

5034-PTO-AM

PointMax™ I/O

Pulse Train Output Module

User Manual

AMCI Networked Products

GENERAL INFORMATION

Important User Information

The products and application data described in this manual are useful in a wide variety of different applications. Therefore, the user and others responsible for applying these products described herein are responsible for determining the acceptability for each application. While efforts have been made to provide accurate information within this manual, AMCI assumes no responsibility for the application or the completeness of the information contained herein.

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24 Hour technical support is available on this product. If you have Internet access, start at www.amci.com. Product documentation and FAQ's are available on the site that answer most common questions.

If you require additional technical support, call (860) 585-1254. Your call will be answered by the factory during regular business hours, Monday through Friday, 8AM - 5PM Eastern. During non-business hours an automated system will ask you to enter the telephone number you can be reached at. Please remember to include your area code. The system will contact an engineer on call. Please have your product model number and a description of the problem ready before you call.

Waste Electrical and Electronic Equipment (WEEE)



At the end of life, this equipment should be collected separately from any unsorted municipal waste.

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ABOUT THIS MANUAL

Read this chapter to learn how to navigate through this manual and familiarize yourself with the conventions used in it. The last section of this chapter highlights the manual's remaining chapters and their target audience.

Audience

This manual explains the installation and operation of the 5034-PTO-AM module from AMCI. It is written for the engineer responsible for incorporating this module into a design, as well as the engineer or technician responsible for its actual installation.

Applicable Units

This manual is applicable to all 5034-PTO-AM devices at the time of its release.

Navigating this Manual

This manual is designed to be used in both printed and on-line forms. Its on-line form is a PDF document. You are allowed to select and copy sections for use in other documents and you are allowed to add notes and annotations. If you decide to print out this manual, all sections contain an even number of pages which allows you to easily print out a single chapter on a duplex (two-sided) printer.

Manual Conventions

Three icons are used to highlight important information in the manual:



NOTES highlight important concepts, decisions you must make, or the implications of those decisions.



CAUTIONS tell you when equipment may be damaged if the procedure is not followed properly.



WARNINGS tell you when people may be hurt or equipment may be damaged if the procedure is not followed properly.

The following table shows the text formatting conventions:

Format	Description
Normal Font	Font used throughout this manual.
<i>Emphasis Font</i>	Font used for parameter names and the first time a new term is introduced.
<i>Cross Reference</i>	When viewing the PDF version of the manual, clicking on a blue cross reference jumps you to referenced section of the manual.
<i>HTML Reference</i>	When viewing the PDF version of the manual, clicking on a red cross reference opens your default web browser to the referenced section of the AMCI website if you have Internet access.

Trademarks Acknowledgments

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Revision Record

This document, 940-04041, is the second release of this manual. It was first released on October 10th, 2025.

Revision History

940-04040: 05/09/2025 Initial Release

Manual Layout

Chapter Title	Start Page	Chapter Description
<i>5034-PTO-AM Specifications</i>	7	Specifications of the 5034-PTO-AM.
<i>Move Profiles</i>	15	Descriptions and formulas for the moves available from the 5034-PTO-AM.
<i>Homing a 5034-PTO-AM</i>	33	Descriptions of the methods used to define a home position on the axis controlled by the 5034-PTO-AM
<i>Hardware Installation</i>	39	Task instructions that give you the information and steps needed to physically install 5034-PTO-AM on your machine.
<i>Software Configuration</i>	47	Instructions to add a 5034-PTO-AM module to your project and configure it for your application.
<i>Controlling the 5034-PTO-AM</i>	53	Instructions to add and use Add-On Instructions to control the 5043-PTO-AM in your application. These AOIs are available on the AMCI website.
<i>AOI Reference</i>	65	A listing of parameters and enumerations for all AMCI Add-On Instructions.
<i>Input Status Bits</i>	75	A listing of all input status and error bits and the states that trigger them.

5034-PTO-AM SPECIFICATIONS

Overview

The 5034-PTO-AM is the latest addition to the line of AMCI products for the PointMax™ I/O system from Rockwell Automation. The 5034-PTO-AM offers a pulse train output that can be used to control any device that requires a variable frequency, fixed duty cycle signal to control it. A typical application for the 5034-PTO-AM module is as a controller for a simple motion axis. If your application requires a fixed frequency, variable duty cycle control signal, consider using an AMCI 5034-PWM-AM pulse width modulated output module. The 5034-PWM-AM module is typically used in valve control applications.

Designed around RA licensed technology, installation of the 5034-PTO-AM is the same as all other PointMax I/O modules. The 5034-PTO-AM uses standard eighteen pin wiring block.

The 5034-PTO-AM is programmed and controlled with network data from a host controller. I/O words transferred between the module and the controller are used to program the module as well as read its status.

PTO Outputs

Two differential outputs are available on the 5034-PTO-AM. These outputs are typically used to control a single motion axis. The module can be programmed to use these outputs for either Step/Direction or CW/CCW control.

Encoder Input

The 5034-PTO-AM has $\pm A$, $\pm B$, and $\pm Z$ differential inputs for an incremental encoder. The module also allows these inputs to be configured as an interface to an absolute encoder that transmits its values over an SSI serial link. An encoder is typically used to verify motor position after a move.

When configured for an incremental encoder, the module can be programmed to update the PTO outputs based on changes to the encoder inputs. This function is called “Encoder Follower” in this manual. This function allows you to build an electronic gear ratio between the axis monitored by the encoder and the axis controlled by the PTO outputs.

Auxiliary Inputs

The 5034-PTO-AM also offers four single ended, sinking inputs. These inputs accept voltages up to 24Vdc. The function of these inputs is programmable from the host controller. Each input can be programmed to any of these functions:

- Home Input
- CW Limit Input
- CCW Limit Input
- Emergency Stop Input
- External Input
- Capture Input
- General Purpose Input

AOP Configuration

An Add-On Profile is available for the 5034-PTO-AM. All platforms that support PointMax-IO support the AOP. Using an AOP simplifies module configuration and programming.

Motion Axis Add-On Instructions

AMCI has developed Add-On Instructions (AIO's) that mimic the RA motion axis instructions that you may already be familiar with. Examples of these instruction include MAM (Motions Axis Move) and MAJ (Motion Axis Jog). These instructions are included in the sample program that is available for download from the www.amci.com website.

Available Move Types

All of these moves are fully explained in the following chapters.

- **Find Home:** Allows the module to search for and find a sensor at a known position on the machine. The AMCI_5034_PTO_AM_MAH (Motion Axis Home) AOI implements this move type.
- **Absolute Move:** Moves from the known, current position to the target position. The AMCI_5034_PTO_AM_MAM (Motion Axis Move) AOI implements this move type.
- **Relative Move:** Moves a programmable distance from the current position. The AMCI_5034_PTO_AM_MAM (Motion Axis Move) AOI implements this move type.
- **Jog Move:** Moves at the commanded speed as long as the command is active. The AMCI_5034_PTO_AM_MAJ (Motion Axis Jog) AOI implements this move type.
- **Registration Move:** Performs a Jog Move as long as the command is active or until a sensor is reached. The AMCI_5034_PTO_AM_Registration AIO implements this move type.
- **Blend Move:** Runs up to sixteen preprogrammed Relative Move segments with a single command. The AMCI_5034_PTO_AM_Run_Blend AIO implements this move type.
- **Encoder Follower:** Allows the module to output pulses in response to changes in the encoder position. The AMCI_5034_PTO_AM_Encoder_Follower AIO instruction implements this move type.

Connector Pinout

Figure R1.1 shows the pin out of the module's eighteen pin connector. A standard removable terminal block is used to wire the module.

- The GPO/SA_Power pin is a General Purpose Output when the absolute encoder is not enabled in the module's configuration. When the absolute encoder is enabled, the SA_Power and SA_Gnd pins are internally connected to the power supply pins of the PointMax I/O power adapter. In this configuration, the GPO is not available.

