EPSON

EPSON RC+ 7.0 Option

AOI

(Add-On Instructions)

Rev.1

EM208S4407F

EPSON RC+ 7.0 Option AOI (Add-On Instructions) Rev.1

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AOI (Add-On Instructions)

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FOREWORD

Thank you for purchasing our robot products.
This manual contains the information necessary for the correct use of the Manipulator.
Please carefully read this manual and other related manuals before installing the robot system.
Keep this manual handy for easy access at all times.

WARRANTY

The robot and its optional parts are shipped to our customers only after being subjected to the strictest quality controls, tests, and inspections to certify its compliance with our high performance standards.

Product malfunctions resulting from normal handling or operation will be repaired free of charge during the normal warranty period. (Please ask your Regional Sales Office for warranty period information.)

However, customers will be charged for repairs in the following cases (even if they occur during the warranty period):

1. Damage or malfunction caused by improper use which is not described in the manual, or careless use.
2. Malfunctions caused by customers' unauthorized disassembly.
3. Damage due to improper adjustments or unauthorized repair attempts.
4. Damage caused by natural disasters such as earthquake, flood, etc.

Warnings, Cautions, Usage:

1. If the robot or associated equipment is used outside of the usage conditions and product specifications described in the manuals, this warranty is void.
2. If you do not follow the WARNINGS and CAUTIONS in this manual, we cannot be responsible for any malfunction or accident, even if the result is injury or death.
3. We cannot foresee all possible dangers and consequences. Therefore, this manual cannot warn the user of all possible hazards.

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TRADEMARK NOTATION IN THIS MANUAL

Microsoft® Windows® 8 Operating system
Microsoft® Windows® 10 Operating system
Throughout this manual, Windows 8, and Windows 10 refer to above respective operating systems. In some cases, Windows refers generically to Windows 8, and Windows 10.

NOTICE

No part of this manual may be copied or reproduced without authorization.
The contents of this manual are subject to change without notice.
Please notify us if you should find any errors in this manual or if you have any comments regarding its contents.

MANUFACTURER

SEIKO EPSON CORPORATION

CONTACT INFORMATION

Contact information is described in “SUPPLIERS” in the first pages of the following manual:

Robot System Safety and Installation Read this manual first

1. Introduction

This manual contains instructions on how to use EPSON RC+ 7.0 SPEL AOI (Add-On-Instructions). AOI allows Allen-Bradley® PLC users to execute commands in EPSON robot controllers from a PLC ladder logic program. EPSON AOI uses extended remote I/O to communicate with the controller via EtherNet/IP.

2. Operation

2.1 Requirements

To use SPEL Add-On-Instructions, the following are required:

- An EPSON robot controller with an EtherNet/IP Fieldbus slave board installed. The controller must have firmware version 7.5.0.0 or greater installed.
- A Windows PC with EPSON RC+ 7.0 v7.5.0 or greater installed. This is used to configure the robot controller for AOI operation, and to create a project in the controller when a robot point file is used.

2.2 Robot Controller Preparation

To prepare the robot controller for SPEL AOI execution:

1. Install an EtherNet/IP Fieldbus slave board in the controller and connect it to the Ethernet network used for communication with the PLC.
2. Configure the robot controller for use with SPEL AOI. See chapter 3. *Configuring the Robot Controller*.

2.3 PLC Project Preparation

To prepare the PLC project for SPEL AOI execution:

1. Setup the A1 EtherNet module for communication with the robot controller. You can import the EpsonEtherNetIP.L5X file (recommended), or you can manually set it up. See chapter 5, *Creating a PLC Program*.
2. Either import all SPEL AOIs into the project by importing SPEL_All.L5x, or import the desired SPEL AOIs separately. You must always import the SPEL_Init AOI.
3. Create a rung for execution of the SPEL_Init AOI. This must be executed once before executing other AOIs. SPEL_Init executes SPEL_ResetError and checks robot controller configuration. There are no errors, then AOI execution is allowed.

2.4 SPEL AOI Common Inputs and Outputs

Each SPEL AOI has the following common inputs and outputs:

Inputs:

Name of AOI	A local tag that references the name of the AOI.
ExtInputs	These are the input IO mapping.
ExtOutputs	These are the output IO mapping.
Start	This is the input that starts the AOI.

Outputs:

InCycle	BOOL output bit that indicates the status of execution of the AOI. If this is high, then the AOI is executing.
Done	BOOL output bit that indicates the status of completion of the AOI. If this is high, then the AOI execution is complete.
Error	BOOL output bit that indicates if an error occurred during execution.
ErrCode1 and ErrCode2	INT error codes from the robot controller. These should be 0 in normal operation, and one or both are greater than 0 when the Error bit is high.

AOIs have additional inputs and/or outputs. These are described separately for each AOI in the chapter 5.*SPEL AOI Reference*.

2.5 SPEL AOI General Operation

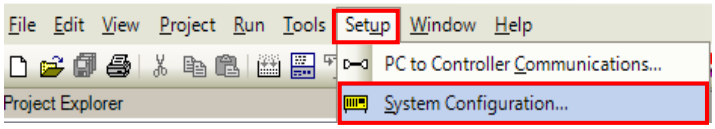
General operation of all SPEL AOIs is as follows:

1. SPEL_Init AOI must have been executed one time sucessfully before executing other SPEL AOIs.
2. Set the Start input from low to high to start execution.
3. During execution, the Done and Error output bits are set to low and the InCycle output bit is set to high.
4. After execution, the Done output bit is set to high and the InCycle output bit is set to low. If an error occurred during execution, the Error output bit is set to high, and the error code values ErrCode1 and ErrCode2 are set. See the chapter *6. Error Codes* for more information.
5. If an error occurs, SPEL AOI execution is prevented until the SPEL_ResetError AOI is executed.

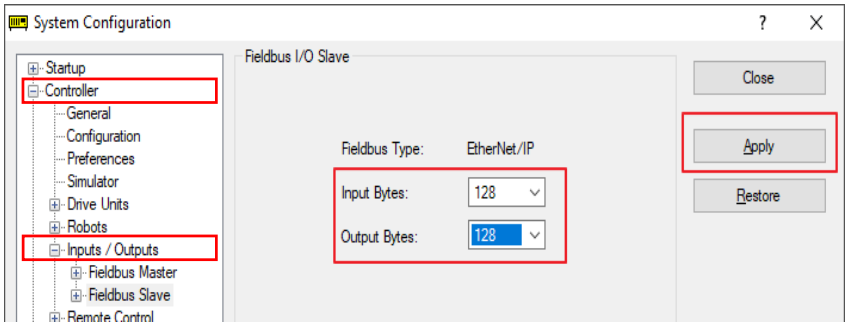
3. Configuring the Robot Controller

In this chapter we will describe how to configure the robot controller Fieldbus slave to work with the PLC when using SPEL AOIs. Perform the following steps:

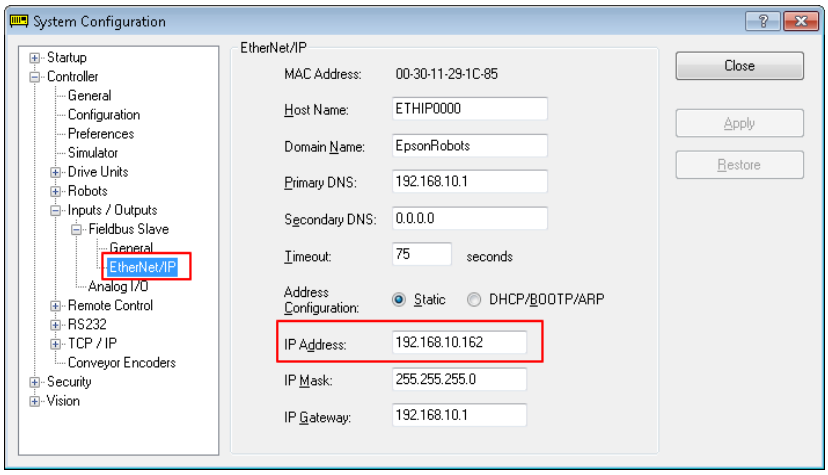
1. Start EPSON RC+ 7.0 on your PC.
2. Connect to the robot controller. You may need to configure a connection to the robot controller in [Setup]-[PC to Controller Communications]. See the EPSON RC+ 7.0 User's Guide for instructions.
3. From the [Setup] menu, select [System Configuration].



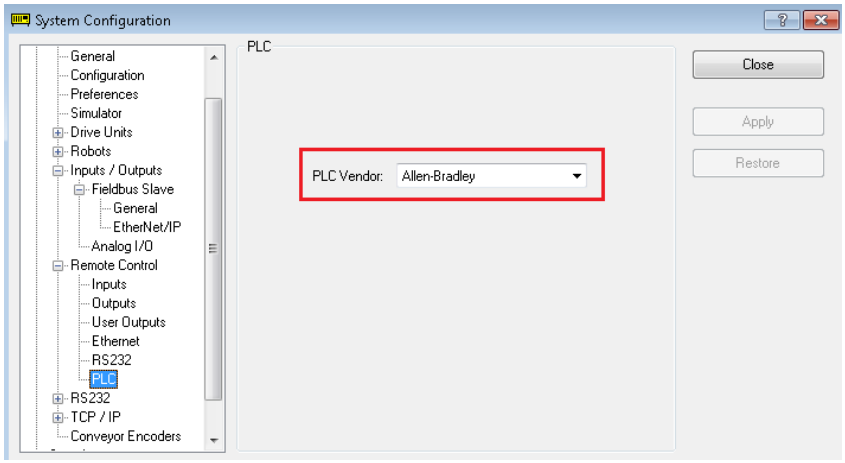
4. Click [Controller]-[Inputs/Outputs]-[Fieldbus Slave]. Configure the number of input and output bytes to 128 as shown below, then click <Apply>.



5. Expand [Fieldbus Slave] in the tree and select [Ethernet/IP].
   Set the IP address, mask, and gateway that will be used for communication from the A1 EtherNet module in the PLC.



6. Select [Remote Control]-[PLC] and select Allen-Bradley® as the PLC Vendor.



7. Click “Close” on the [System Configuration] dialog. The controller will restart.

4. Creating a PLC Project using SPEL AOIs

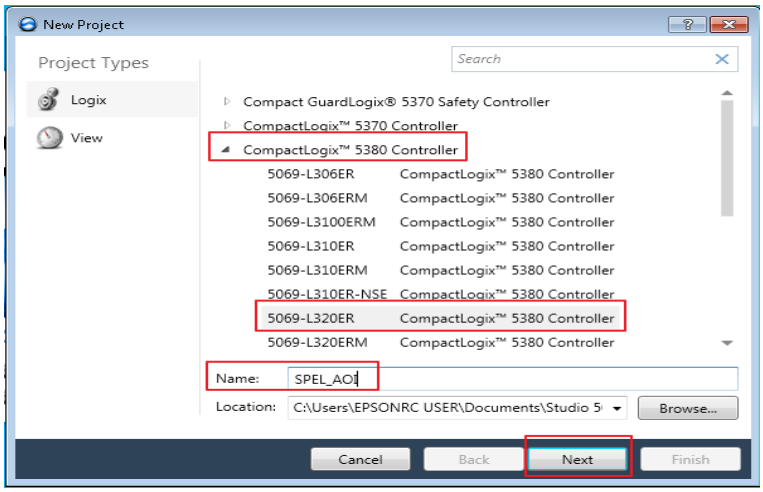
EPSON RC+ 7.0 users are provided with Allen-Bradley® Logix Designer files which are installed on the user PC by the EPSON RC+ v7.5.0 or greater installer. The files are located in \EpsonRC70\Fieldbus\EtherNetIP\AOI on the user PC.

In this chapter, we will show how to create a simple example project to turn robot motors on and off using SPEL AOIs.

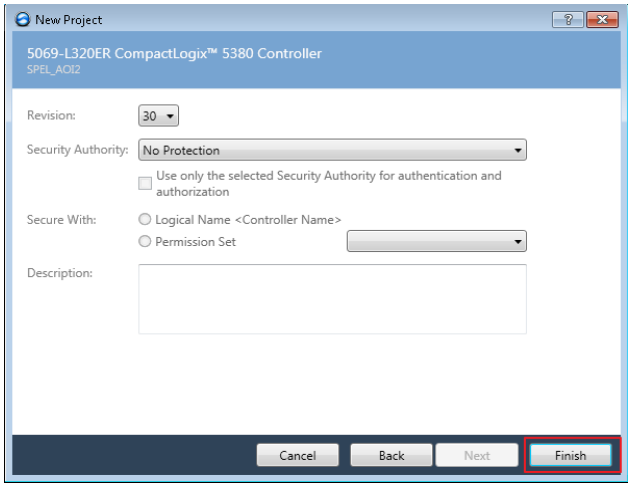
To create a new project, make sure you are in offline mode and follow these steps:

1. Start the Studio 5000® software, then click [New Project]. The New Project dialog will be displayed.

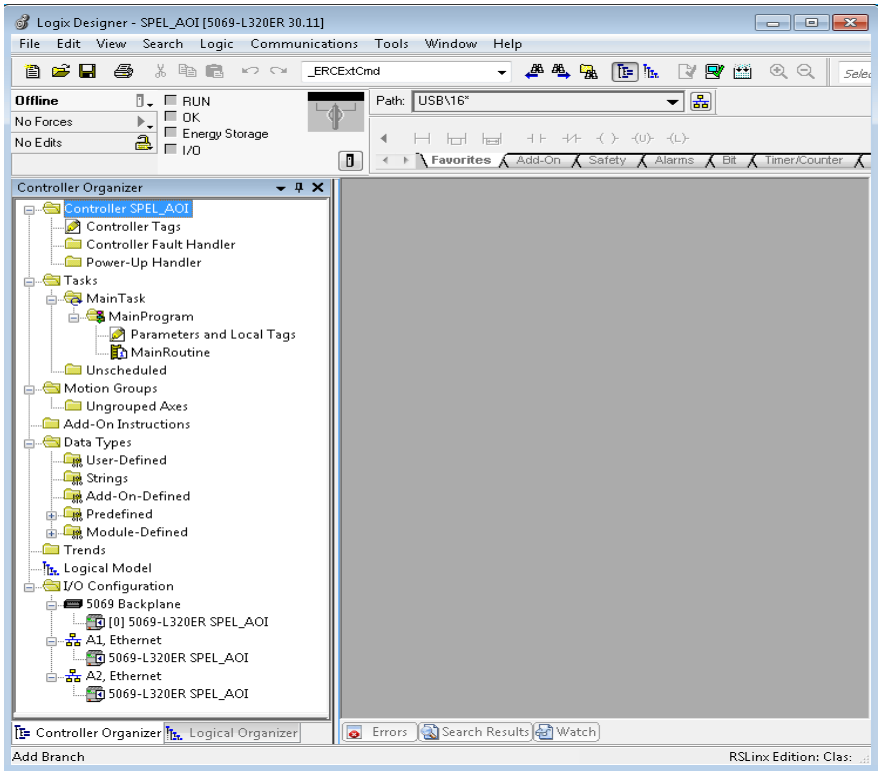
2. Choose your Controller family and PLC controller model number. Enter a project name under [Name], then click <Next>.



