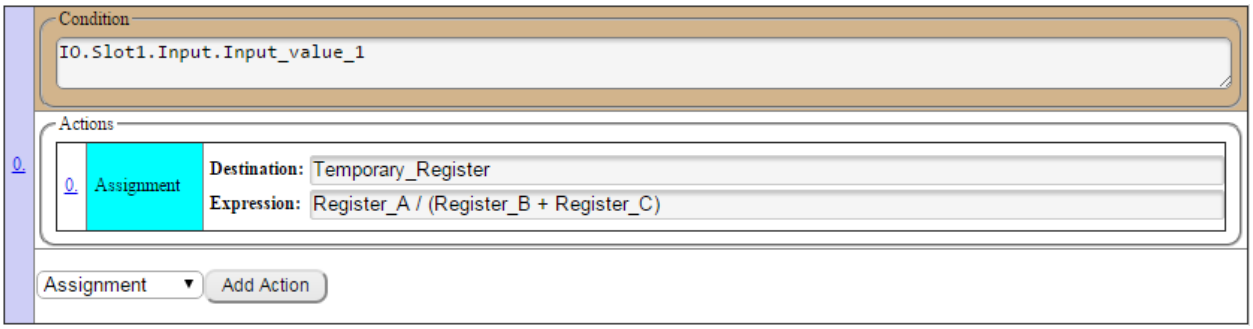


Explaining the Example: When Input_value_1 is true, ARGEE will take the largest value between Register_A and Register_B and place that value into the Math Operation. The result will be stored in Temporary_Register.

Brackets

The user will use Brackets ( ) to show the order of operations while performing Math.

Example of Brackets

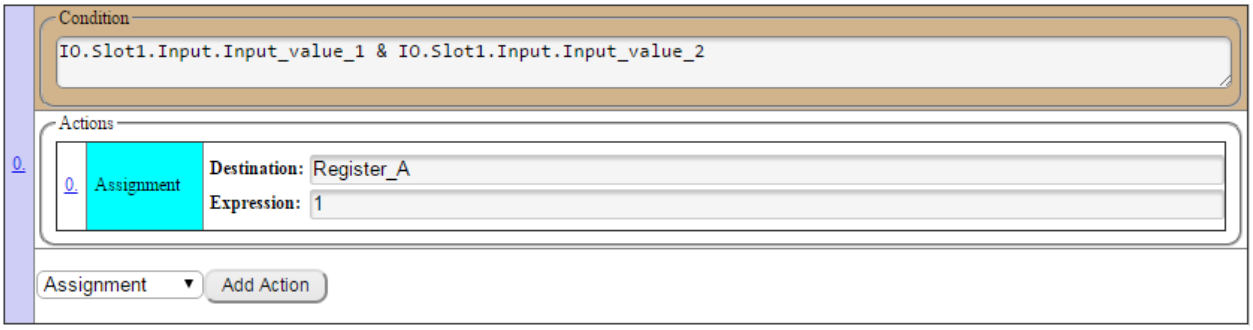


Explaining the Example: When Input_value_1 is true, ARGEE will examine the “(Register_B + Register_C)” first and then divide the answer into the value in Register_A. The result will be stored in Temporary_Register.

Boolean AND

The user will use the Boolean AND Operation (&) if the user wants to combine several *Conditions* together before allowing a specific Action to occur.

Example of Boolean AND

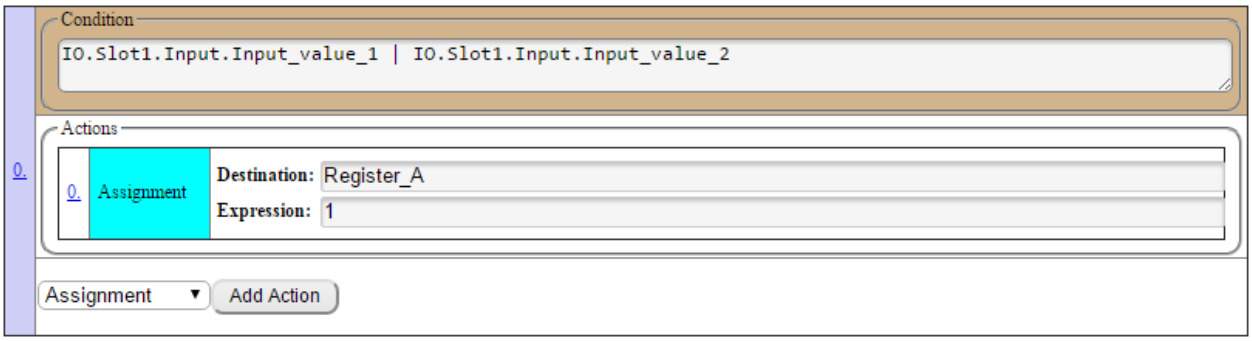


Explaining the Example: When both Input_value_1 AND input_value_2 are true, load the value “1” into Register_A.

Boolean OR

The user will use the Boolean OR Operation (I) if the user wants one of several *Conditions* to cause an Action to occur.

Example of Boolean OR

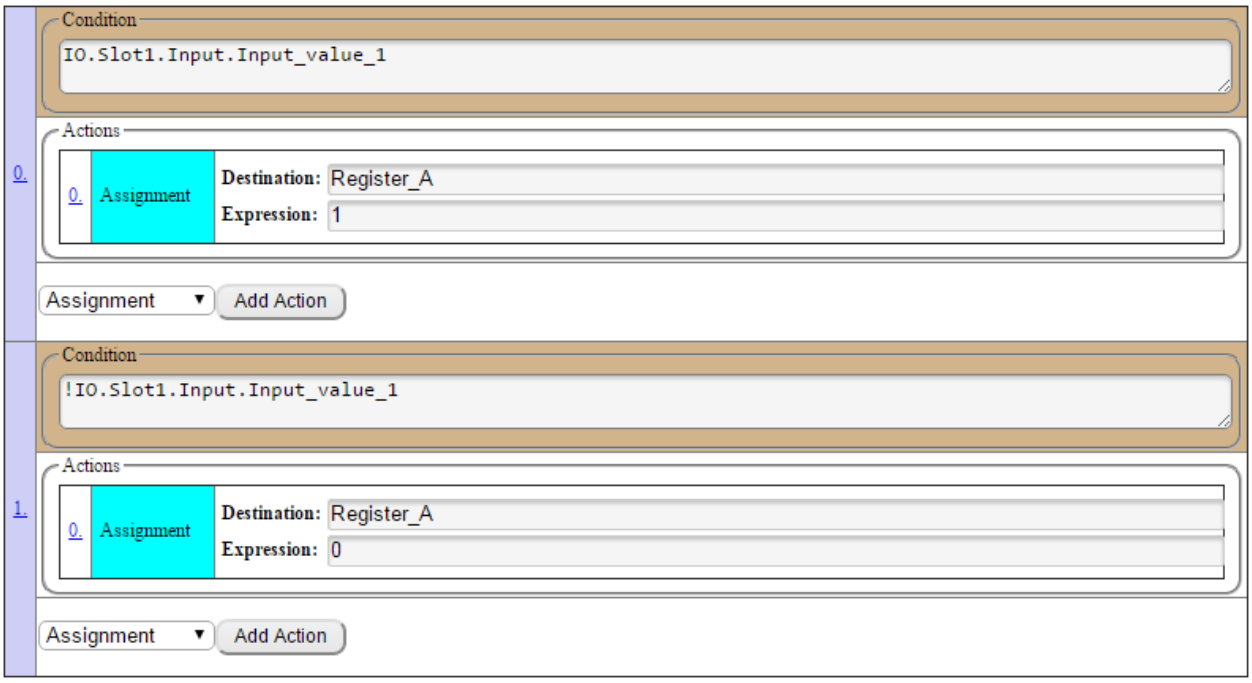


Explaining the Example: When either Input_value_1 OR input_value_2 are true, load the value “1” into Register_A.

Boolean NOT

The user will use the Boolean NOT Operation (!) if the user wants an Action to occur while a *Condition* is false.

Example of Boolean NOT

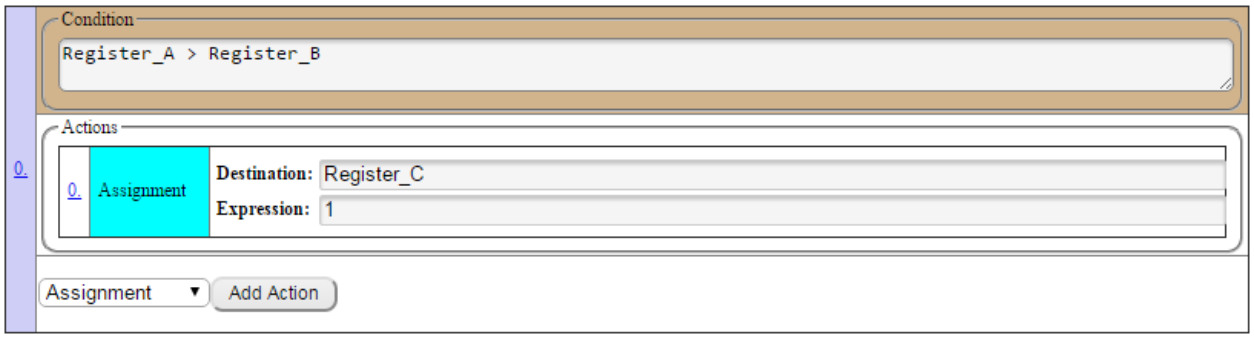


Explaining the Example: When Input_value_1 is true, load the value “1” into Register_A. When Input_value_1 is false, load the value “0” into Register_A.

Greater Than

The user will use the Greater Than Operation (>) if the user wants a *Condition* to occur when one register value is Greater Than another register value.

Example of Greater Than

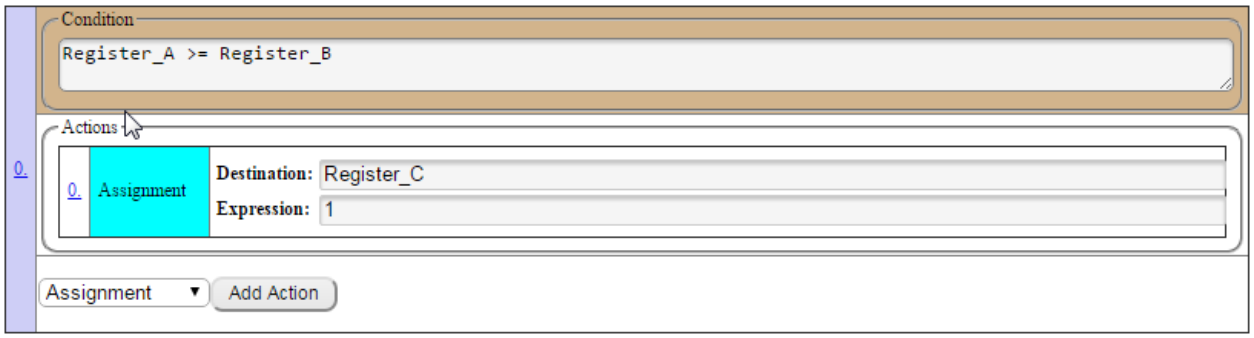


Explaining the Example: When the value in Register_A is Greater Than the value in Register_B, the value “1” will be loaded into Register_C.

Greater Than or Equal to

The user will use the Greater Than or Equal to Operation (>=) if the user wants a *Condition* to occur when one register value is Greater Than or Equal to another register value.

Example of Greater Than

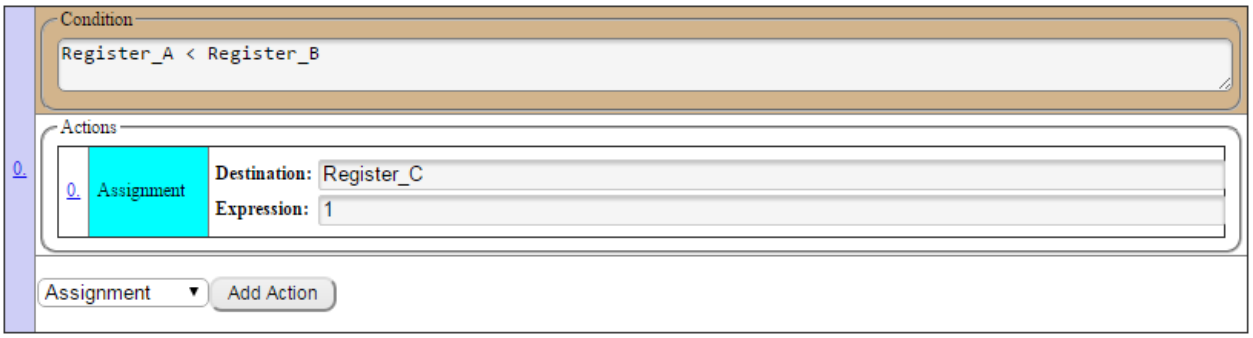


Explaining the Example: When the value in Register_A is Greater Than or Equal to the value in Register_B, the value “1” will be loaded into Register_C.

Less Than

The user will use the Less Than Operation (<) if the user wants a *Condition* to occur when one register value is Less Than another register value.

Example of Greater Than

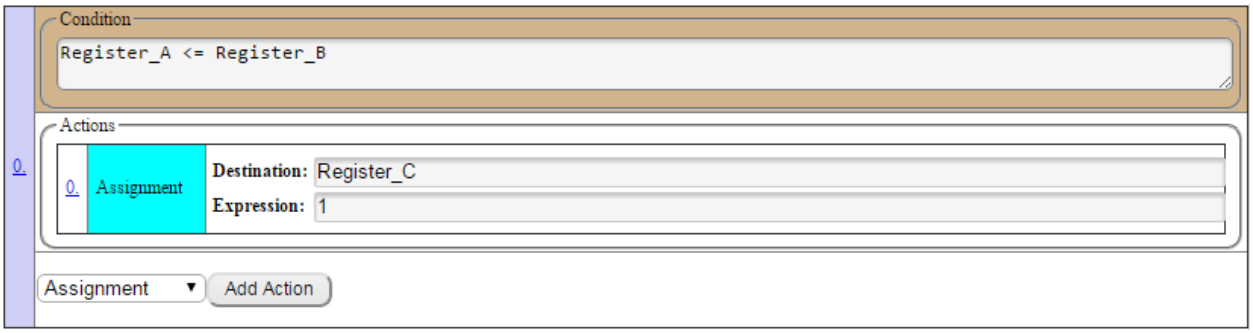


Explaining the Example: When the value in Register_A is Less Than the value in Register_B, the value "1" will be loaded into Register_C.

Less Than or Equal to

The user will use the Less Than or Equal to Operation (<=) if the user wants a *Condition* to occur when one register value is Less Than or Equal to another register value.

Example of Greater Than

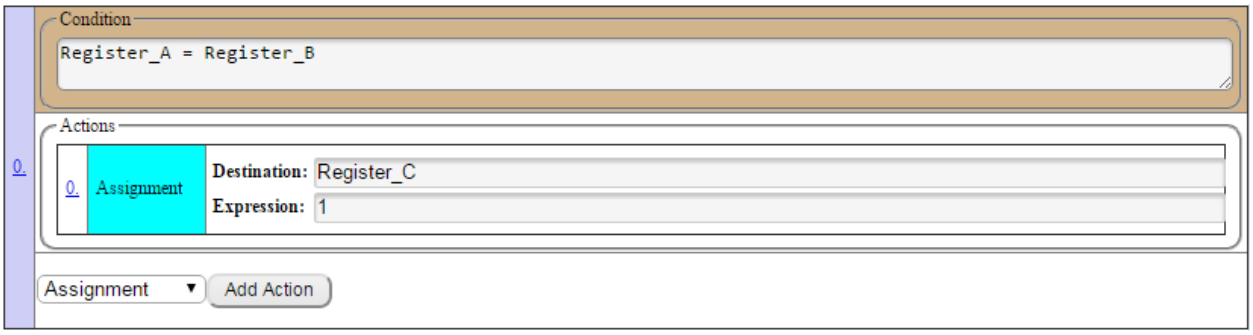


Explaining the Example: When the value in Register_A is Less Than or Equal to the value in Register_B, the value "1" will be loaded into Register_C.

Equal

The user will use the Equal Operation (=) if the user wants a *Condition* to occur when one register value is Equal to another register value.

Example of Equal

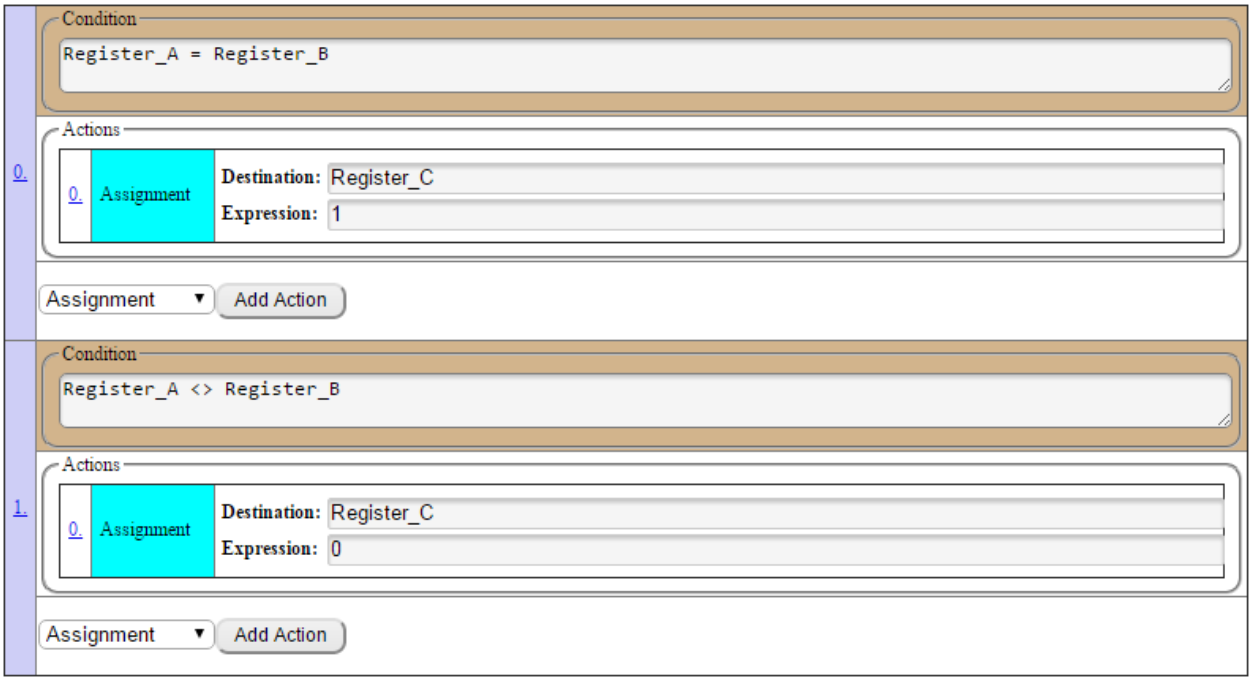


Explaining the Example: When the value in Register_A is Equal to the value in Register_B, the value “1” will be loaded into Register_C.

Not Equal

The user will use the Not Equal Operation (<>) if the user wants a *Condition* to occur when one register value is Not Equal to another register value.

Example of Not Equal

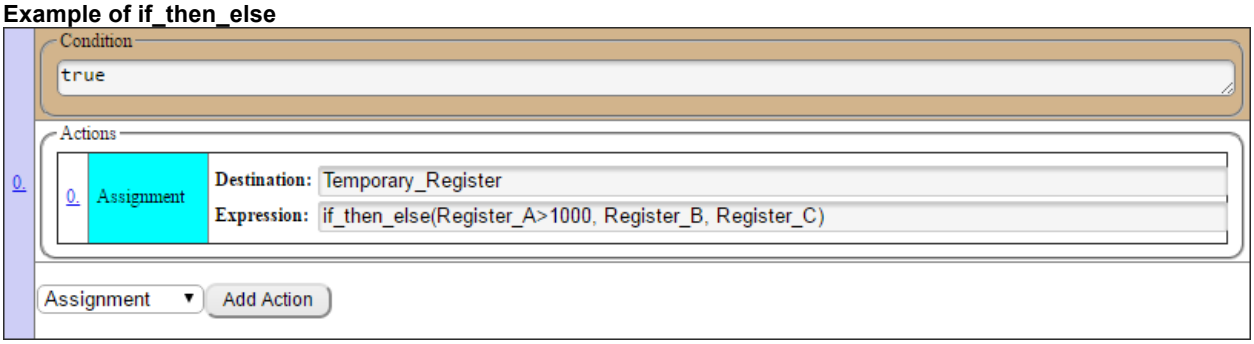


Explaining the Example: When the value in Register_A is Equal to the value in Register_B, the value “1” will be loaded into Register_C. When the value in Register_A is Not Equal to the value in Register_B, the value “0” will be loaded into Register_C.

If_Then_Else

The user will use the If_Then_Else operation if they want an expression to be set *only* if a particular test evaluates as true. If it evaluates as false, a secondary expression is chosen.

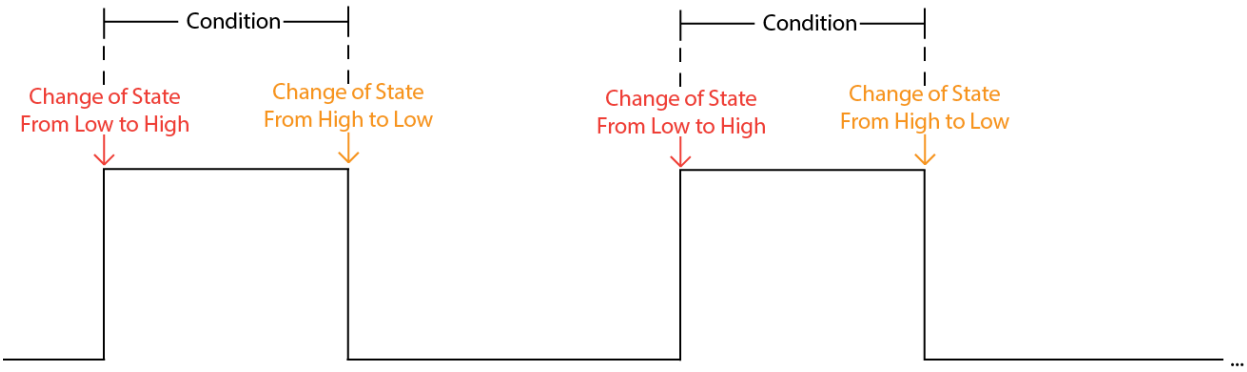
Example of if_then_else



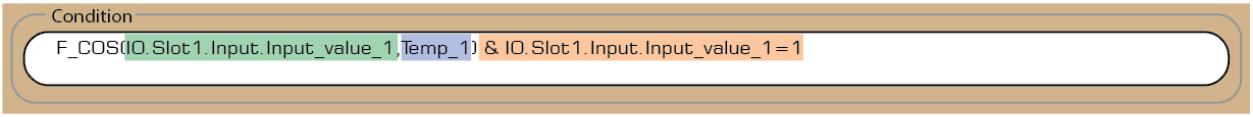
Explaining the Example: If the value in Register_A is below 1000, then the value in Register_B is loaded into the Temporary_Register. If the value in Register_A is above 1000, then the value in Register_C is loaded into the Temporary_Register.

Change of State

The user will use the Change of State Operation (F_COS) if the user wants an Action only to occur when a *Condition* changes state. A *Condition* can change state from either “low to high” or “high to low”.



Change of State Command Structure:

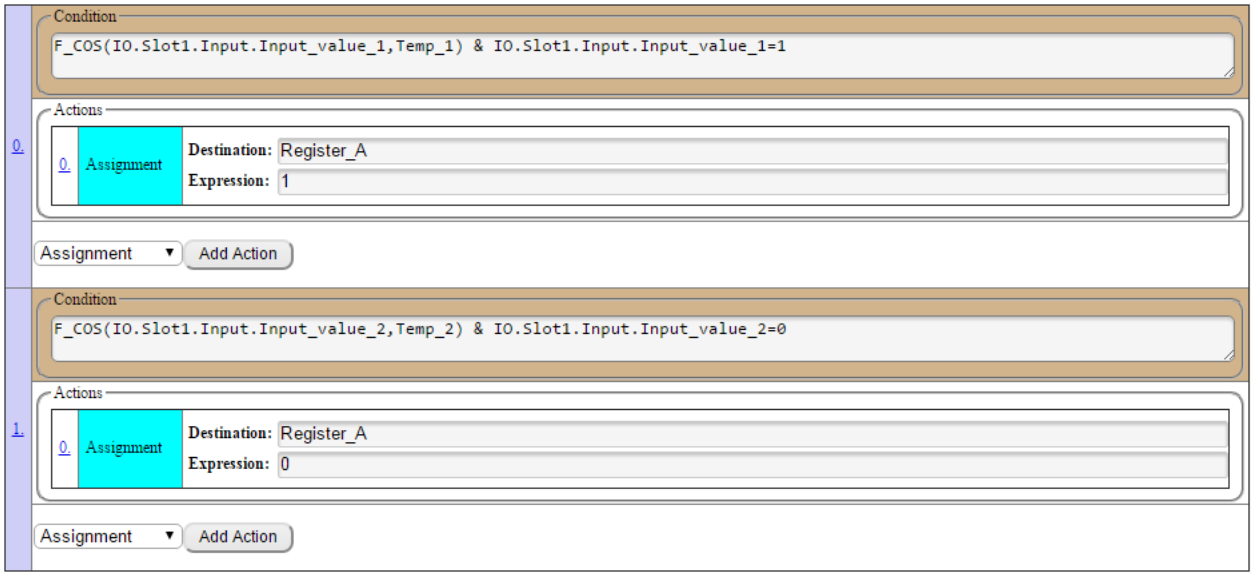


= The *Condition* that is being monitored for a *Change of State.*

= The register that stores the monitored *Condition’s* current state.

= The part of the *Condition* that tells *ARGEE* to monitor the “low to high” *Change of State or* the “high to low” *Change of State.*

Example of Change of State

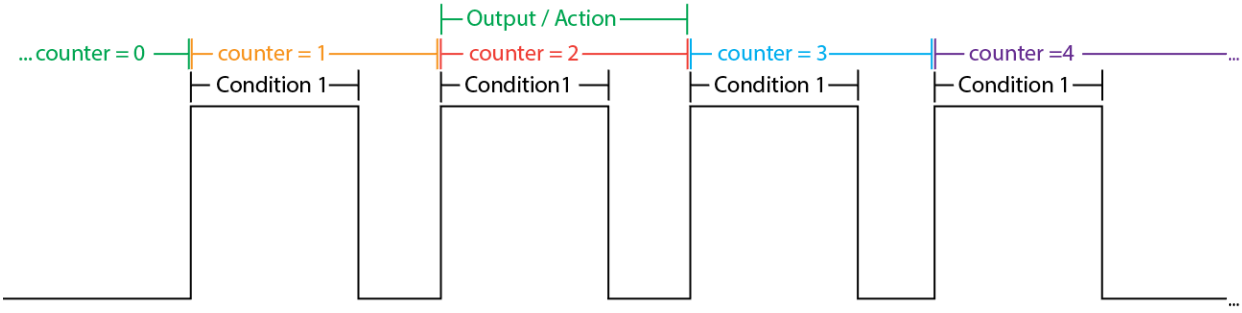


Explaining the Example: When Input_value_1 does a Change of State from low (zero) to high (one), the value “1” is loaded into Register_A. When Input_value_2 does a Change of State from high (one) to low (zero), the value “0” is loaded into Register_A.