NOTE

The SA_Power and SA_Gnd are available to power the encoder *only*. They are not to be used to power the Auxiliary Inputs or the device connected to the PTOs. See [Power Wiring](#) on page 41 for additional information.

- The Common pin must be connected to the common of the power supply used to power the inputs.
- If shielded cable is used to wire to the I/O points, Pin 17 (Chassis GND) can be used to connect their shields to chassis ground.

PointMax I/O Terminal Block

0		+A Encoder In
1		–A Encoder In
2		+B Encoder In / +SSI Data
3		–B Encoder In / –SSI Data
4		+Z Encoder In / +SSI CLK
5		–Z Encoder In / –SSI CLK
6		+Step/CW Out
7		–Step/CW Out
8		+Dir/CCW Out
9		–Dir/CCW Out
10		GPO/SA_Power
11		SA_Gnd
12		Input_1
13		Input_2
14		Input_3
15		Input_4
16		Common
17		Chassis Gnd

Figure R1.1 Connector Pin Out

Status LED's

The module has a total of four status LED's. The two on the right are controlled by the RA backplane interface IC. The two on the left are controlled by the 5034-PTO-AM module.

Mod

State	Description
Off	The module is not powered
Steady Green	The module is operational and all I/O connections are active.
Flashing Green	The module has no I/O connections.
Flashing Red	One of the following conditions exists: ➤ A module firmware update is in progress. ➤ A module firmware update attempt failed. ➤ The device has experienced a recoverable fault. ➤ A connection to the module has timed out.
Steady Red	The module experienced a nonrecoverable fault.

S/A PWR

State	Description
Off	The module is not powered
Steady Green	There is SA power to the module.
Steady Red	There is no SA power to the module or the SA power voltage is not in the valid range.

Axis LED (Green)

State	Description
Steady Green	Module OK, no active PT output
Blinking Green	Module OK, active PT output.
Alternating blink with Error LED	Module failed power up diagnostics
Sync blink with Error LED	Communication lost between the 5034-PTO-AM and the backplane ASIC
Off	Not Configured, or error.

Error LED (Red)

State	Description
Off	No errors
Steady Red	Communication between module and PLC interrupted
Blinking Red	Programming Error.
Alternating blink with Axis LED	Module failed power up diagnostics
Sync blink with Axis LED	Communication lost between the 5034-PTO-AM and the backplane ASIC

Specifications**Number of PTO Control Channels**

One pair

Programmable Step & Direction or CW/CCW formats.

PTO Output Frequency Range

1 Hz to 1 MHz.

Programmable with 1 Hz resolution.

PTO Output Drivers

5 Vdc differential drivers. 20 mA max. per output.

Discrete Inputs

Type: Sinking - All inputs share a common return.

On Voltage: 8 to 24 Vdc

Off Voltage: 0 to 2 Vdc

Input Current: 15 mA @ 24 Vdc

Active State: Programmable to act as a Normally Open or Normally Closed input.

Incremental Encoder Inputs

Type: +5 Vdc differential

Max Input Current: 10 mA @ 5Vdc

Max Input Frequency: 250 kHz

Incremental decode: X4

Absolute Encoder Inputs

Type: +5 Vdc differential

Max Input Current: 10 mA @ 5Vdc

Protocol: SSI

Discrete Output

Function: General Purpose

Type: Sourcing

Power Source: SA Power on PointMax-IO adapter.

Max. Output Current: 460mA @ 25°C

Output is not available when using an absolute encoder. (Pin is used to power the encoder.)

Add-On Profile

Available directly in Studio 5000. The AOP defines the I/O words and offers a UI to configure the unit.

RPI Time

Default: 5 milliseconds

Programmable from 2 to 750 milliseconds.

SA PWR Current Draw

Refers to current drawn from power supply attached to SA PWR pins on PointMax-I/O network adapter.

Operating Current: 40 mA @ 24 Vdc

Current used to power the General Purpose Output or Absolute Encoder must also be considered when sizing SA PWR supply. (460mA @ 25°C max.)

Operating Temperature

32°F to 140°F (0°C to 60°C)

Relative Humidity

5% to 95%, non-condensing

Storage Temperature

-40°F to +185°F (-40°C to +85°C)

Connector

Not Included. Uses standard 18 pin PointMax-I/O removable terminal block available from Rockwell Automation.

Pulse Train Output

The PTO of the 5034-PTO-AM can be configured to output pulses in one of two formats, CW/CCW or Step & Direction. The two formats are shown in the figure below. In this figure, a high signal shows the output's active state, while a low signal shows its inactive state. For the differential outputs, an active state is when the +output has a positive voltage with respect to the –output.

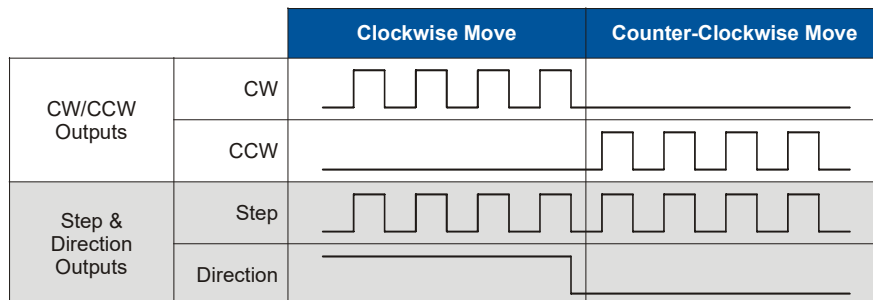


Figure R1.2 Directional Outputs

NOTE ⚠ Clockwise moves will always increase the motor position register that is reported back to the controller. Some of the moves, such as the Jog Move, have a clockwise and counter-clockwise version of the command.

The 5034-PTO-AM module has several parameters that control the PTO. These parameters are introduced briefly here. These parameters, and their uses, are covered in the following chapter.

Starting Speed: The frequency that all PTO moves begin and end at.

Programmed Speed: The maximum frequency achieved during a PTO move.

Acceleration Value: The rate of change in frequency between the Starting and Programmed Speeds at the start of a PTO move.

Deceleration Value: The rate of change in frequency between the Starting and Programmed Speeds at the end of a PTO move.

Number of Pulses: The number of pulses output during a PTO move. Not all moves use this parameter. Some moves output pulses as long as the enabling conditions are true.

Encoder Input

The 5034-PTO-AM supports encoder feedback for position verification and stall detection. The module can be configured to support incremental or absolute encoders. When configured for incremental encoders, the 5034-PTO-AM also supports an “Encoder Follower” move, where the module output motor pulses in response to changes on the encoder inputs.

Incremental Encoders

The 5034-PTO-AM supports incremental encoders for position verification and encoder follower moves. Incremental Encoders with differential or single ended outputs are supported. Single ended outputs with an output voltage greater than 5 Vdc must use current limiting resistors.

Absolute Encoders

The 5034-PTO-AM supports absolute encoders for position verification. The encoder must support the SSI Protocol. When the module is configured to use an absolute encoder, the following configuration parameters are used to define the interface with the encoder.

Note that the General Purpose output is unavailable when the 5034-PTO-AM is configured to use an absolute encoder. In this case, the general purpose output pin can be used to power the absolute encoder.

SSI Clock Frequency

This parameter allows you to set the SSI clock frequency to one of four values: 125 kHz, 250 kHz, 500 kHz or 1 MHz. The default frequency of 125KHz allows for the greatest sensor cable length. Increasing the frequency will not decrease the network transfer time to your host controller. The frequency should only be increased if your sensor cannot operate at 125KHz.

Number of SSI Clock Bits

This parameter sets the number of bits in the entire SSI data transfer. This parameter has a range of one to thirty-two. Its default value is twenty-four.