3. The dialog shown below will be displayed. Leave all choices as default, then click <Finish>.



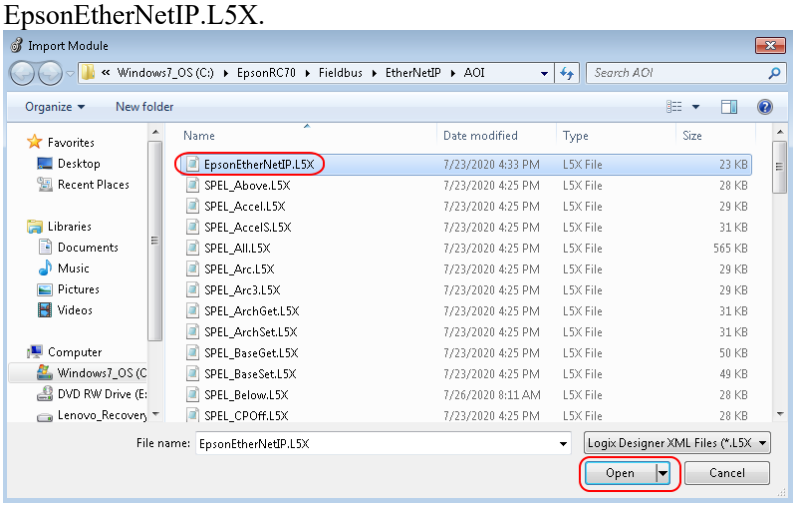
4. You have just created a new empty PLC project



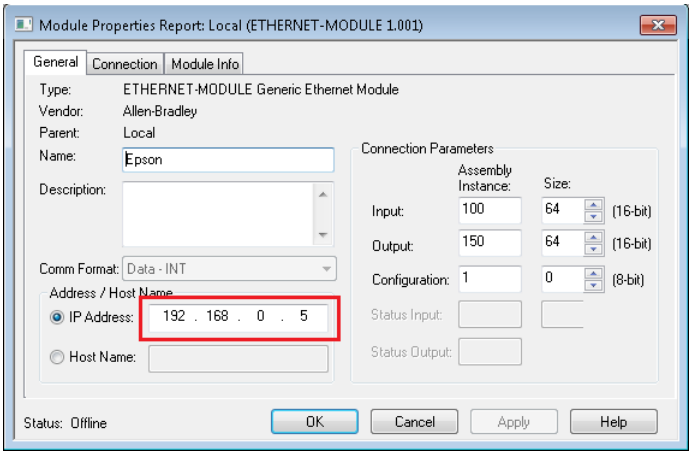
5. Now you need to add and configure the Ethernet module for communications with the robot controller. There are two methods: Import the file EpsonEtherNetIP.L5X, or perform manual configuration.

Importing the Ethernet configuration

1. Right click on [A1, Ethernet], then click [Import Module].
2. Navigate to \EpsonRC70\Fieldbus\EtherNetIP\AOI and select the file EpsonEtherNetIP.L5X.

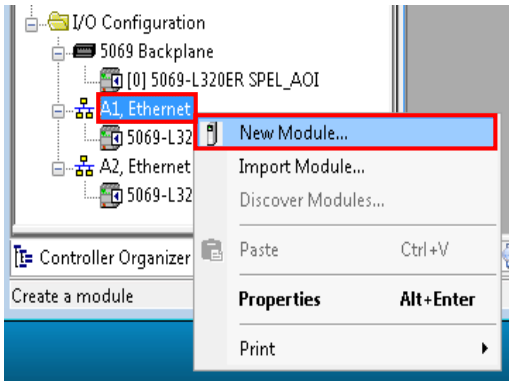


3. After import, right-click on the module and select Properties. Change the default IP address to be the address of the robot controller's EtherNetIP slave board.

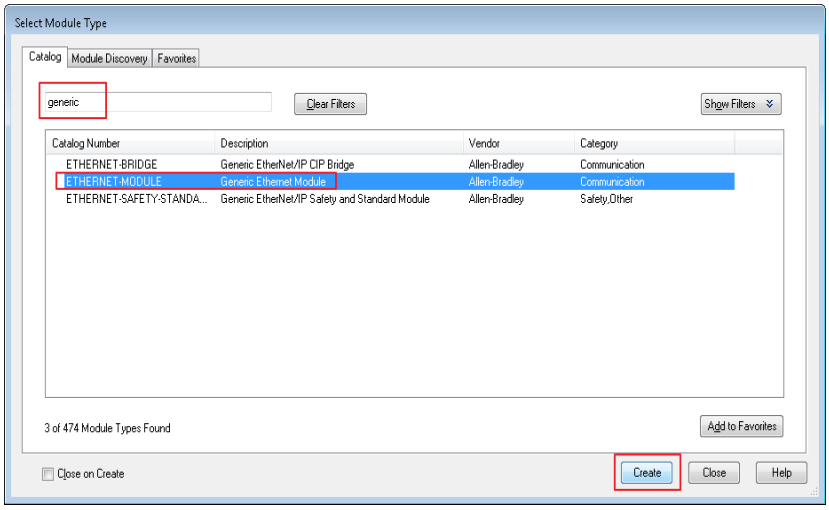


Manual Ethernet configuration

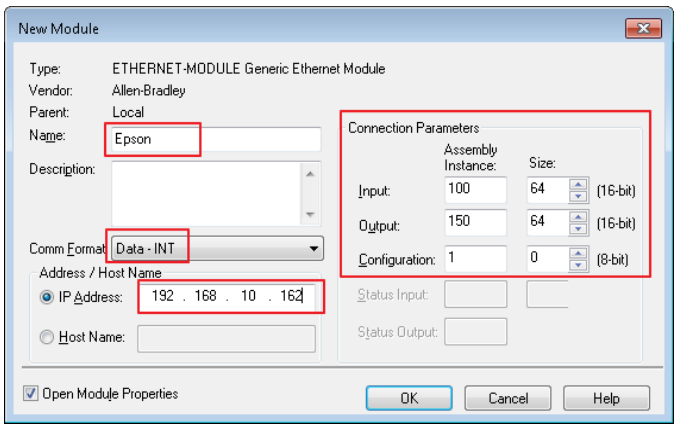
1. Right click on [A1, Ethernet], then click [New Module].



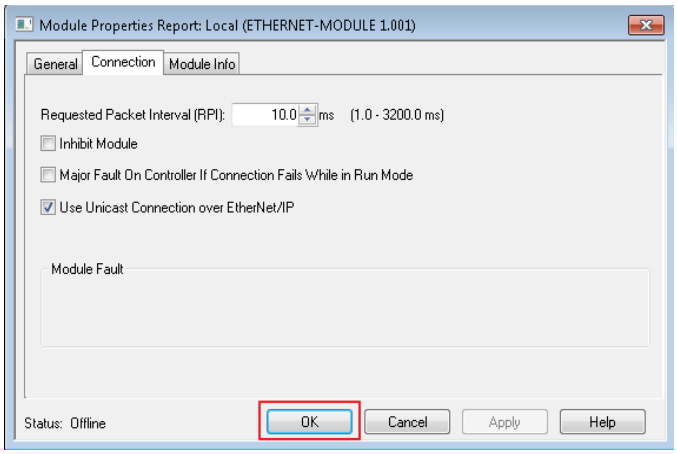
2. Type in “generic” in the search field. Click “ETHERNET MODULE” under catalog number, then click <Create>.



3. Enter the values as shown, and use the IP address of the robot controller EtherNet/IP slave, then click <OK>.



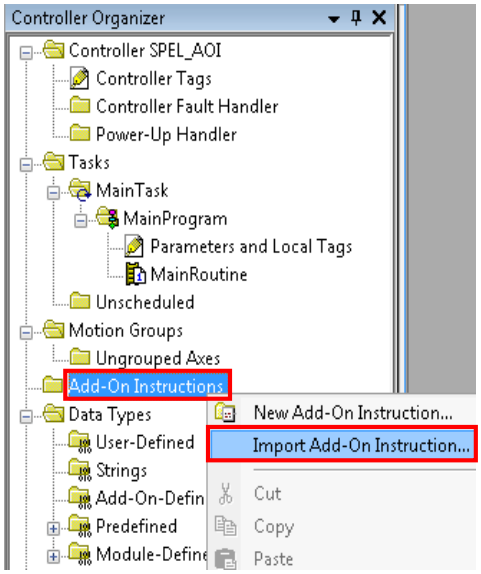
4. Click <OK> on the next window.



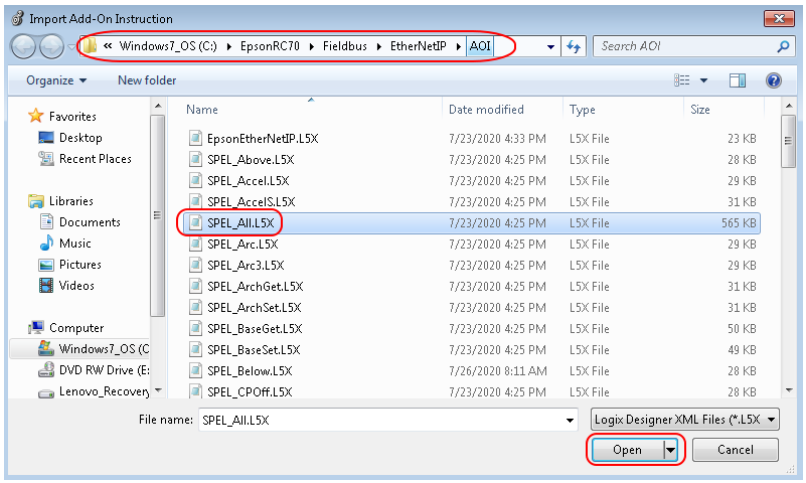
Saving your project at this stage is a good idea. When creating a new Ethernet module, please note that connection parameter values should match your robot controller values.

Import SPEL AOIs in to the new project

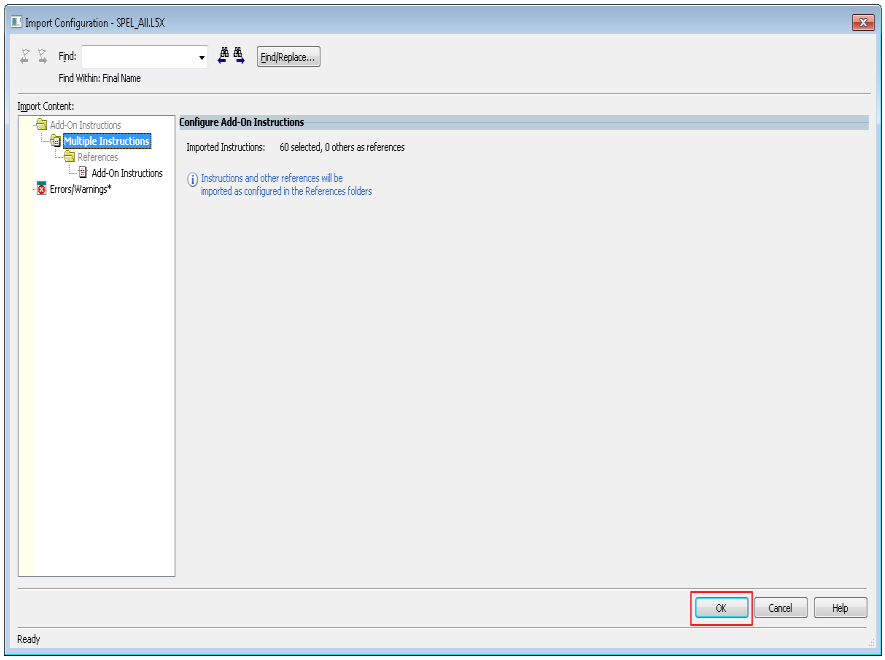
1. Now you need to import AOIs in the new project. For this example, you will import all SPEL AOIs. You can also import individual AOIs.
   To do this, right click on [Add-On Instructions] folder from [Controller Organizer], click [Import Add-On Instruction].



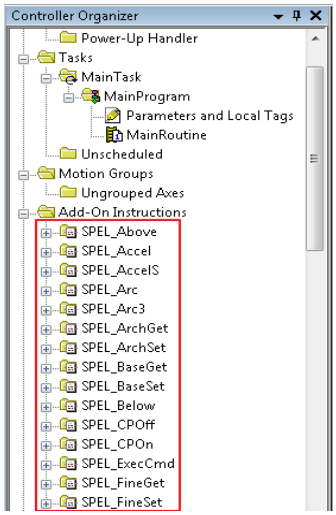
2. Navigate to \EpsonRC70\Fieldbus\EtherNetIP\AOI, then select “SPEL_All.L5X” file and click <Open>.



3. The dialog below is displayed. Check to make sure that there are no errors, then click <OK>.



4. Now you should see the list of all SPEL AOIs in the project.

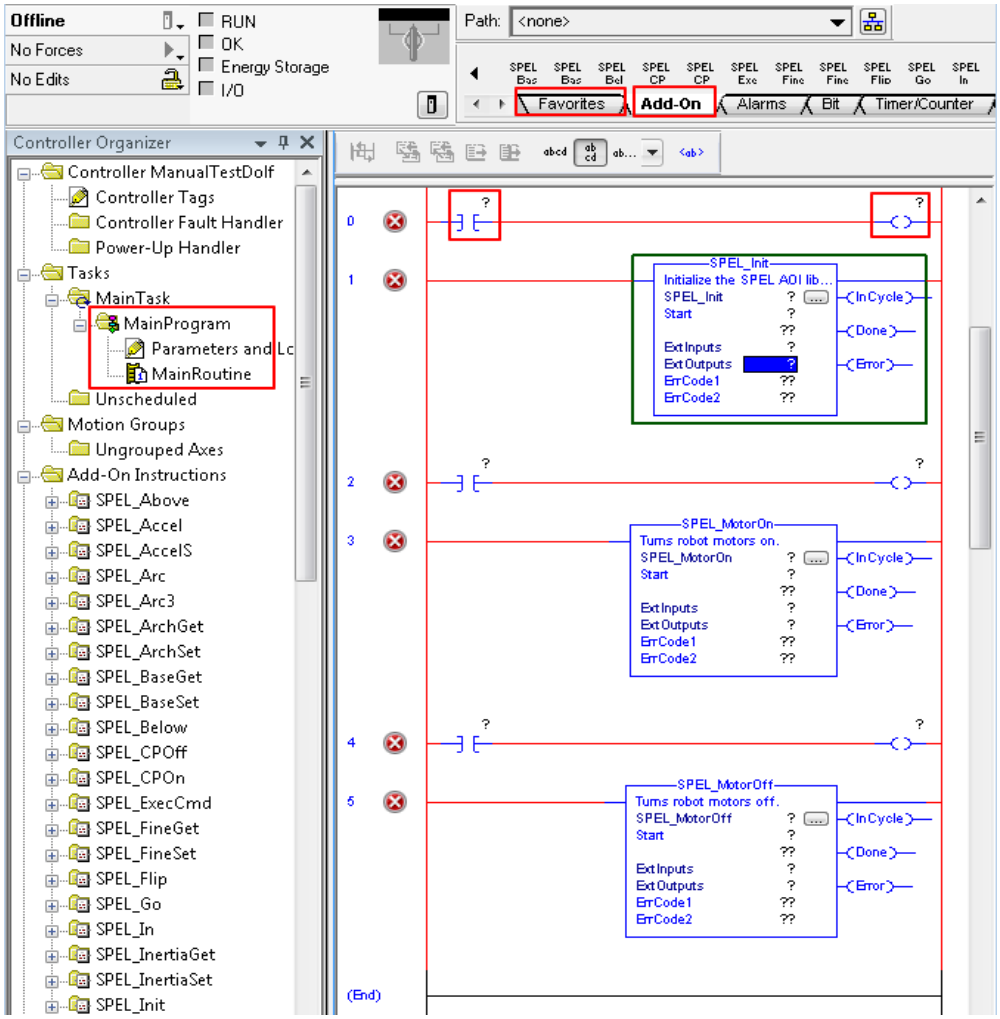


5. Now you can create a program.

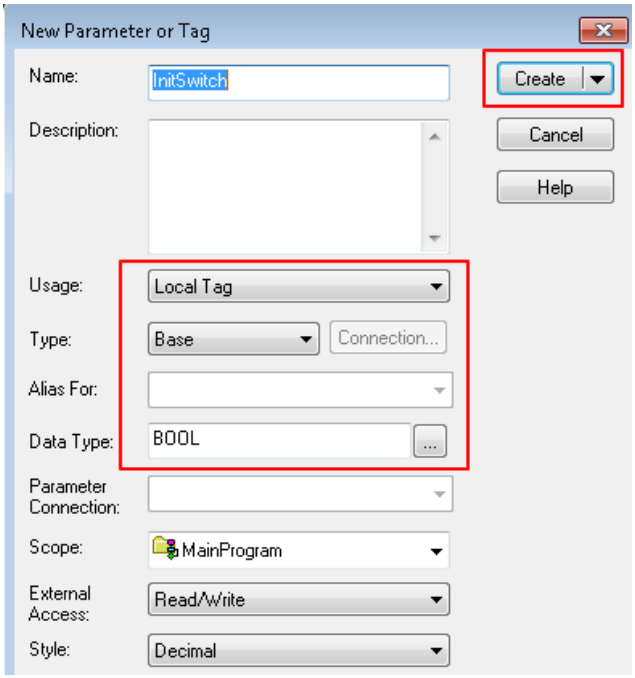
5-1. Expand [MainProgram], then double click on [MainRoutine].