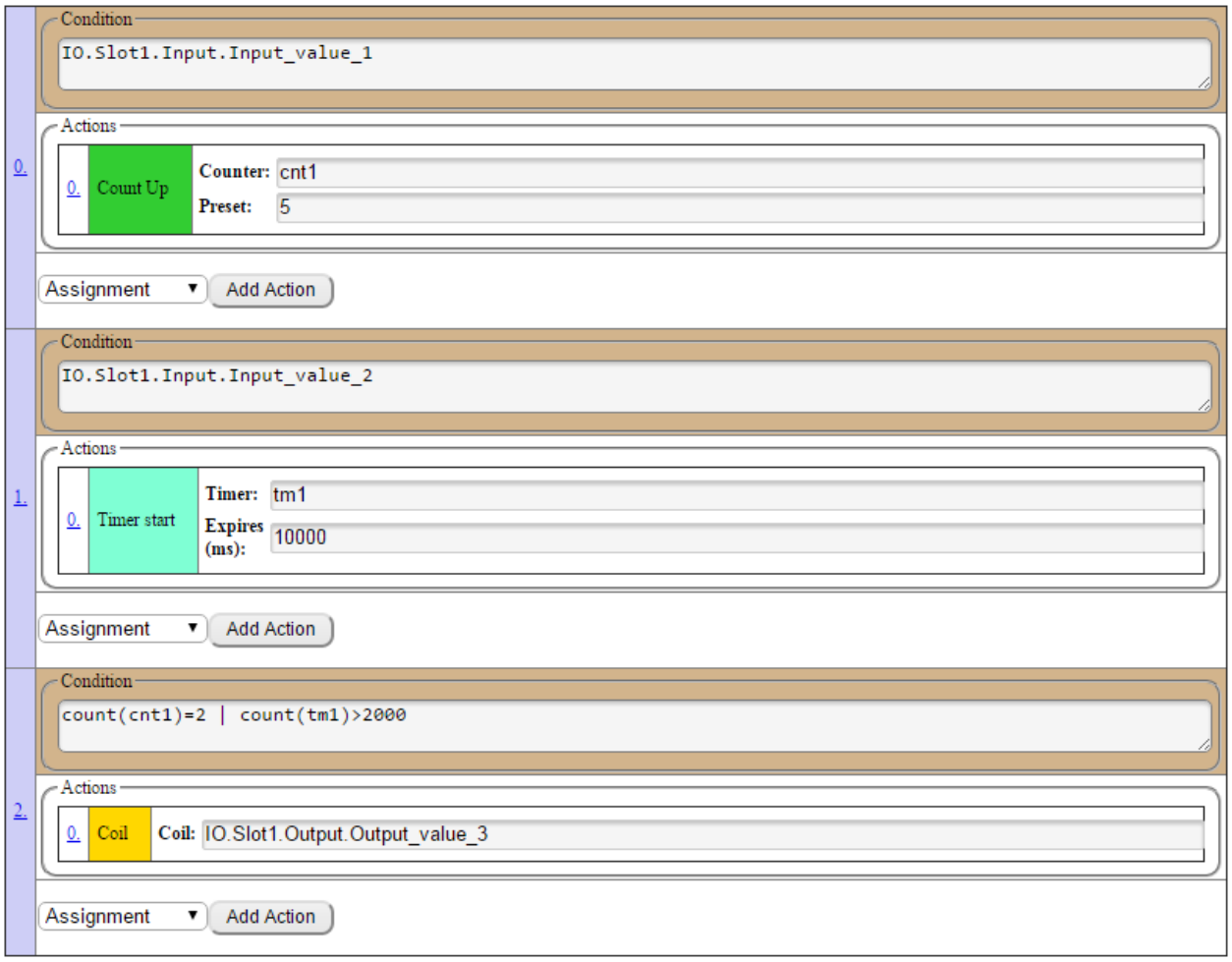
Note: Each monitored Condition requires its own Current State register. Notice in the example, Temp_1 was used to monitor the Change of State of Input_value_1 and Temp_2 was used to monitor the Change of State of Input_value_2.

Count

The user will use the Count Operation (count) if the user wants to perform an Action when a counter or timer is at a specific value but has not yet expired.



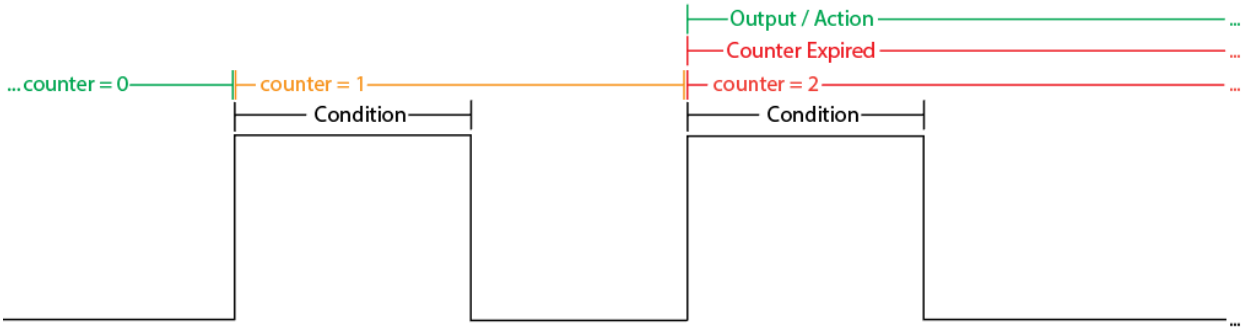
Example of Count



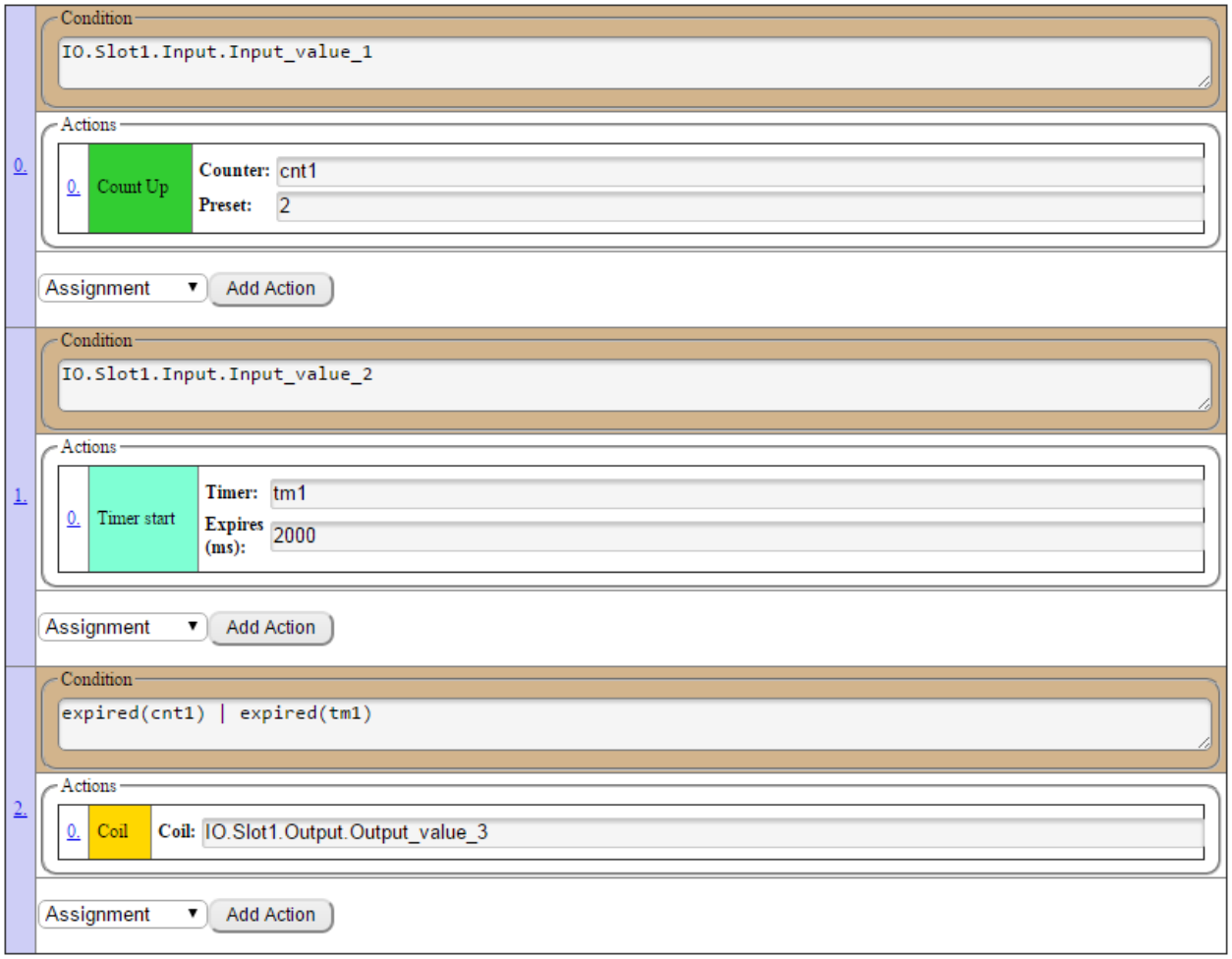
Explaining the Example: Each time Input_value_1 goes true, counter 1 counts up one time. Counter 1 expires after five counts. After input_value_2 goes true, timer 1 starts. Timer 1 will expire after ten seconds (or 10,000ms). When counter 1 counts to “2” OR timer 1 is Greater Than two seconds (or 2000ms), Output_value_3 is coiled on.

Expired

The user will use the Expired Operation (expired) if they want to perform an Action when a counter or timer has expired.



Example of Expired

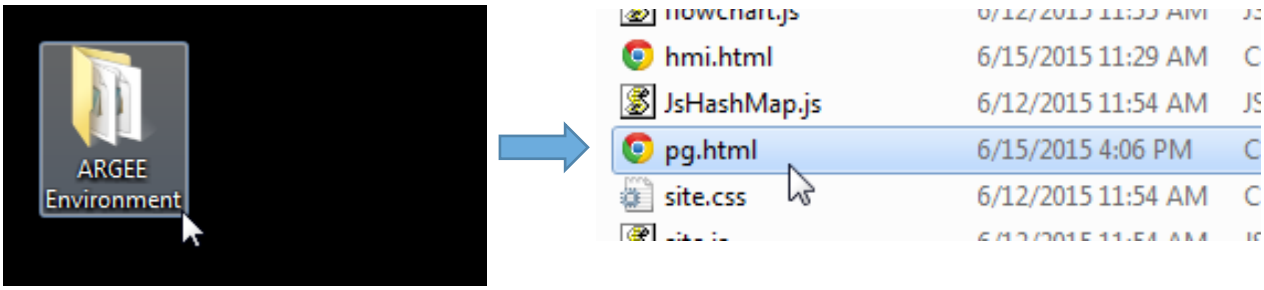


Explaining the Example: Each time Input_value_1 goes true, counter 1 counts up one time. Counter 1 expires after two counts. After input_value_2 it goes true, timer 1 starts. Timer 1 will expire after two seconds (or 2,000ms). When counter 1 OR timer 1 expires, Output_value_3 is coiled on.

Chapter 7 - ARGEE Simulation Mode

Opening the Environment

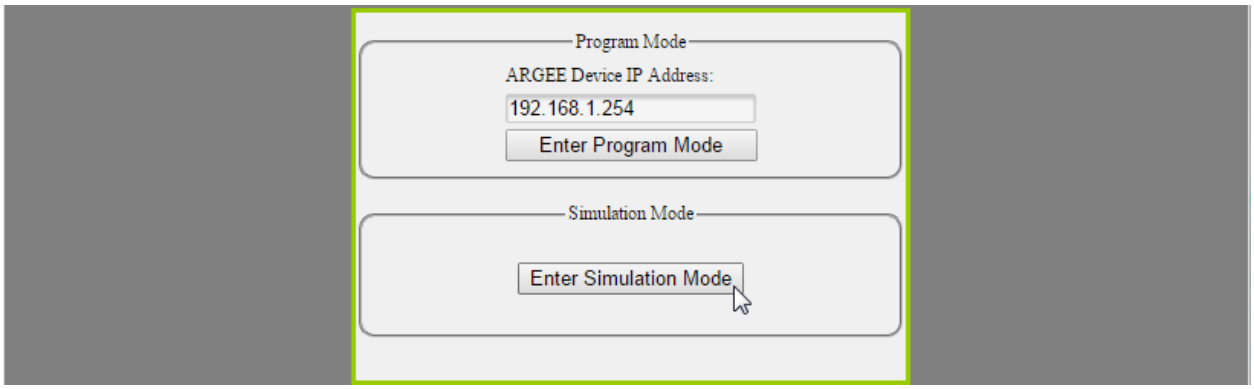
Open the ARGEE Environment and double click on pg.html.



NOTE: ARGEE only opens up in HTML 5 compliant web browsers such as Google Chrome or Firefox.

Logging into Simulation Mode

Click *Enter Simulation Mode*.



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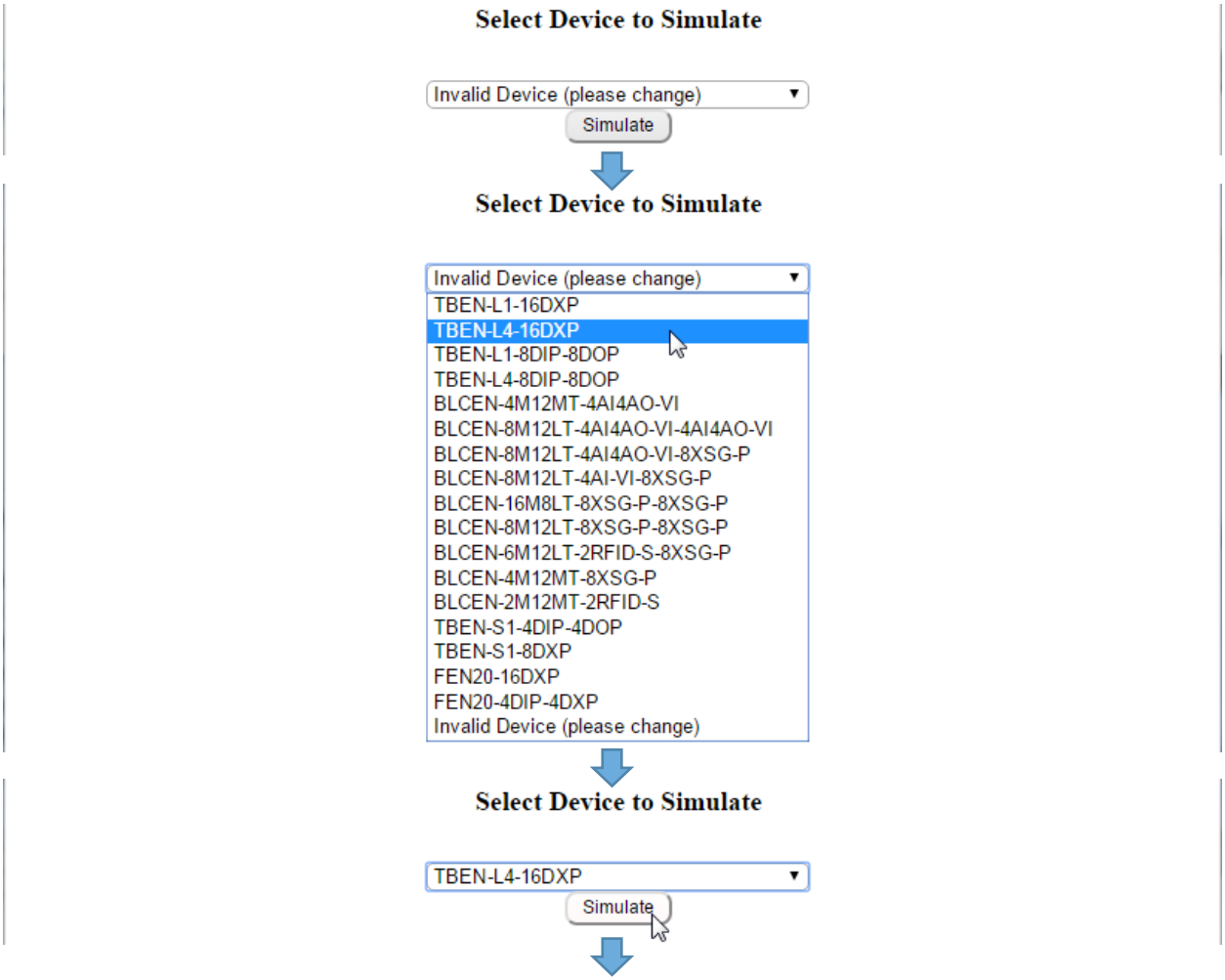
Select Device to Simulate

If the user has never used Simulation Mode before, the first thing they will have to do is select a device to simulate from the drop down arrow.



Welcome to ARGEE Simulation Mode.

Project Title: TBEN-L4-16DXP (Simulation)

| *Run* | *Debug* | *Print* | Edit HMI | View HMI | Project | About | *Set Title* |

Project Checksum:15846

ARGEE Program

Keyboard shortcuts:
Press Ctrl-q for list of program variables
Press Ctrl-i for list of I/O variables
Press Ctrl-f for list of operations
Press Ctrl-s for list of State Names
These shortcuts are used to write variables and expressions in all the screens

In order to configure the IO of the station, follow the Link

Add Condition

Chapter 8 - ARGEE Security

General Security

Security is a concern to some users. ARGEE provides several security features, the first of which is General Security. General Security is the term used to explain a block's behavior with ARGEE programming versus a block's behavior without ARGEE programming.

Visual Behavior

If there is an ARGEE program running on the block and:

- The BUS LED will flash green three times and then stay off for 1 second.

If there is not an ARGEE program running on the block:

- The block's LED's will behave in accordance with that block's data sheet.

Connection Behavior

Ethernet IP Master (Allen Bradley)

If there is an ARGEE program running on the block before a PLC connection is established:

- The PLC connection point combinations 101,102 or 103,104 will not be allowed
- ARGEE will block any attempt by the PLC to upload parameters from the block
- The PLC will only be able to make connection to the block via the ARGEE connection pair 101, 110

If the PLC makes a connection to the block before an ARGEE program is loaded:

- The PLC connection point combinations 101,102 or 103,104 will be allowed
- The AGREE connection pair 101, 110 will not be allowed
- The ARGEE environment will not allow upload of new code

Modbus TCP Master (VT500 or Red Lion HMI)

If there is an ARGEE program running on the block before a Modbus connection is established:

- Regular Modbus/TCP registers will not be accessible
- Access to Regular Modbus/TCP registers results in "exception"
- Only ARGEE Modbus/TCP registers can be read/written from:
  - 0x4000 - 0x407F (Registers 16384 - 16512 in decimal) Read only Input Data (ARGEE -> PLC)
  - 0x4400 – 0x447F (Register 17408 - 17536 in decimal) Read/Write Output Data (PLC -> ARGEE)

If a Modbus/TCP connection is established before an ARGEE program is loaded:

- Regular Modbus/TCP registers are accessible
- Access to ARGEE specific registers results in "exception"

PROFINET Master

If there is an ARGEE program running on the block before a PROFINET connection is established:

- Standard IO PROFINET connection is not allowed. ARGEE PROFINET connection is allowed
- Access to the block can be established by installing the ARGEE GSD file to the project

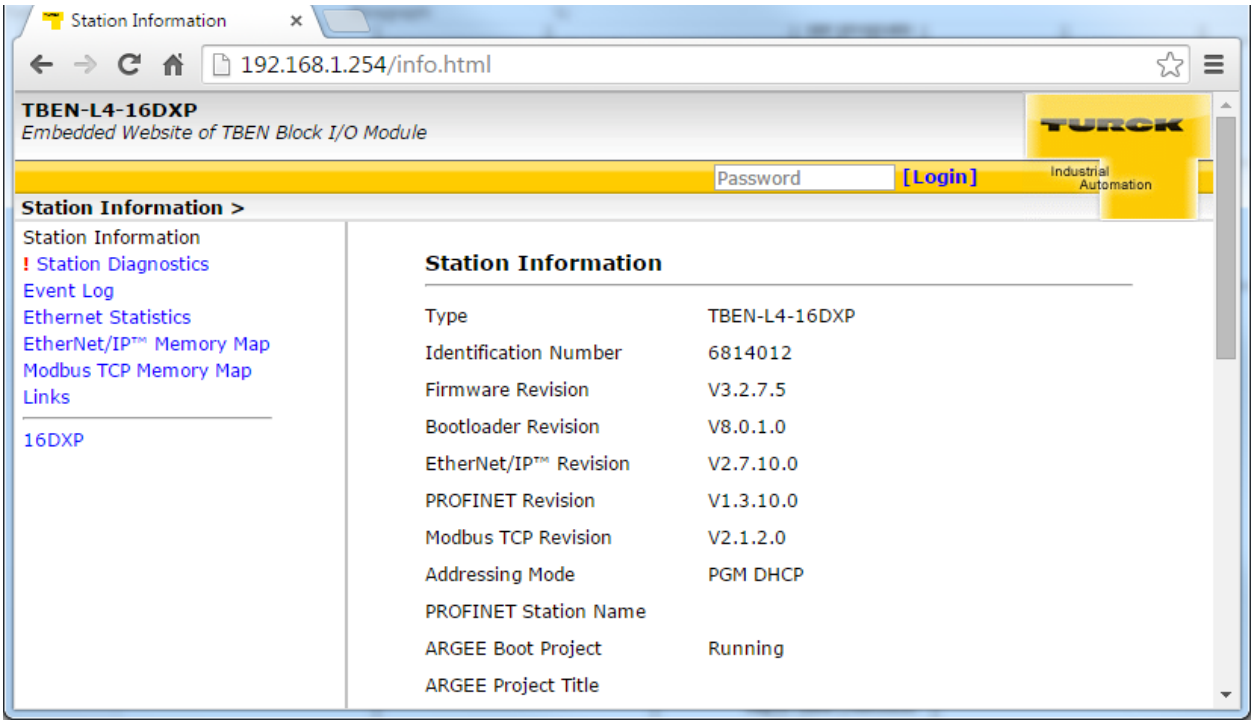
If a PROFINET connection is established before an ARGEE program is loaded:

- The regular PROFINET module ID is accessible. ARGEE PROFINET connection is not allowed. If the ARGEE environment attempts to load an ARGEE code when a standard PROFINET connection is establish, the ARGEE environment will block the upload.

Note: PLC Connection examples can be found in Chapter 10 – Common Applications.

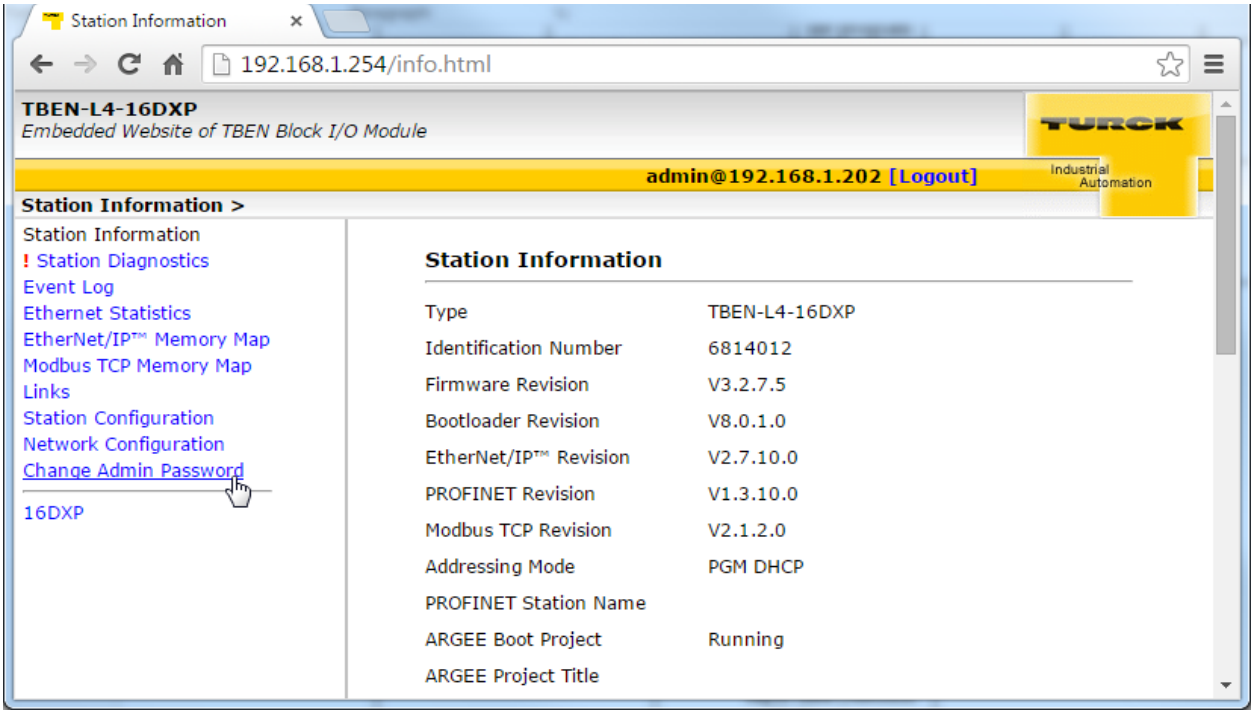
Password Protection – ARGEE Environment

All Turck block devices support a password protected webserver. To access the block's webserver, the user needs to type the blocks IP address into any web browser.

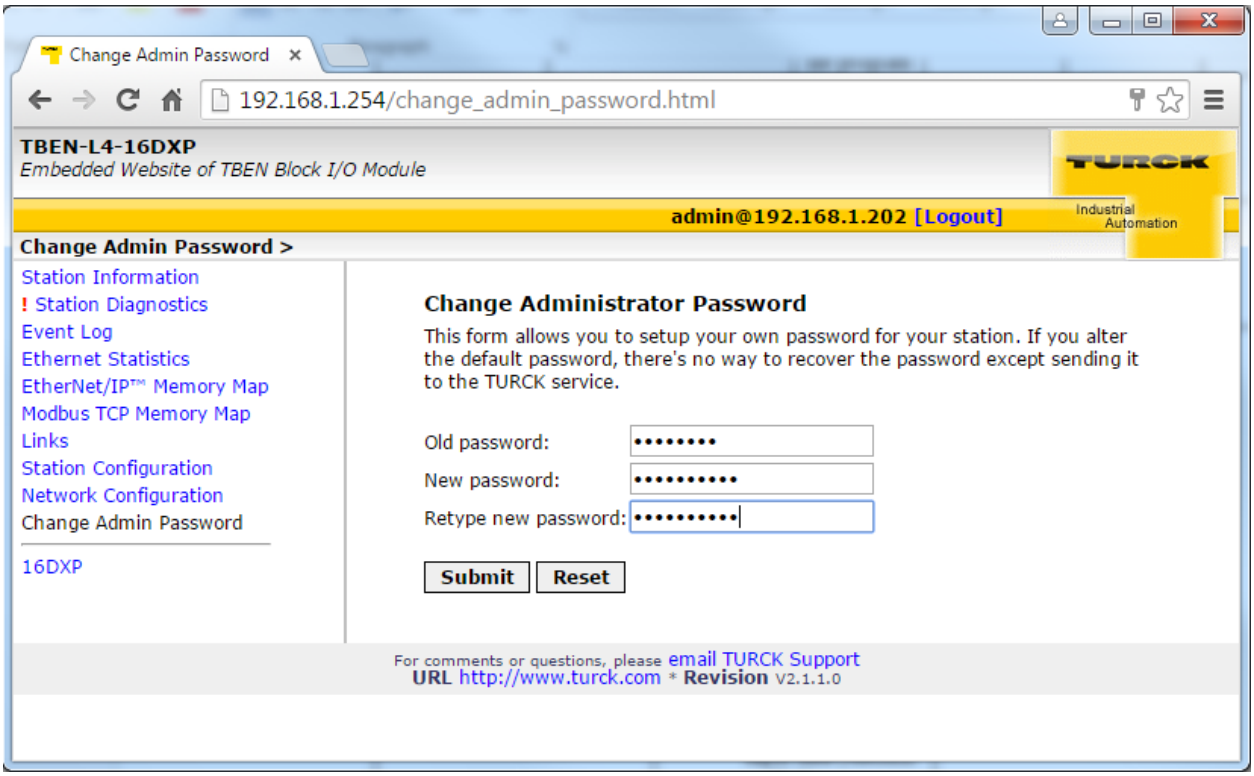


Note: The default password to log into the blocks webserver is "password".

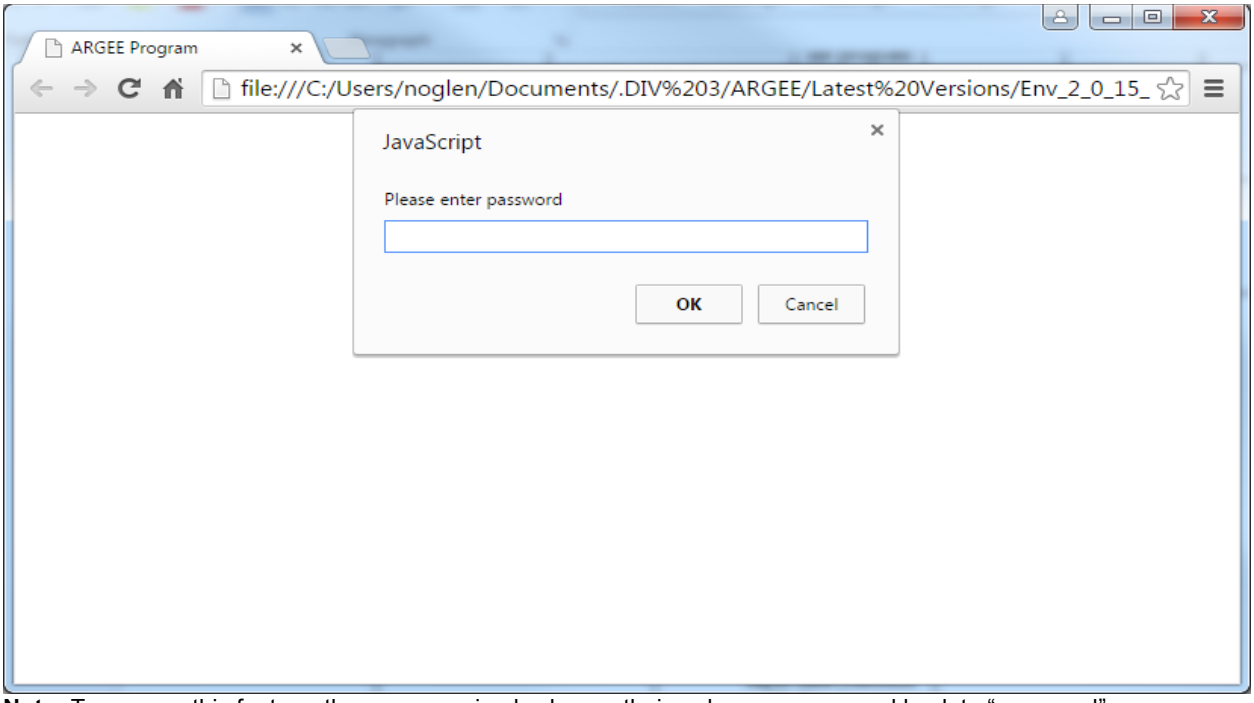
To password protect the users ARGEE environment, the user must change the Admin password on their webserver.