Most Significant Bit & Number of Data Value Bits Parameters

As the examples show in figure R1.3, these two parameters tell the 5034-PTO-AM where the Data Value is embedded in the SSI data stream. The Most Significant Bit parameter specifies the location of the first bit of the Data Value in the SSI data stream. The Number of Data Value Bits parameter specifies the length of the Data Value. The default value of the Most Significant Bit parameter is one. The default value for the Number of Data Value Bits parameter is twenty-four. The default values will work with AMCI multi-turn SSI DuraCoders as well as many other multi-turn rotary SSI encoders and linear sensors.

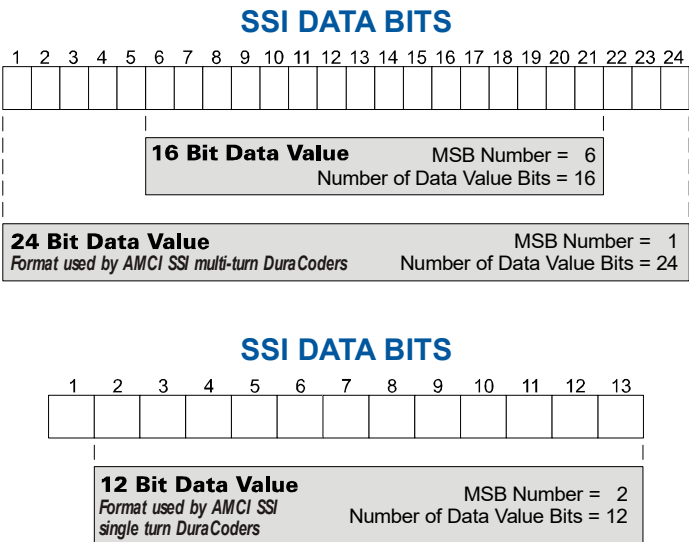


Figure R1.3 Data Value in SSI Data Stream Examples

Encoder Input (continued)

Absolute Encoders (continued)

Data Type

This parameter tells the 5034-PTO-AM to interpret the data from the SSI sensor as a binary number or as a gray code encoded number. The default is *Binary*.

Full Scale Count

The Full Scale Count parameter is important only if you are using a rotary encoder. If you have a linear device, such as a magneto-restrictive linear displacement sensor or a laser range finder, leave this parameter at its default value of *zero*.

If you are using a rotary encoder, the Full Scale Count parameter sets the number of counts the module can expect before the position rolls over to zero. If this value is not set, or set incorrectly, the 5034-PTO-AM will not be able to handle the roll over between the maximum value and zero correctly.

The Full Scale Count parameter must be set to the total number of counts generated by the encoder. For example, the single turn SSI DuraCoder from AMCI is a twelve bit encoder by default. For this encoder, the Full Scale Count should be set to $2^{12} = 4,096$. For multi-turn encoders, the Full Scale Count parameter should be set to (the number of counts per turn) * (the total number of turns). For example, the multi-turn SSI DuraCoder from AMCI defaults to 4,096 counts per turn and 4,096 turns. In this example, the Full Scale Count should be set to $4,096 * 4,096 = 16,777,216$.

NOTE

The SSI DuraCoders from AMCI are fully programmable with a software utility available on our website. While programming, you set the DuraCoder's Full Scale Count parameter. When configuring the 5034-PTO-AM, make sure its Full Scale Count parameter matches the DuraCoder's Full Scale Count parameter.

Count Direction

The Count Direction parameter allows you to reverse the direction of travel needed to increase the Data Value. For simplicity's sake, the two values for this parameter are called *From Encoder* and *Reversed Encoder*. When this parameter is set to its default of *From Encoder*, the Data Value is not changed. When this parameter is set to *Reversed Encoder*, the change in Data Value depends on the value of the Full Scale Count parameter.

If the Full Scale Count parameter equals zero, a linear sensor is assumed and the Data Value is changed to $(2^n - (\text{Data Value}))$, where 'n' is the value of the Number of Data Value Bits parameter.

If the Full Scale Count parameter is non-zero, a rotary sensor is assumed. The Data Value is change to $((\text{Full Scale Count} - \text{Data Value}) \text{ MOD Full Scale Count})$. The modulus function is required to keep the zero position as zero.

NOTE

Changing this parameter will most likely change the Data Value reported by the 5034-PTO-AM. The only time this does not occur is if you are using a rotary encoder and the position is at zero when you reverse the count direction. Because of this, set the Count Direction parameter before you preset the Data Value.

Position Status Bit

The 5034-PTO-AM module has a single bit in the input registers that reports the status of the motor position value. The name of this bit is Position_Invalid, and it is set the "1" when the reported motor position may not match the corresponding position on the machine. The Position_Invalid bit is always set on power up. A successful Find_Home command or a Preset Motor Position command will reset this bit to "0". Absolute Moves cannot be run while this bit is set. Attempting one will result in a command error response from the module. All other move types can be run while this bit is set.

Motion Status Bits

The 5034-PTO-AM module has five bits in the input registers that report on the state of a move in progress. These bits are Stopped, MovingCW, MovingCCW, Accelerating, and Decelerating and are fully described in the following chapter.

Command Status Bits

The 5034-PTO-AM module has six bits in the input registers that report on the state of the last command issued to the module. These bits are Move_Complete, In_Hold_State, At_Home, Command_Error, Home_Invalid, and Profile_Invalid. They are fully described in the following chapter.

Module Status Bits

The 5034-PTO-AM module has sixteen bits in the input registers that report on the state of the module. These bits are fully described in the following chapter.

Motion Command Bits

Motion command bits do not have to be directly manipulated when using the available motion axis AOI's. They are listed here for completeness.

Mutually Exclusive Bits

The following motion command bits are mutually exclusive. This means that only one of these bits can be at a logic "1" state at a time. The module will issue a command error if two or more of these bits are a logic "1" at the same time.

- | | |
|---------------------------------------|---------------------------|
| ➤ Absolute Move | ➤ Relative Move |
| ➤ Hold Move | ➤ Resume Move |
| ➤ Find Home CW | ➤ Find Home CCW |
| ➤ Jog CW [†] | ➤ Jog CCW [†] |
| ➤ Run Blend CW | ➤ Run Blend CCW |
| ➤ Preset Current Position | ➤ Preset Encoder Position |
| ➤ Immediate Stop | ➤ Reset Errors |
| ➤ Store Minimum Registration Distance | |

[†] The two Jog bits are also used to trigger Registration and Encoder Follower Moves.

Acceleration Type Bits

As described in the following chapter, there are three acceleration/deceleration types available with the 5034-PTO-AM. There are two bits in the Motion Command Bits that define the acceleration/deceleration type used by the programmed move.

Blend Move Programming Bits

There are two bits in the network output data and two bits in the network input data that are used to program a Blend Move. The two output bits are named BlendMoveProfileProgramEnable and BlendMoveTransmit. The two input bits are named BlendMoveRunning and ProfileInvalid. These bits do not have to be directly manipulated when using the available motion axis AOI's.

General Purpose Output Bit

A general purpose output is available when the 5034-PTO-AM is not programmed to use an absolute encoder. When the 5034-PTO-AM is programmed to use an absolute encoder, this output is used to power the encoder. There is one bit in the network output data to control the state of the output.

REFERENCE 2

MOVE PROFILES

When a move command is sent to the 5034-PTO-AM, the module calculates the entire profile before starting the move or issuing an error message. This chapter explains how the profiles are calculated and the different available moves.

Definitions

Units of Measure

Distance: Every distance is measured in steps. Your driver and motor combination will give you a specific number of steps needed to complete one rotation of the motor shaft. It is up to you to determine how many steps are required to travel the required distance in your application.