5-2. Click [Favorites] tab, add 5 extra rungs. Then drag “Examine On” and “Output Energize” to rung 0, 2 and 4.

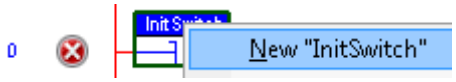
5-3. Click [Add-On] tab, drag “SPEL_Init” to rung 1, “SPEL_MotorOn” to rung 3, and “SPEL_MotorOff” to rung 5, like shown below.



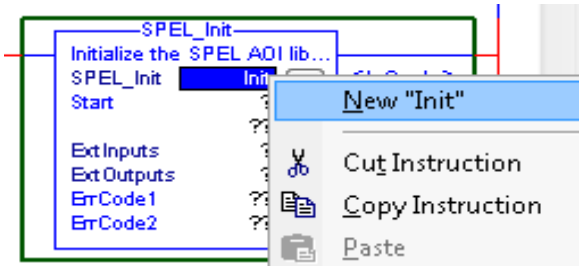
6. In rung 0, double click at [?] of “Examine On”, type in the name of the variable. In this case we will use “InitSwitch”.



7. Do the same step as above, in rung 0, double click on [?] of the “Output Energize”, and type “InitCoil”.
8. Right click on [InitSwitch], click on [New “InitSwitch”], then click <Create>, as shown below.



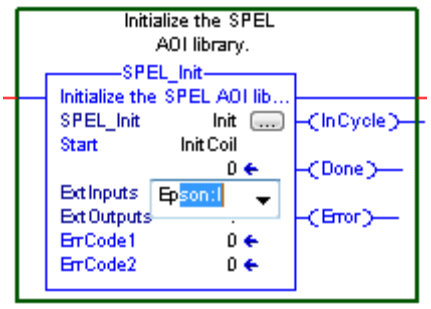
9. Create new variable “InitCoil” same method used in “InitSwitch”.
10. Do same steps in 14 to 17 for rung 2 and 4 to create new variables. Use variable name “MotorOnSwitch”, “MotorOnCoil” for rung 2, and “MotorOffSwitch”, “MotorOffCoil” for rung 4.
11. Now we configure SPEL_Init AOI inputs.
    11-1. Inside “SPEL_Init” block, click [?] to the right of [SPE_Init], and type “Init”.
    11-2. Right click on [Init], choose [New “Init”]. then click <Create>.



“Init” will be the name of the structure that holds all internal variable of “SPEL_Init” AOI.

    11-3. Click [?] next to “Start”, type “InitCoil”, you do not need to create a new variable.

11-4. Click [?] next to [ExtInputs], type “Ep”, it will auto populate, press <Enter>.



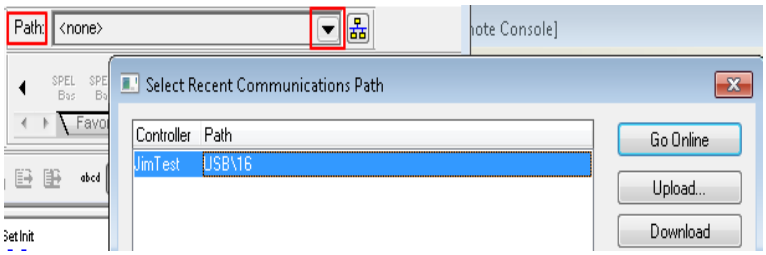
11-5. Do same step to [ExtOutputs]. “SPEL_Init” is now configured and the rung lines should change from red to blue.

11-6. Do the same steps as in 11-1 to 11-2 for rung 3 and 5. Choose “MotorOn” for rung 3, “MotorOff” for rung 5.

11-7. Do the same steps as in 11-3 for rung 3 and 5. Use “MotorOnCoil” for rung 3, “MotorOffCoil” for rung 5.

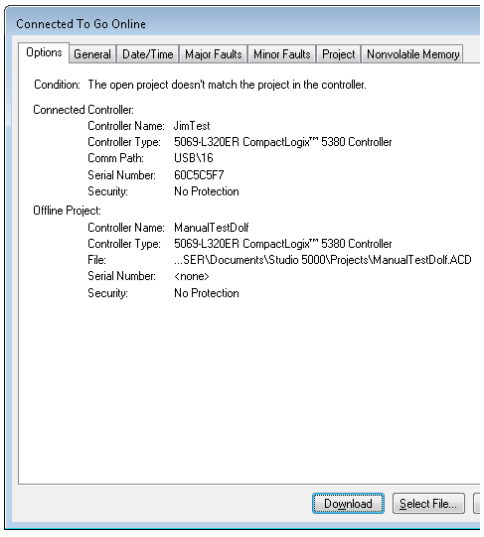
12. The program in now complete. Save the project.

13. Click the down arrow right to [Path] to choose communication path with controller.

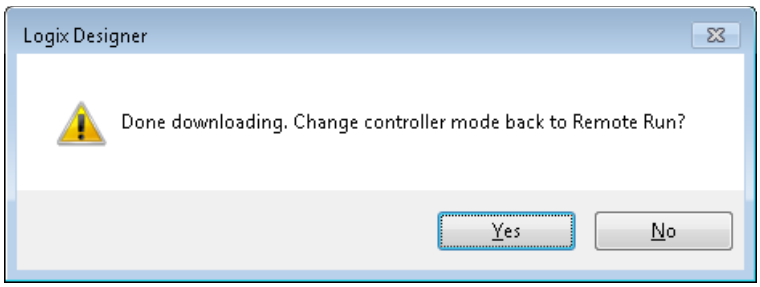


In this example I am using USB to connect my PC to the PLC controller.

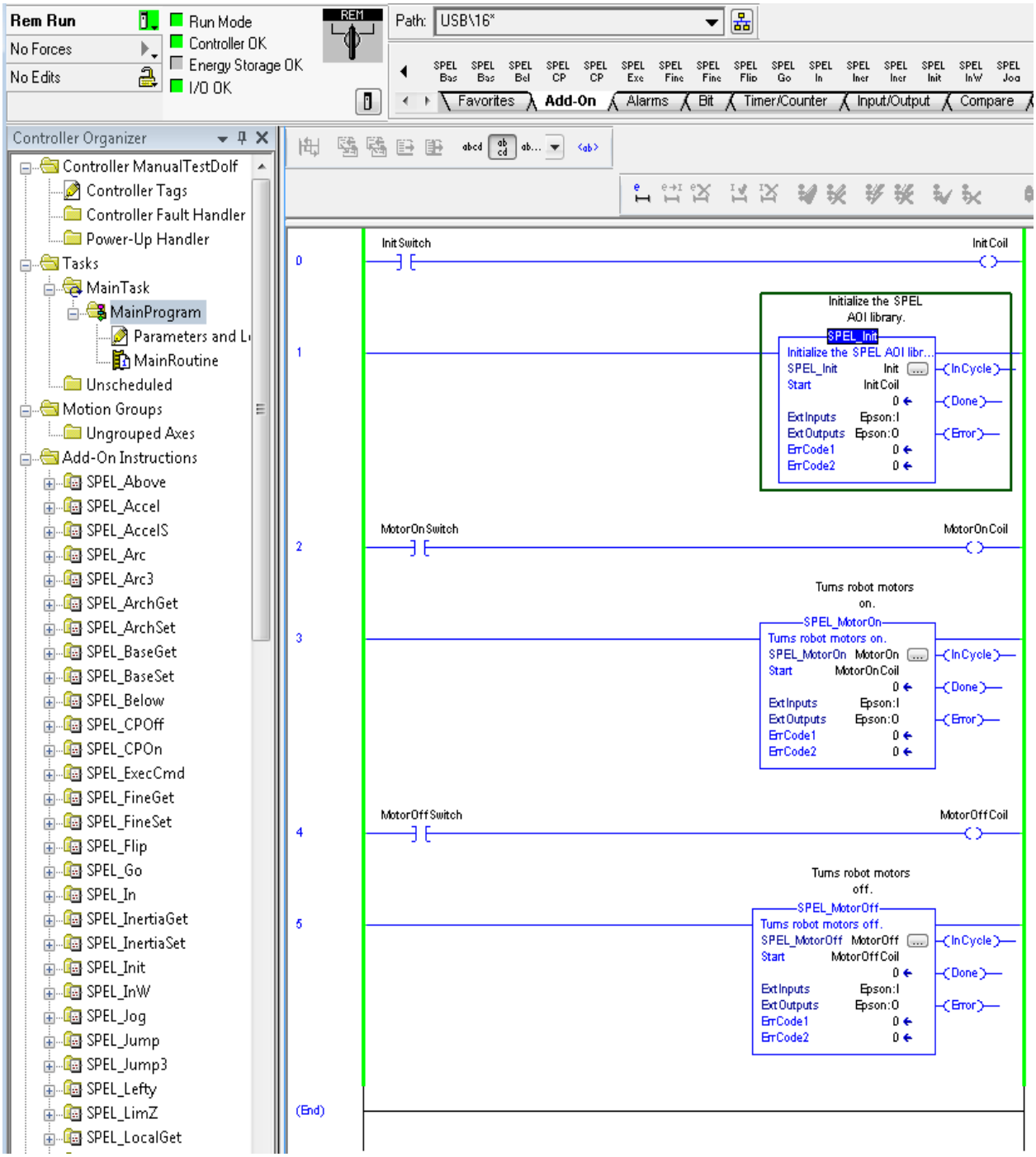
14. Double click on “USB” to close the window, then click <Download> in the next window to transfer program to PLC controller.



15. Click <Yes> in the next window if prompted to change PLC into “Remote Run” mode, like shown below.



16. PLC now in run mode and program is ready to be executed.



5. SPEL AOI Reference

In this chapter each SPEL AOI is described.

For AOI operation in general, refer to section 2.5, SPEL AOI General Operation.

For each AOI in the Operation section, there is also a referal to the corresponding SPEL+ command in the SPEL+ Language Reference manual which has more details about the command.

Each AOI has a simple example.

SPEL_Above

Description

Sets the elbow orientation of the specified point to Above.

Common inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT point number to set its orientation to ABOVE.

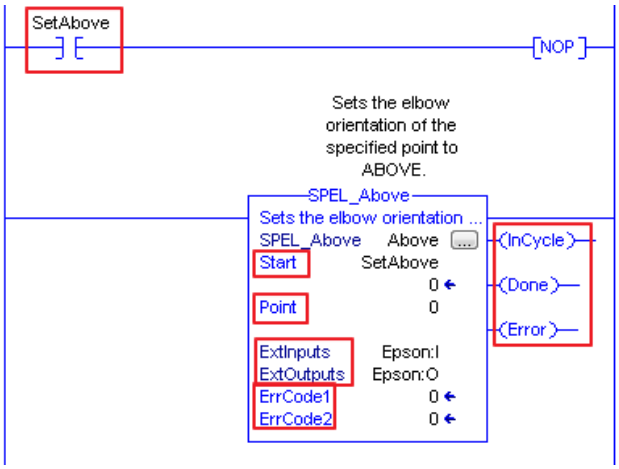
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Elbow Statement* in the SPEL+ Language Reference manual.

Example

To set P0 orientation to Above, set [Point] to “0”, as shown below.



SPEL_Accel

Description

Sets the point to point acceleration and deceleration. Specifies the ratio (%) of the maximum acceleration/deceleration using an integer equals to or greater than 1.

Common inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Accel INT value of acceleration as percentage.
Decel INT value of deceleration as percentage.

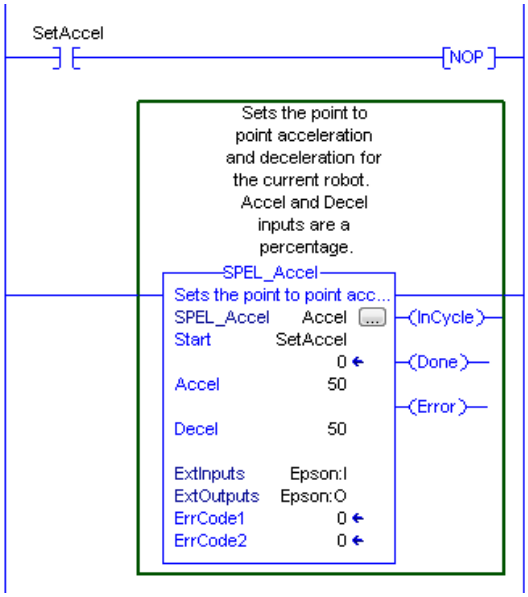
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Accel Statement* in the SPEL+ Language Reference manual.

Example

To set acceleration to 50% and deceleration to 50%, set [Accel] to “50” and [Decel] to “50”, as shown below.



SPEL_AccelS

Description

Sets acceleration and deceleration. Specifies the value which is the actual acceleration/deceleration in linear or CP motion (Unit: mm/sec2).

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Accel REAL value of acceleration.
Decel REAL value of deceleration.

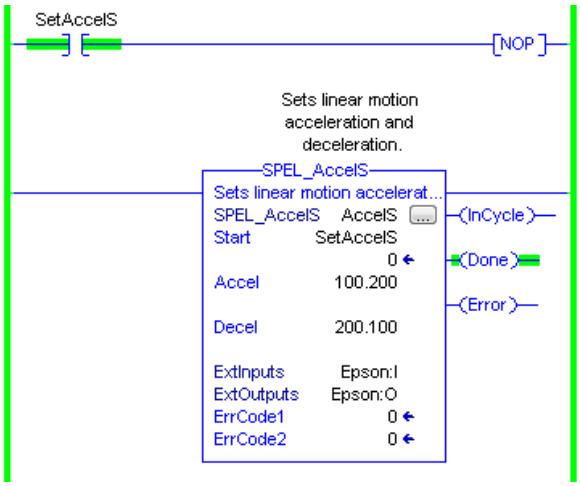
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *AccelS Statement* in the SPEL+ Language Reference manual.

Example

To set acceleration to 100.200, deceleration to 200.100, set [Accel] to “100.200”, [Decel] to “200.100”, as shown below.



SPEL_Arc

Description

Moves the arm from the current position to the specified position in circular interpolation motion on XY plane face.

Common Inputs and Outputs

Refer to section *2.4 SPEL AOI Common Inputs and Outputs.*

Inputs

midPoint	INT middle point in Arc command.
endPoint	INT end point in Arc command.

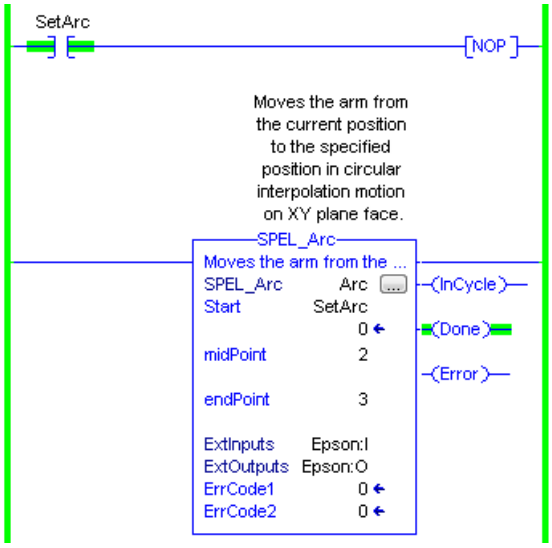
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Arc Statement* in the SPEL+ Language Reference manual.