To change the Admin password, select *Change Admin Password* link, follow the instructions, and click *Submit*.



Now every time the user try's to log into the block, they will be prompted to input a password.

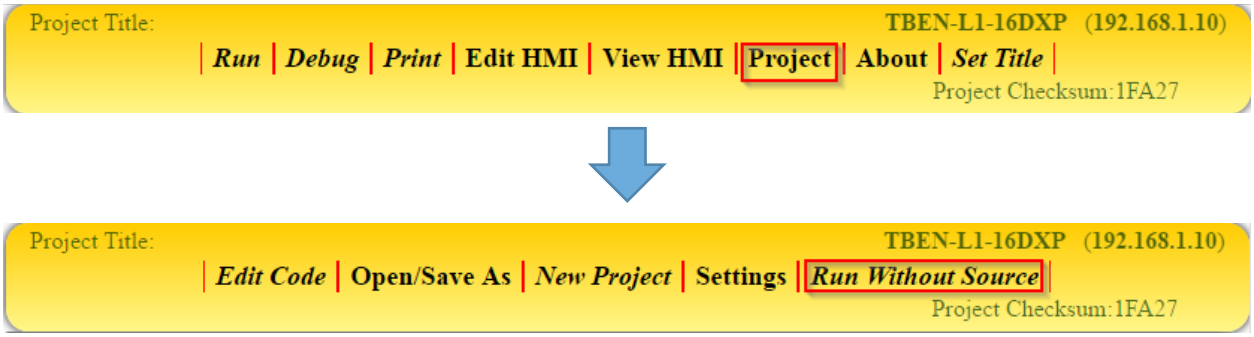


Note: To remove this feature, the user can simply change their webserver password back to "password".

Source Code Protection – Run Without Source

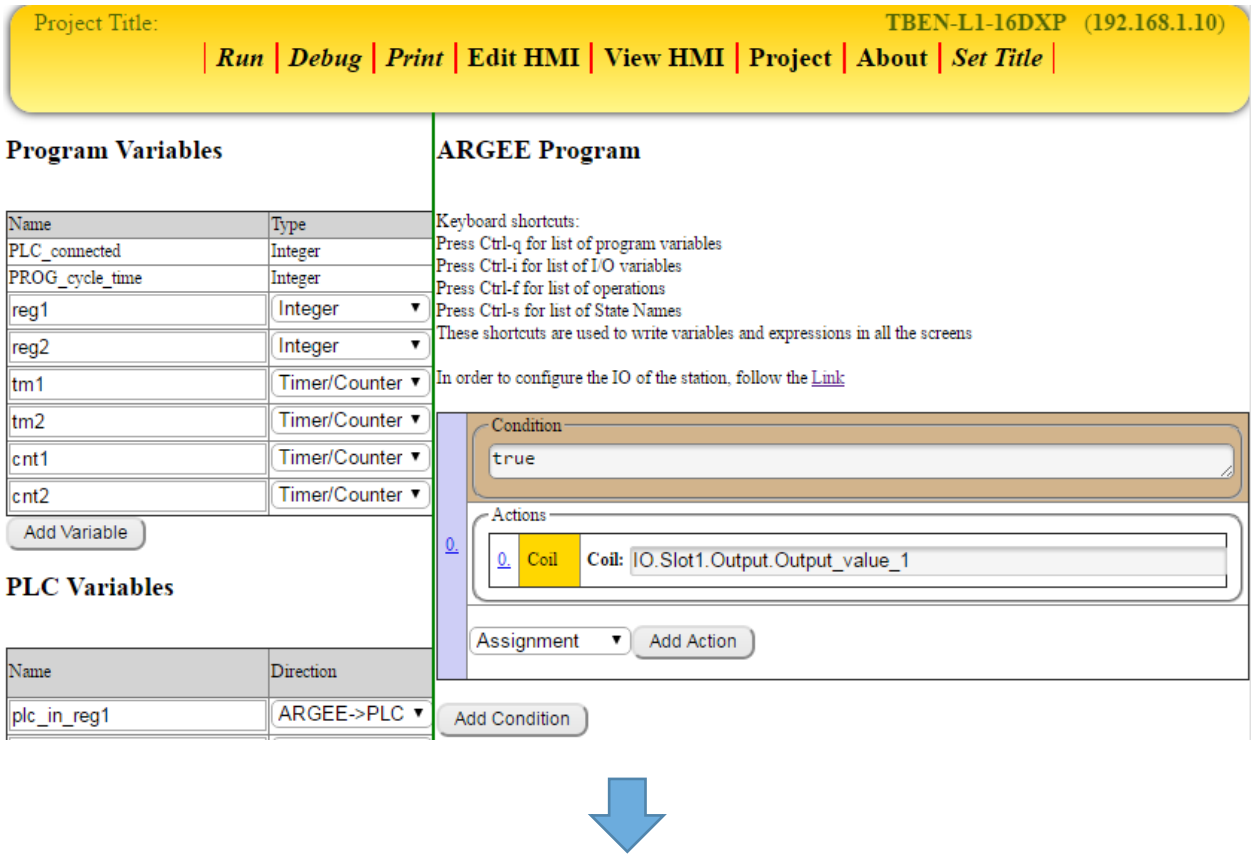
If a user wants to prevent “end users” from logging into the block and seeing or modifying code, the user will want to use the *Run Without Source* feature.

The access the *Run Without Source* button, the user must first click on *Project* and navigate to the second ARGEE menu bar.

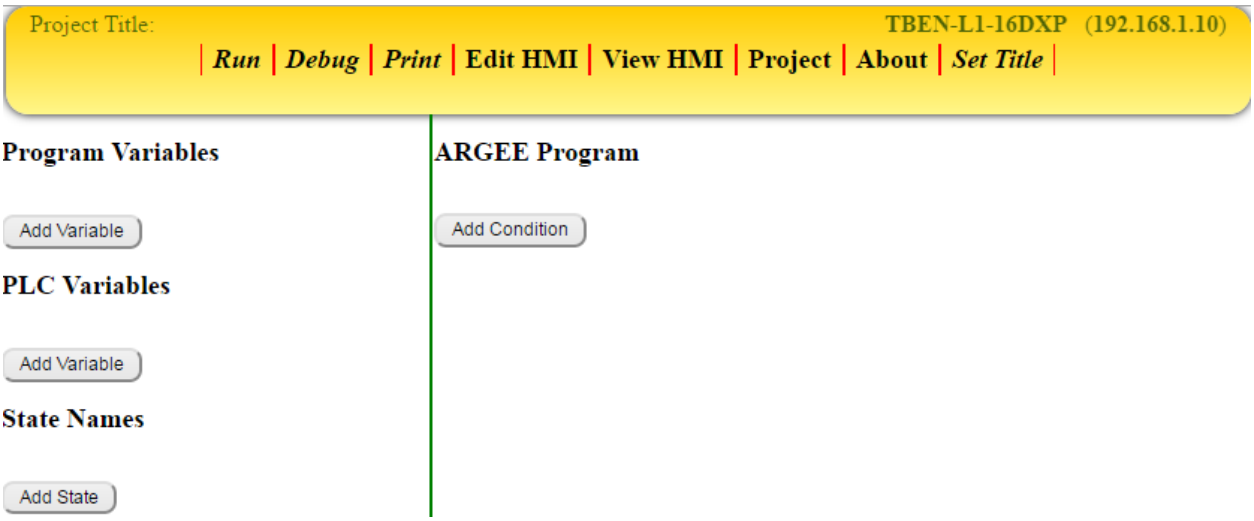


If the user clicks on *Run Without Source* and then logs out of the environment, the ARGEE program will be hidden the next time anyone logs into the block.

Logging in before clicking Run Without Source



Logging in after the user click Run Without Source



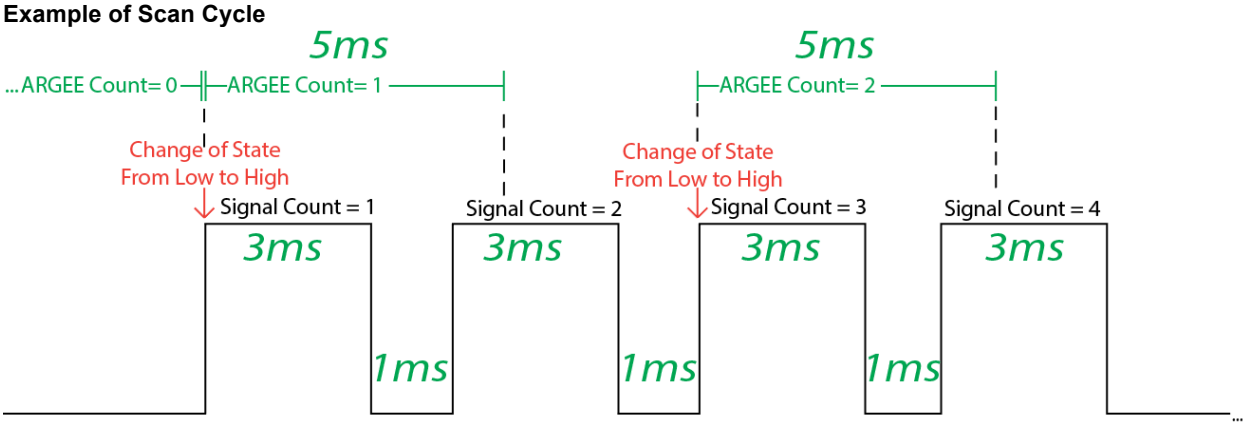
Very Important Note: The user needs to save a Master Copy of the program before the user logs out of the environment if the user wants to view/edit the code in the future.

Chapter 9 – System Performance

Scan Cycle Information

The ARGEE Scan Cycle is typically between 5 – 10 ms depending on the code size. If the user attempts to use ARGEE in an application with scan cycles less than 5 ms, it is possible that ARGEE may miss the signal.

Example of Scan Cycle

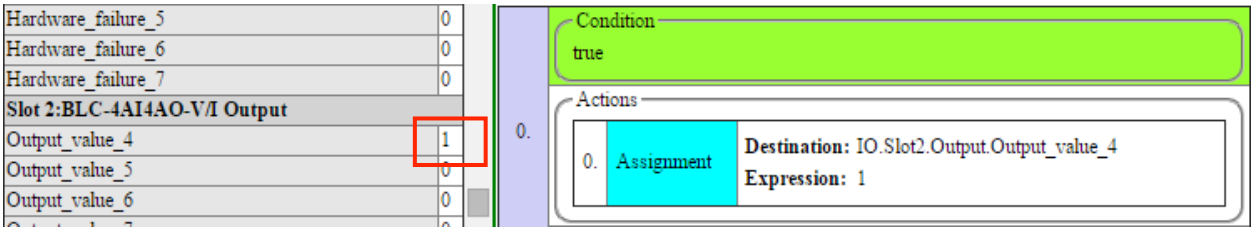


Explaining the Example: In this example, the user is hammering ARGEE with repeated 3 ms signals. Notice that ARGEE does not catch all the signals because the signal is occurring faster than ARGEE's Scan Cycle.

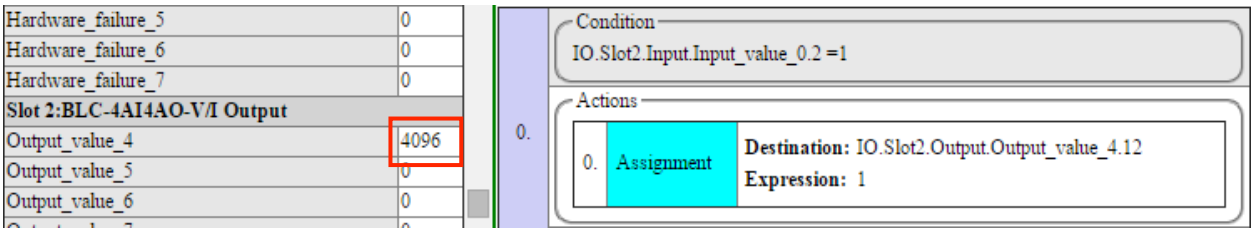
Note: ARGEE is not suited for motion control applications.

IO Variable Formats

IO.Slot2.Output.Output_value_X -> This example loads the value "1" into Output 4 bit 0.



IO.Slot2.Output.Output_value_X.Y -> In this example, when Input_value_0 Bit_2 equals "1", a "1" is loading into Output_value_4 Bit_12.



How Actions Respond to Conditions

Action	Condition=FALSE	Condition=TRUE
Assignment	No action	Assigns a destination variable to a result of expression evaluation.
Coil	Resets a variable to 0	Sets the variable to 1
Timer start	No action	If the timer is not started – it starts the timer. Otherwise it restarts the timer. The timer is executed in the background until the accumulator >= “Expires” Preset value.
Timer On	Resets the timer accumulator and Done flag.	If timer Done flag is 0, run the timer. The timer is accumulated every millisecond until the accumulator >=“Expires” Preset value. In that case the Done flag is raised.
Timer Off	If timer Done flag is 0, run the timer. The timer is accumulated every millisecond until the accumulator >=“Expires” Preset value. In that case, the Done flag is raised.	Resets the timer accumulator and Done flag.
Comment	-	-
Count up	Increments the counter whenever the condition changes from false to true.	
Count down	Decrements the counter whenever the condition changes from false to true. (note - the Preset can be a negative value)	
Reset	-	Restarts the counter to - 0
Trace	-	Record trace information into a trace buffer.

Defining Variable Types – (Advanced Definitions)

Type	Description	Type	Allowed arithmetic expressions	Specific actions	Size in bytes
Integer Variables	Variables are defined in the program.	All these variables are 32 bit signed integers.	All integer arithmetic	Assignment	4
Retain Integer	Variables which are automatically saved to flash.	All these variables are 32 bit signed integers.	All integer arithmetic	Assignment	8 bytes (4 bytes of data 4 bytes of additional information)
PLC Variables	Variables mapping upper level PLC (Modbus/TCP, EtherNet/IP or PROFINET) exchange data to an integer variable accessible in the program.	They are mapped to integer variables in the program	All integer arithmetic	Assignment	20
Timer/Counter	Timers Counters can be used with appropriate functions, such as “expired”, “count” and appropriate actions such as “Timer On”	Complex data types	Only used as argument to functions “expired” and “count”	Specific actions: Timer on, Timer off, Start timer, Count up, Count down	16
State	Integer variable that is used to designate states in state machine. Behaves identically to a regular integer variable except for 2 things: 1) Initialize – will list states 2) In the debugger, a state name matching the current value will show up	32 bit integer	All integer arithmetic	Assignment	4
Local IO	Input/Output/Diagnostic points	They are mapped to integer variables in the program	All integer arithmetic	Assignment	(not allocated out of 1KB of RAM)
System variables	PLC Connected	32 bit integer		Only 1 bit is used to indicate PLC connected state	4
System variables	Max Cycle time (since program start)	32 bit integer indicating time in ms		Time from the previous cycle to the current cycle.	4

Chapter 10 - Common Applications

Communicating with an EtherNet/IP Master – Allen Bradley

ARGEE blocks have the ability to communicate with an EtherNet/IP Master. The E/IP Master can establish communication via connection points 101 & 110.

Example of Communicating with an EtherNet/IP Master

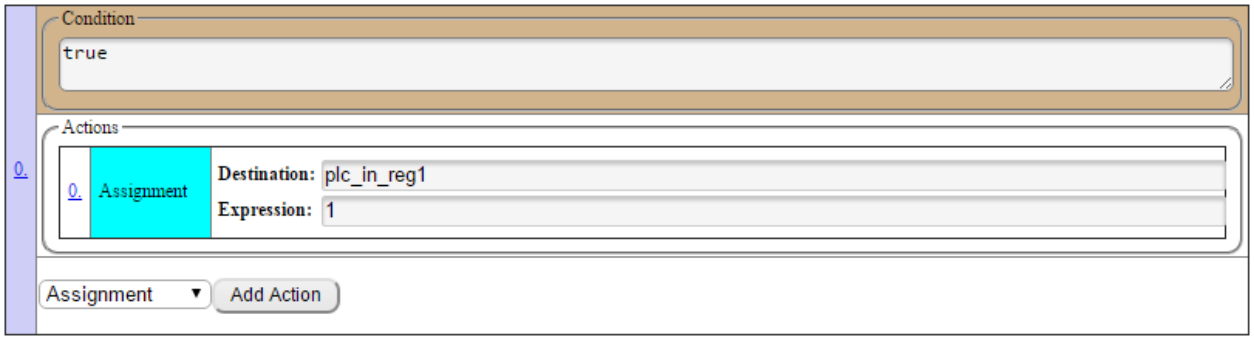
The user wants to check and see if data is being passed back and forth between the ARGEE block and the E/IP Master. The first thing the user does is set up PLC variables.

PLC Variables

Name	Direction	Word index	Bit offset	Size	Signed	Actions
plc_in_reg1	ARGEE->PLC	0	0	Word (16 bit)	unsigned	Delete Add Above
plc_out_reg1	PLC->ARGEE	0	0	Word (16 bit)	unsigned	Delete Add Above

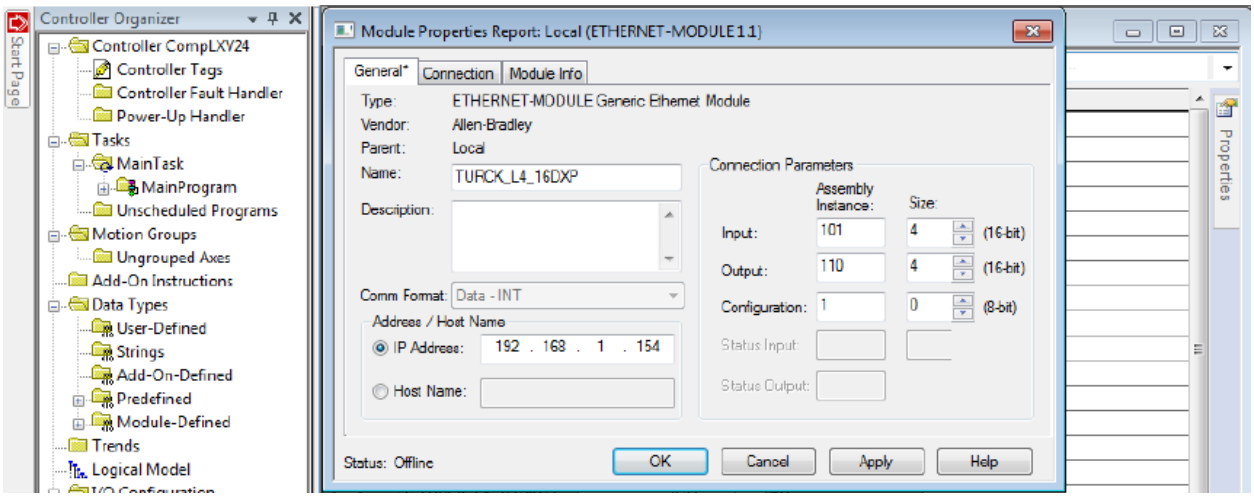
Explaining the Set-up: The user creates two PLC Variables, and they set the direction the data will travel. Data transmitted from ARGEE to the PLC is mapped into AB PLC Instance 101 and the data size is defined in the ARGEE PLC variable section (ARGEE->PLC). Data transmitted from the PLC to ARGEE is mapped into AB PLC Instance 110 and the data size is defined in the ARGEE PLC variable section (PLC->ARGEE).

The next step is to write the ARGEE code.

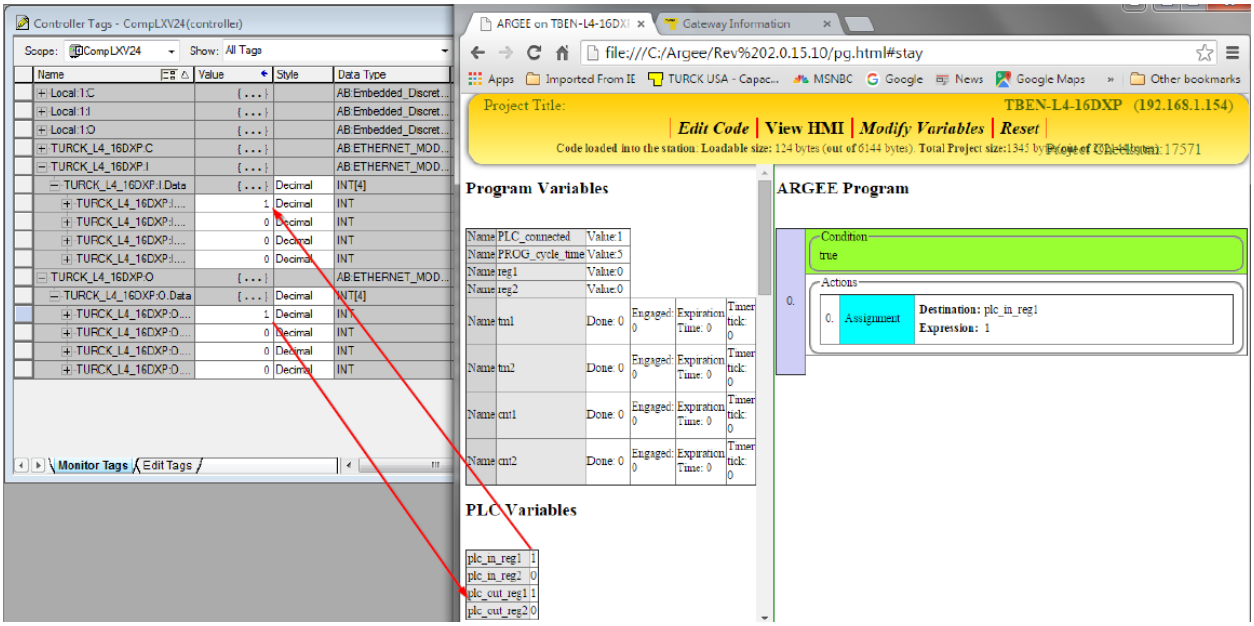


Explaining the Code: The user wrote the value “1” into plc_in_reg1.

The third step is to set up the connection points inside the PLC.



Explaining the Set up: The user created a Generic Ethernet Device and set the connection points to be 101 & 110**.** The last step is to connect to the device, place a value in the Output Register and verify data transfer.



Explaining the Example: The user inserted the value “1” into the PLC’s Output register “0”, bit “0”. The data transfer is verified by observing the PLC registers and the ARGEE registers.

Communicating with a Modbus TCP/IP Master – Red Lion

ARGEE blocks have the ability to communicate with a Modbus TCP/IP Master. The Modbus Master can establish communication via registers 0x4000 (register 16384 in decimal) and 0x4400 (register 17408 in decimal). 0x4000 is a read only register, while 0x4400 is a read/write register.

Note: Some Modbus Masters automatically increment the register value by one. For example, register 16384 might be 16385. If the user is having connection issues, the user should try and increment the register value by one.

Example of Communicating with a Modbus TCP/IP Master

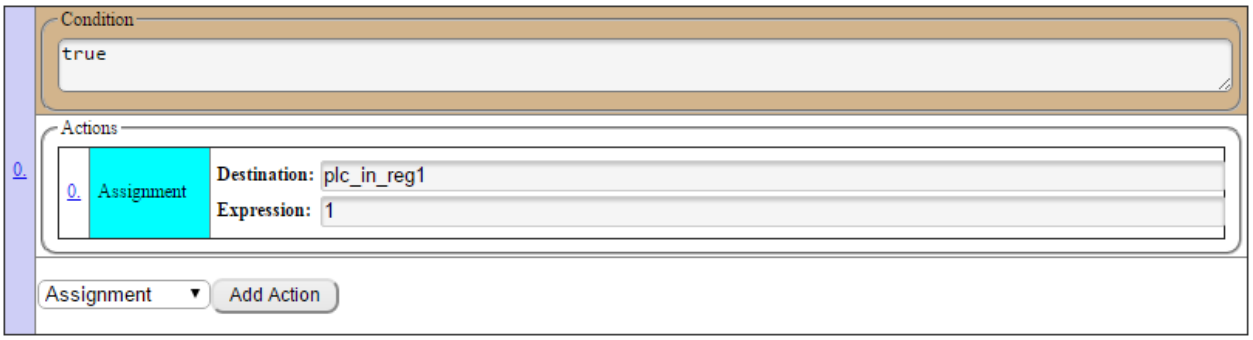
The user wants to check and see if data is being passed back and forth between the ARGEE block and the Modbus Master. The first thing the user does is set up the PLC variables.

PLC Variables

Name	Direction	Word index	Bit offset	Size	Signed	Actions
plc_in_reg1	ARGEE->PLC	0	0	Word (16 bit)	unsigned	Delete Add Above
plc_out_reg1	PLC->ARGEE	0	0	Word (16 bit)	unsigned	Delete Add Above

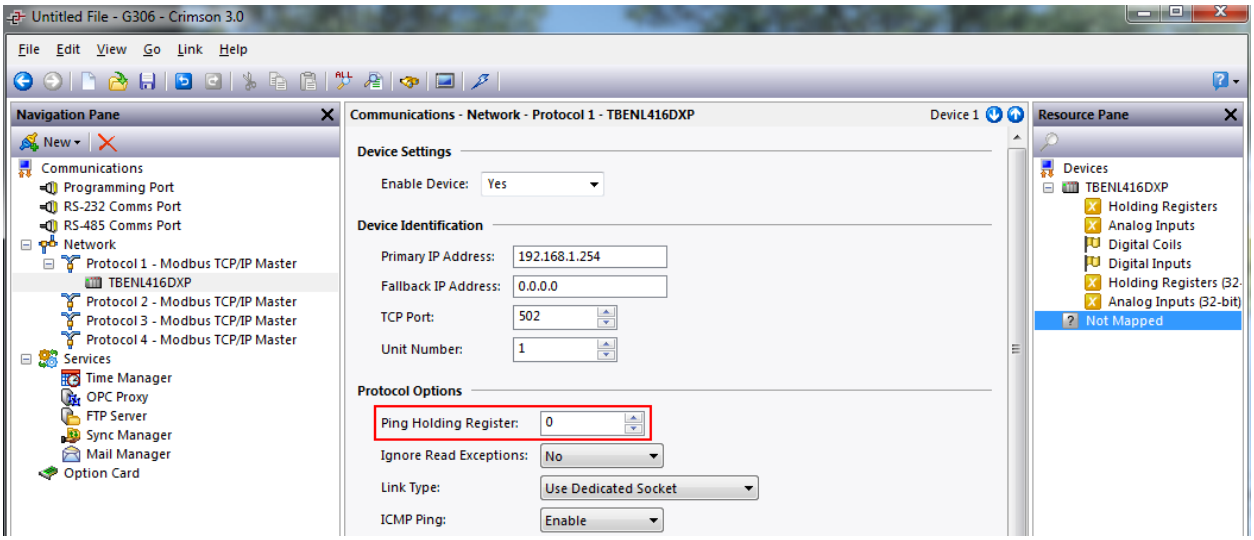
Explaining the Setup: The user creates two PLC Variables, then sets the direction the data will travel. Data transmitted from the ARGEE block to Modbus Master is mapped into register 0x4000(hex) and data size as defined in the ARGEE PLC variable section (ARGEE->PLC). Max input data size is 0x80(hex). Data transmitted from the Modbus Master to the ARGEE block is mapped into register 0x4400(hex), and data size as defined in the ARGEE PLC variable section (PLC->ARGEE). Max output data size is 0x80(hex).

The next step is to write the ARGEE code.