Speed: All speeds are measured in steps/second. Since the number of steps needed to complete one shaft rotation is determined by your driver and motor combination, it is up to you to determine how many steps per second is required to rotate the motor shaft at your desired speed.

Acceleration & Deceleration: The formulas in the rest of this chapter use the unit of measure of steps/second/second (steps/second^2) for acceleration and deceleration. However, when programming the 5034-PTO-AM, all acceleration and deceleration values must be programmed in the unit of measure of steps/second/millisecond.

- To convert from steps/second^2 to steps/second/millisecond, divide the value by 1000. This must be done when converting from a value used in the equations to a value programmed into the 5034-PTO-AM.
- To convert from steps/second/millisecond to steps/second^2 , multiply the value by 1000. This must be done when converting from the value programmed into the module to the value used in the equations.

Motor Position

Motor Position is defined in counts. Motor position is reported with a signed 32 bit integer, so its range is -2,147,483,648 to +2,147,483,647 counts. In continuous rotation applications, the motor position will wrap around to the opposite maximum if the count is exceeded.

Home Position

The Home Position is any position on your machine that you can sense and stop at. There are two ways to defining the Home Position. The first is using the Preset Position command to set the Motor Position register to a known value. The second method is using one of the *Find Home* commands. If you use the unit's *Find Home* commands, the motor position and encoder position registers will automatically be set to zero once the home position is reached. Defining a Home Position is completely optional. Some applications, such as those that use the 5034-PTO-AM for speed control, don't require position data at all.

Count Direction

Clockwise moves will always increase the motor position register reported back to the host. Some of the moves, such as the Jog Move, have a clockwise and counter-clockwise command.

Starting Speed

The Starting Speed is the speed that most moves will begin and end at. This value is set while configuring the unit and it has a valid range of 1 to 1,000,000 steps/second. This value is typically used to start the move above the motor's low frequency resonances. In micro-stepping applications, this value is also used to limit the amount of time needed for acceleration and deceleration. The default value of fifty steps/second will work as a starting point in most applications. Your final value should be based on motor size, inertia of attached load, and the motor drive's steps/turn setting. Note that the inverse of the starting speed is equal to the time needed to output the first pulse. For example, setting the starting speed to one means the first pulse will be one second in length and then the pulses accelerate from there. Setting the starting speed to fifty means the first pulse will be twenty milliseconds in length.

Definitions (continued)

Target Position

The Target Position is the position that you want the move to end at. There are two ways to define the Target Position, with relative coordinates or absolute coordinates.

Relative Coordinates

Relative coordinates define the Target Position as an offset from the present position of the motor. Most 5034-PTO-AM moves use relative coordinates.

- The range of values for the Target Position when it is treated as an offset is –8,388,607 to 8,388,607 counts, which fits in a signed 24 bit integer. Positive offsets will result in clockwise moves, while negative offsets result in counter-clockwise moves.
- The Motor Position value reported back to the host is a signed 32 bit integer. The only way to move beyond a signed 24 bit position value is with multiple relative moves or with jog moves.

Absolute Coordinates

Absolute coordinates treat the Target Position as an actual position on the machine. Note that you must set the Home Position on the machine before you can run an Absolute Move. (See [Home Position](#) on the previous page.)

- The range of values for the Target Position when it is treated as an actual position on the machine is –8,388,607 to 8,388,607 counts, which fits in a signed 24 bit integer. The move will be clockwise if the Target Position is greater than the Current Position and negative if the Target Position is less than the Current Position.
- The Motor Position value reported back to the host is a signed 32 bit value. However, you cannot move beyond the –8,388,607 to 8,388,607 limit with an Absolute Move. The only way to move beyond this limit is with multiple relative moves or with jog moves.

Position Status Bit

The 5034-PTO-AM module has one position status bit, the Position_Invalid bit. This bit is set when the reported motor position may not correspond to the actual machine position. The reported motor position is a bi-directional counter that tracks the number, and direction, of the output pulses. The actual machine position is the physical position of the axis on the machine.

Absolute Moves cannot be run while the Position_Invalid bit is set. All other move types can be run while the Position_Invalid bit is set.

There are two ways to reset the Position_Invalid bit.

- 1) Use a Find_Home (MAH) AOI. If the AOI completes successfully, the motor position will be reset to zero and the Position_Invalid bit will be reset to zero.
- 2) Use a Preset_Motor_Position (MRP) AOI. Once the AOI completes, the motor position will be set to the commanded value and the Position_Invalid bit will be reset to zero.

Two operations will always set the Position_Invalid bit.

- 1) Cycle power to the 5034-PTO-AM.
- 2) Write Configuration data to the 5034-PTO-AM. When using the AOP, this is done from the module properties page.

Some events during a move, such as using the Immediate_Stop AOI, will also cause the Position_Invalid bit to be set. These events depend on the type of move in progress when they occur, and are explained in the descriptions of each move type below. See [Basic Move Types](#) starting on page 22, for the move type descriptions.

Motion Status Bits

The 5034-PTO-AM module has six motion status bits:

- **MovingCW:** Set while the 5034-PTO-AM module outputs clockwise pulses.
- **MovingCCW:** Set while the 5034-PTO-AM module outputs counter-clockwise pulses.
- **Accelerating:** Set while the move is in its acceleration phase and the frequency of the output pulses is increasing.
- **Decelerating:** Set while the move is in its deceleration phase and the frequency of the output pulses is decreasing.
- **MoveComplete:** Set at the end of any move that has a predefined stopping point. These moves are the Absolute, Relative, and Blend moves.
- **Stopped:** Set at the end of any move that does not have a predefined stopping point. These moves are the Jog, Registration, and Encoder Follower moves.

Command Status Bits

- **InHoldState:** Relative and Absolute Moves can be interrupted after they have started. The move decelerates to a stop and is placed in a “Hold State”. This bit is on while the move is in its Hold State. Once it is in its Hold State, a move can be restarted or a new move can be issued.
- **AtHome:** This bit is set to “1” when a homing command completes successfully. It is reset to “0” when the next command is accepted.
- **CommandError:** This bit is set to “1” when there is an error in a command.
- **HomeInvalid:** This bit is set to “1” when there is an error in the data of the Home command or when the module fails to find the machine’s home sensor. A list of the conditions that set this bit can be found in the [HomeInvalid Bit](#) section starting on page 75.
- **InvalidProfile:** This bit is set to “1” under various error conditions for most move types. The [InvalidProfile Bit](#) section, which starts on page 75, lists the specific conditions that will set this bit.

Acceleration Types

With the exception of homing operations, all of the move commands allow you to define the acceleration type used during the move. The 5034-PTO-AM supports three types of accelerations and decelerations.

Linear Acceleration

The axis accelerates (or decelerates) at a constant rate until the programmed speed is reached. Linear Acceleration offers the fastest acceleration, but the transition from, or to, the Starting Speed may not be smooth. The smoothest transitions occur when the configured Starting Speed is equal to the square root of the programmed acceleration or deceleration. Note that other accelerations will work correctly, but you may notice a quick change in velocity at the beginning of the acceleration phase or the end of the deceleration phase.

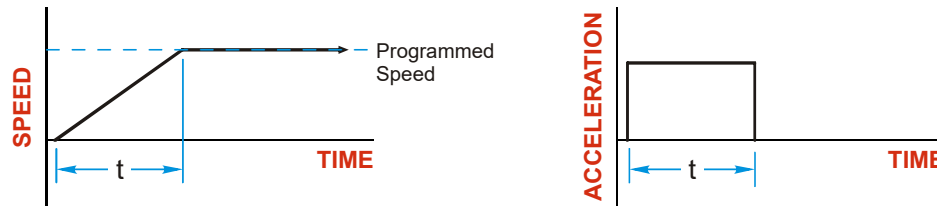


Figure R2.1 Linear Acceleration

Triangular S-Curve Acceleration

The axis accelerates (or decelerates) at a constantly changing rate that is slowest at the beginning and end of the acceleration phase of the move. The Triangular S-Curve type offers the smoothest acceleration, but it takes twice as long as a Linear Acceleration to achieve the same velocity.