Example

To move from current position passing through P2 and ending at P3, in a circular motion.



SPEL_Arc3

Description

Moves the arm from the current position to the specified position in circular interpolation in 3 dimensions.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

midPoint	INT middle point in Arc3 command.
endPoint	INT end point in Arc3 command.

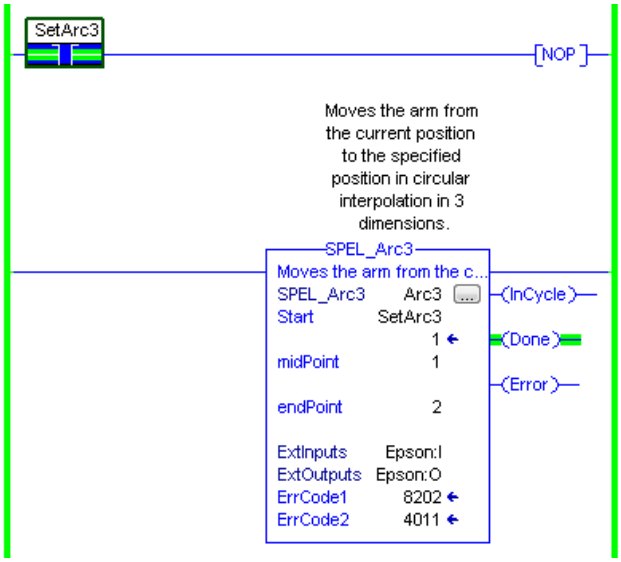
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Arc3 Statement* in the SPEL+ Language Reference manual.

Example

To move from current position passing through P1 and ending at P2, in a circular motion.



SPEL_ArchGet

Description

Gets the Arch parameter.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

ArchNum	INT desired Arch number.

Outputs

DepartDist	INT departing distance of the given Arch number.
ApproachDist	INT approaching distance of the given Arch number.

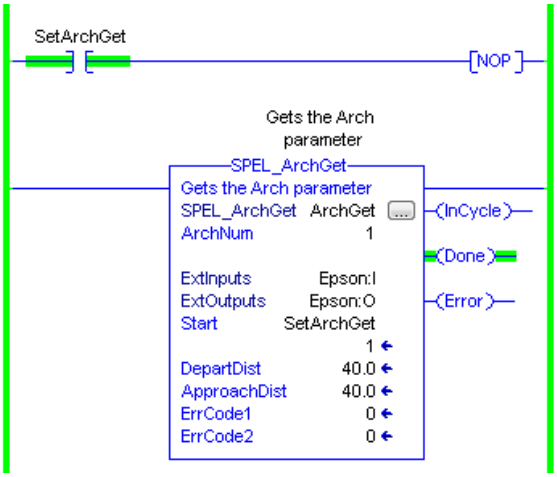
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Arch Function* in the SPEL+ Language Reference manual.

Example

To get the current values of approach and depart distances of given Arch, set the Arch number.



SPEL_ArchSet

Description

Sets the Arch parameter.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

ArchNum	INT desired Arch number.
DepartDist	REAL departing distance of the given Arch number.
ApproachDist	REAL approaching distance of the given Arch number.

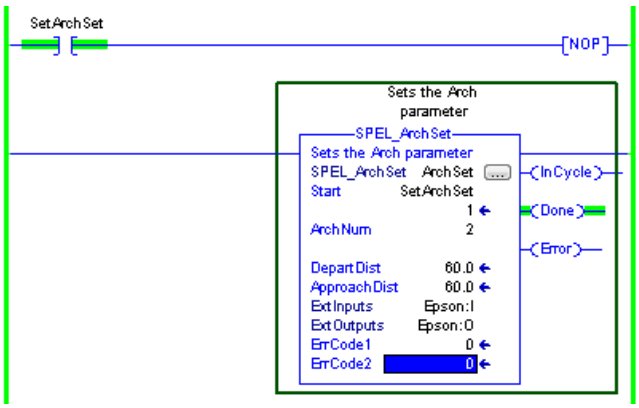
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Arch Statement* in the SPEL+ Language Reference manual.

Example

To set 60.0, 60.0 as depart and approach distances respectively of Arch 2, see below.



SPEL_BaseGet

Description

Gets the base coordinate system.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

NumAxes	INT number of robot axes. For a SCARA robot, use 4. For a 6-axis robot, use 6.

Outputs

BaseX	REAL base value of coordinate X.
BaseY	REAL base value of coordinate Y.
BaseZ	REAL base value of coordinate Z.
BaseU	REAL base value of coordinate U.
BaseV	REAL base value of coordinate V.
BaseW	REAL base value of coordinate W.

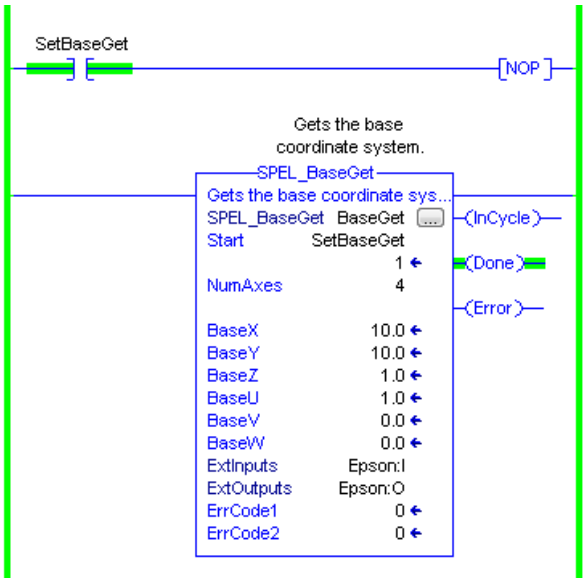
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Base Statement* in the SPEL+ Language Reference manual.

Example

To get the base values of X through W coordinates for SCARA robot, plug 4 for NumAxes. Base values will update as shown below.



SPEL_BaseSet

Description

Sets the base coordinate system.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

NumAxes	INT number of robot axes. For a SCARA robot, use 4. For a 6-axis robot, use 6.
BaseX	REAL base value of coordinate X.
BaseY	REAL base value of coordinate Y.
BaseZ	REAL base value of coordinate Z.
BaseU	REAL base value of coordinate U.
BaseV	REAL base value of coordinate V.
BaseW	REAL base value of coordinate W.

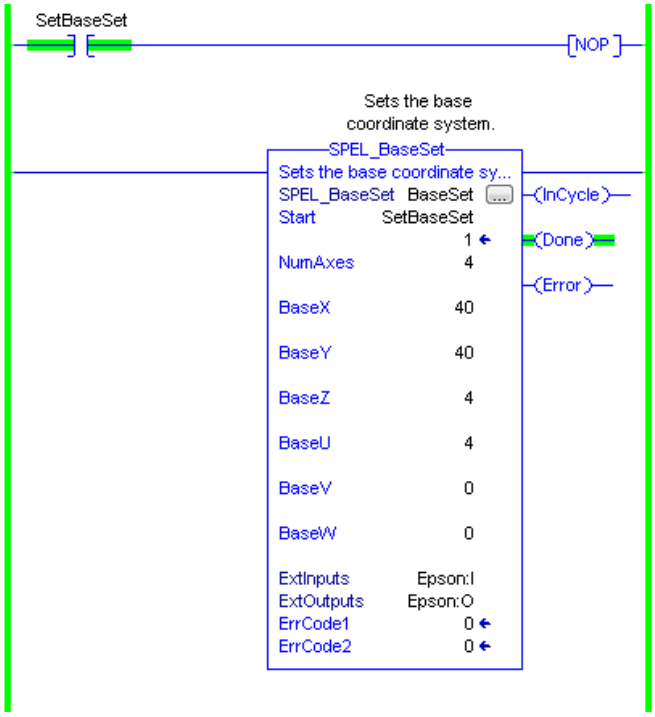
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Base Statement* in the SPEL+ Language Reference manual.

Example

To set the base value of a SCARA robot, set NumAxes = 4. Enter the base coordinate value for each axis, as shown below.



SPEL_Below

Description

Sets the elbow orientation of the specified point to Below.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point number.

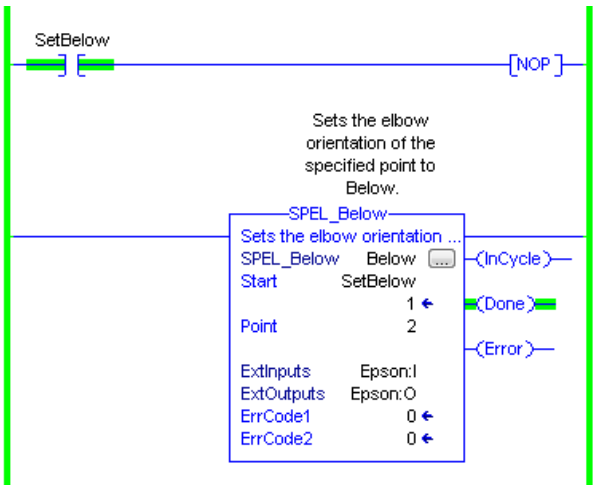
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Elbow Statement* in the SPEL+ Language Reference manual.

Example

To set orientation of P2 to below, enter 2 as point. As shown below.



SPEL_CPOff

Description

Turns off Continuous Path parameter.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

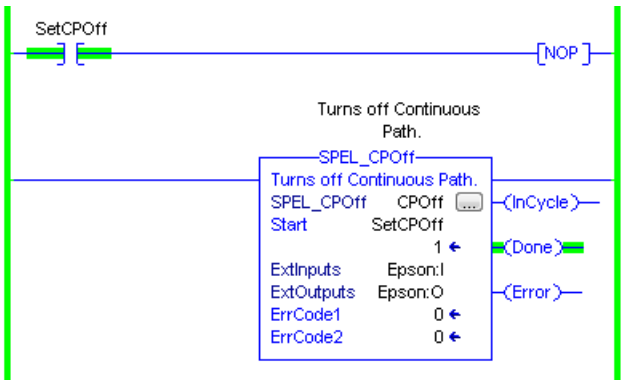
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *CP Statement* in the SPEL+ Language Reference manual.

Example

To set CP to off, run the AOI like as shown below.



SPEL_CPOn

Description

Turns on Continuous Path parameter.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

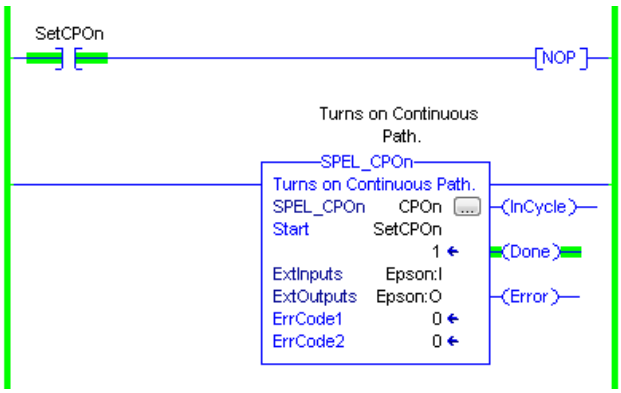
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *CP Statement* in the SPEL+ Language Reference manual.

Example

To set CP to On, run the AOI as shown below.



SPEL_ExecCmd

Description

The SPEL_ExecCmd AOI is used by other AOIs to execute a command in the robot controller.

SPEL_FineGet

Description

Gets the setting of positioning end judgement range for all joints.

Outputs

Axis INT position accuracy for each joint in encoder pulses.

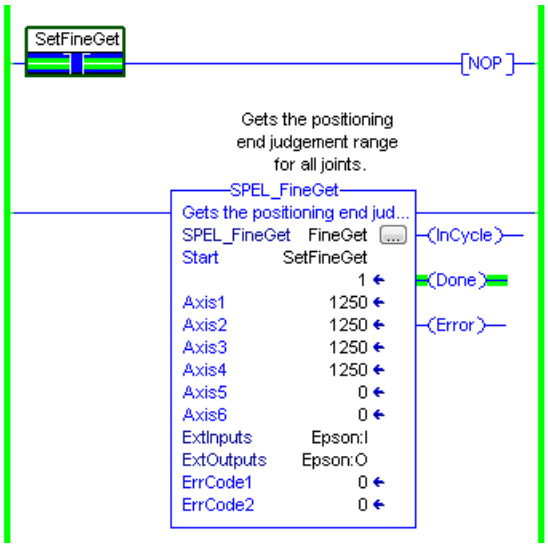
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Fine Function* in the SPEL+ Language Reference manual.

Example

To get the position accuracy for the robot, run the AOI as shown below.



SPEL_FineSet

Description

Sets the positioning end judgement range for all joints.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Axis1..Axis6 INT position accuracy for each joint in encoder pulses.

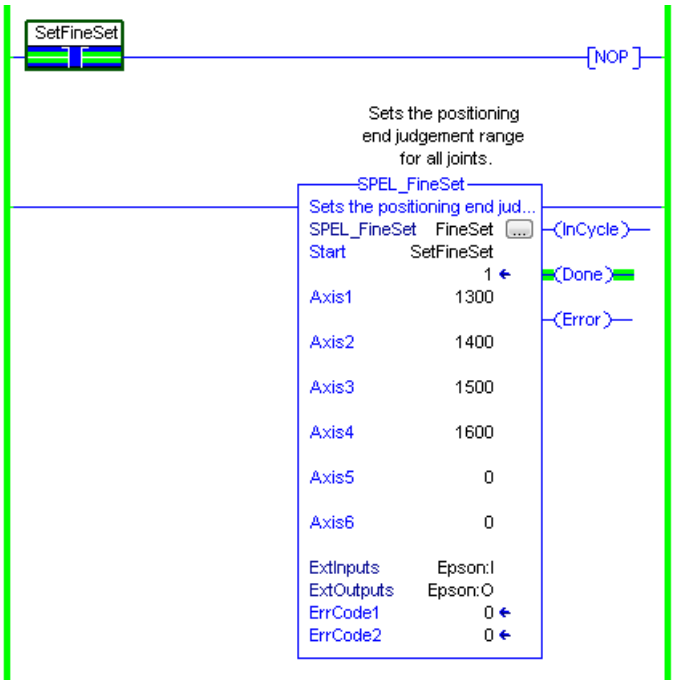
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Fine Statement* in the SPEL+ Language Reference manual.

Example

To set the position accuracy for the robot, enter the Axis values and run the AOI as shown below.



SPEL_Flip

Description

Sets the wrist orientation of the specified point to Flip.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point number.

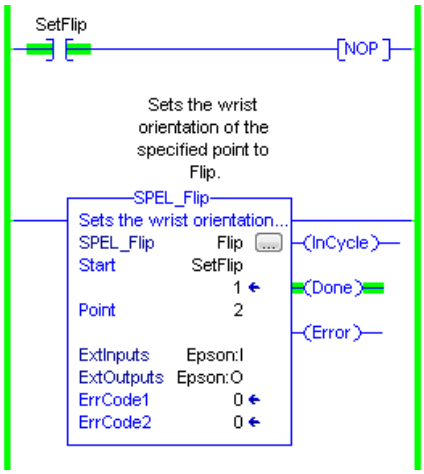
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Wrist Statement* in the SPEL+ Language Reference manual.

Example

To set orientation of robot point P2 to flip, enter 2 as the point number and run the AOI as shown below.