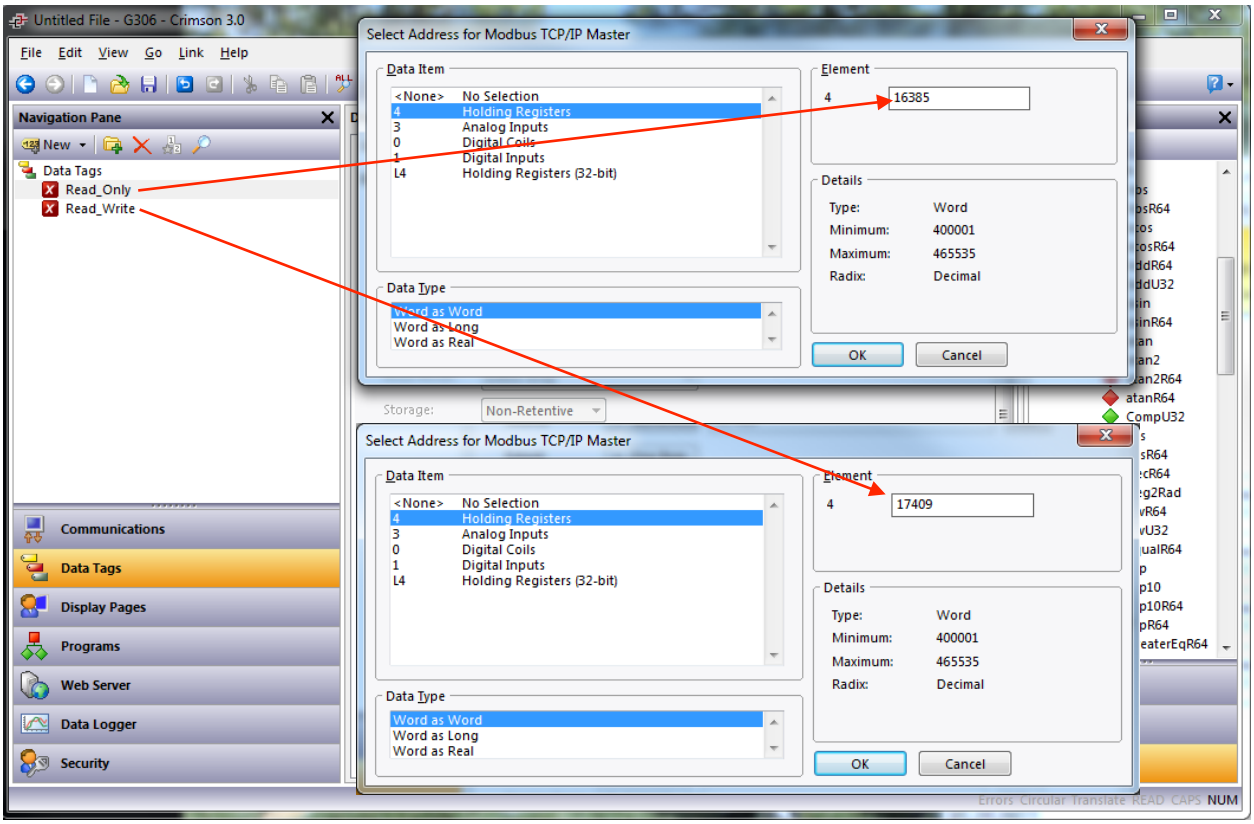
Explaining the Code: The user wrote the value “1” into plc_in_reg1.

The third step is to connect a device to the Modbus Master.



IMPORTANT NOTE: If the user is using a Red Lion HMI, the user needs to set the Ping Holding Register to zero.

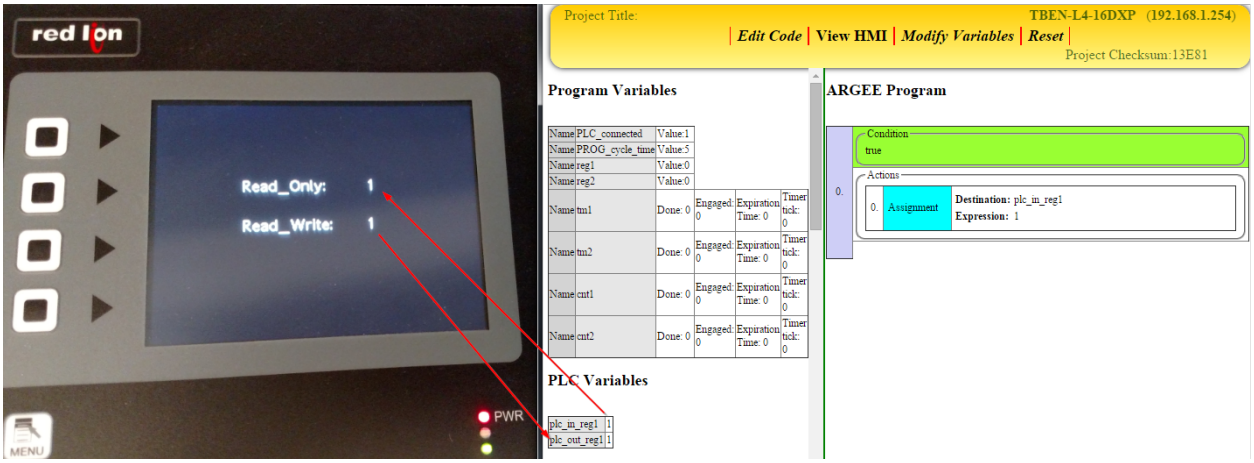
The fourth step is to create tags and assign them to the correct registers.



IMPORTANT NOTE: Red Lion Modbus master register addressing = Original address +1

Example: Original address 0x4000(hex) = 16384
Red Lion address = 16384 + 1 = 16385

The last step is to connect to the device, place a value in the Modbus TCP Master's Output Register and verify data transfer.



Explaining the Example: The user inserted the value "1" into the HMI's Output register "17409". The data transfer is verified by observing the HMI screen and the ARGEE registers.

Communicating with a PROFINET Master – Siemens

ARGEE blocks have the ability to communicate with a PROFINET Master. The PROFINET Master can establish communication via an ARGEE GSD file.

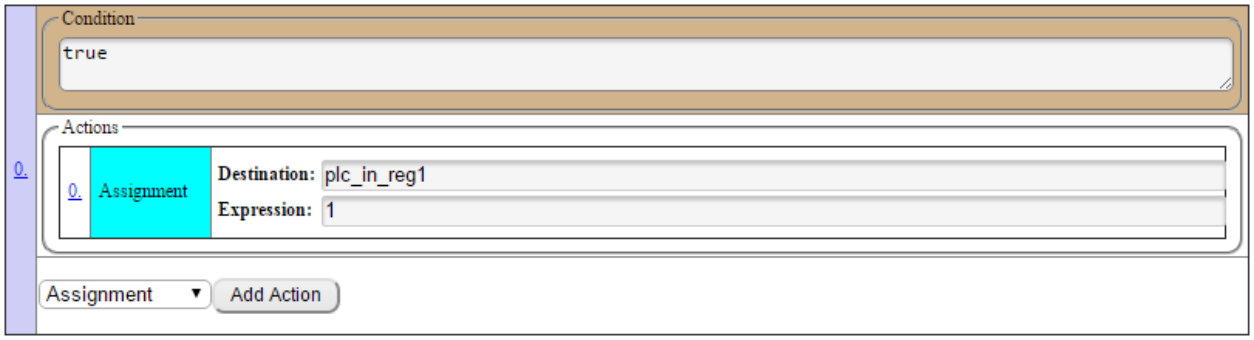
Example of Communicating with a PROFINET Master
The user wants to check and see if data is being passed back and forth between the ARGEE block and the PROFINET Master. The first thing the user does is set up the PLC variables.

PLC Variables

Name	Direction	Word index	Bit offset	Size	Signed	Actions
plc_in_reg1	ARGEE->PLC	0	0	Word (16 bit)	unsigned	Delete Add Above
plc_out_reg1	PLC->ARGEE	0	0	Word (16 bit)	unsigned	Delete Add Above

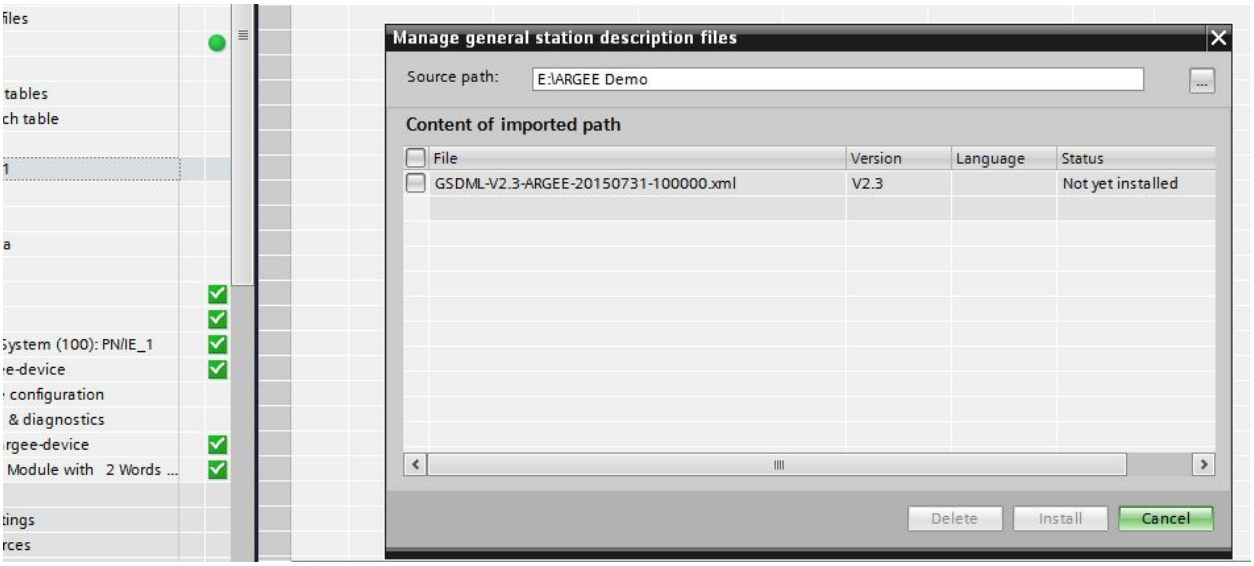
Explaining the Set-up: The user creates two PLC Variables. The user sets the direction the data will travel. Data transmitted from ARGEE to the PLC is mapped into the Siemens input address and the data size is defined in the ARGEE PLC variable section (ARGEE->PLC). Data transmitted from the PLC to ARGEE is mapped into the Siemens output address and the data size is defined in the ARGEE PLC variable section (PLC->ARGEE).

The next step is to write the ARGEE code.



Explaining the Code: The user wrote the value “1” into plc_in_reg1.

The third step is to install the ARGEE GSD file.



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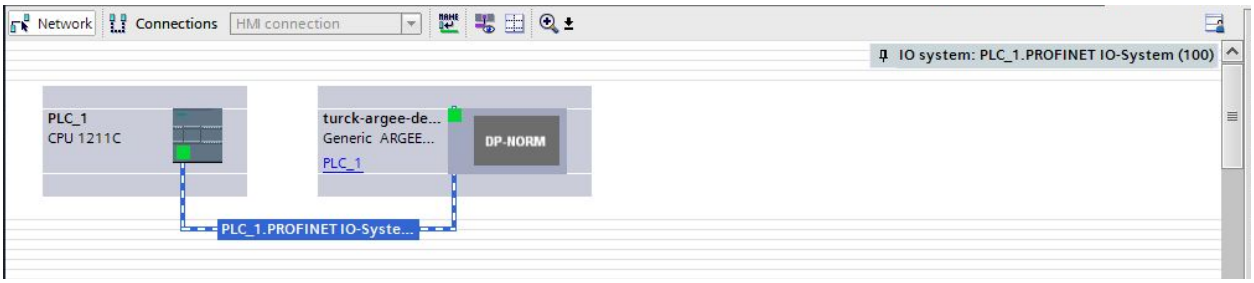
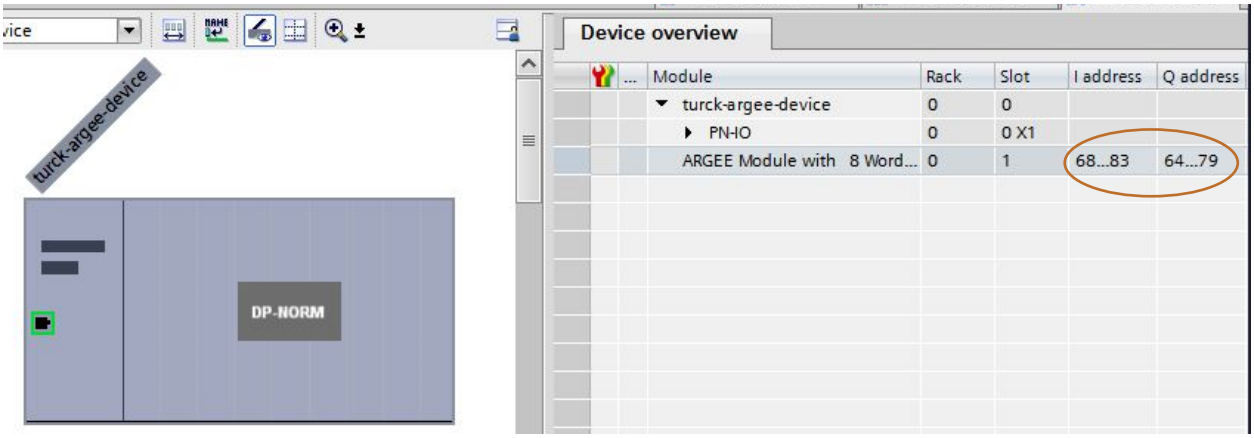
The fourth step is to add the device to the program.



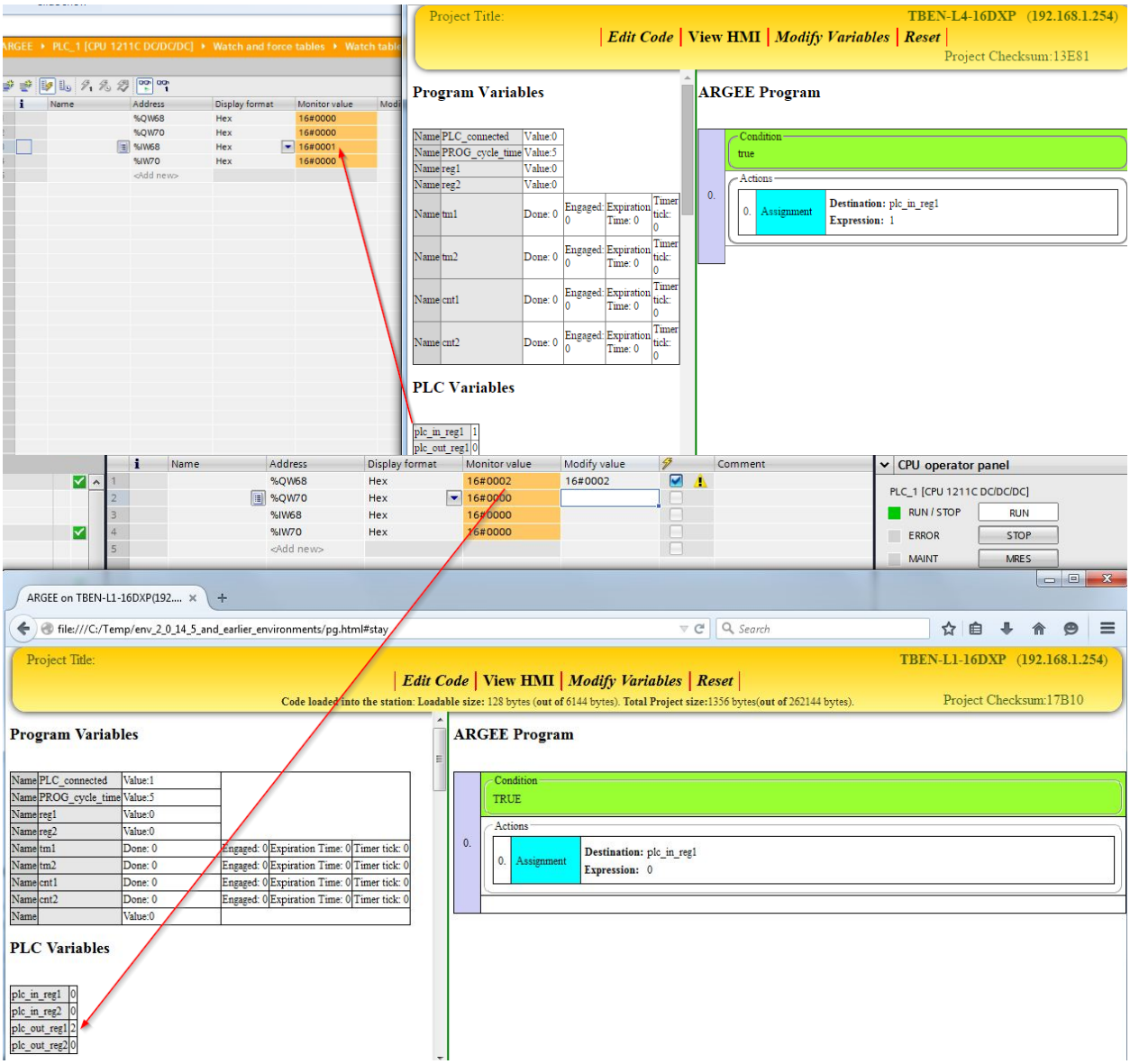
Explaining the Set up: The user created an ARGEE Device in the devices and networks area.

The fifth step is to set up device addresses.



Explaining the Set up: The user defines the “I address” and “Q address” in the device overview.

The user can now verify the data has been transferred.



Explaining the example: The user inserted the value “2” into the PLC’s Output register and verifies the data transfer.

Using State Variables

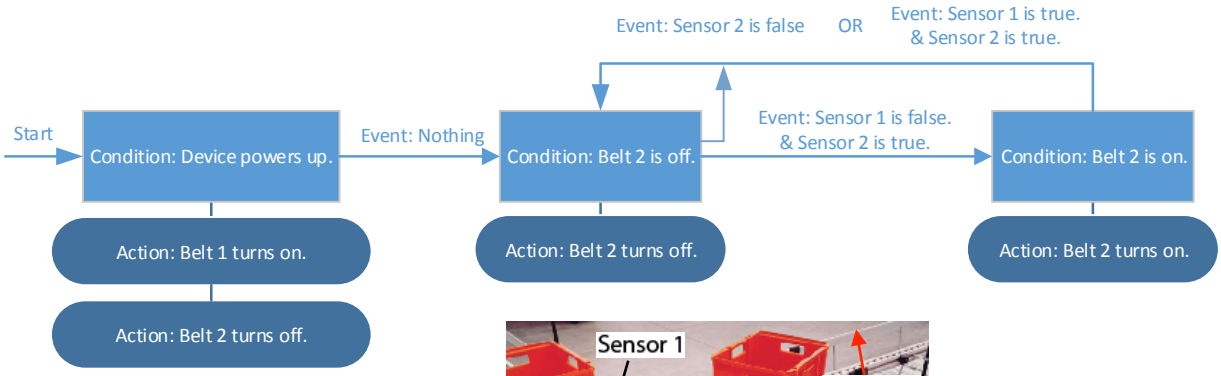
State Variables are helpful in keeping track of the signal as it steps through the code. Before the user creates State Variables, it is a good idea to create a State Machine.

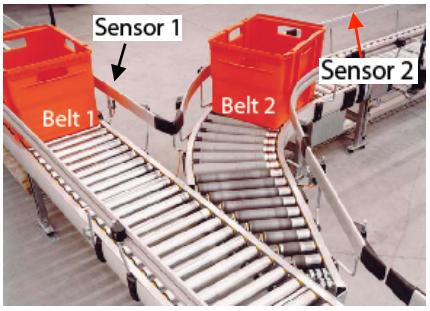
State Machine

A state machine is drawing on a piece of paper that shows how the signal transitions from one state to another.

Example of a State Machine

The user wants to use their ARGEE block to create a Traffic Cop. A Traffic Cop is a device that merges two conveyer belts together without causing a box collision. The first thing the user does is gets out a piece of paper and draws up a State Machine.





Explaining the State Machine: All the States are in light blue boxes. All the Events occur on the arrows. All Actions are in dark blue ovals.

Example of State Variables are on the next page.

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Example of a State Variables
The user is satisfied with the Traffic Cop State Machine. The user now creates Program and State Variables.

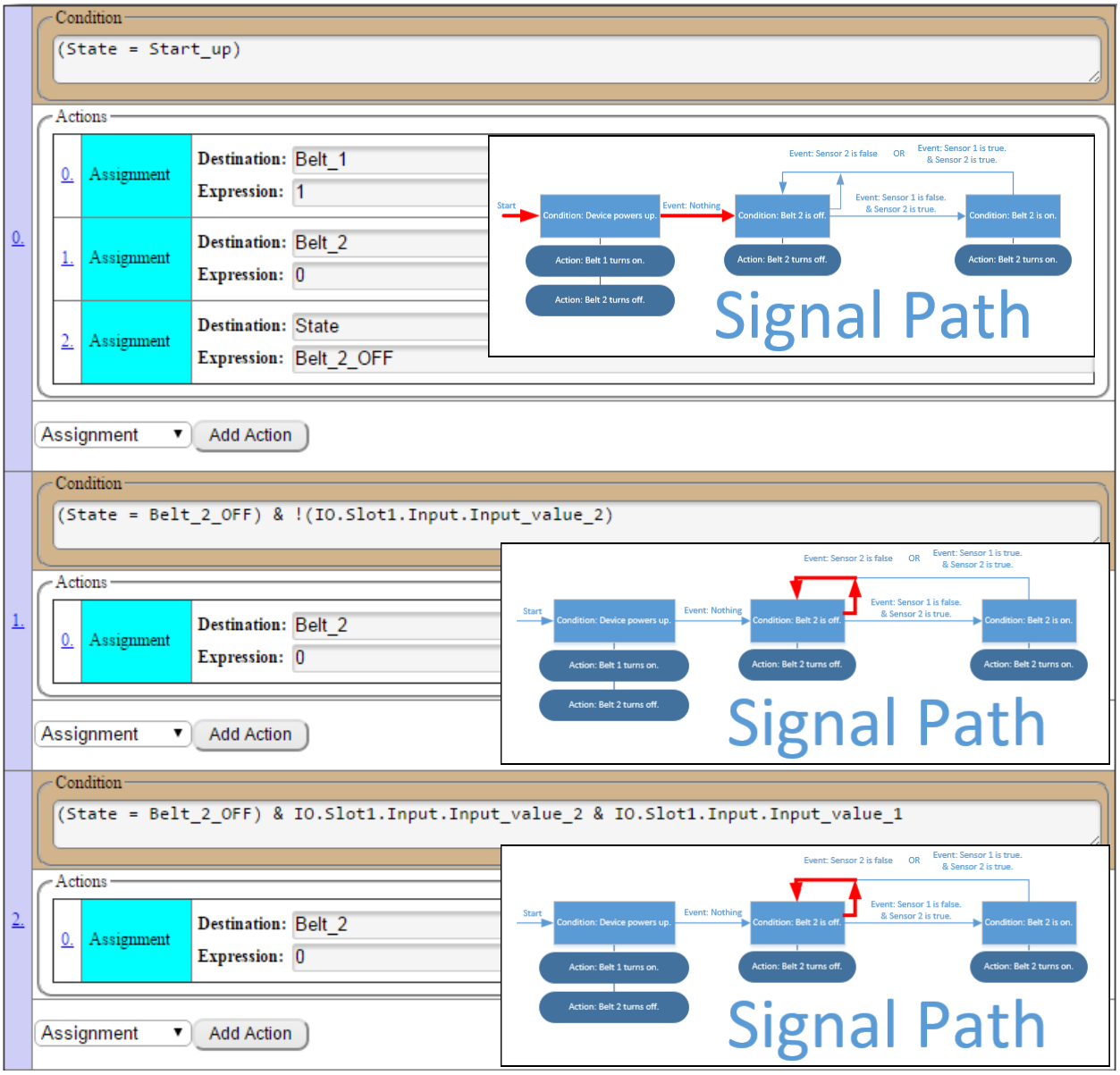
Program Variables

State	State	init:Start_up		
		Delete	Add Above	Init
Belt_1	Integer	Delete	Add Above	Init
Belt_2	Integer	Delete	Add Above	Init

State Variables

Name	Actions	
Start_up	Delete	Add Above
Belt_2_OFF	Delete	Add Above
Belt_2_ON	Delete	Add Above

Note: Program Variable "State" is initalized to Start-up.



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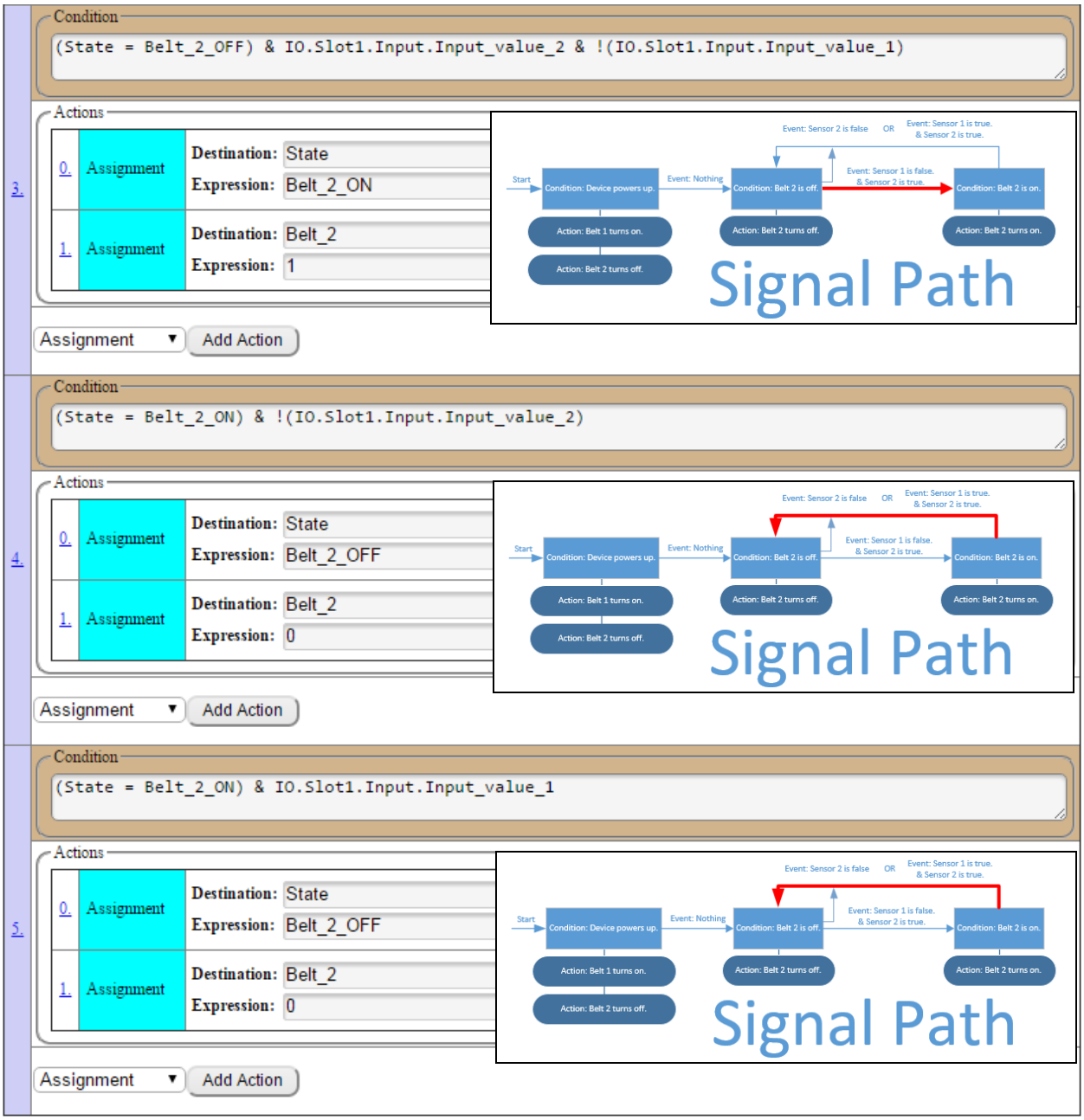


Explaining the Example: When the device is powered up, Belt 1 is turned on and Belt 2 is turned off. If Sensor 2 goes true (or a box shows up on Belt 2), ARGEE will check and see if Sensor 1 is true (or if a box is on Belt 1). If Sensor 1 is true then Belt 2 stays off. If Sensor 1 is false, Belt 2 turns on and clears the box on Belt 2.

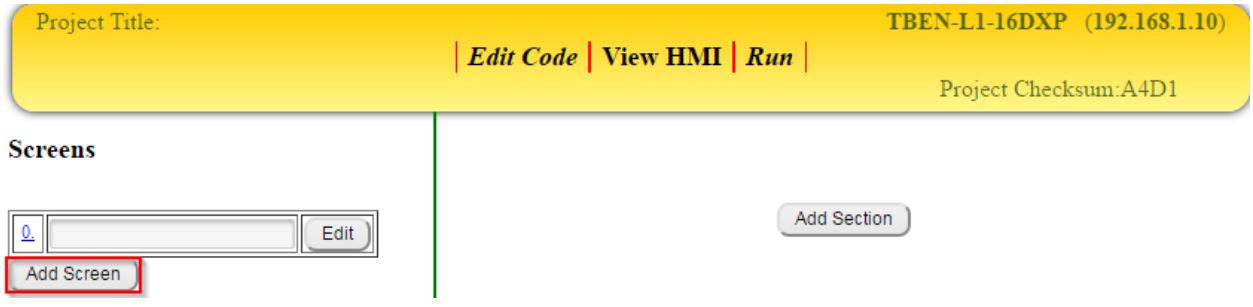
ARGEE HMI

Many user applications can be enhanced with the use of the AGREE HMI. The two main ARGEE HMI operations are Editable Fields and Display Fields. General Buttons are used in both types of fields.