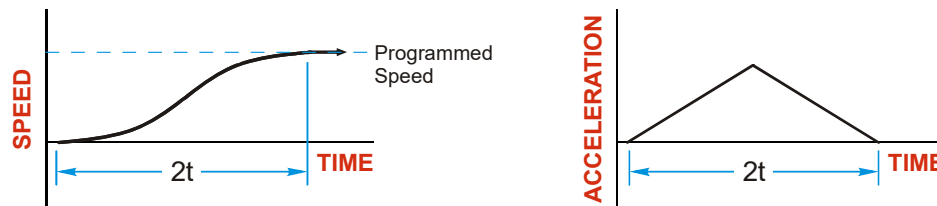


Figure R2.2 Triangular S-Curve Acceleration

Trapezoidal S-Curve Acceleration

The Trapezoidal S-Curve acceleration is a good compromise between the speed of Linear acceleration and the smoothness of Triangular S-Curve acceleration. Like the Triangular S-Curve, this acceleration type begins and ends the acceleration phase smoothly, but the middle half of the acceleration phase is linear. Because of this, the Trapezoidal S-Curve acceleration only requires 33% more time to achieve the same velocity as a Linear Acceleration, compared to the 100% more time of a Triangular S-Curve acceleration.

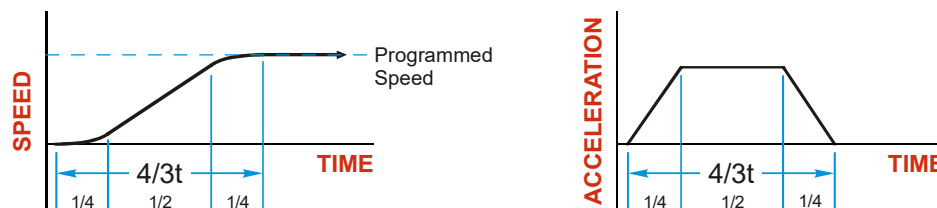


Figure R2.3 Trapezoidal S-Curve Acceleration

How to Control Moves in Progress

There are two ways of stopping a move in progress.

- **Controlled Stops:** The axis decelerates at the move's programmed deceleration value until it reaches the configured Starting Speed. The move stops at this point. If the Position_Invalid bit is reset to "0" at the end of the move, the motor position value is still considered valid. The machine does not need to be homed again before Absolute Moves can be run.
- **Immediate Stops:** The axis immediately stops outputting pulses regardless of the speed the motor is running at. Because it is possible for the inertia of the load to pull the motor beyond the stopping point, the motor position value is considered invalid after an Immediate Stop. The Position_Invalid bit will be set to "1" and the machine must be homed again before Absolute Moves can be run.

The 5034-PTO-AM also give you the ability to "hold" a relative and absolute move. The move is brought to a controlled stop, and the move is placed in a Hold State. The move can later be resumed and it will run to its completion. One example of the use of the Hold Move feature is on an axis that runs until there is an out of material condition. After the material is replenished, the axis can be restarted.

Note that a move that has been held does not have to be resumed. If a new move is written to the module while the previous move is in its held state, the previous move is canceled and the new move begins from the current position.

Available Inputs

The table below shows the available DC input types and available network bits, that affect the available moves. The complete table is shown here for easy reference. The appropriate rows are repeated in the sections below that explain each move in detail.

Note that the 5034-PTO-AM has four physical digital inputs, each of which can be programmed for one of seven different functions. One of these input functions is General Purpose Input. An input with this function type has its state reported over the network, but has no effect on moves.

	DC Digital Input Types							Backplane Bits		
	General Purpose	CW L.S.	CCW L.S.	Home L.S.	Capture	External	E-Stop	Hold Move	Resume Move	Immediate Stop
Absolute Move		1	1		2	3	4	3	5	4
Relative Move		1	1		2	3	4	3	5	4
CW Find Home		6	7	8	2		4	9		4
CCW Find Home		7	6	8	2		4	9		4
CW Jog Move		10	10		2	11	4	12		4
CCW Jog Move		10	10		2	11	4	12		4
CW Registration Move		10	10		2	13	4	12		4
CCW Registration Move		10	10		2	13	4	12		4
CW Blend Move		1	1		2		4	14		4
CCW Blend Move		1	1		2		4	14		4
Encoder Follower Move		1	1		15		4	12		4

Table R2.1 Control Inputs

See the numbered notes below.

A blank cell means that the state of the input has no effect on the move.

How to Control Moves in Progress (continued)

Available Inputs (continued)

- 1) An active limit switch input will immediately stop all motion, and prevent further motion.
- 2) An inactive-to-active transition on a Capture input will copy a position value into the Captured Position tag. If an encoder is not configured, the captured position is the motor position. If an encoder is configured, the captured position is the encoder value.
- 3) An inactive-to-active transition on an External input, or an active Hold AOI, will start to decelerate the move. The move will stop when the configured Starting Speed is reached and the move will enter its Hold State. If an External input is active when a move is started, the controller will output one pulse before the move enters its Hold State.
- 4) An inactive-to-active transition on an Emergency Stop Input, or an active Immediate_Stop AOI will immediately stop all pulse train output. The Position_Invalid bit will be set if motion was occurring when either of these conditions became true.
- 5) An active Resume AOI will resume an absolute or relative move if it is in its hold state. Activating the Resume AOI when a move is not in its hold state will generate a Command Error response from the module. If the move is running at this time, the move will continue.
- 6) An inactive-to-active transition on this limit switch input will immediately stop all motion. The controller will wait for two seconds, and then begin motion in the opposite direction while searching for the Home Input.
- 7) An inactive-to-active transition on this limit switch input will immediately stop all motion. The module will set the HomeInvalid, PositionInvalid, and InputError bits and abort the Find Home command.
- 8) Transitions on a Home Limit Switch input type will cause the controller to finish its homing sequence. Detailed explanations of the homing sequences can be found in the [Homing a 5034-PTO-AM](#) chapter, starting on page 33.
- 9) A Motion_Axis_Home (MAH) AOI cannot be held. If the Hold AOI is triggered during a MAH sequence, the module will respond by setting the Command Error bit in the network input data. The MAH command will continue to run.
- 10) An active limit switch input that shares the direction of motion with the move will immediately stop all motion, and prevent further motion. For example, an active CW limit will stop a CW Jog move. An active limit switch opposite to the direction of motion has no effect. For example, an active CCW limit will stop a CW Jog move.
- 11) An inactive-to-active transition on an External input will start to decelerate the move. The move will stop when the configured starting speed is reached. If the External Input is active when a move is started, the controller will output one pulse.
- 12) Jog, Registration, and Encoder Follower moves cannot be held. If the Hold AOI is triggered during one of these moves, the module will set the Command Error bit in the network input data, immediately begin to decelerate the move and bring the move to a controlled stop.
- 13) In general, an inactive-to-active transition on an External Input will start the end of the Registration Move. The move will output the programmed number of steps, which includes the deceleration phase, and stop when the configured starting speed is reached. See the [Registration Move](#) section, which starts on page 25, for complete information on how an External Input interacts with a Registration Move. If the External Input is active when a Registration Move is started, the controller will issue a command error.
- 14) Blend moves cannot be held. If the Hold AOI is triggered during one of these moves, the module will set the Command Error bit in the network input data to “1” and the move will continue. The Command Error bit in the network input data will be reset to “0” when the move is complete.
- 15) An inactive-to-active transition on a Capture input will copy the encoder value into the Captured Position tag.

A Simple Move

As shown in the figure below, a move from A (Current Position) to B (Target Position) consists of several parts.