SPEL_Go

Description

Moves from the current position to the specified position in PTP motion.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point number.

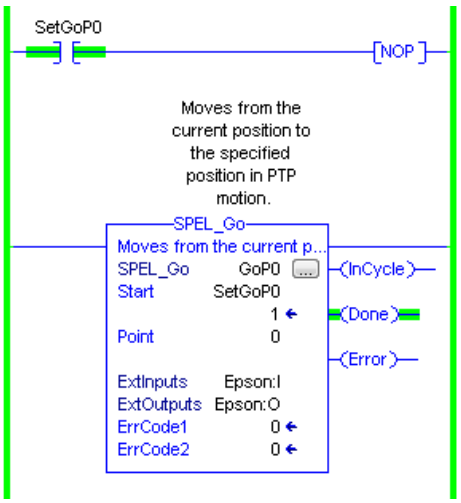
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Go Statement* in the SPEL+ Language Reference manual.

Example

To move the robot to point 0 using PTP motion, enter “0” as the point and run the AOI, as shown below.



SPEL_In

Description

Reads a byte of input.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

PortNum INT desired input byte port number.

Outputs

Value INT value of the desired input port.

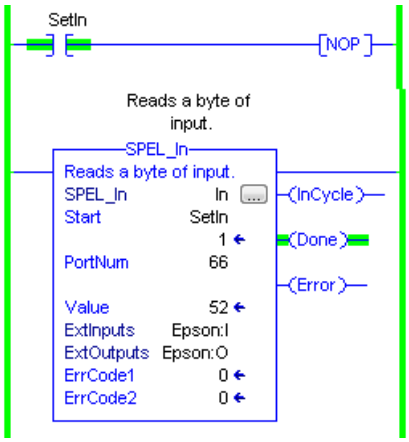
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *In Function* in the SPEL+ Language Reference manual.

Example

To read input port number 66, set [PortNum] to “66”.



SPEL_InertiaGet

Description

Gets the load inertia.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Outputs

Inertia	REAL acquired Inertia.
Eccentricity	REAL acquired Eccentricity.

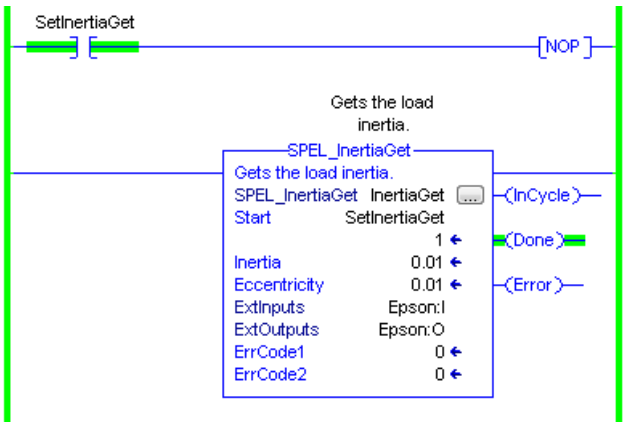
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Inertial Function* in the SPEL+ Language Reference manual.

Example

To read load Inertia and Eccentricity, run the AOI, as shown below.



SPEL_InertiaSet

Description

Sets the load inertia.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Inertia	REAL desired Inertia.
Eccentricity	REAL desired Eccentricity.

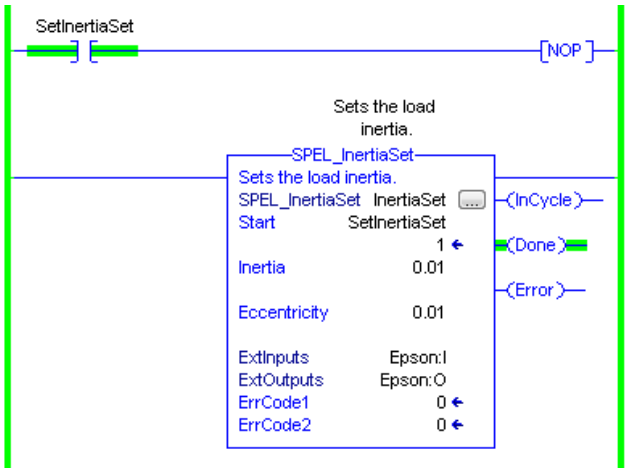
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Inertia Statement* in the SPEL+ Language Reference manual.

Example

To set load Inertia and Eccentricity to 0.01, 0.01 respectively, enter the values and run the AOI.



SPEL_Init

Description

Initializes the PLC program for SPEL AOI execution. It is required to execute SPEL_Init before executing any other AOIs.

Note: If the controller has a system error, then it must be reset before SPEL_Init and other SPEL AOIs can execute successfully.

Common Inputs and Outputs

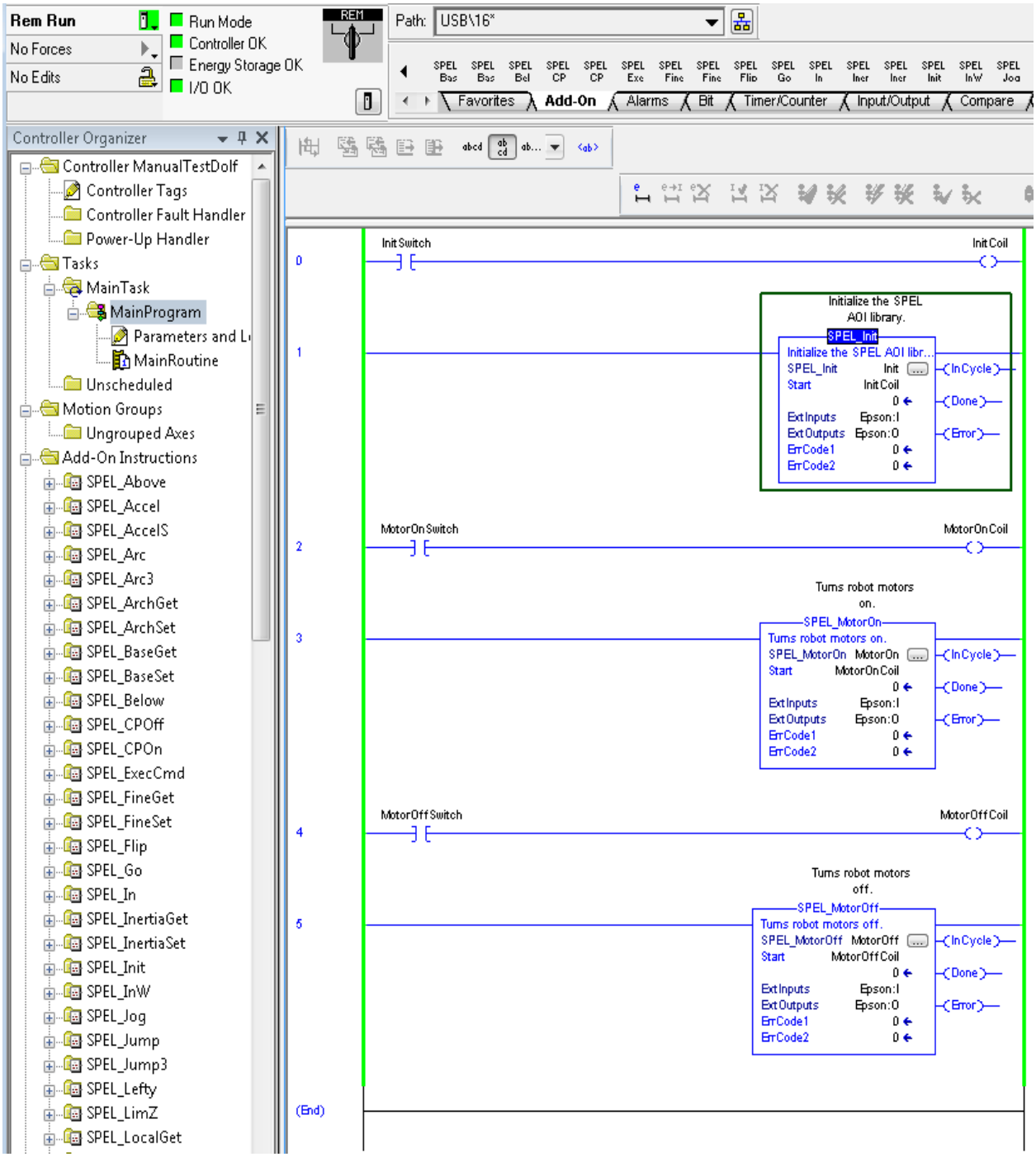
Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Example

As shown below, toggle [Init Switch] to high to start the AOI.


Rem Run
Run Mode
Controller OK
Energy Storage OK
I/O OK
No Forces
No Edits
REM
Path: USB\16*
Favorites
Add-On
Alarms
Bit
Timer/Counter
Input/Output
Compare
Controller Organizer
Controller ManualTestDolf
Controller Tags
Controller Fault Handler
Power-Up Handler
Tasks
MainTask
MainProgram
Parameters and L
MainRoutine
Unscheduled
Motion Groups
Ungrouped Axes
Add-On Instructions
SPEL_Above
SPEL_Accel
SPEL_AccelS
SPEL_Arc
SPEL_Arc3
SPEL_ArchGet
SPEL_ArchSet
SPEL_BaseGet
SPEL_BaseSet
SPEL_Below
SPEL_CPOff
SPEL_CPOn
SPEL_ExecCmd
SPEL_FineGet
SPEL_FineSet
SPEL_Flip
SPEL_Go
SPEL_In
SPEL_InertiaGet
SPEL_InertiaSet
SPEL_Init
SPEL_InW
SPEL_Jog
SPEL_Jump
SPEL_Jump3
SPEL_Lefty
SPEL_LimZ
SPEL_LocalGet
Init Switch
Init Coil
Initialize the SPEL AOI library.
SPEL_Init
Initialize the SPEL AOI libr...
SPEL_Init
Init
Start
Init Coil
InCycle
Done
Error
ExtInputs
Epson:I
ExtOutputs
Epson:O
ErrCode1
ErrCode2
MotorOn Switch
MotorOn Coil
Turns robot motors on.
SPEL_MotorOn
Turns robot motors on.
SPEL_MotorOn
MotorOn
MotorOn Coil
MotorOff Switch
MotorOff Coil
Turns robot motors off.
SPEL_MotorOff
Turns robot motors off.
SPEL_MotorOff
MotorOff
MotorOff Coil
(End)

SPEL_InW

Description

Returns the status if an input word.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

PortNum INT desired port number.

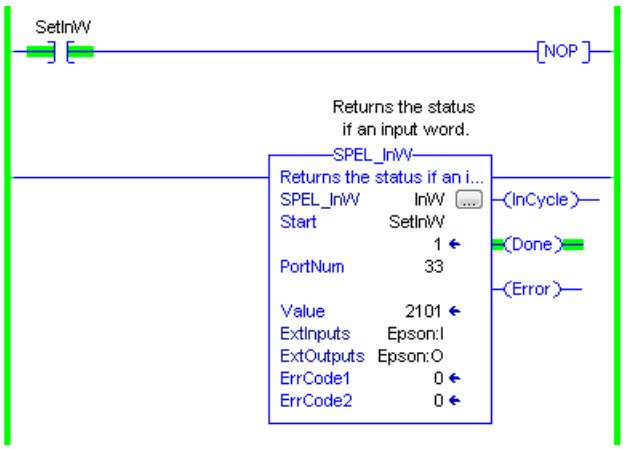
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *InW Function* in the SPEL+ Language Reference manual.

Example

To read content of port number 33, enter the value and run the AOI.



SPEL_Jog

Description

Jogs the robot.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

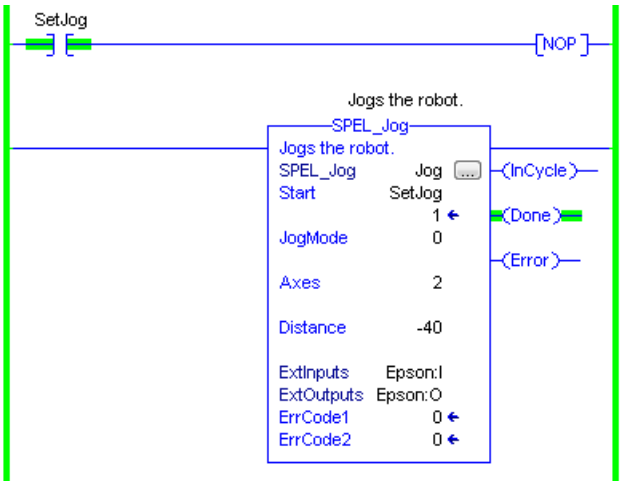
JogMode	INT desired mode. 0=World, 1=Joint.
Axis	INT desired axis.
Distance	REAL value: World: X,Y,Z in mm. U,V,W in deg. Joint: J1-J6 in deg.

Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Example

To move robot in -Y direction for 40mm, enter values and run the AOI as shown below.



SPEL_Jump

Description

Moves the arm using gate motion for a SCARA robot.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point.

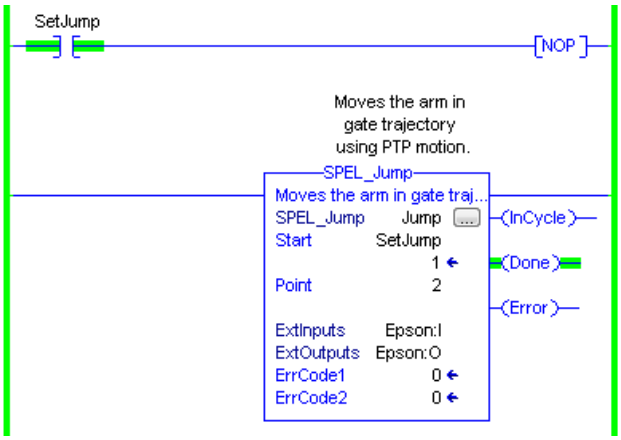
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Jump Statement* in the SPEL+ Language Reference manual.

Example

To move the robot to point P2 using gate trajectory, enter the value for Point and run the AOI as shown below.



SPEL_Jump3

Description

Moves the arm with 3D gate motion for a 6-axis robot. This is a combination of two CP motion and one PTP motion.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

DepartPoint INT desired depart point.

ApproPoint INT desired approach point.

DestPoint INT desired destination point.

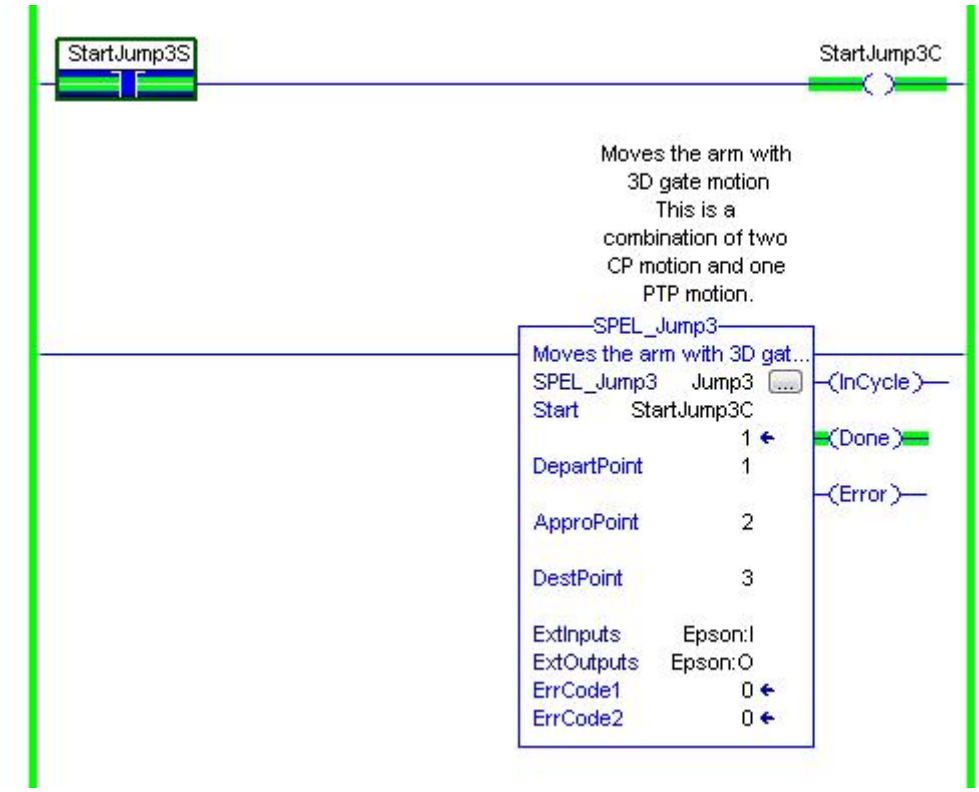
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Jump3CP Statement* in the SPEL+ Language Reference manual.