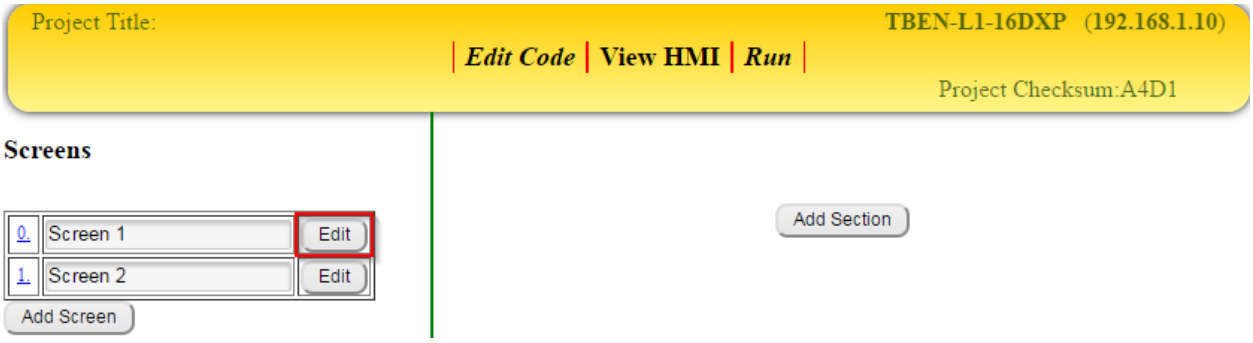
General Buttons

Add Screen

The *Add Screen* button is available under the Edit HMI tab. *Add Screen* allows the user to add several HMI screens to the project.



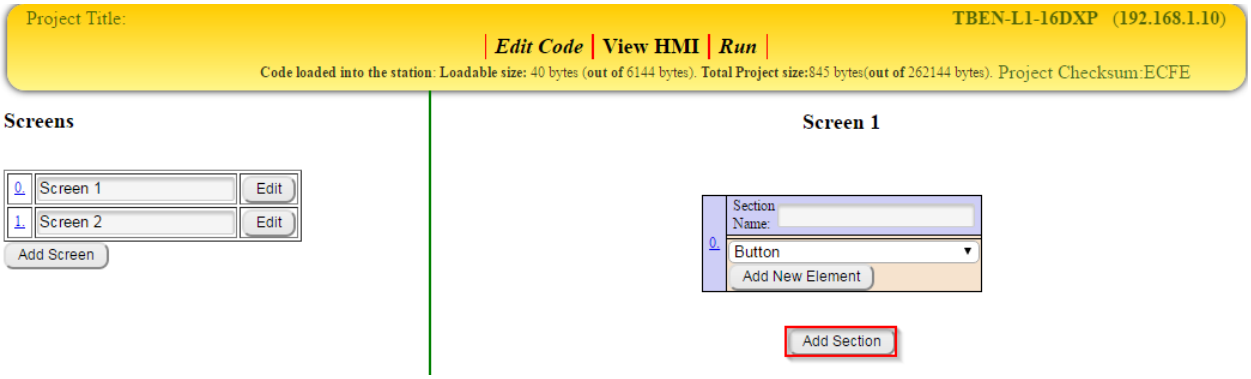
The user can toggle between multiple screens by clicking on the *Edit* button.



When on the View HMI tab, the user can toggle between screens by clicking on the *Screen* name.

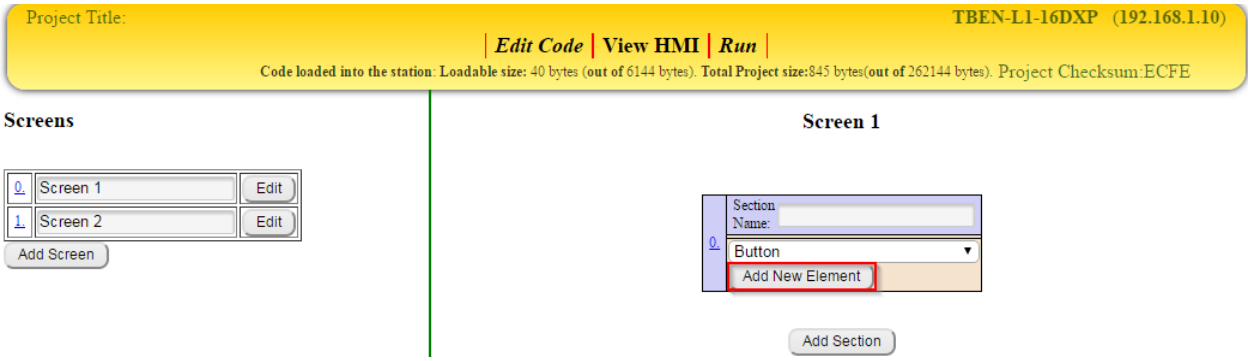
Add Section

The *Add Section* button is available under the Edit HMI tab. The user will click on the *Add Section* button if they want to add more sections to their HMI screen.



Add New Element

The user can *Add New Elements* to a specific Section of a specific Screen by selecting an *Element* from the drop down arrow and clicking *Add New Element*.



Editable Fields

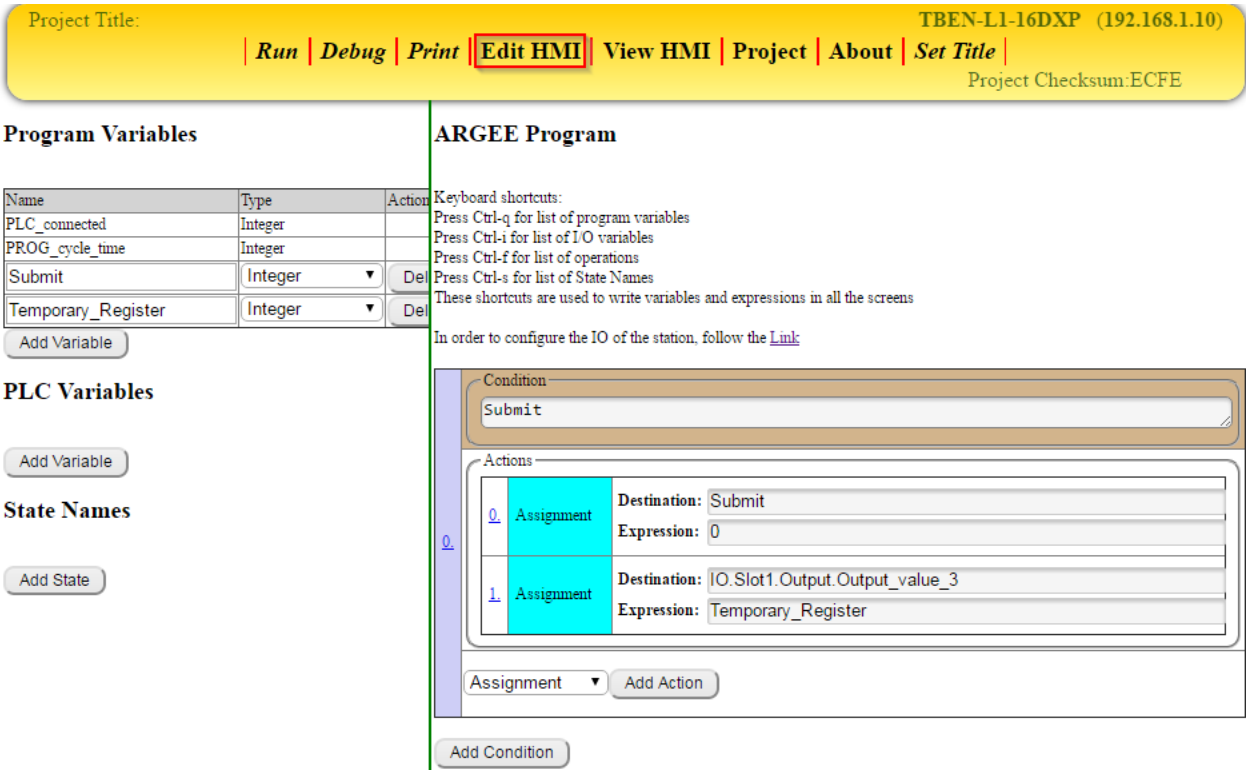
The Editable Field elements in the ARGEE HMI are *Enter number*, *Enter state* and *Edit hex* number. The *Button* element is used to submit the new value into the program.

Enter number (and Button)

The *Enter number* element, in conjunction with the *Button* element, allows the user to manually input a value into a register while a program is running.

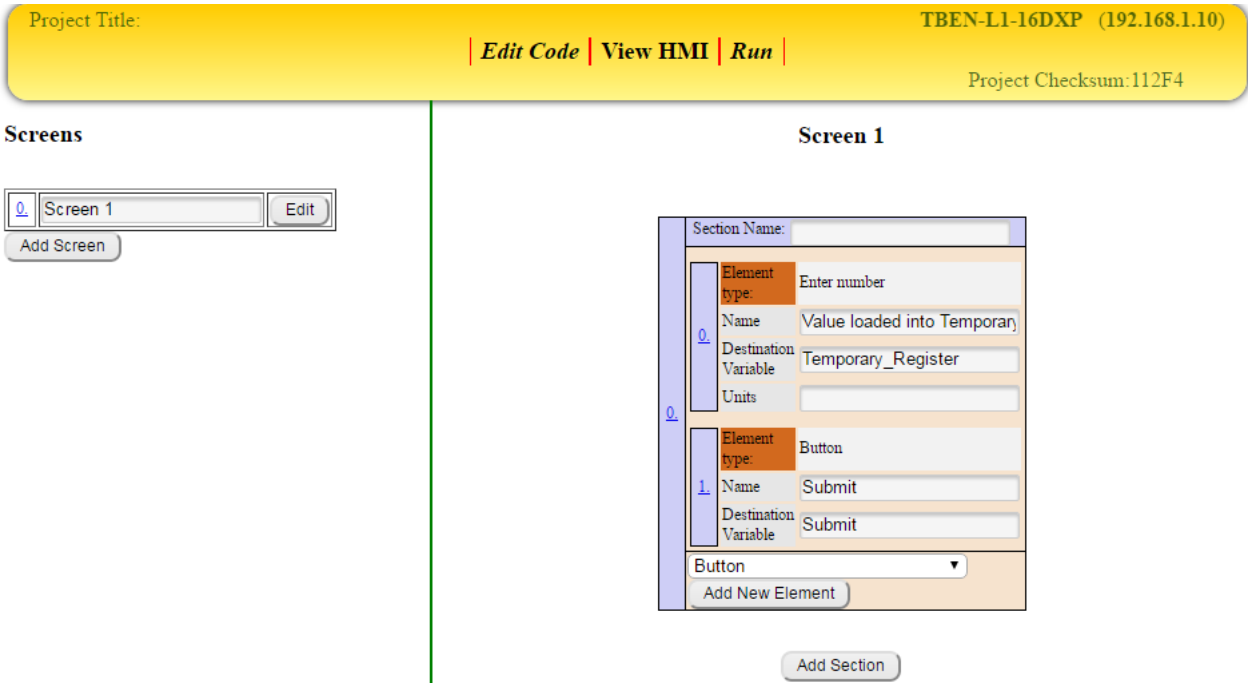
Example of Enter number (and Button)

For the HMI to compile, the user must first create some code and then click *Edit HMI* from the ARGEE menu tab.



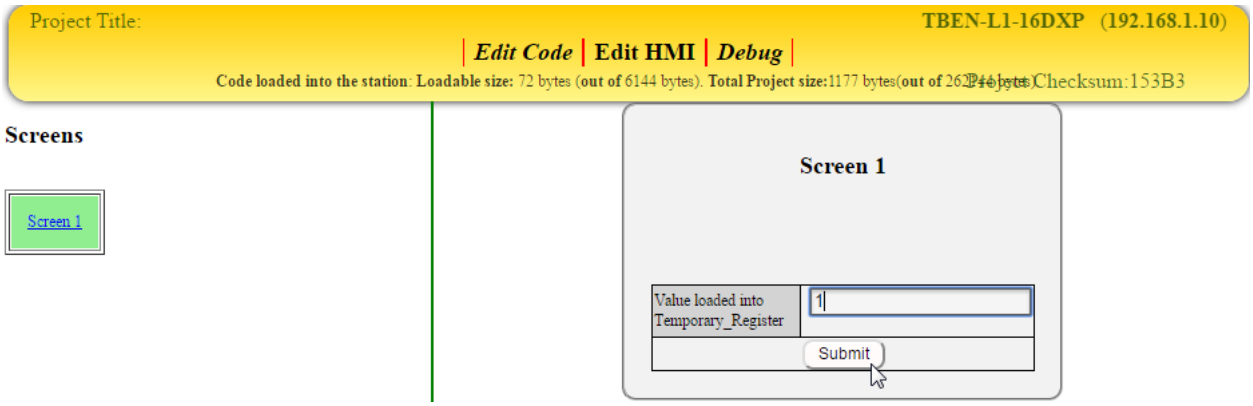
Explaining the code: The user created two Program Variables: Submit and Temporary_Register. When Submit goes true, the code sets Submit false and loads the value that is in Temporary_Register into Output_value_3.

The user creates an HMI screen and adds an *Enter number* and *Button* element to it.



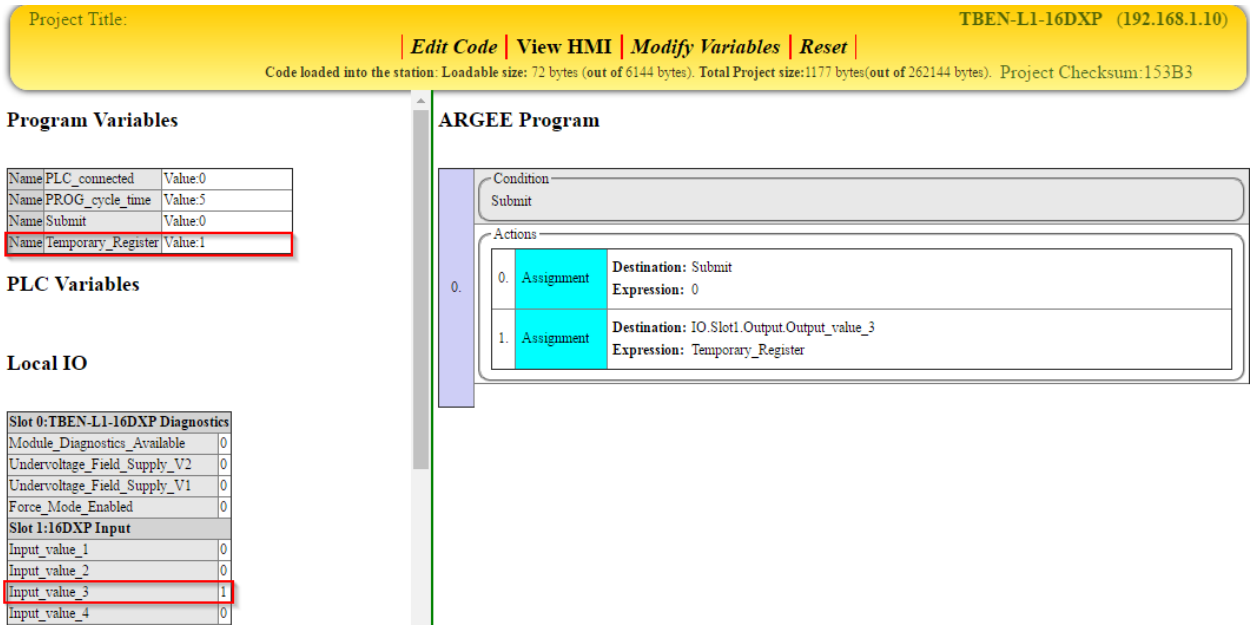
Explaining the Example: The user named the Enter number element “Value loaded into Temporary Register”. The user then set the destination variable to be Temporary_Register. The user then named the Button element “Submit”. The user then set the destination variable to be Submit.

The user clicks *Run* to download the code to the block and then clicks *View HMI* to view the HMI.



Explaining the Example: The user entered the value “1” into the editable field. The user then clicked the Submit Button to load that value into Temporary_Register.

To observe the bits moving, the user can click on *Debug* and see that Temporary_Register and Output_value_3 have the same values loaded into them.

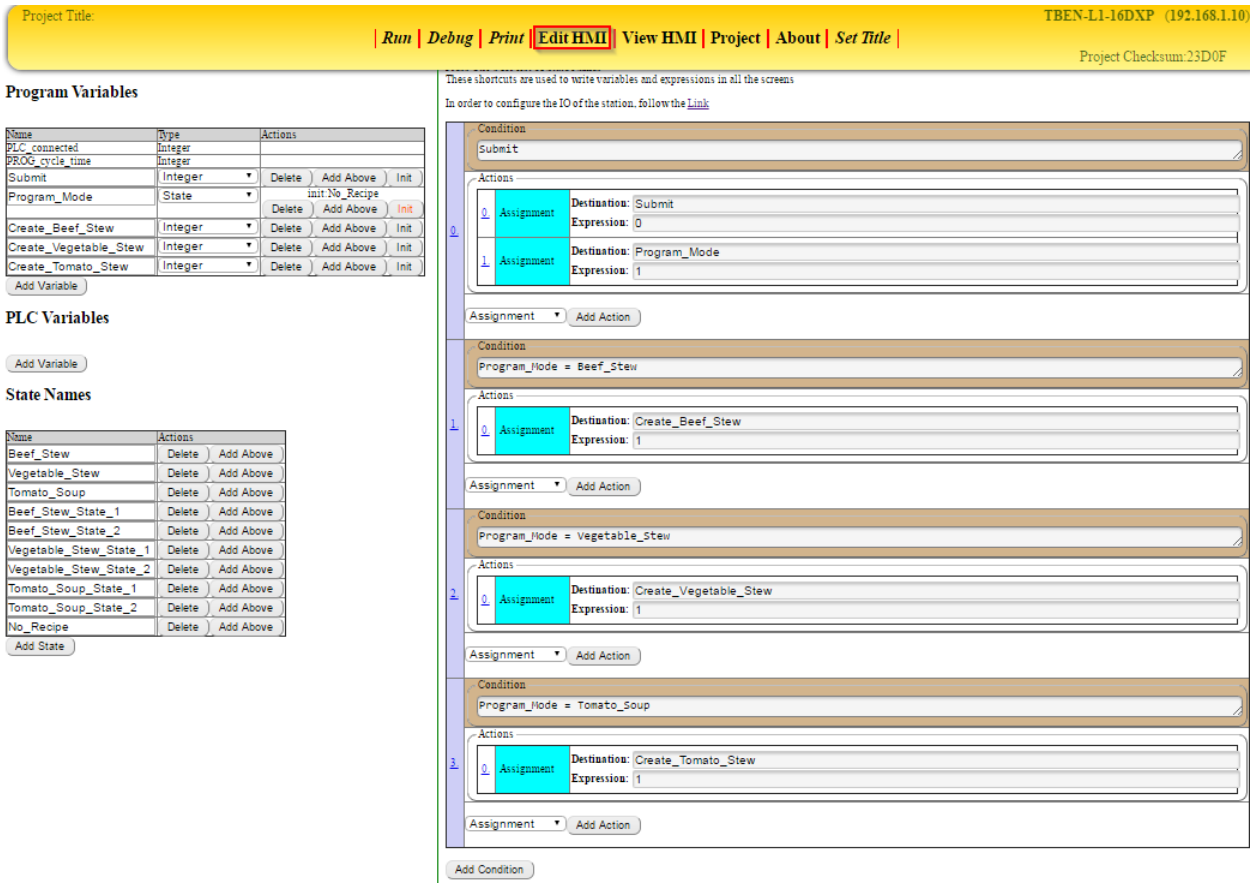


Enter state

The *Enter state* element is used when multiple State Machines are running on the same device. This feature is useful in recipe applications, RFID applications and even pick-to-light applications.

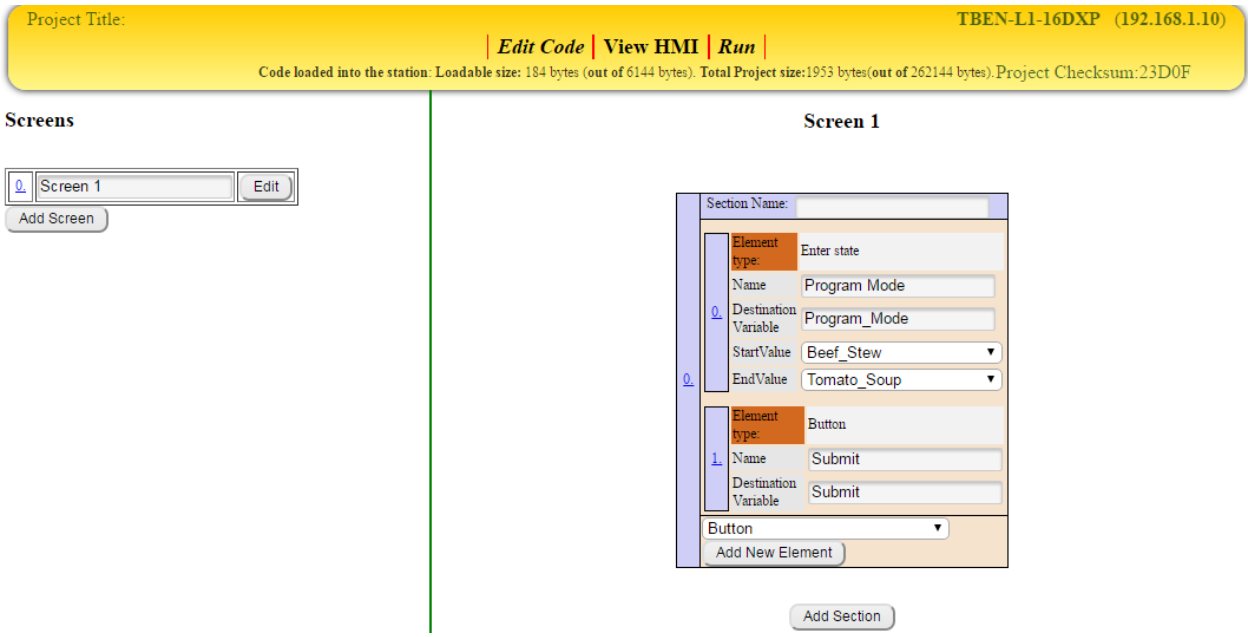
Example of Enter state

The user wants to toggle between the Beef Stew, Vegetable Stew and Tomato Soup state machines. The user must first create the code and then click *Edit HMI*.



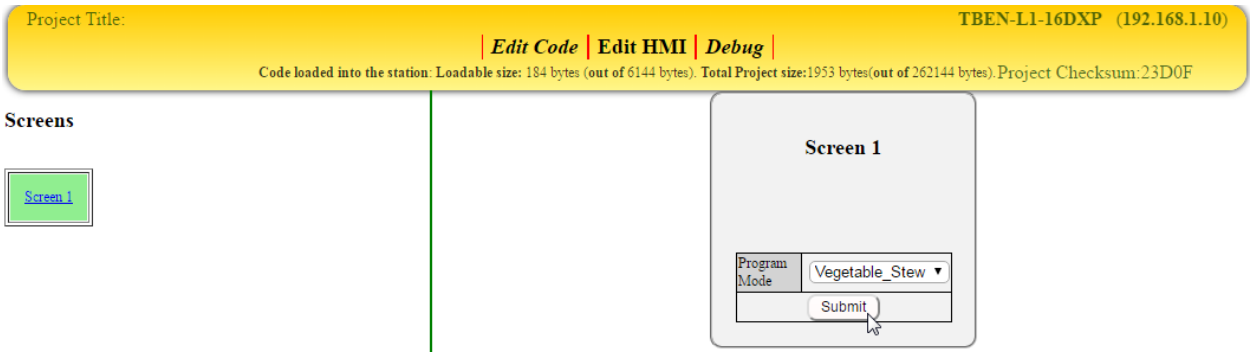
Explaining the code: The user created three State Machines (Beef_Stew, Vegetable_Stew and Tomato_Soup). Each State Machine has its own individual Sub-States (Beef_Stew_State_1/2, Vegetable_Stew_State_1/2, Tomato_Soup_State_1/2) associated with it. The user created five Program Variables. When Submit goes true, the code sets Submit false and loads the value “1” into Program Mode. When Program Mode goes true, it loads the value “1” into the selected stews State Machine. The other three Program Variables (Create_Beef_Stew, Create_Vegetable_Stew, and Create_Tomato_Soup) were created to signify the specific type of stews being created. They don’t actually do anything in this code.

The user creates an HMI screen and adds an *Enter state* and *Button* element to it.



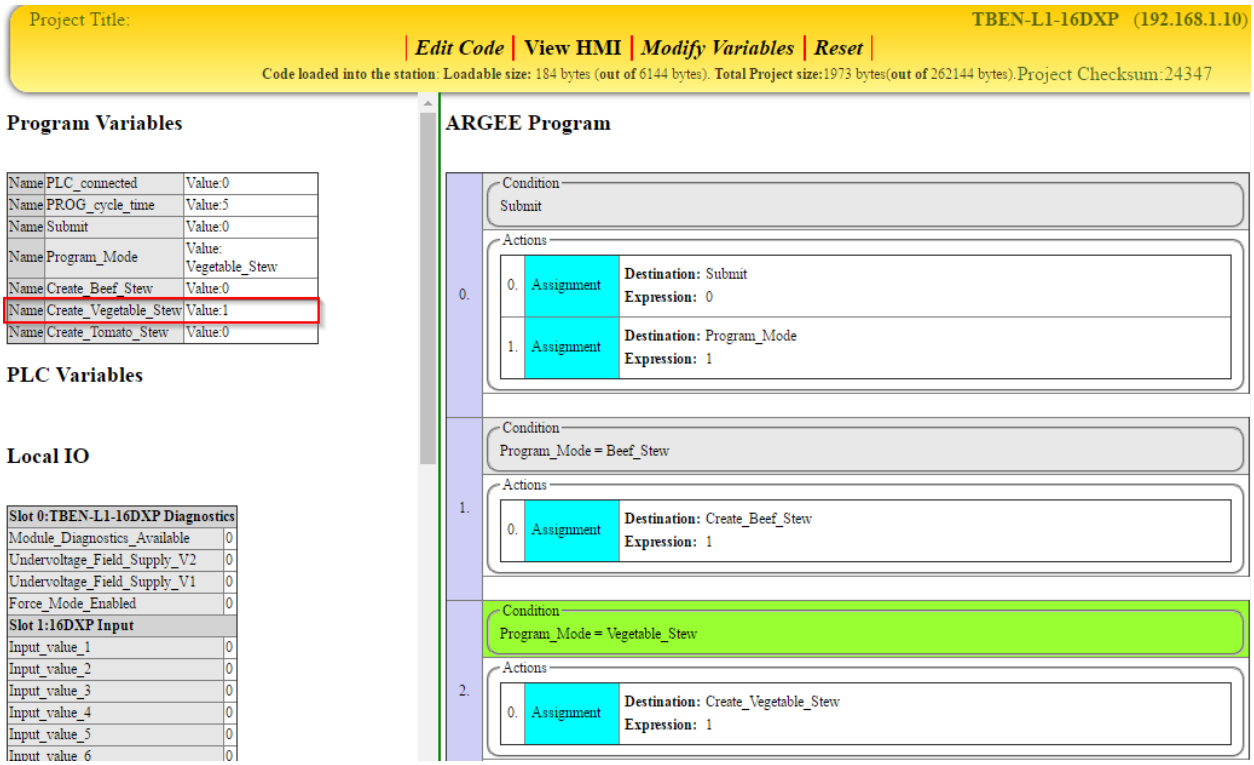
Explaining the Example: The user named the *Enter state* element “Program Mode”. The user then set the *Destination Variable* to be Program_Mode. The user used the *StartValue* and *EndValue* to set the limits on the states that the user wants to display in the HMI drop down menu. The user then named the Button element “Submit”. The user then set the *Destination Variable* to be Submit.

The user clicks *Run* to download the code to the block and then clicks *View HMI* to view the HMI.



Explaining the Example: The user selects the recipe from the drop down arrow and then clicks the Submit Button to execute the Vegetable _Stew State Machine.

To observe the bits moving, the user can click on *Debug* and see that the Create_Vegetable_Stew register is true.