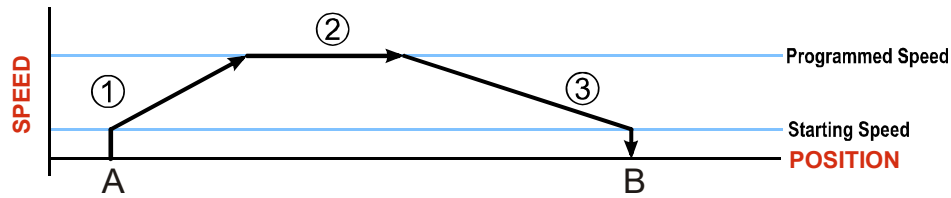


Figure R2.4 A Trapezoidal Profile

- 1) The move begins at point A, where the motor jumps from rest to the configured *Starting Speed*. The motor then accelerates at the programmed *Acceleration Value* until the speed of the motor reaches the *Programmed Speed*. Both the Acceleration Value and the Programmed Speed are programmed when the move command is sent to the 5034-PTO-AM. The Starting Speed is defined in the module's configuration.
- 2) The motor continues to run at the Programmed Speed until it reaches the point where it must decelerate before reaching point B.
- 3) The motor decelerates at the *Deceleration Value*, which is also programmed by the move command, until the speed reaches the Starting Speed, which occurs at the Target Position (B). The motor stops at this point. Note that the acceleration and deceleration values can be different in the move.

Figure R2.4 above shows a Trapezoidal Profile. A Trapezoidal Profile occurs when the Programmed Speed is reached during the move. This occurs when the number of steps needed to accelerate and decelerate are less than the total number of steps in the move.

Figure R2.5 below shows a Triangular Profile. A Triangular Profile occurs when the number of steps needed to accelerate to the Programmed Speed and decelerate from the Programmed Speed are greater than or equal to the total number of steps in the move. In this case, the profile will accelerate as far as it can before decelerating and the Programmed Speed is never reached.

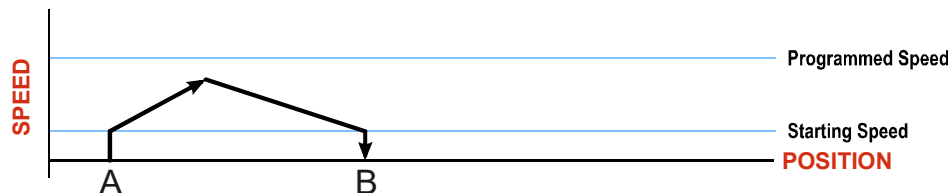


Figure R2.5 A Triangular Profile

Basic Move Types

Absolute Move

Absolute Moves move from the Current Position (A) to a given position (B). The module calculates the direction and number of steps needed to move to the given position and moves that number of steps. A trapezoidal profile is shown to the right, but Absolute Moves can also generate triangular profiles. The command's Target Position must be in the range of -8,388,607 to +8,388,607 counts.

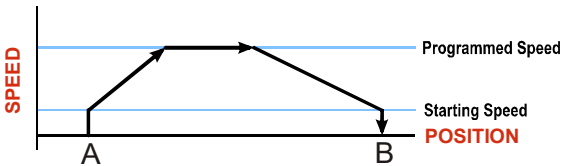


Figure R2.6 Absolute Move

NOTE

- 1) The *Home Position* of the machine must be set before running an Absolute Move. Refer to the reference section, *Homing a 5034-PTO-AM*, which starts on page 33.
- 2) The Motor Position must be valid before you can use an Absolute Move. The Motor Position becomes valid when you preset the position or home the machine. In other words, the Position_Invalid bit must be “0”.
- 3) Absolute Moves allow you to move your machine without having to calculate relative positions. If you are controlling a rotary table, you can drive the table to any angle without having to calculate the distance to travel. For example an Absolute Move to 180° will move the table to the correct position regardless of where the move starts from.

Motion Status Bits

The motion status bits function as described in the *Motion Status Bits* section on page 17.

Control Inputs

	DC Digital Input Types							Backplane Bits		
	General Purpose	CW L.S.	CCW L.S.	Home L.S.	Capture	External	E-Stop	Hold Move	Resume Move	Immediate Stop
Absolute Move		1	1		2	3	4	3	5	4

Table R2.2 Absolute Move Control Inputs

A blank cell means that the state of the input has no effect on the move.

- 1) A limit switch input will immediately stop all motion, and prevent further motion, as long as the input is active.
- 2) An inactive-to-active transition on a Capture input will copy a position value into the Captured Position tag. If an encoder is not configured, the captured position is the motor position. If an encoder is configured, the captured position is the encoder value.
- 3) An inactive-to-active transition on an External input, or a 0-to-1 transition on the Hold Move bit, will start to decelerate the move. The move will stop when the configured starting speed is reached and the move will enter its Hold State. If an External input or Hold Move bit is active when a move is started, the controller will output one pulse before the move enters its Hold State.
- 4) An inactive-to-active transition on an Emergency Stop Input, or setting the Immediate Stop bit in the network output data will immediately stop all pulse train output. The Position_Invalid bit will be set if motion was occurring when either of these conditions became true.
- 5) A 0-to-1 transition on the Resume_Move bit will resume an absolute or relative move if it is in its hold state. A 0-to-1 transition on this bit when a move is not in its hold state will generate a Command Error response from the module. If the move is running at this time, the move will continue.

Basic Move Types (continued)

Relative Move

Relative Moves move an offset number of steps (n) from the Current Position (A). A trapezoidal profile is shown to the right, but Relative Moves can also generate triangular profiles. The command's Target Position is the move's offset. The offset can be in the range of -8,388,607 to +8,388,607 counts. Positive offsets will result in clockwise moves, while negative offsets result in counter-clockwise moves.

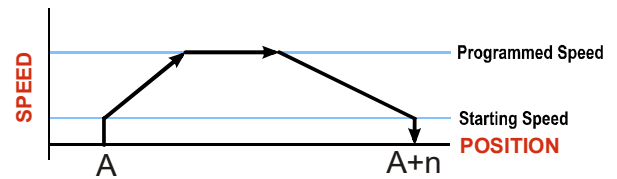


Figure R2.7 Relative Move

NOTE

- 1) You do not have to preset the position or home the machine before you can use a Relative Moves. That is, the Position_Invalid status bit can be set.
- 2) Relative Moves allow you to move your machine without having to calculate absolute positions. If you are indexing a rotary table, you can perform a relative move of 30° multiple times without recalculating new target positions in your controller. If you perform the same action with Absolute Moves, you would have to calculate your 30° position followed by your 60° position, followed by your 90° position, etc.

Motion Status Bits

The motion status bits function as described in the [Motion Status Bits](#) section on page 17.

Control Inputs

	DC Digital Input Types							Backplane Bits		
	General Purpose	CW L.S.	CCW L.S.	Home L.S.	Capture	External	E-Stop	Hold Move	Resume Move	Immediate Stop
Relative Move		1	1		2	3	4	3	5	4

Table R2.3 Relative Move Control Inputs

A blank cell means that the state of the input has no effect on the move.

- 1) A limit switch input will immediately stop all motion, and prevent further motion, as long as the input is active.
- 2) An inactive-to-active transition on a Capture input will copy a position value into the Captured Position tag. If an encoder is not configured, the captured position is the motor position. If an encoder is configured, the captured position is the encoder value.
- 3) An inactive-to-active transition on an External input, or a 0-to-1 transition on the Hold Move bit, will start to decelerate the move. The move will stop when the configured starting speed is reached and the move will enter its Hold State. If an External input or Hold Move bit is active when a move is started, the controller will output one pulse before the move enters its Hold State.
- 4) An inactive-to-active transition on an Emergency Stop Input, or setting the Immediate Stop bit in the network output data, will immediately stop the pulse train output. The Position_Invalid bit will be set if motion was occurring when either of these conditions became true.
- 5) A 0-to-1 transition on the Resume_Move bit will resume an absolute or relative move if it is in its hold state. A 0-to-1 transition on this bit when a move is not in its hold state will generate a Command Error response from the module. If the move is running at this time, the move will continue.