Example

To move the robot to point P2 using gate trajectory, enter the values for the points and run the AOI as shown below.



SPEL_Jump3CP

Description

Moves the arm with 3D gate motion for a 6-axis robot. This is a combination of three CP motions.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

DepartPoint INT desired depart point.

ApproPoint INT desired approach point.

DestPoint INT desired destination point.

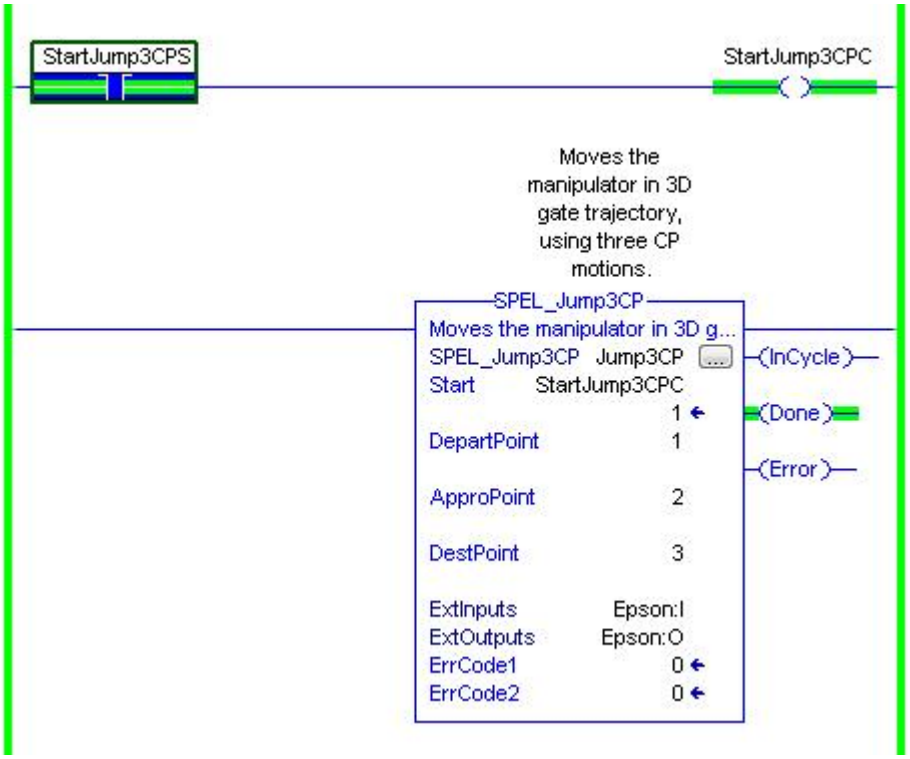
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Jump3CP Statement* in the SPEL+ Language Reference manual.

Example

To move the robot to point P2 using gate trajectory, enter the values for the points and run the AOI as shown below.



SPEL_Lefty

Description

Sets the hand orientation of the specified point to Lefty.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point number.

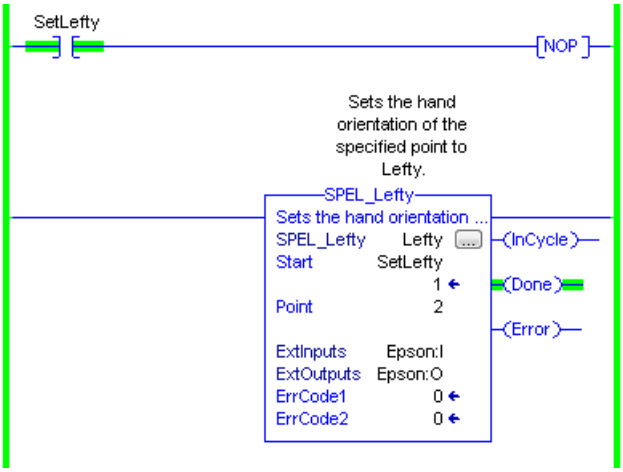
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Hand Statement* in the SPEL+ Language Reference manual.

Example

To change P2's hand orientation to Lefty, enter values and run the AOI as shown below.



SPEL_LimZ

Description

Sets the initial Joint #3 height (Z coordinate value) in Jump command.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Height REAL desired Z limit in mm.

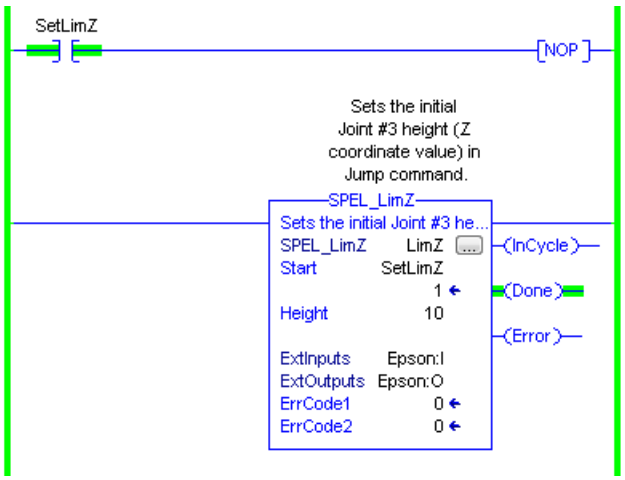
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *LimZ Statement* in the SPEL+ Language Reference manual.

Example

To set LimZ value of 10mm, enter values and run the AOI as shown below.



SPEL_LocalGet

Description

Gets data for a given local coordinate system.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

NumAxes	INT number of axes in the robot. For SCARA, use 4, for Articulate robot, use 6.
LocalNum	INT desired local number you want to get.

Outputs

LocalX	REAL the coordinate value of that axis.
LocalY	REAL the coordinate value of that axis.
LocalZ	REAL the coordinate value of that axis.
LocalU	REAL the coordinate value of that axis.
LocalV	REAL the coordinate value of that axis.
LocalW	REAL the coordinate value of that axis.

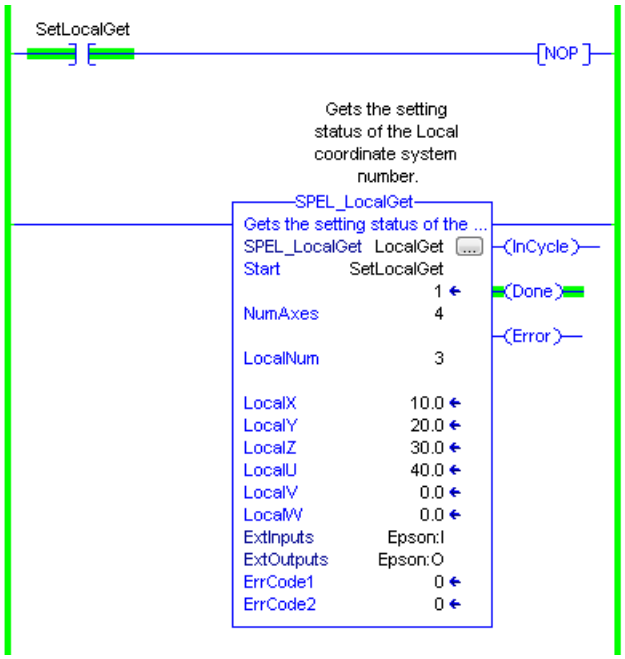
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Local Statement* in the SPEL+ Language Reference manual.

Example

To get the coordinate values for local number 3 of a SCARA robot, enter values and run the AOI as shown below.



SPEL_LocalSet

Description

Sets the local coordinate number.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

NumAxes	INT number of axes in the robot. For SCARA, use 4, for Articulate robot, use 6.
LocalNum	INT desired local number you want to get.
LocalX	REAL the desired coordinate value of X axis.
LocalY	REAL the desired coordinate value of Y axis.
LocalZ	REAL the desired coordinate value of Z axis.
LocalU	REAL the desired coordinate value of U axis.
LocalV	REAL the desired coordinate value of V axis.
LocalW	REAL the desired coordinate value of W axis.

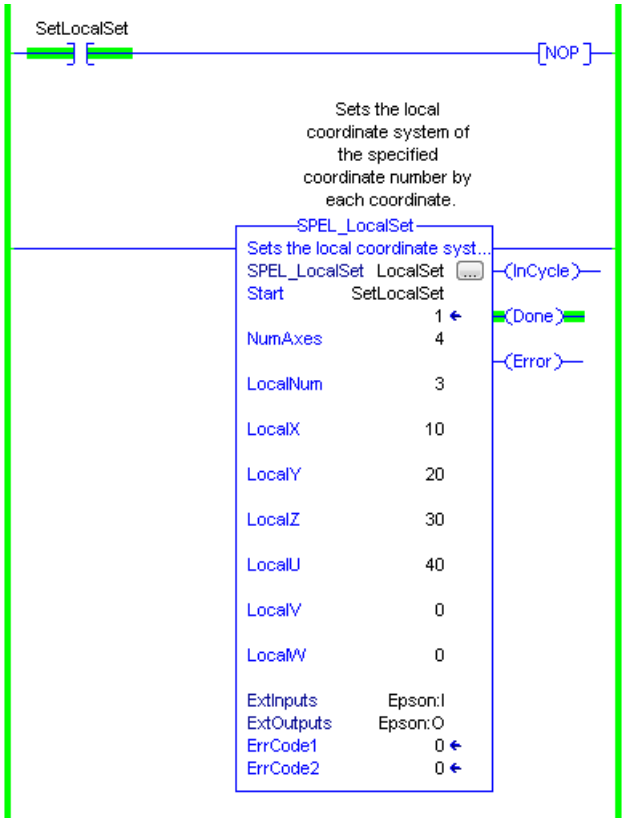
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Local Statement* in the SPEL+ Language Reference manual.

Example

To set the coordinate values for local number 3 of a SCARA robot, enter values and run the AOI as shown below.



SPEL_MemIn

Description

Reads a byte of memory IO.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

PortNum INT port number to be read. Port number refers to byte number.

Outputs

Value INT value of the port.

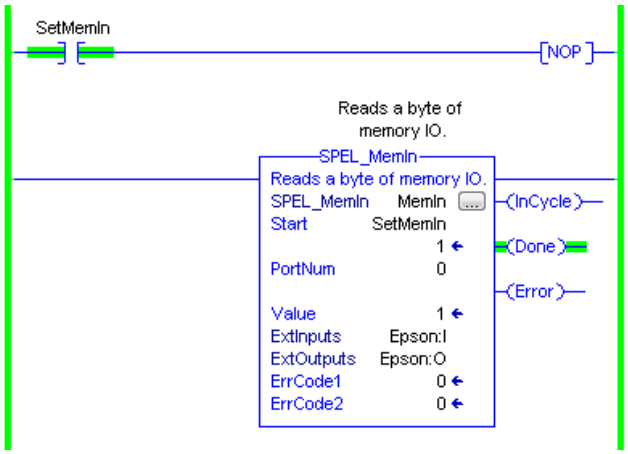
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *MemIn Function* in the SPEL+ Language Reference manual.

Example

To read port number 0 of memory I/O, run the AOI as shown below.



SPEL_MemInW

Description

Reads a word of memory IO.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

PortNum INT port number to be read.

Outputs

Value INT value of the port.

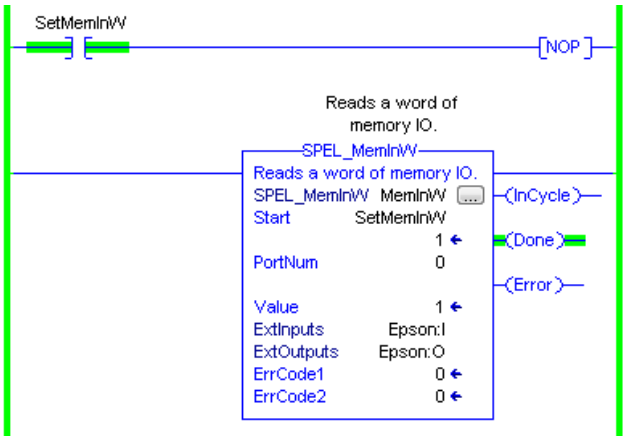
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *MemInW Function* in the SPEL+ Language Reference manual.

Example

To read port number 0 as word, run the AOI as shown below.



SPEL_MemOff

Description

Turns a memory IO bit off.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Bit INT bit number to be turned off.

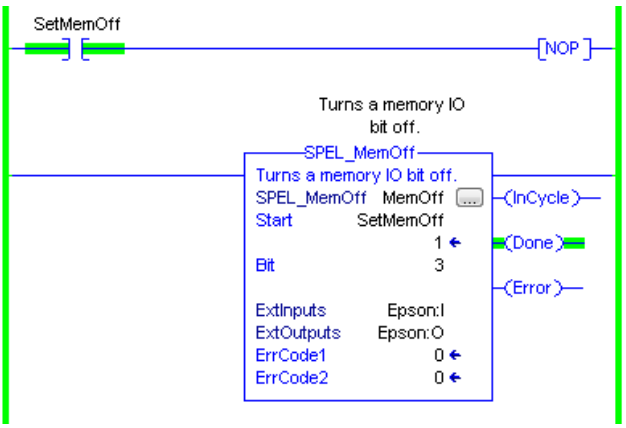
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *MemOff Statement* in the SPEL+ Language Reference manual.

Example

To turn off memory bit number 3, run the AOI as shown below.



SPEL_MemOn

Description

Turns a memory IO bit on.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Bit INT bit number to be turned on.

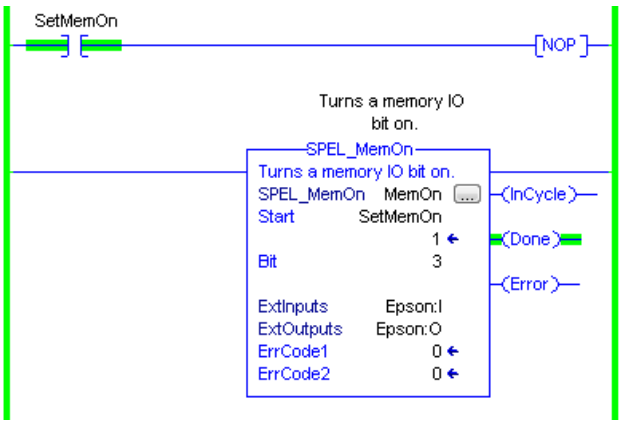
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *MemOn Statement* in the SPEL+ Language Reference manual.

Example

To turn on memory bit number 3, run the AOI as shown below.



SPEL_MemOut

Description

Sets a byte of memory IO.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

PortNum	INT desired output port number.
OutData	INT value of the data to be sent to output port.