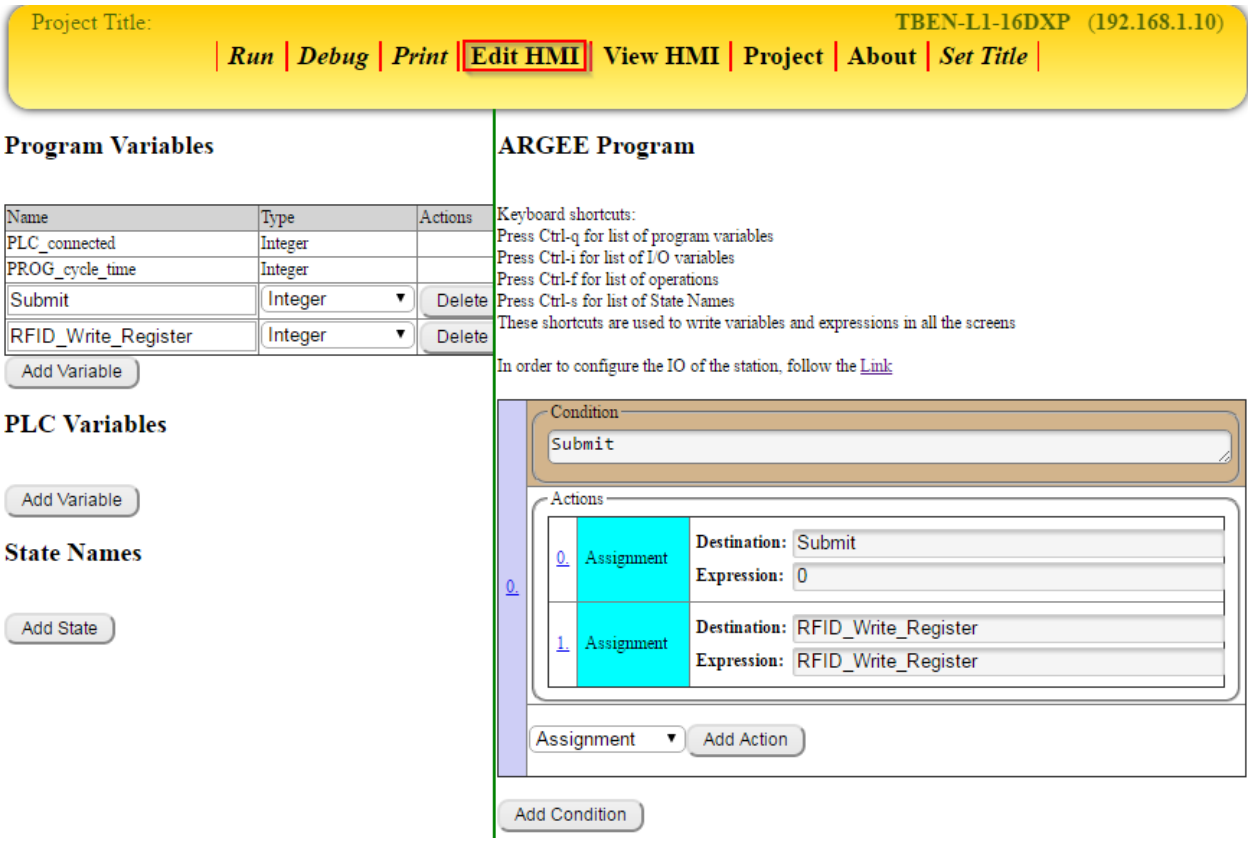


Edit hex number

The *Edit hex number* element allows the user to manually input a value (in Hex) into a register while a program is running.

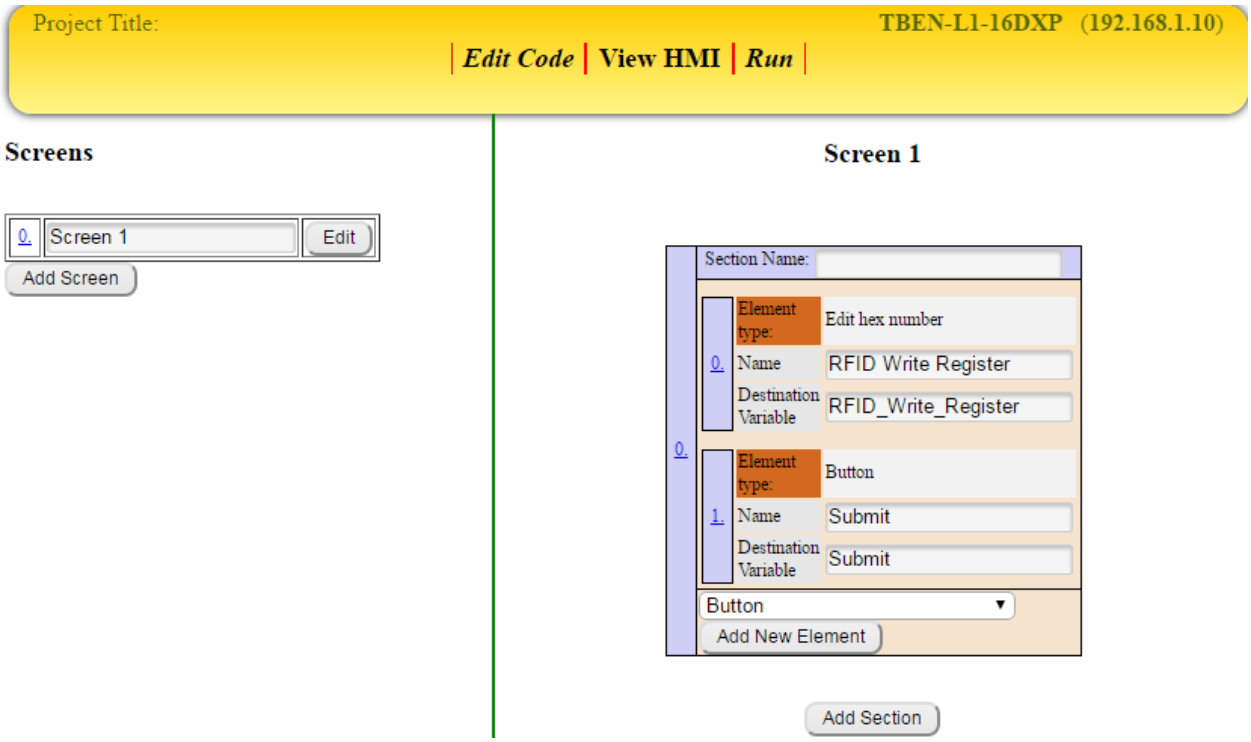
Example of Edit hex number

The user wants to load data into the RFID Write Register. After the code is written, the user clicks on the *Edit HMI* tab.



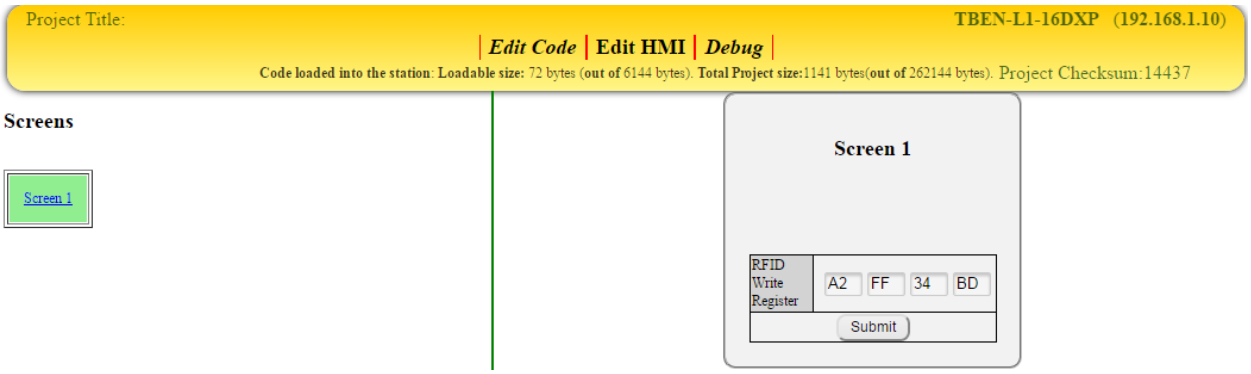
Explaining the code: The user created two Program Variables, Submit and RFID_Write_Register. When Submit goes true, the code sets Submit false and loads the value that is in RFID_Write_Register into RFID_Write_Register.

The user creates an HMI screen and adds an *Edit hex number* and *Button* element to it.



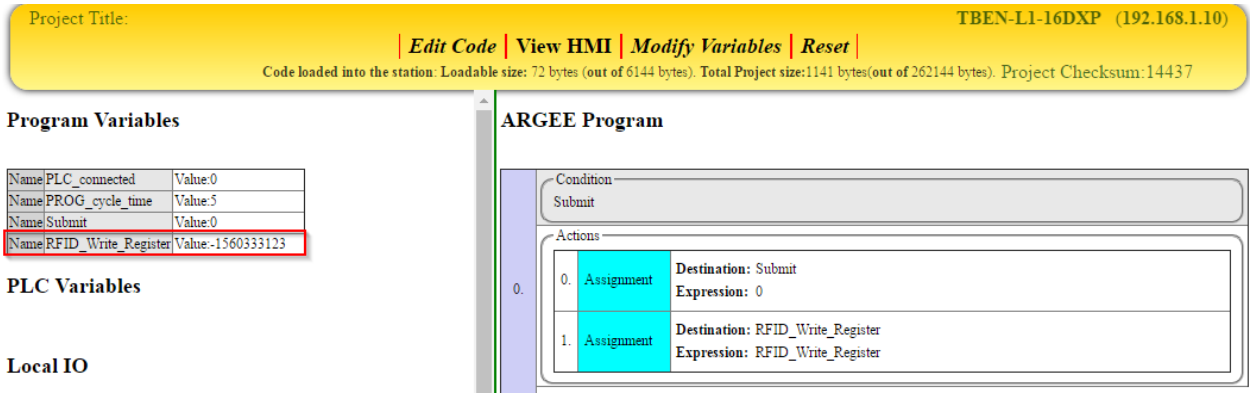
Explaining the Example: The user named the Edit hex number element “RFID Write Register”, and then set the destination variable to be RFID_Write_Register. The user then named the Button element “Submit”, and then set the destination variable to be Submit.

The user clicks *Run* to download the code to the block and then clicks *View HMI* to view the HMI.



Explaining the Example: The user entered the hex value “A2 FF 34 BD” into the editable field. The user then clicked the Submit Button to load that value into Temporary_Register_1.

To observe the bits moving, the user can click *Debug* and see that RFID_Write_Register has the hex number A2 FF 34 BD loaded into it.



Display Fields

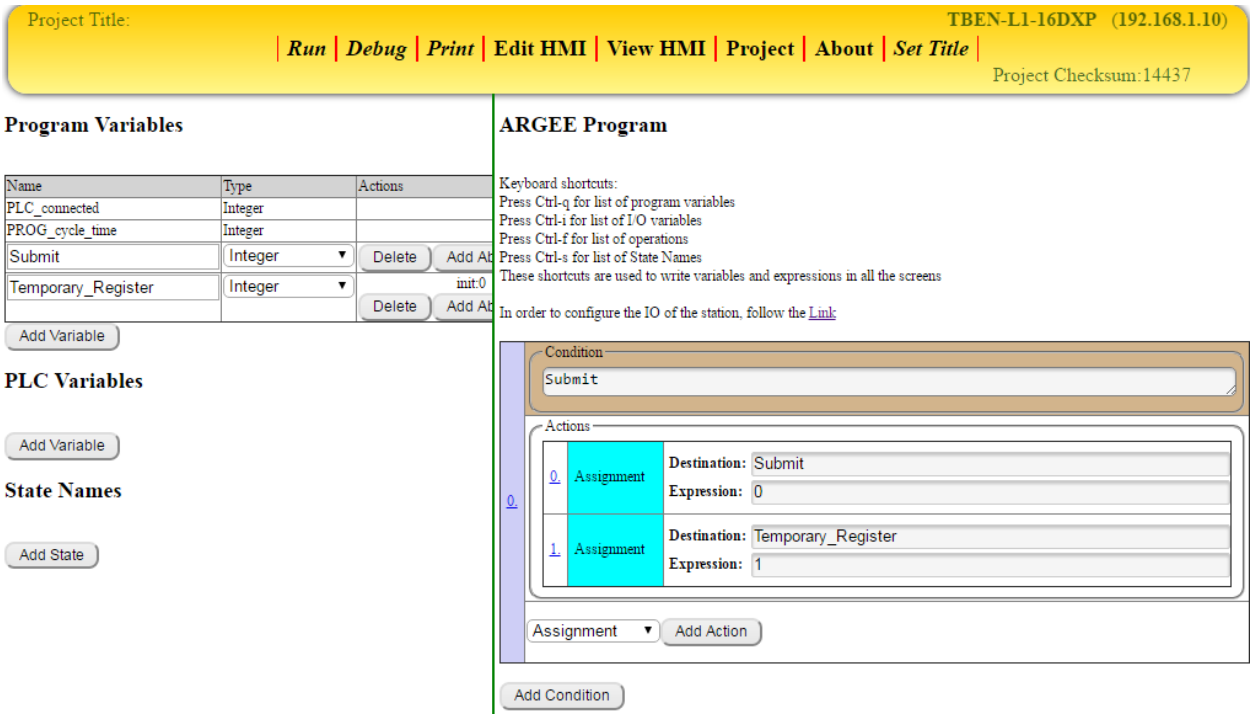
The Display Field elements in the ARGEE HMI are *Display number or state*, *Display number with valid range*, *Display hex number*.

Display number or state

The *Display number or state element* is a feature that allows the user to see the current value in a particular register.

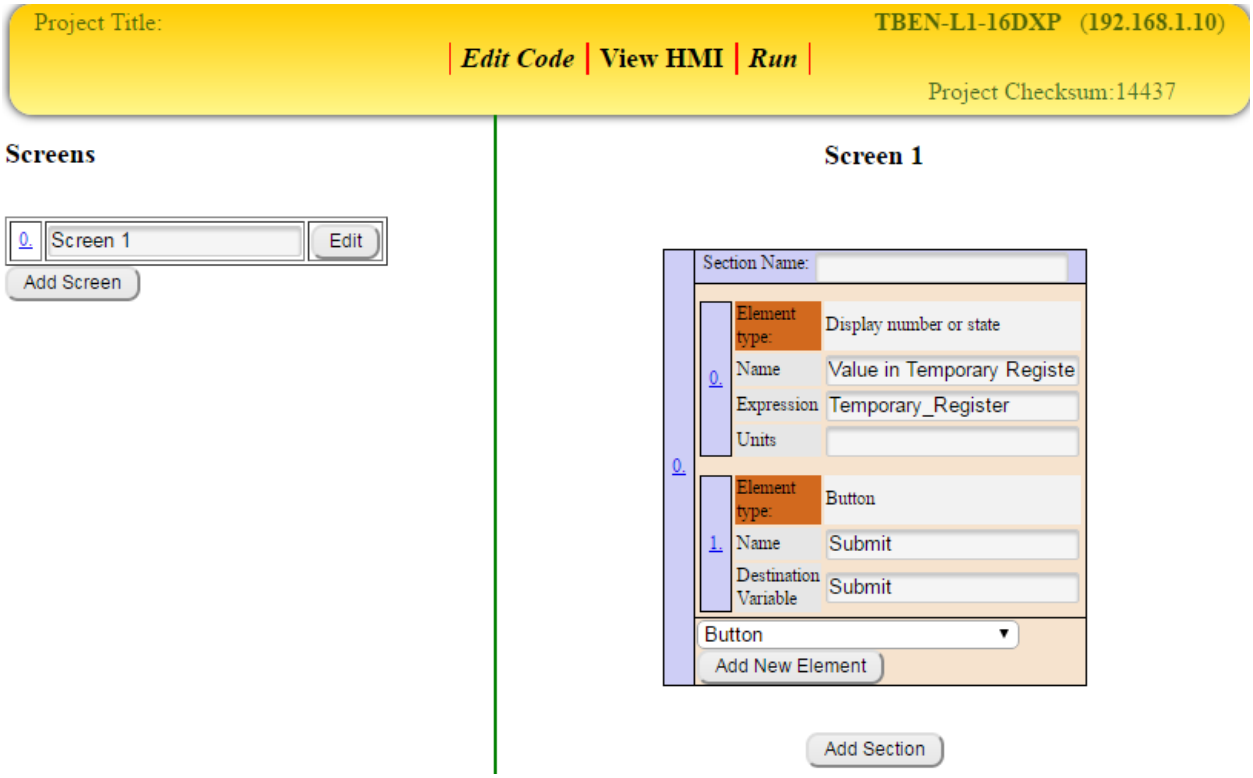
Example of Display number or state

The user wants to monitor the value in Temporary_Register.



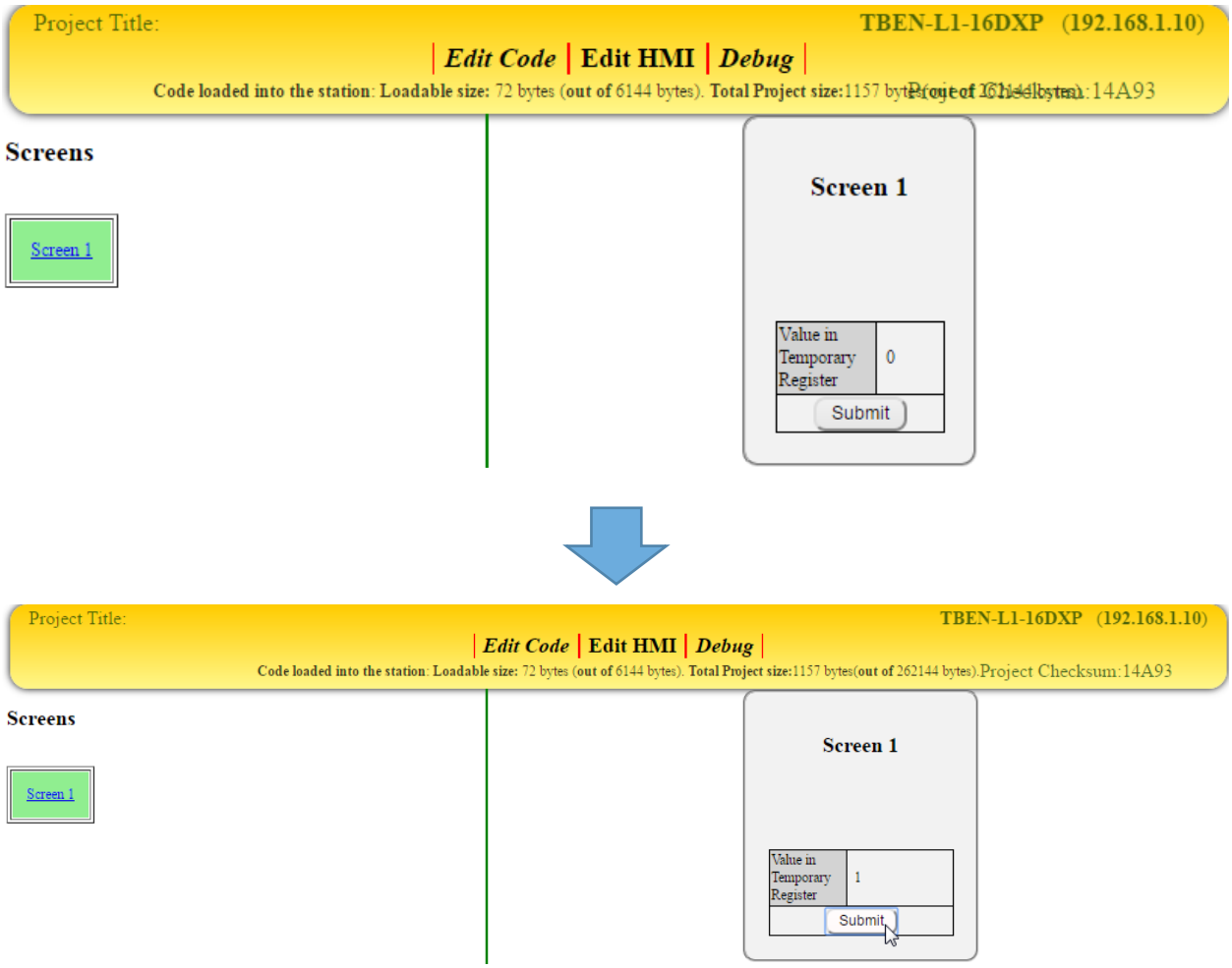
Explaining the code: The user created two Program Variables, Submit and Temporary_Register. When Submit goes true, the code sets Submit false and loads the value “1” into Temporary_Register.

The user creates an HMI screen and adds a *Display number or state* and *Button* element to it.



Explaining the Example: The user named the Display number or state element “Value in Temporary Register”, and then sets the destination variable to be Temporary_Register. Next, the user named the Button element “Submit”, and then set the destination variable to be Submit.

The user clicks *Run* to download the code to the block and then clicks *View HMI* to view the HMI.



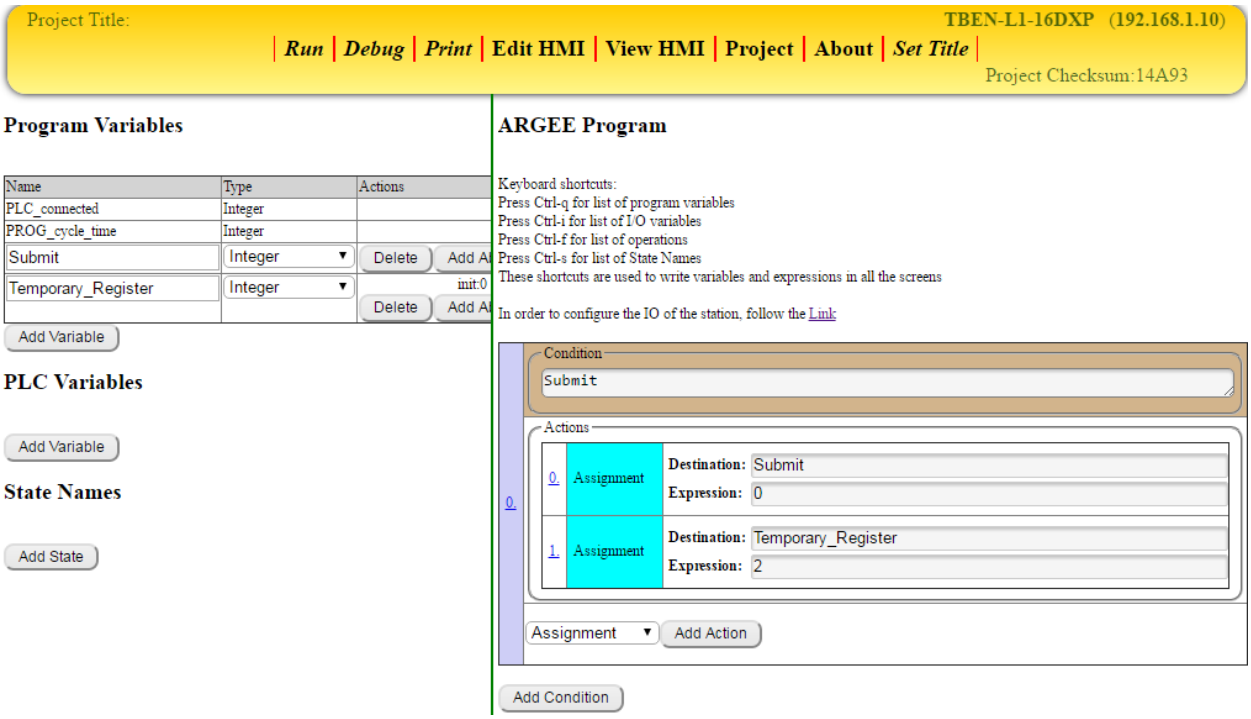
Explaining the Example: When the HMI first loads up, the value “0” is in Temporary_Register. When the user presses the Submit button, the value “1” is loaded in to Temporary_Register.

Display number with valid range

The *Display number with valid range* element is a feature that allows the user to see the current value in a particular register. It also lets the user know when that value has exceeded a preset range.

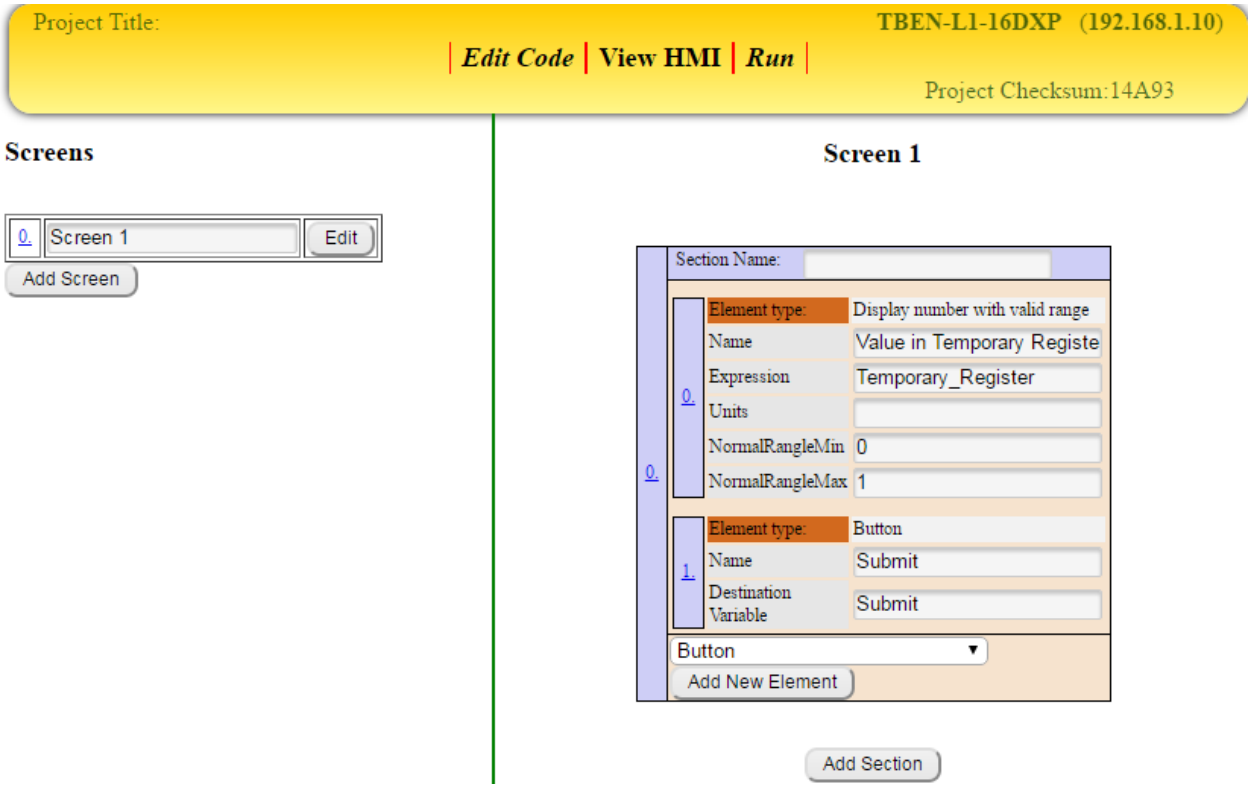
Example of Display number with valid range

The user wants to monitor the value in Temporary_Register. The user also wants a visual notification when that value has exceeded a preset range.



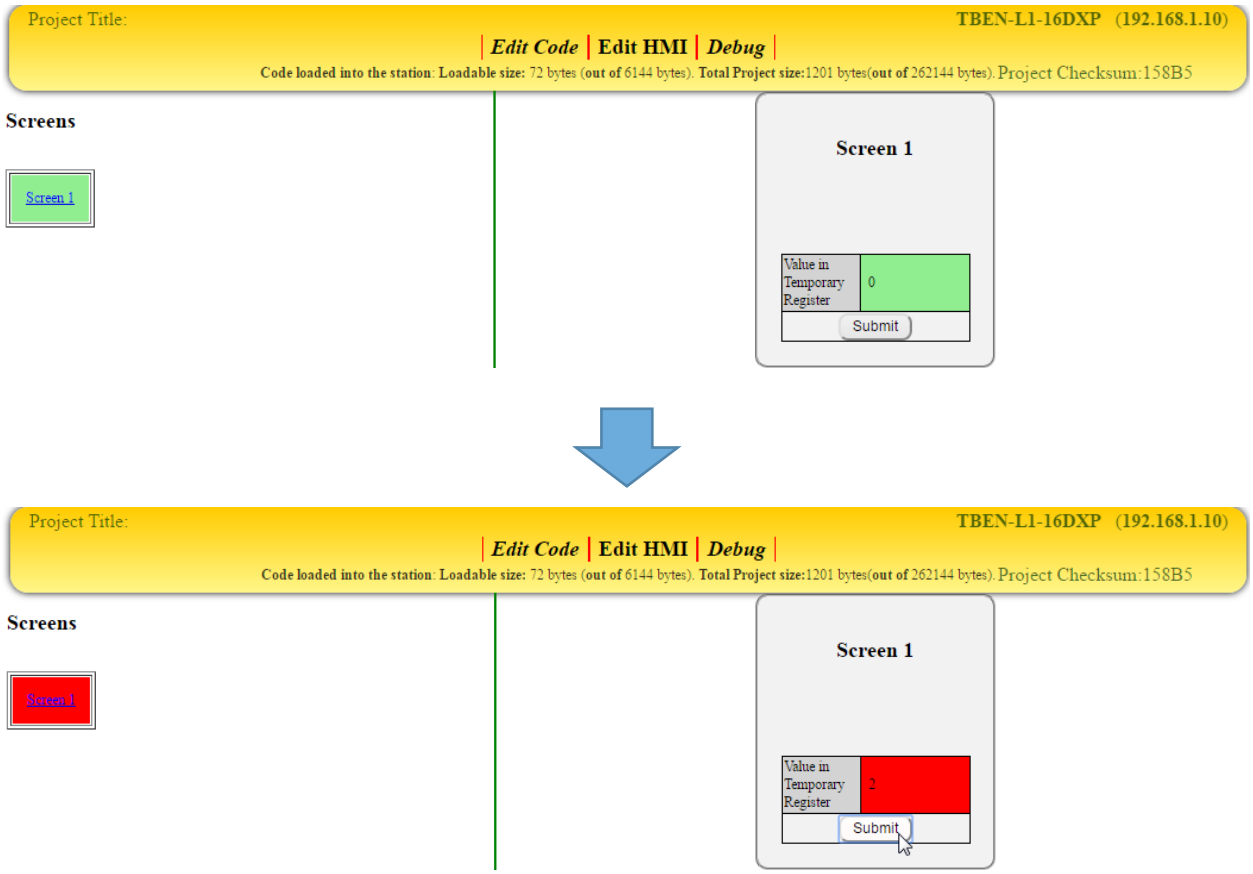
Explaining the code: The user created two Program Variables, Submit and Temporary_Register. When Submit goes true, the code sets Submit false and loads the value “2” into Temporary_Register.