Basic Move Types (continued)**Jog Move**

Jog Moves move in the programmed direction, clockwise or counter-clockwise, as long as the command is active. These commands are often used to give the operator manual control over the axis.

NOTE  The Target Position value must be zero during a Jog Move. If it is not zero, the move will actually be a *Registration Move*, and the final stopping position may be unexpected.

Jog Moves can be brought to a Controlled Stop by the Stop_Jog AOI or activating the External Input. The axis will decelerate at the programmed rate to the configured Starting Speed and stop.

NOTE  The 5034-PTO-AM will output one step in the specified direction if the External Input is active when a Jog Move is started.

The CW Limit and CCW Limit inputs behave differently for Jog Moves than all other move types except for Registration Moves. Like all moves, activating a limit that is the same as the direction of travel, for example activating the CW Limit during a CW Jog Move, will bring the move to an Immediate Stop. Unlike the other moves, activating a limit that is opposite to the direction of travel, for example activating the CCW Limit during a CW Jog Move, has no effect. This allows you to jog off of the activated limit switch.

If the initial Programmed Speed is greater than the configured Starting Speed when the command is issued, then the move's Programmed Speed, Acceleration Value and Type, and Deceleration Value and Type can be changed while the move is running. The axis will accelerate or decelerate to the new Programmed Speed when it is changed. Note that the acceleration and deceleration parameters are not changed unless the Programmed Speed is also changed.

If the initial Programmed Speed is set to a value less than or equal to the configured Starting Speed when the command is issued, the 5034-PTO-AM will perform a *Constant Speed Jog*. The move will run at the Programmed Speed only. The move's Programmed Speed, Acceleration Value and Type, and Deceleration Value and Type cannot be changed while the move is running. Attempting to do so will cause an error.

If the Programmed Speed is set to zero when the command is issued, the 5034-PTO-AM will perform a *One Shot Jog* and output one pulse in the specified direction. The pulse is output at the configured Starting Speed.

Motion Status Bits

The motion status bits function as described in the *Motion Status Bits* section on page 17.

Basic Move Types (continued)**Jog Move (continued)****Control Inputs**

	DC Digital Input Types							Backplane Bits		
	General Purpose	CW L.S.	CCW L.S.	Home L.S.	Capture	External	E-Stop	Hold Move	Resume Move	Immediate Stop
CW Jog Move		10	10		2	11	4	12		4
CCW Jog Move		10	10		2	11	4	12		4

Table R2.4 Jog Move Control Inputs

See numbered notes below

A blank cell means that the state of the input has no effect on the move.

- 2) An inactive-to-active transition on a Capture input will copy a position value into the Captured Position tag. If an encoder is not configured, the captured position is the motor position. If an encoder is configured, the captured position is the encoder value.
- 4) An inactive-to-active transition on an Emergency Stop Input, or an active Immediate_Stop AOI will immediately stop all pulse train output. The Position_Invalid bit will be set if motion was occurring when either of these conditions became true.
- 10) An active limit switch input that shares the direction of motion with the move will immediately stop all motion, and prevent further motion. For example, an active CW limit will stop a CW Jog move. An active limit switch opposite to the direction of motion has no effect. For example, an active CCW limit will stop a CW Jog move.
- 11) An inactive-to-active transition on an External input will start to decelerate the move. The move will stop when the configured starting speed is reached. If the External Input is active when a move is started, the controller will output one pulse.
- 12) Jog, Registration, and Encoder Follower moves cannot be held. If the Hold AOI is triggered during one of these moves, the module will set the Command Error bit in the network input data, immediately begin to decelerate the move and bring the move to a controlled stop.

Registration Move

Similar to a Jog Move, a Registration Move will travel in the programmed direction as long as the Registration AOI is active. When the command terminates under Controlled Stop conditions, the 5034-PTO-AM will output a programmed number of steps as part of bringing the move to a stop. Controlled Stop conditions are resetting the command bit from the backplane or activating the External Input. Note that all position values programmed with a Registration Move are relative values, not absolute machine positions.

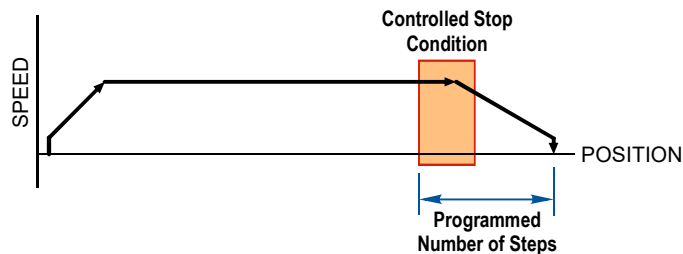


Figure R2.8 Registration Move

Available Move Types (continued)

Registration Move (continued)

If the Programmed Number of Steps are less than the number of steps needed to bring the axis to a stop based on the Programmed Speed and Deceleration values set with the command, the 5034-PTO-AM will issue an error message instead of starting the move.

Registration Moves can be brought to a Controlled Stop by the Stop_Jog AOI or activating the External Input. The axis will decelerate at the programmed rate to the configured Starting Speed and stop. An error message will be issued if the External Input is active when a Registration Move is initiated.

Like the Jog Moves, activating a limit that is opposite to the direction of travel, for example activating the CCW Limit during a CW Registration Move, has no effect.

An additional feature of the 5034-PTO-AM is the ability to program the module to ignore the Controlled Stop conditions until a minimum number of steps have occurred. This parameter is the Minimum Registration Move Distance and is programmed with the Prog_Min_Reg_Dist AOI. This value is stored until the module is re-configured or power is cycled. Figure R2.9 shows how the Minimum Registration Move Distance effects when the Stop Condition is applied to the move. As shown in the second diagram, Controlled Stop conditions are level triggered, not edge triggered. If a Controlled Stop Condition occurs before the Minimum Registration Move Distance is reached and stays active, the move will begin its controlled stop once the Minimum Registration Move Distance is reached.

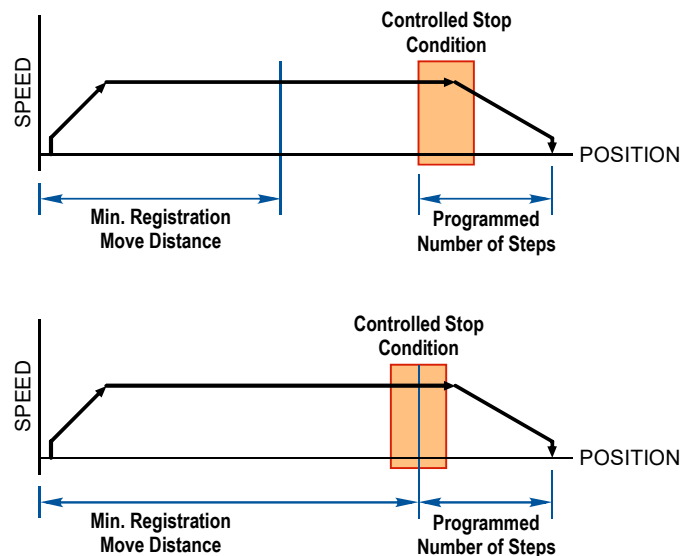


Figure R2.9 Min. Registration Move Distance

The Programmed Speed can be changed while the move is occurring under the following conditions:

- The value cannot be changed once a Controlled Stop condition occurs.
- The value can only be decreased.
- When changing the Programmed Speed, the Acceleration and Deceleration values must be the same as they were when the original command was sent to the module.