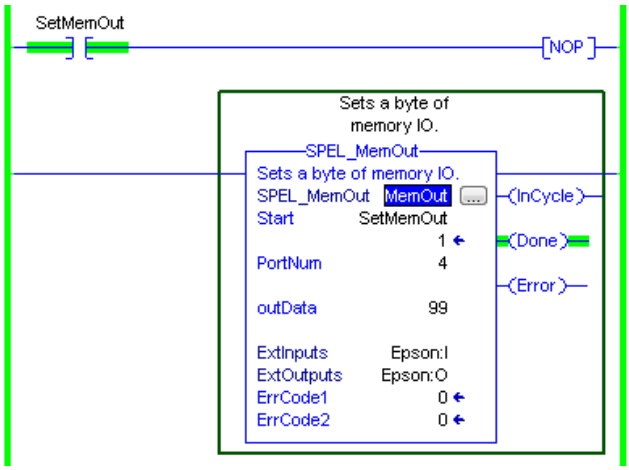
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *MemOut Statement* in the SPEL+ Language Reference manual.

Example

To send 99 to port number 4, run the AOI as shown below.



SPEL_MemOutW

Description

Sets a word of memory IO.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

PortNum	INT desired output port number.
OutData	INT value of the data need to be sent to output port.

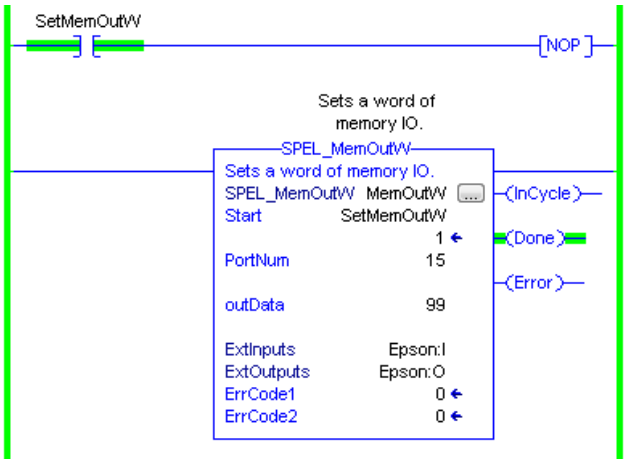
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *MemOutW Statement* in the SPEL+ Language Reference manual.

Example

To send 99 to port number 15, run the AOI as shown below.



SPEL_MemSw

Description

Reads a single bit of memory IO.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Bit INT desired memory bit number.

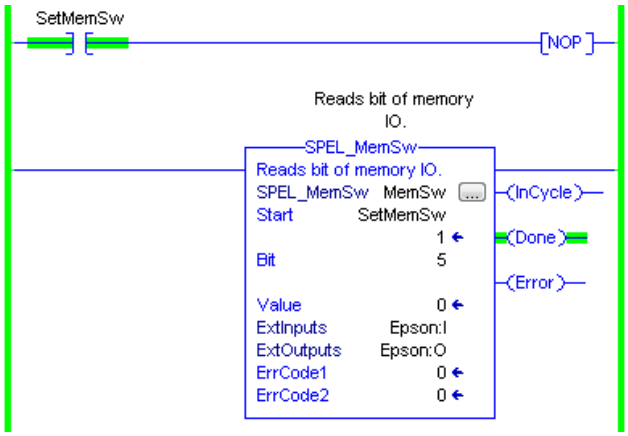
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *MemSw Function* in the SPEL+ Language Reference manual.

Example

To read memory bit number 5, run the AOI as shown below.



SPEL_MotorOff

Description

Turns robot motors off.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

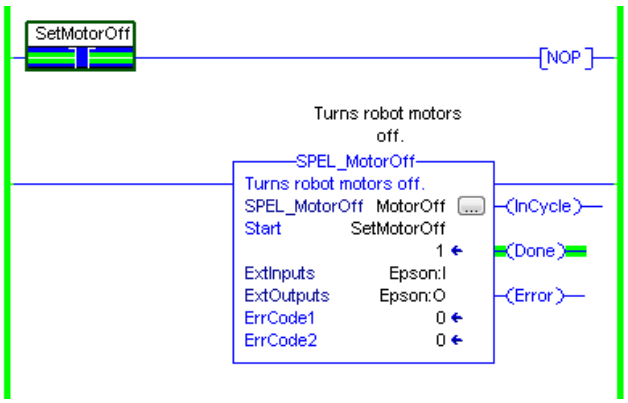
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Motor Statement* in the SPEL+ Language Reference manual.

Example

To turn off motors, run the AOI as shown below.



SPEL_MotorOn

Description

Turns robot motors on.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

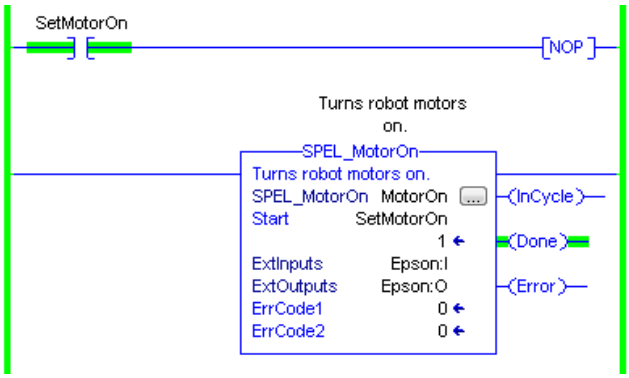
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Motor Statement* in the SPEL+ Language Reference manual.

Example

To turn on motors, run the AOI as shown below.



SPEL_Move

Description

Moves the arm from the current position to the specified position in a linear interpolation motion.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point number.

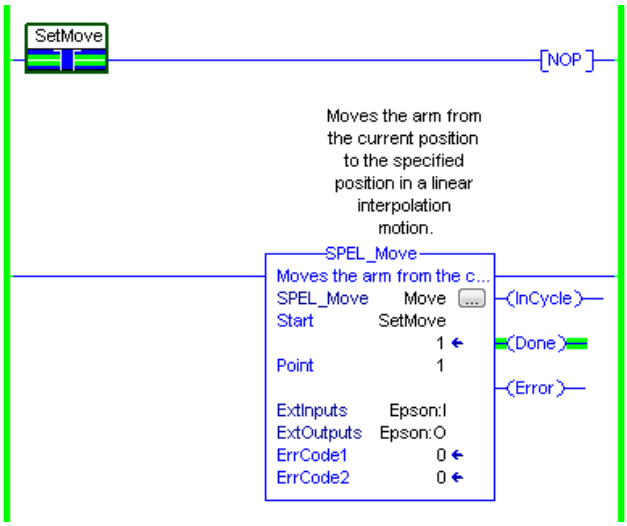
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Move Statement* in the SPEL+ Language Reference manual.

Example

To move the end effector to point P1, run the AOI as shown below.



SPEL_NoFlip

Description

Sets the wrist orientation of the specified point to NOFLIP.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point number.

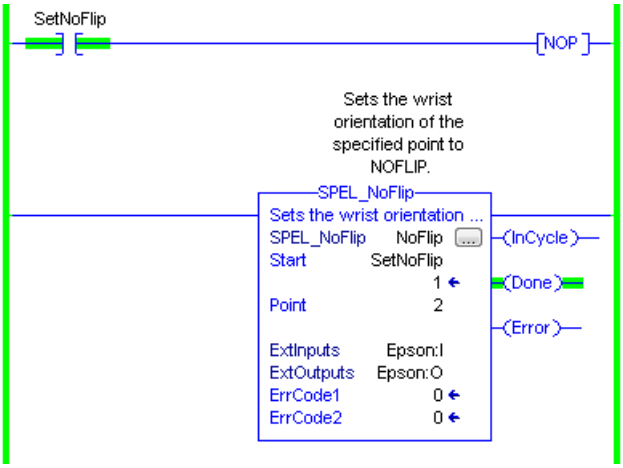
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Wrist Statement* in the SPEL+ Language Reference manual

Example

To set point P2 orientation to NoFlip, run the AOI as shown below.



SPEL_Off

Description

Turns an output bit off.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Bit INT desired output bit number.

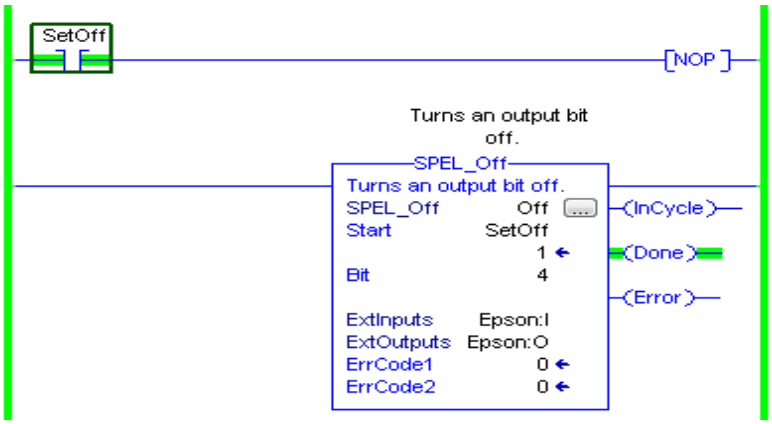
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Off Statement* in the SPEL+ Language Reference manual.

Example

To turn off bit number 4, run the AOI as shown below.



SPEL_On

Description

Turns an output bit on.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Bit INT desired output bit number.

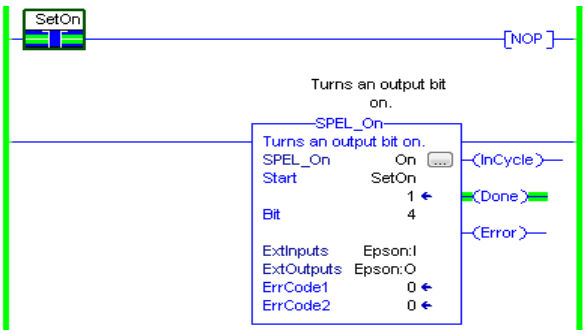
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *On Statement* in the SPEL+ Language Reference manual.

Example

To turn on bit number 4, run the AOI as shown below.



SPEL_Out

Description

Sets an output byte to a given value.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

PortNum	INT desired output port number.
outData	INT desired output port value.

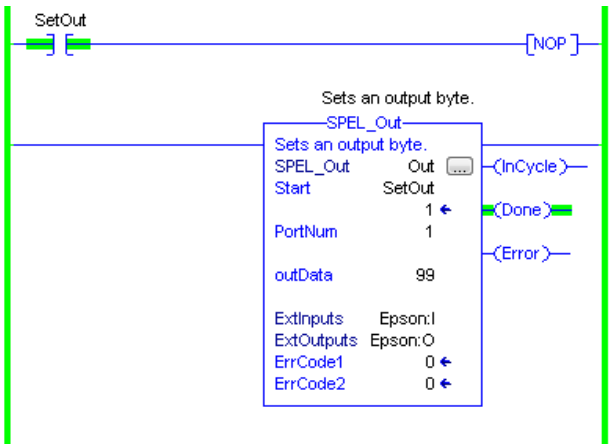
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Out Statement* in the SPEL+ Language Reference manual.

Example

To set port number 1 with value of 99, run the AOI as shown below.



SPEL_OutW

Description

Sets an output word to a given value.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

PortNum	INT desired output port number.
outData	INT desired output port value.

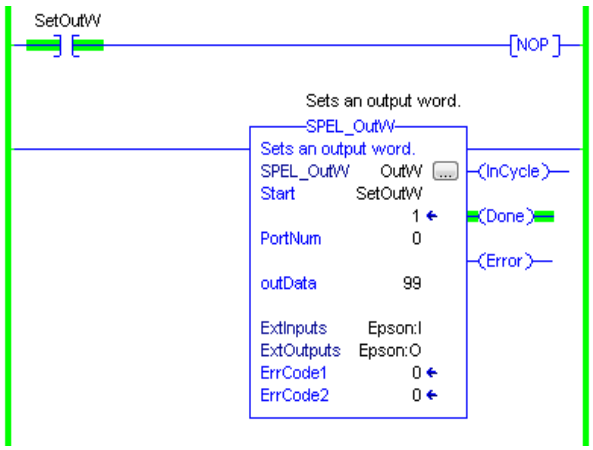
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *OutWStatement* in the SPEL+ Language Reference manual.

Example

To set port number 0 with value of 99, run the AOI as shown below.



SPEL_PowerHigh

Description

Sets the power level of robot to high.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

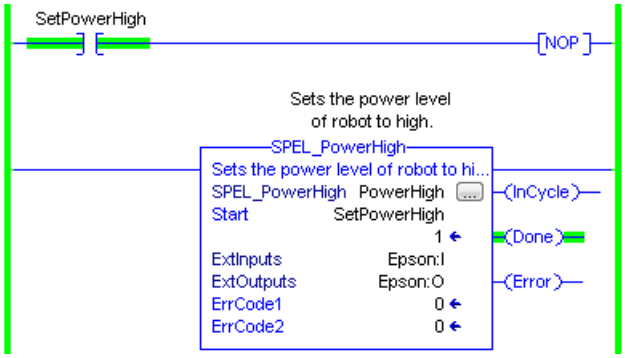
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Power Statement* in the SPEL+ Language Reference manual.

Example

To set power high to the robot, run the AOI as shown below.



SPEL_PowerLow

Description

Sets the power level of robot to low.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

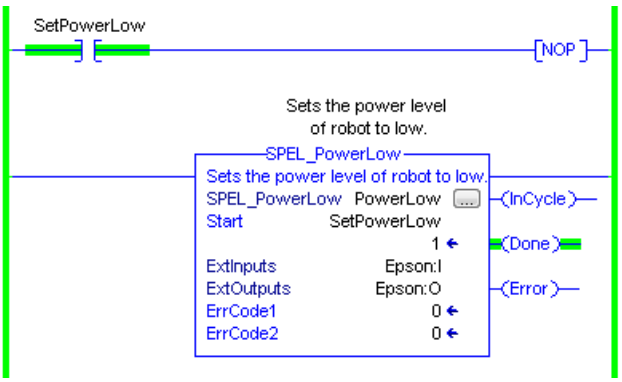
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Power Statement* in the SPEL+ Language Reference manual.

Example

To set power low to the robot, run the AOI as shown below..



SPEL_ResetError

Description

Reset the robot controller AOI error state. After an error has occurred while executing a SPEL AOI, you must execute SPEL_ResetError successfully before you can execute another AOI.

Note: If the controller has a system error, then it must be reset before SPEL_Init and other SPEL AOIs can execute successfully.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

SPEL_Righty

Description

Sets the hand orientation of the specified point to Righty.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point.

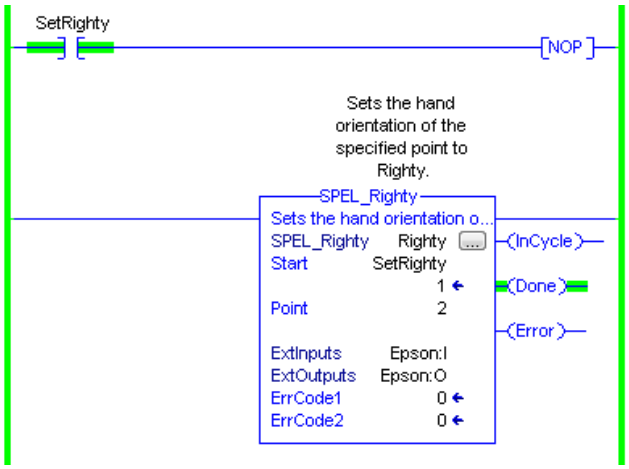
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Hand Statement* in the SPEL+ Language Reference manual

Example

To set orientation of P2 to Righty, run the AOI as shown below.