The user creates an HMI screen and adds a *Display number with valid range* and *Button* element to it.



Explaining the Example: The user named the Display number with valid range element “Value in Temporary Register”. The user then set the destination variable to be Temporary_Register. The user set the range minimum to be “0” and the range maximum to be “1”. The user then named the Button element “Submit”, and set the destination variable to be Submit.

The user clicks *Run* to download the code to the block and then clicks *View HMI* to view the HMI.



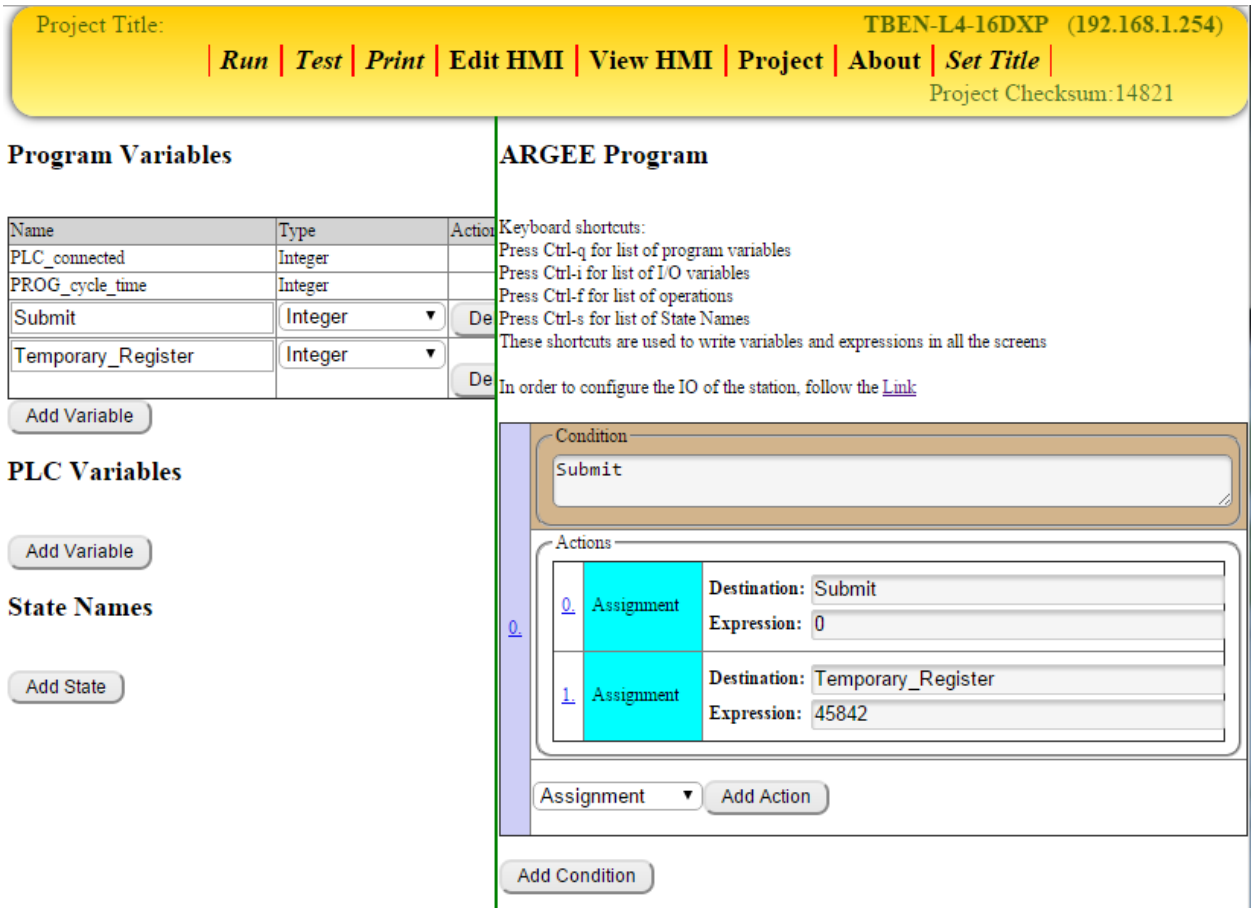
Explaining the Example: When the HMI first loads up, the value “0” is in Temporary_Register. When the user presses the Submit button, the value “2” is loaded in to Temporary_Register. The value “2” exceeds the preset maximum so the HMI goes red.

Display hex number

The *Display hex number* element is a feature that allows the user to see the current value in a particular register displayed in Hex.

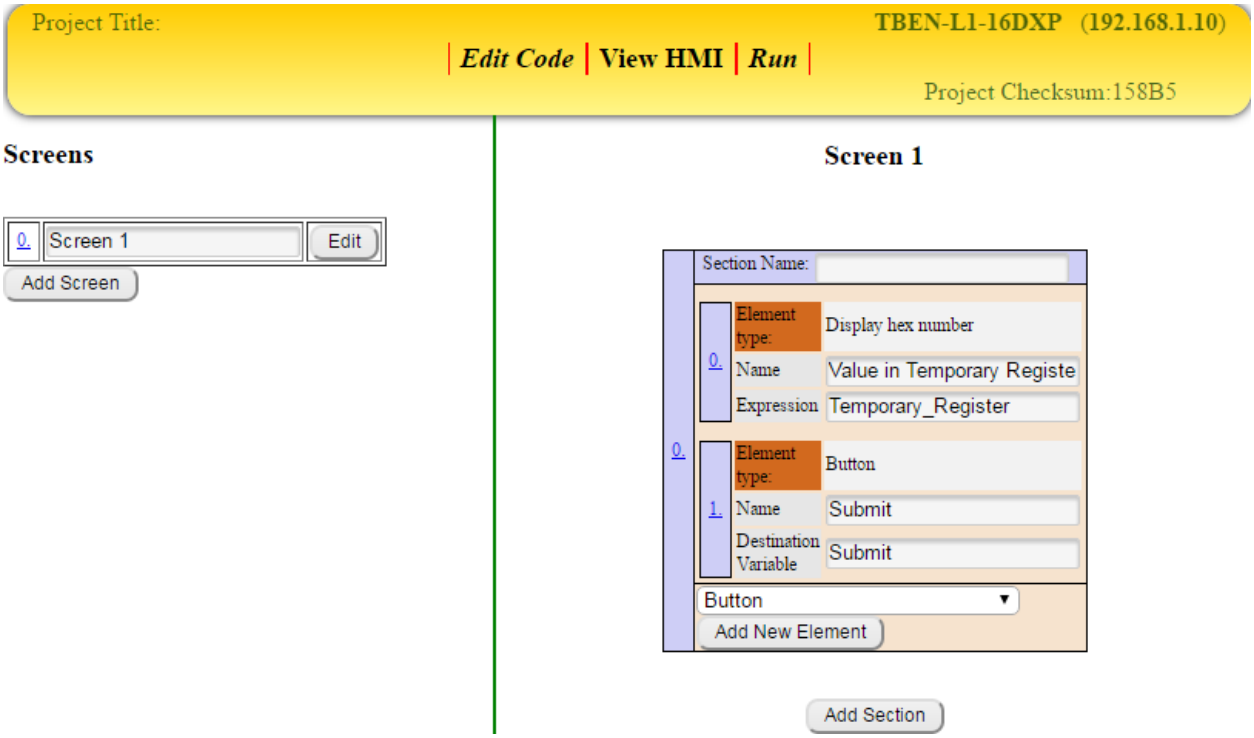
Example of Display hex number

The user wants to monitor the value in Temporary_Register. The user also wants to display that value in hex.



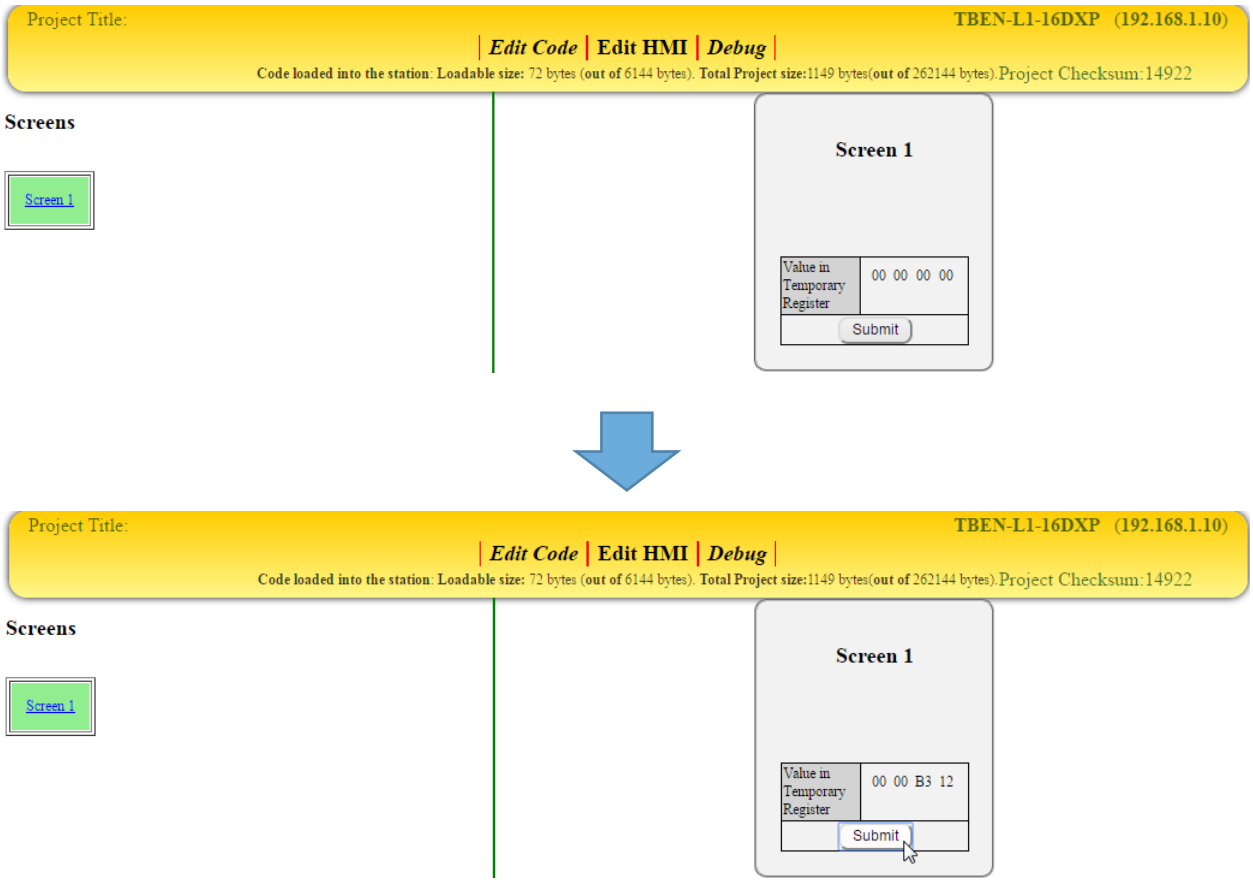
Explaining the code: The user created two Program Variables, Submit and Temporary_Register. When Submit goes true, the code sets Submit false and loads the value “45842” into Temporary_Register.

The user creates an HMI screen and adds a *Display number or state* and *Button* element to it.



Explaining the Example: The user named the Display hex number “Value in Temporary Register”, and then set the destination variable to be Temporary_Register. Next, the user named the Button element “Submit” and set the destination variable to be Submit.

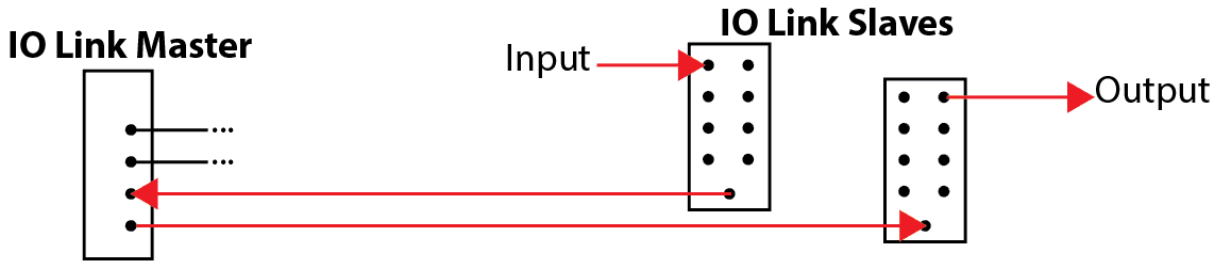
The user clicks *Run* to download the code to the block and then clicks *View HMI* to view the HMI.



Explaining the Example: When the HMI first loads up, the value “00 00 00 00” is in Temporary_Register. When the user presses the Submit button, the value “45842” is loaded in to Temporary_Register. The value “45842” is transformed into hex and is displayed in the HMI.

Working with IO-Link

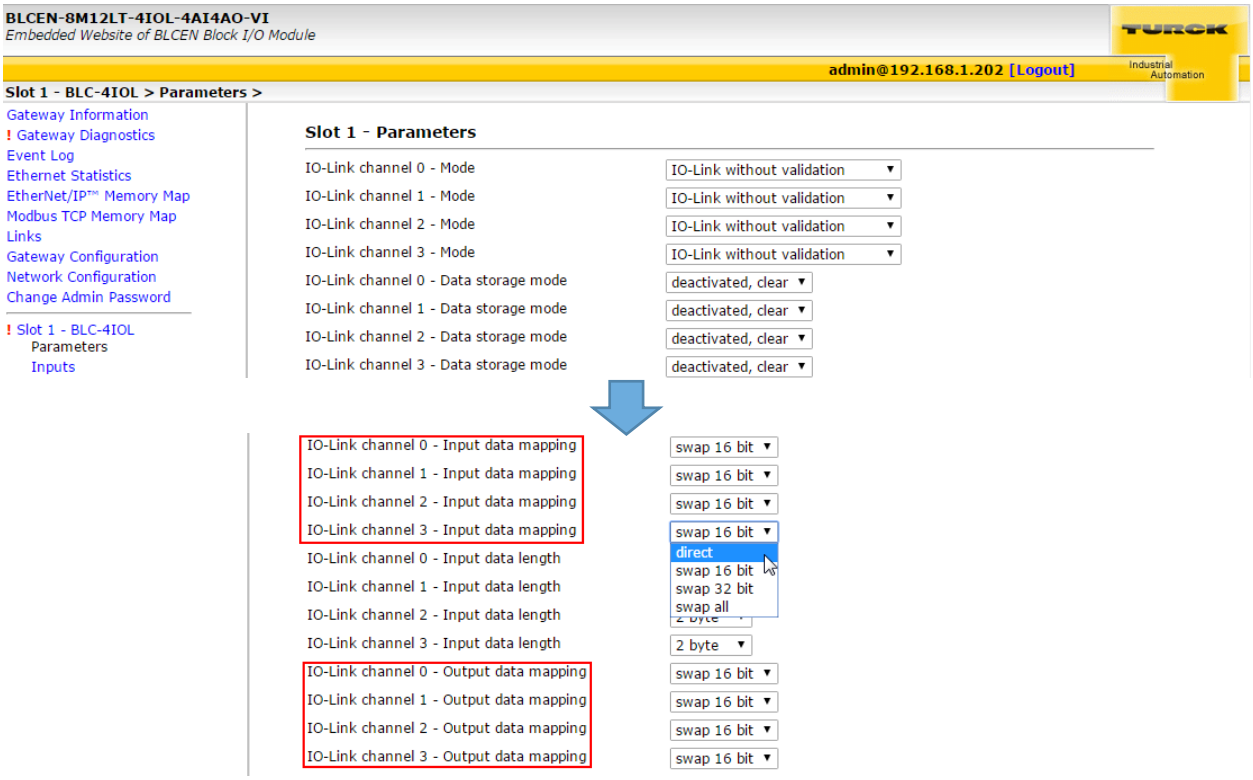
When a user combines IO-Link technology with AGREE, the application solutions that can be created become endless. IO-Link can support digital and analog signals. Because there are so many IO-Link configurations, it is recommended that the user read the IO-Link user manual before attempting any IO-Link applications.



IMPORTANT NOTE: When using IO-Link over EtherNet-IP or a Modbus/TCP, the user must change the Input and Output Data Mapping parameter from “swap 16 bit” to “direct” in the webserver.

Example of IO-Link

The user wants to use a digital input on an IO-Link slave to turn on a digital output on a different IO-Link slave using EtherNet/IP. The first thing the user has to do is change the Input and Output Data Mapping parameter from “swap 16 bit” to “direct”.



Explaining the Example: The user logged into the webserver and changed the Input and Output Data Mapping parameter from “swap 16 bit” to “direct”, and then clicked submit.

The next thing the user does is look at the data map of the two IO-Link slaves and determine which Input and Output to link together.

Slave 1 Data Map (A TBIL-M1-16DIP Connected to Port 0)

Process Data

	Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
Inputs	0	DI8 C4P2 (B)	DI7 C4P4 (A)	DI6 C3P2 (B)	DI5 C3P4 (A)	DI4 C2P2 (B)	DI3 C2P4 (A)	DI2 C1P2 (B)	DI1 C1P4 (A)
	1	DI16 C8P2 (B)	DI15 C8P4 (A)	DI14 C7P2 (B)	DI13 C7P4 (A)	DI12 C6P2 (B)	DI11 C6P4 (A)	DI10 C5P2 (B)	DI9 C5P4 (A)

C... = slot no., P... = pin no.

Slave 2 Data Map (A TBIL-M1-16DXP Connected to Port 1)

Process Data

	Byte	Bit 7 MSB	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 LSB
Inputs	0	DI8 C4P2 (B)	DI7 C4P4 (A)	DI6 C3P2 (B)	DI5 C3P4 (A)	DI4 C2P2 (B)	DI3 C2P4 (A)	DI2 C1P2 (B)	DI1 C1P4 (A)
	1	DI16 C8P2 (B)	DI15 C8P4 (A)	DI14 C7P2 (B)	DI13 C7P4 (A)	DI12 C6P2 (B)	DI11 C6P4 (A)	DI10 C5P2 (B)	DI9 C5P4 (A)
Outputs	0	DO8 C4P2 (B)	DO7 C4P4 (A)	DO6 C3P2 (B)	DO5 C3P4 (A)	DO4 C2P2 (B)	DO3 C2P4 (A)	DO2 C1P2 (B)	DO1 C1P4 (A)
	1	DO16 C8P2 (B)	DO15 C8P4 (A)	DO14 C7P2 (B)	DO13 C7P4 (A)	DO12 C6P2 (B)	DO11 C6P4 (A)	DO10 C5P2 (B)	DO9 C5P4 (A)

C... = slot no., P... = pin no.

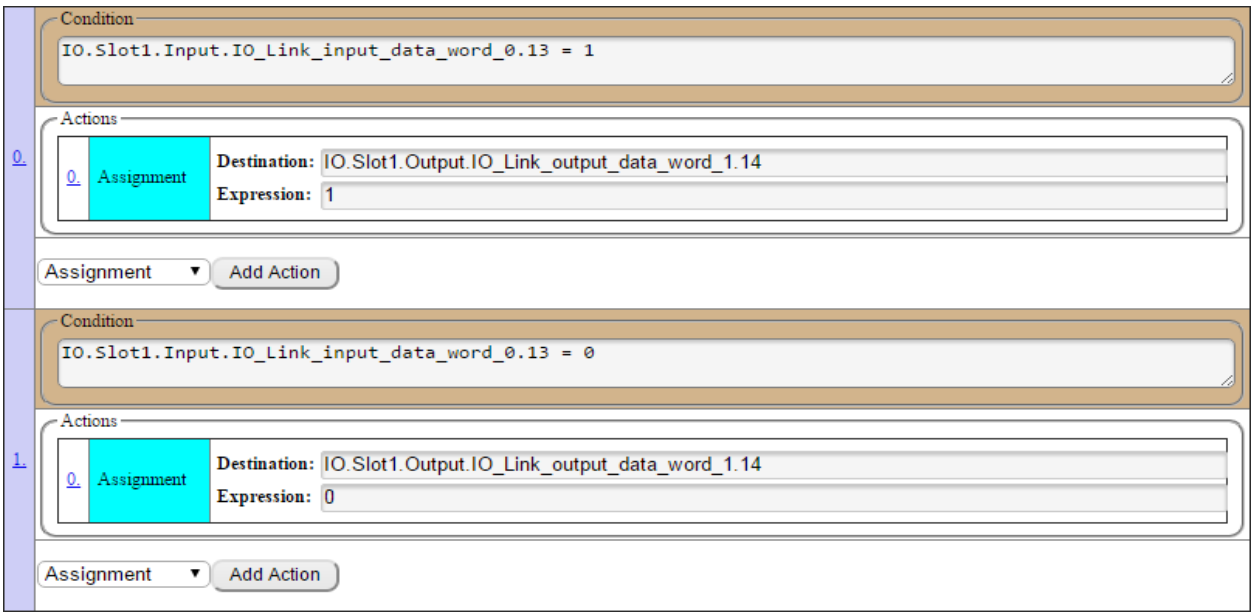
Explaining the user's decision: The user wants Connector 7 Pin 2 (Port B) on the input block to turn on Connector 8 Pin 4 (Port A) on the output block.

IO-Link Command Structure

= *The I/O location and data word that is being targeteted.*

= *The specific bit in the data word that is being targeted.*

= *The value that is being loaded into that bit location*



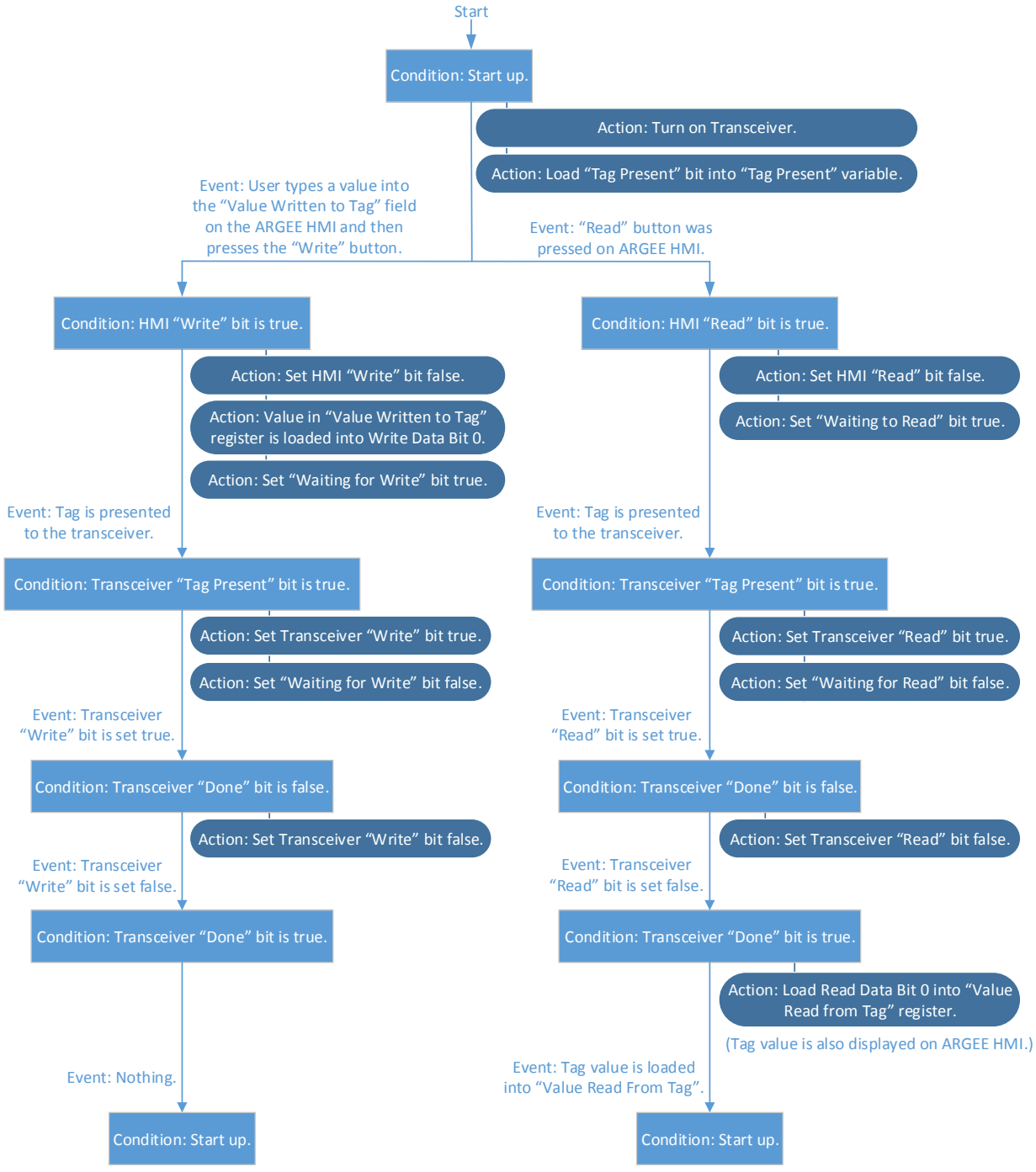
Explaining the example: When Connector 7 Port B on the input slave block is true, Connector 8 Port A on the output slave block is true. When Connector 7 Port B on the input slave block is false, Connector 8 Port A on the output slave block is false.

Working with RFID

If a user needs to solve a simple tracking application, using RFID technology (powered by ARGEE) might be the solution. Many factors influence RFID Read/Write applications. The user can reference the RFID user manual for more information about RFID.

Example of RFID

The user wants to create an ARGEE HMI that can read from and write to RFID tags. The first thing the user must do is break out a pen and paper and draw up a state machine.



Explaining the RFID State Machine: When the device powers up, the transceiver gets turned on. From the ARGEE HMI screen the user can select two paths: *Read from Tag*, or *Write to Tag* path. If the user wants to read a tag value, simply click the *Read* button on the HMI and present a tag to the transceiver. If the user wants to write to a tag, just type a value into the HMI, click *Write* on the HMI, and then present a tag to the transceiver. After a Read/Write has occurred, the program goes back to the "Startup" state and waits for the next command.

Writing the Code:

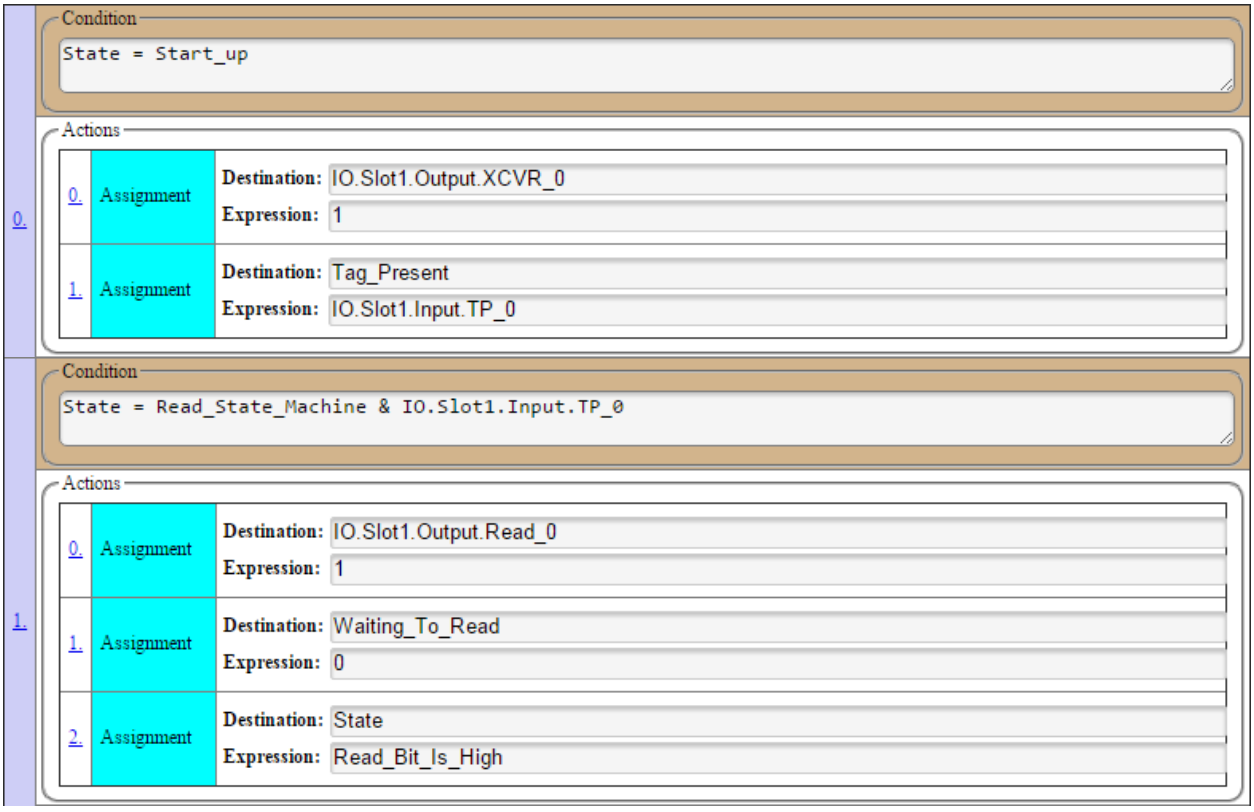
Program Variables

Read	Integer
Write	Integer
State	State
Value_Read_From_Tag	Integer
Value_Written_To_Tag	Integer
Tag_Present	Integer
Waiting_To_Read	Integer
Waiting_To_Write	Integer

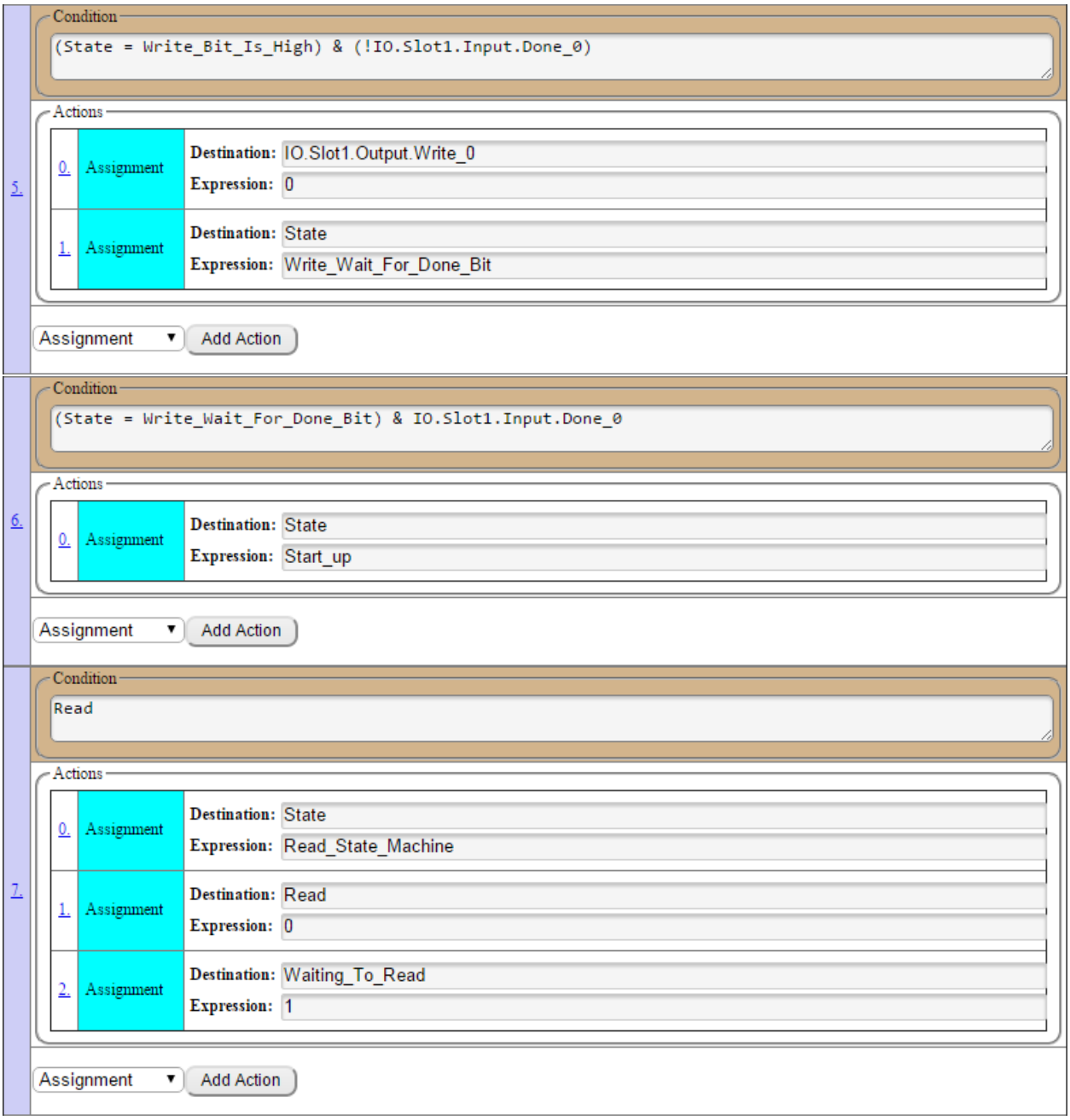
State Variables

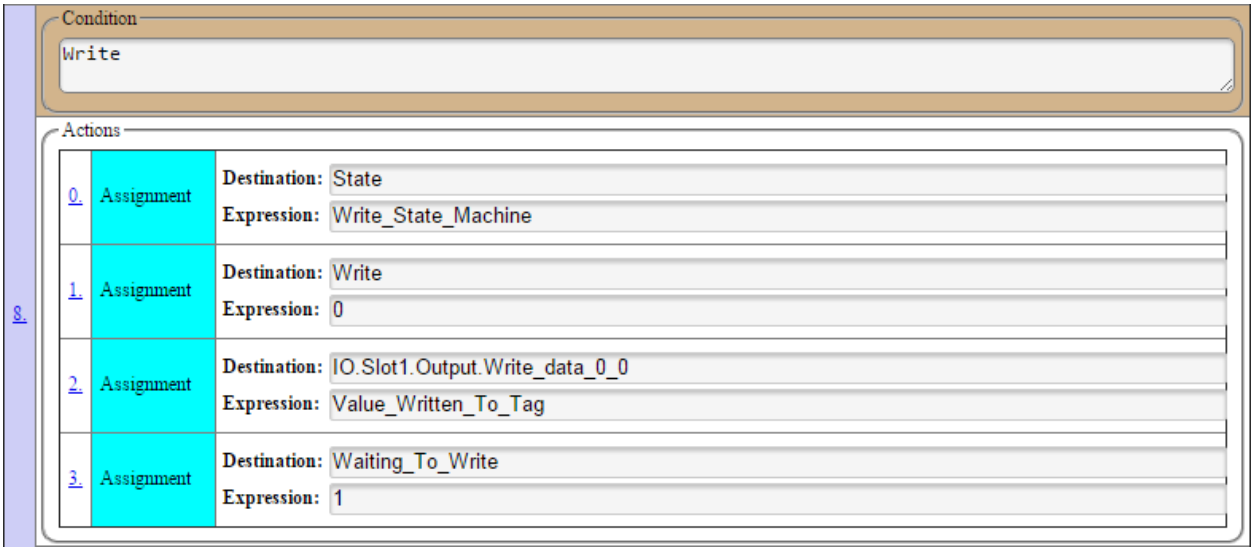
Start_up
Read_State_Machine
Read_Bit_Is_High
Read_Wait_For_Done_Bit
Write_State_Machine
Write_Bit_Is_High
Write_Wait_For_Done_Bit

Note: Set initial state for Program Variable "State" to "Start_up"




2.
Condition
(State = Read_Bit_Is_High) & (!IO.Slot1.Input.Done_0)
Actions
0. Assignment
Destination: IO.Slot1.Output.Read_0
Expression: 0
1. Assignment
Destination: State
Expression: Read_Wait_For_Done_Bit
Assignment
Add Action
3.
Condition
(State = Read_Wait_For_Done_Bit) & IO.Slot1.Input.Done_0
Actions
0. Assignment
Destination: Value_Read_From_Tag
Expression: IO.Slot1.Input.Read_data_0_0
1. Assignment
Destination: State
Expression: Start_up
4.
Condition
State = Write_State_Machine & IO.Slot1.Input.TP_0
Actions
0. Assignment
Destination: IO.Slot1.Output.Write_0
Expression: 1
1. Assignment
Destination: Waiting_To_Write
Expression: 0
2. Assignment
Destination: State
Expression: Write_Bit_Is_High
Assignment
Add Action

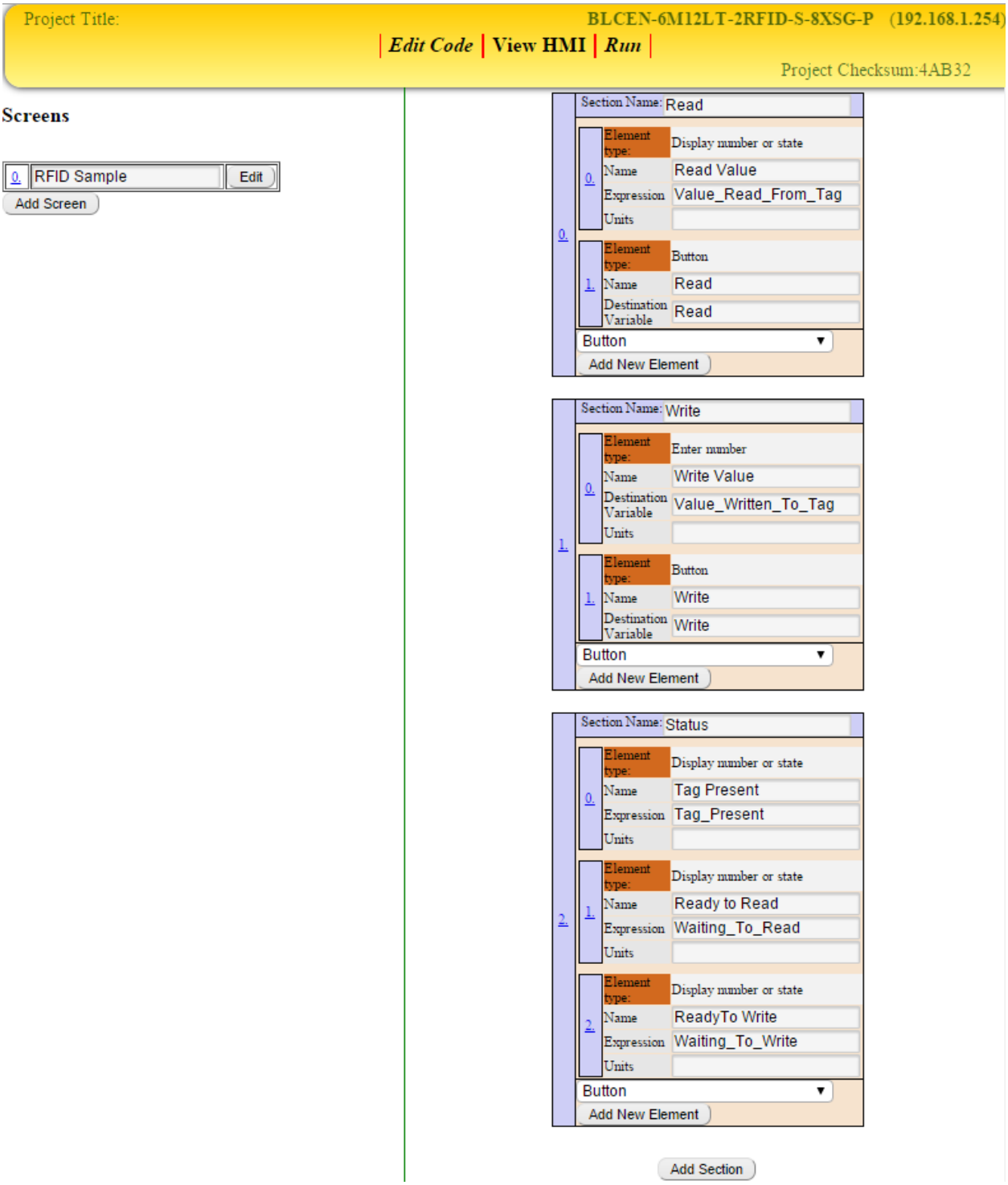

5.
Condition
(State = Write_Bit_Is_High) & (!IO.Slot1.Input.Done_0)
Actions
0. Assignment
Destination: IO.Slot1.Output.Write_0
Expression: 0
1. Assignment
Destination: State
Expression: Write_Wait_For_Done_Bit
Assignment
Add Action
6.
Condition
(State = Write_Wait_For_Done_Bit) & IO.Slot1.Input.Done_0
Actions
0. Assignment
Destination: State
Expression: Start_up
Assignment
Add Action
7.
Condition
Read
Actions
0. Assignment
Destination: State
Expression: Read_State_Machine
1. Assignment
Destination: Read
Expression: 0
2. Assignment
Destination: Waiting_To_Read
Expression: 1
Assignment
Add Action



Explaining the Code: The user created the “Read” and “Write” program variables so the ARGEE HMI buttons would have a way to start the RFID operation. The “Tag Present”, “Waiting To Read” and “Waiting To Write” program variables are status bits that can be displayed on the HMI. Everything else is identical to the state machine explanation.

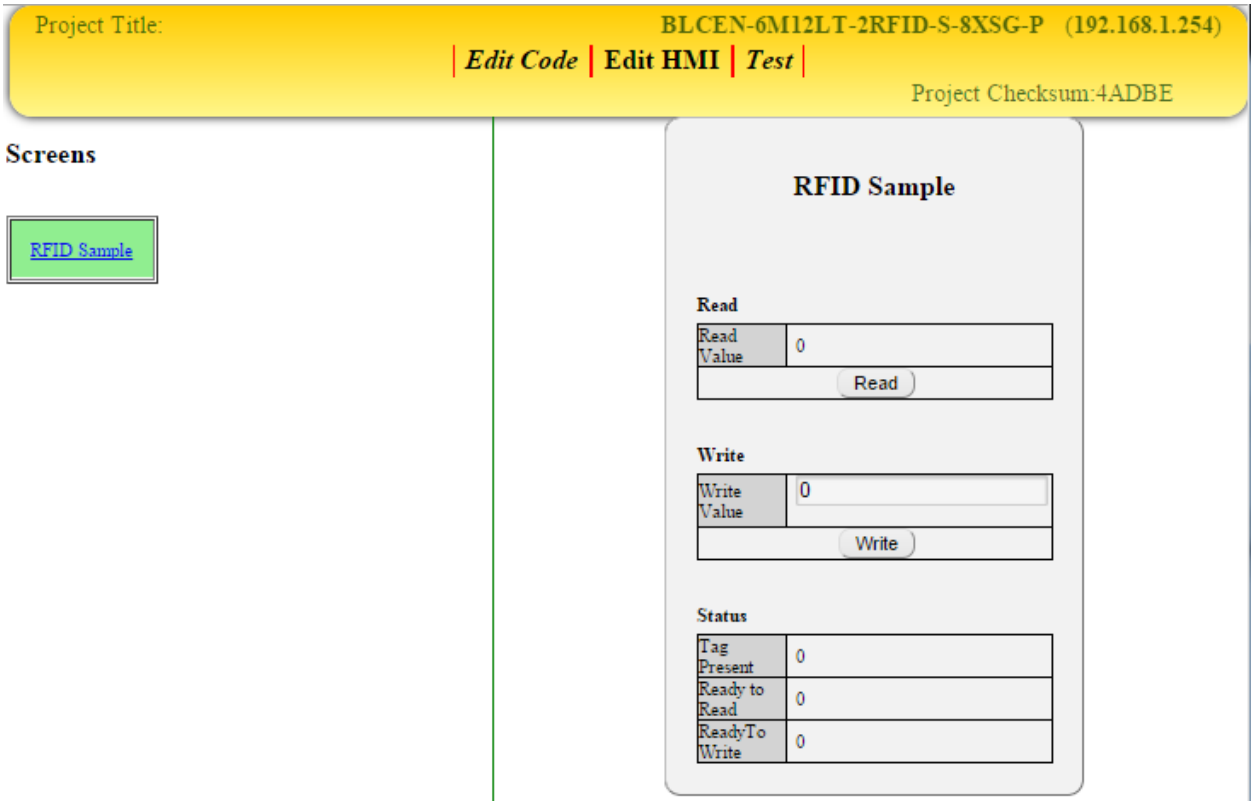
The RFID example continues on the next page.

Building the RFID HMI
After the code is written, the user clicks *Edit HMI* from the ARGEE menu bar.



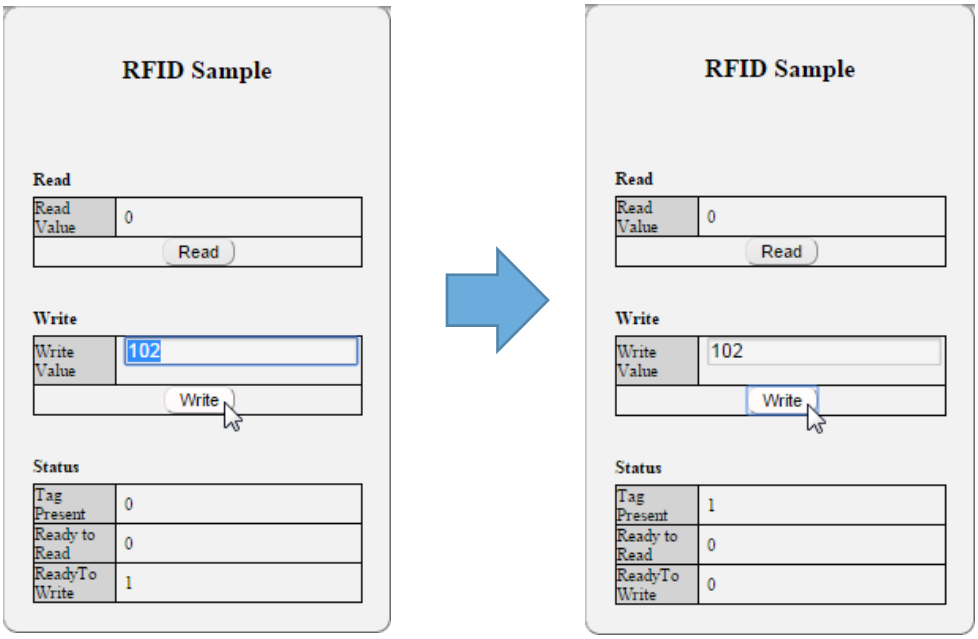
Explaining the RFID HMI: The user creates a “Read” section with two elements. One element displays the tag value and the other is a button that starts the “Read” operation. They also create a “Write” section with two elements. One element allows the user to enter a value and the other is a button that starts the “Write” operation. The “Status” section just displays status bits.

Working with the RFID HMI
To start working with the RFID HMI, the users clicks *Run* and then *View HMI* from the ARGEE menu bar.



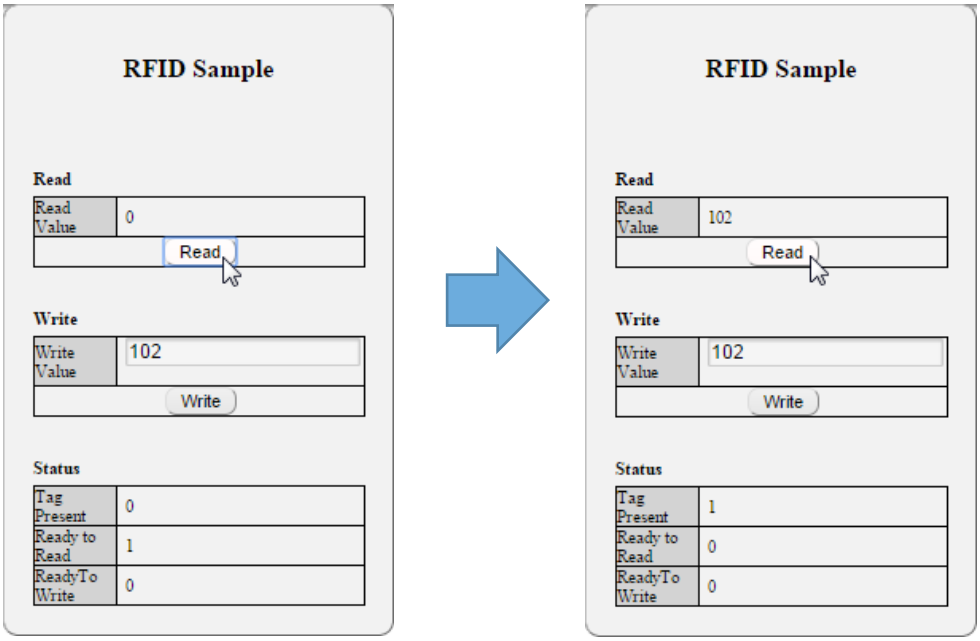
The RFID example continues on the next page.

Writing to a tag
If the user wants to write to a tag, they must first type a value into the *Write Value* field and click the *Write* button.



Explaining "Write": When the user types a value into the *Write Value* field and clicks *Write*, the "Ready To Write" status bit is true. When a tag is presented to the transceiver, the "Ready To Write" status bit goes false and the "Tag Present" bit goes true.

Reading from a tag
If the user wants to read tag, simply click the *Read* button and then present a tag to the transceiver.

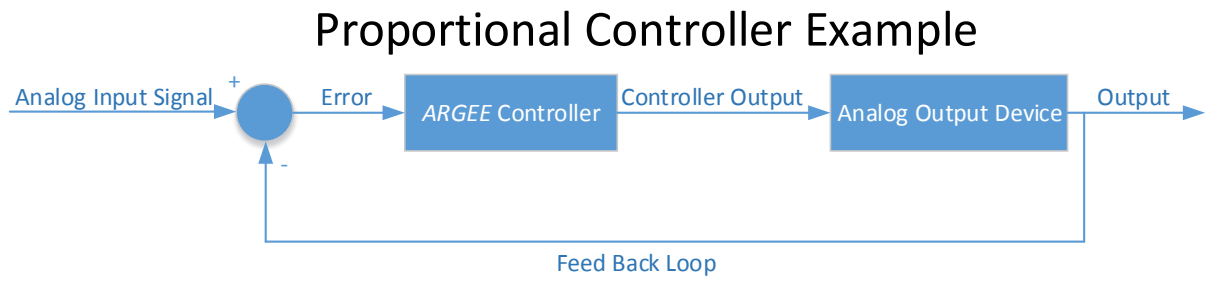


Explaining "Read": When the user clicks "Read", the "Ready To Read" status bit is true. When a tag is presented to the transceiver, the "Ready To Read" status bit goes false and the "Tag Present" bit goes true. The tag value is displayed in the "Read Value" field.

Working with Analog

If the user wants to use an Analog input signal to track errors and make corrections to an Analog output signal (Similar to a proportional Controller), they no longer need a PLC. ARGEE has the ability to apply logic and math to analog signals.

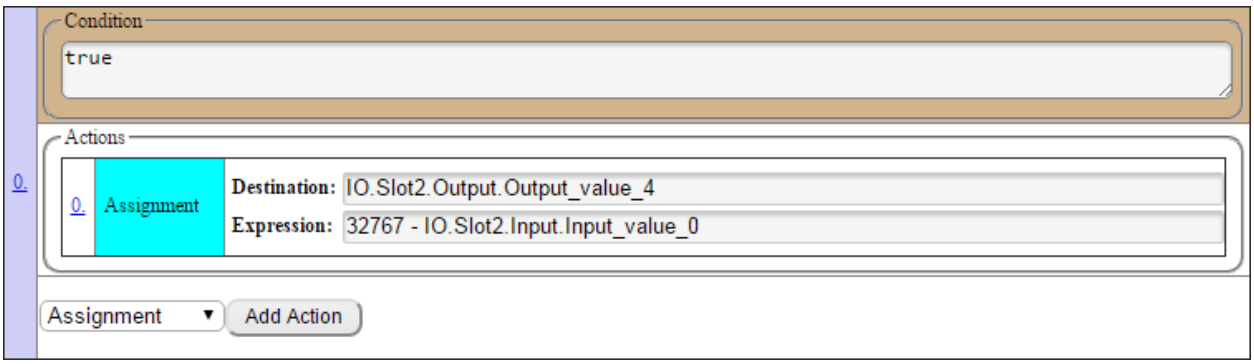
Explaining a Proportional Controller: A proportional controller continuously calculates the difference between the output and the input. The purpose of a proportional controller is to minimize the difference (error) by adjusting the controller's output.



Example of Analog - Proportional Controller

The user wants to create a simple proportional controller, where an Analog input signal inversely controls an Analog output signal. The user must first teach the analog input sensor what the minimum and maximum ranges of the application are (Read sensor data sheet to learn how to teach minimum and maximum ranges). The user is using a 4-20 mA input signal and outputting a 0-10 VDC signal.

Write the Code



Explaining the Code: Analog sensors use 16 bit signed integers. Therefore the range of the analog input signal is from -32767 -> +32767. The user want's an inversely proportional controller, so they are taking 32767 – Input_value-_0 and loading that value into Output_value_4.

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Appendix

I/O Variable Definitions

Slot “0” Diagnostics Definitions

Module_Diagnostics_Available : Module Diagnostics Bit
Station_Configuration_Changed : Station Configuration Changed Bit.
Overcurrent_Isys : Station Overcurrent Register Bit
Overvoltage_Field_Supply_V1 - Overvoltage_Field_Supply_V2 : Station Overvoltage Register Bit
Undervoltage_Field_Supply_V1 - Undervoltage_Field_Supply_V1 : Station Under Voltage Register Bit
Modulebus_Communication_Lost : Module communication register Bit
Modulebus_Configuration_Error : Module Error Bit
Force_Mode_Enabled : Force Mode Enabled Bit

Slot 1 or 2 Input Definitions

Input_Value_0 – Input_Value_7 : Input Channel Registers
XCVR_DETUNED_0 - XCVR_DETUNED_1 : Transceiver Detuned Bit
TFR_0 – TFR_1 : Transfer Data Bit
TP_0 – TP_1 : Tag Present Bit
XCVR_ON_0 - XCVR_ON_1 : Transceiver On Bit
XCVR_CON_0 - XCVR_CON_1 : Transceiver Connected Bit
Error_0 – Error_1 : Error Bit
Busy_0 – Busy_1 : Busy Bit
Done_0 – Done_1 : Done Bit
Error_code_0_0 - Error_code_2_0 : Error Code Bits
Read_data_0_0 – Read_data_7_0 : Read Data Registers

Diagnostics Definitions

Output_signal_overcurrent_1 - Output_signal_overcurrent_16 : Signal Overcurrent Error Bit
Overcurrent_on_sensor_group : Sensor Overcurrent Error Bit
Overcurrent_supply_VAUX1/2_at_channels_1-7 : Supply Overcurrent Error Bit
Overcurrent_VAUX1/2_Digital_In_CH1-16: AUX Power Overcurrent Error Bit
Measued_value_out_of_range_0 - Measued_value_out_of_range_3 : Measured Value Out of Range Bit
Wire_break_0 – Wire_break_3 : Wire Break Bit. Used for wire break detection.
Hardware_failure_0 – Hardware_failure_7 : Hardware Failure Bit
Output_value_out_of_range_4 - Output_value_out_of_range_7: Output Value Out of Range Bit
Output_signal_overcurrent_0 - Output_signal_overcurrent_16 : Output Signal Overcurrent Bit
Transc_param_not_supported_0/1: Transceiver Parameter Not Supported Bit
Module_parameter_invalid_0/1: Module Parameter Invalid Bit
Hardware_failure_transceiver_0/1: Transceiver Hardware Failure Bit
Transc_power_supply_error_0/1: Transceiver Power Supply Error Bit

Slot 1 or 2 Output Definitions

Output_value_0 – Output_value_7 : Output channel register.
Reset_0 – Reset_1 : Transceiver Reset Bit
XCVR_Info_0 - XCVR_Info_1 : Transceiver Information Bit
TAG_Info_0 - TAG_Info_1 : Tag Information Bit
Write_0 – Write_1 : Write Bit
Read_0 – Read_1 : Read Bit
Tag_ID_0 – Tag_ID_1 : Tag ID Bit
Next_0 – Next_1 : Next Bit
XCVR_0 – XCVR_1 : Turn Transceiver On Bit
Byte_count_0 – Byte_count_2 : The Byte Count Bytes.
Domain_0 – Domain_1 : Domain Bit
Address_0 – Address_1 : Set Read/Write Address Bit
Write_data_0_0 - Write_data_7_0 : Wrtie Registers