SPEL_SavePoints

Description

Saves the current point data in robot controller memory to the default point file for robot 1 (robot1.pts) in the robot controller. To use this command, a valid RC+ project must exist in the controller. Typically, SavePoints is used to save points taught using the SPEL_Teach AOI. When the controller starts up, it loads the project and the default point file, so the saved points are in memory.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

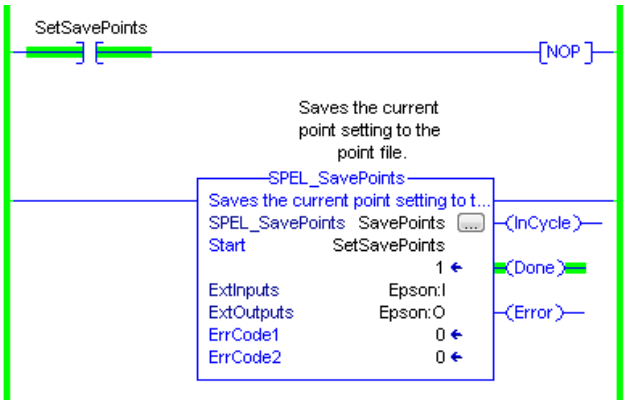
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *SavePoints Statement* in the SPEL+ Language Reference manual

Example

To save all points in robot controller memory to the file robot1.pts in the robot controller, run the AOI as shown below.



SPEL_Speed

Description

Sets the arm speed setting for PTP motion.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Speed	INT desired speed.
ApproSpeed	INT desired approach speed, units are %.
DepartSpeed	INT desired depart speed, units are %.

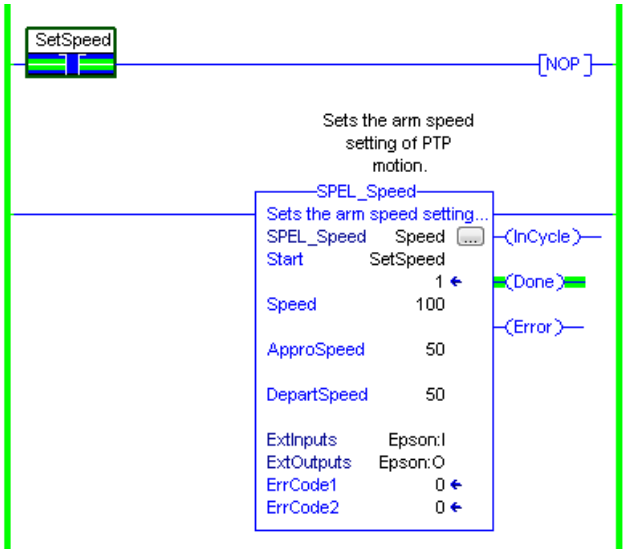
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Speed Statement* in the SPEL+ Language Reference manual.

Example

To set Speed to 100%, Approach, Depart Speed to 50%, run the AOI as shown below.



SPEL_SpeedS

Description

Sets the arm speed setting of CP motion. This will set the depart, and approach speed as well.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Speed	INT desired speed.
ApproSpeed	INT desired approach speed.
DepartSpeed	INT desired depart speed.

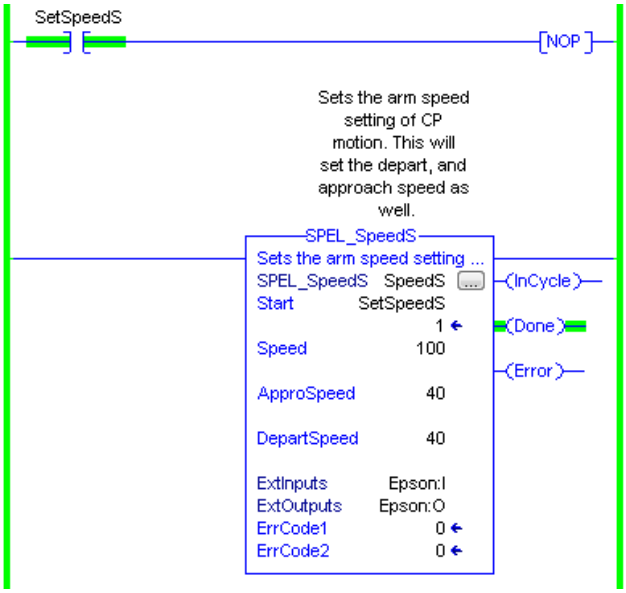
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *SpeedS Statement* in the SPEL+ Language Reference manual.

Example

To set Speed to 100, Approach, Depart Speed to 40, run the AOI as shown below.



SPEL_Sw

Description

Reads the status of an input bit.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Bit INT desired input bit.

Outputs

Value INT the value of the input bit.

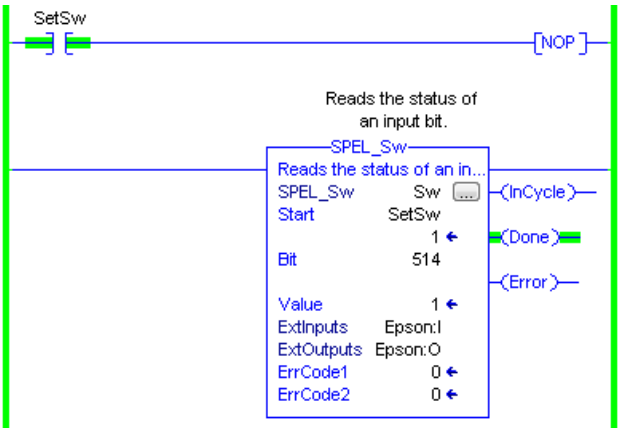
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Sw Function* in the SPEL+ Language Reference manual.

Example

To read the value of input bit number 514, run the AOI as shown below.



SPEL_Teach

Description

Teaches specified robot point in the robot controller to the current robot position.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

Point INT desired point.

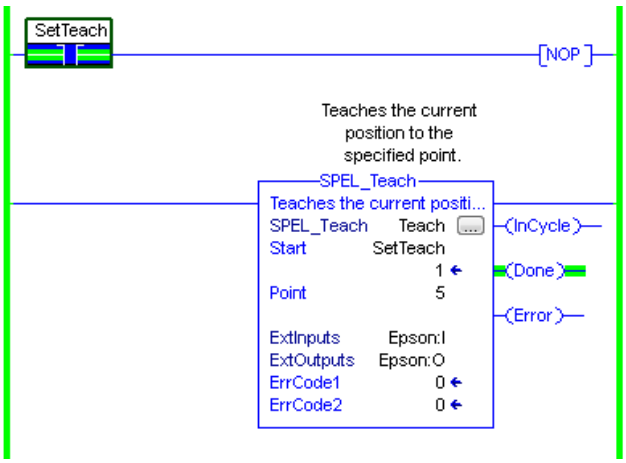
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Here Statement* in the SPEL+ Language Reference manual.

Example

To teach current robot position for robot point P5, run the AOI as shown below.



SPEL_ToolGet

Description

Gets the tool selection status.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Outputs

ToolNum INT the tool selected.

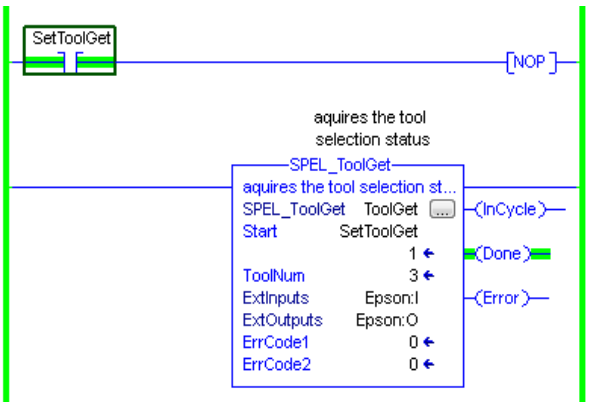
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Tool Function* in the SPEL+ Language Reference manual.

Example

To read the selected tool by the robot, run the AOI as shown below.



SPEL_ToolSet

Description

Sets the tool.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

ToolNum INT the tool to be set.

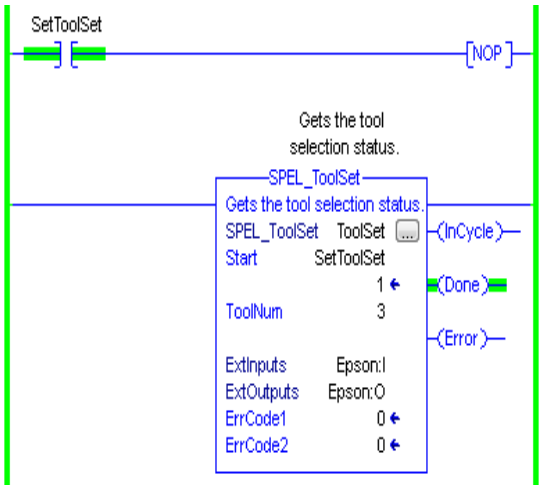
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Tool Statement* in the SPEL+ Language Reference manual.

Example

To set current tool to 3, run the AOI as shown below.



SPEL_WeightGet

Description

Gets the hand weight and arm length parameters.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

HandWeight	REAL weight of the hand.
ArmLength	REAL length of the arm.

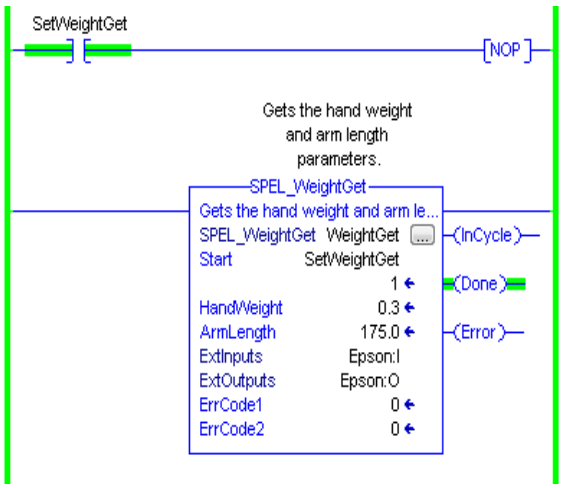
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Weight Function* in the SPEL+ Language Reference manual.

Example

To get the current hand weight and arm length, run the AOI as shown below.



SPEL_WeightSet

Description

Sets the weight parameter.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

HandWeight REAL weight of the hand.
ArmLength REAL length of the arm.

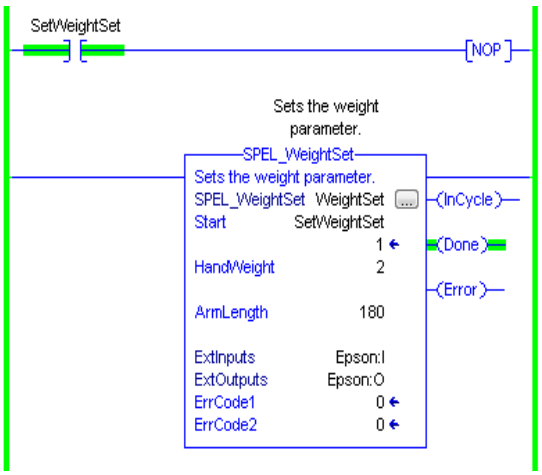
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *Wait Statement* in the SPEL+ Language Reference manual.

Example

To set the hand weight and arm length, run the AOI as shown below.



SPEL_XYLimGet

Description

Gets the value of the allowable motion area by specifying the lower and upper limit positions.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Outputs

XLower	REAL X lower limit.
Xupper	REAL X upper limit.
YLower	REAL Y lower limit.
Yupper	REAL Y upper limit.
ZLower	REAL Z lower limit.
Zupper	REAL Z upper limit.

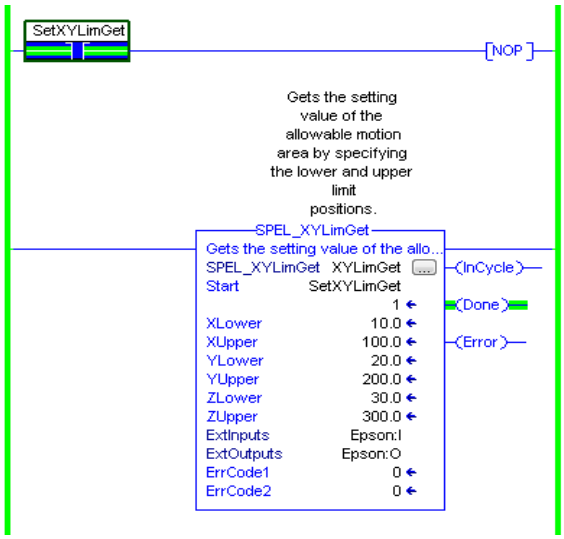
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *XYLim Function* in the SPEL+ Language Reference manual.

Example

To get the upper and lower limits of X,Y and Z, run the AOI as shown below.



SPEL_XYLimSet

Description

Sets the allowable motion area by specifying the lower and upper limit positions.

Common Inputs and Outputs

Refer to section 2.4 *SPEL AOI Common Inputs and Outputs.*

Inputs

XLower	REAL X lower limit.
Xupper	REAL X upper limit.
YLower	REAL Y lower limit.
Yupper	REAL Y upper limit.
ZLower	REAL Z lower limit.
Zupper	REAL Z upper limit.

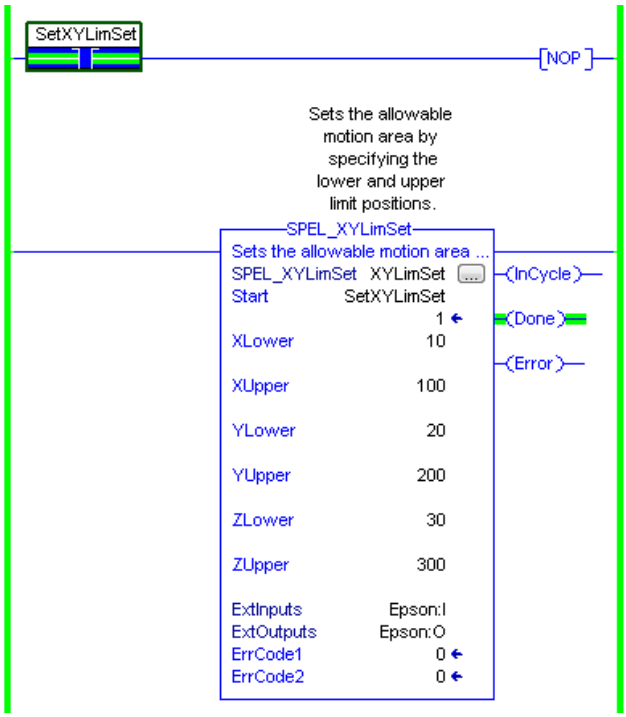
Operation

Refer to section 2.5 *SPEL AOI General Operation.*

Refer to *XYLim Statement* in the SPEL+ Language Reference manual.

Example

To set the upper and lower limits of X,Y and Z, run the AOI as shown below.



6. Error Codes

Each AOI has an Error output bit and two INT error codes: ErrCode1 and ErrCode2. The error output is set to high when an error has occurred, and ErrCode1, ErrCode2 indicate which error has occurred as described in the table below.

ErrCode1	ErrCode2	Description	Cause/Remedy
0x200A (8202)	1 -9999	A robot controller error has occurred. ErrCode2 is the robot controller error.	See the section *SPEL+ Error Messages* in the SPEL+ Language Reference manual.
0x200B (8203)	0	Command not accepted by the controller	The controller is in a state where it cannot accept commands. Power cycle the controller.
0x3000 (12288)	0x280A (10250)	AOI execution timeout	Ethernet communications was lost during command execution, or the command took too long to execute.
0x3000 (12288)	0x280B (10251)	Cannot execute instruction because of previous error or ExtReset input in the controller is low.	After any error has occurred, SPEL_ResetError must be executed.
0x3000 (12288)	0x280C (10252)	Cannot execute instruction because of invalid robot controller configuration.	Check that Remote I/O and PLC Vendor settings are correct in the robot controller.
0x3000 (12288)	1 -9999	A robot controller error has occurred. ErrCode2 is the robot controller error.	See the section *SPEL+ Error Messages* in the SPEL+ Language Reference manual.