All other parameter values are fixed when the command is first issued.

Available Move Types (continued)**Registration Move (continued)****Control Inputs**

	DC Digital Input Types							Backplane Bits		
	General Purpose	CW L.S.	CCW L.S.	Home L.S.	Capture	External	E-Stop	Hold Move	Resume Move	Immediate Stop
CW Registration Move		10	10		2	13	4	12		4
CCW Registration Move		10	10		2	13	4	12		4

Table R2.5 Registration Move Control Inputs

See numbered notes below

A blank cell means that the state of the input has no effect on the move.

- 2) An inactive-to-active transition on a Capture input will copy a position value into the Captured Position tag. If an encoder is not configured, the captured position is the motor position. If an encoder is configured, the captured position is the encoder value.
- 4) An inactive-to-active transition on an Emergency Stop Input, or an active Immediate_Stop AOI will immediately stop all pulse train output. The Position_Invalid bit will be set if motion was occurring when either of these conditions became true.
- 10) An active limit switch input that shares the direction of motion with the move will immediately stop all motion, and prevent further motion. For example, an active CW limit will stop a CW Jog move. An active limit switch opposite to the direction of motion has no effect. For example, an active CCW limit will stop a CW Jog move.
- 12) Jog, Registration, and Encoder Follower moves cannot be held. If the Hold AOI is triggered during one of these moves, the module will set the Command Error bit in the network input data, immediately begin to decelerate the move and bring the move to a controlled stop.
- 13) In general, an inactive-to-active transition on an External Input will start the end of the Registration Move. The move will output the programmed number of steps, which includes the deceleration phase, and stop when the configured starting speed is reached. See the [Registration Move](#) section, which starts on page 25, for complete information on how an External Input interacts with a Registration Move. If the External Input is active when a Registration Move is started, the controller will issue a command error.

Available Move Types (continued)

Blend Move

This command allows you to create more complicated move profiles consisting of two to sixteen segments that are all programmed as relative moves. The figure below shows a three segment Blend Move that is run twice. It is first run in the clockwise direction, and then in the counter-clockwise direction.

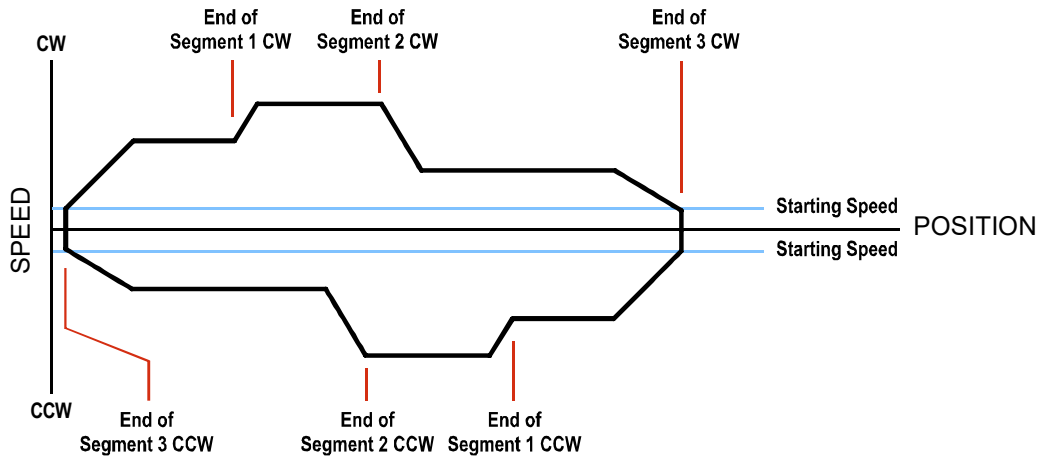


Figure R2.10 Blend Move Profile

Each segment is programmed with a single Program_Blend_Move AOI. The AOI programs the number of segments, the speed, length, and acceleration of each segment, and the final deceleration value for the move.

The Programmed Speed must change between segments. The Segment Length and the Acceleration/Deceleration rates do not have to change from one segment to the next. An Invalid Profile Error will be generated if the Programmed Speed parameter is the same in two consecutive blend move segments. An Invalid Profile Error will also be issued if the segment length does not contain enough steps to reach the Programmed Speed based on the programmed Acceleration Type and Value.

The blend move programming is done before the move is begun, with all of the segments of the blend move profile stored in the internal memory of the 5034-PTO-AM. This data will remain in the module's memory until power is removed from the module, the configuration data is programmed, or a new blend move profile is programmed for the axis. Once stored, multiple Blend Move commands can be run on the data stored in memory. You do not have to re-program the Blend Move segments before every move.

NOTE By default, the Program_Blend_Move AOI uses the Linear Acceleration type when programming the acceleration and deceleration types. The acceleration and deceleration types can be programmed to the Triangular or Trapezoidal S-Curve types by using a hidden variable in the AOI.

When a Blend Move command is issued, the first segment starts at the configured Starting Speed and accelerates to the specified Programmed Speed. The starting speed for the next segment is equal to the Programmed Speed of the current segment. The final segment will decelerate from its Programmed Speed to the Starting Speed and then stop. It is not possible to program a direction reversal in the Blend Move profile.

Blend Moves cannot be brought into a Hold State. The External Input is ignored during a Blend Move and issuing a Hold command will only result in the *Command Error* bit being set. The move profile will continue until it is complete, at which time the error bit will be reset.

Available Move Types (continued)**Blend Move (continued)****Control Inputs**

	DC Digital Input Types							Backplane Bits		
	General Purpose	CW L.S.	CCW L.S.	Home L.S.	Capture	External	E-Stop	Hold Move	Resume Move	Immediate Stop
CW Blend Move		1	1		2		4	14		4
CCW Blend Move		1	1		2		4	14		4

Table R2.6 Blend Move Control Inputs

See numbered notes below

A blank cell means that the state of the input has no effect on the move.

- 1) An active limit switch input will immediately stop all motion, and prevent further motion.
- 2) An inactive-to-active transition on a Capture input will copy a position value into the Captured Position tag. If an encoder is not configured, the captured position is the motor position. If an encoder is configured, the captured position is the encoder value.
- 4) An inactive-to-active transition on an Emergency Stop Input, or an active Immediate_Stop AOI will immediately stop all pulse train output. The Position_Invalid bit will be set if motion was occurring when either of these conditions became true.
- 14) Blend moves cannot be held. If the Hold AOI is triggered during one of these moves, the module will set the Command Error bit in the network input data to "1" and the move will continue. The Command Error bit in the network input data will be reset to "0" when the move is complete.

Encoder Follower Moves (Incremental Encoders Only)

An encoder is typically used in an open-loop system for position verification. The encoder is mounted to the back of the controlled motor and the encoder position is read after a move to verify that the motor moved as expected.

When the 5034-PTO-AM is used in Encoder Follower mode, the encoder is not mounted on the controlled motor. Instead, the encoder is typically mounted on a second motor, but it can be mounted anywhere, including on something as simple as a hand crank. While in this mode, the 5034-PTO-AM does not accept move commands over the backplane. Instead, the 5034-PTO-AM will output motor control pulses in response to pulses on the encoder inputs.

The move is controlled by the Encoder_Follower AOI. One of the parameters in the AOI is Direction. A *PositiveCW* setting will output clockwise pulses when the encoder count increases. A *NegativeCCW* setting will output counter-clockwise pulses when the encoder count increases. The 5034-PTO-AM increases the encoder count register when the encoder's A signal leads the B signal. Note that the programmable Direction cannot be changed while an Encoder Follower move is occurring.

This mode is also known as Electronic Gearing, because the motor behaves as if it is mechanically geared to the encoder. The 5034-PTO-AM has Multiplier and Divisor parameters that allow you to adjust the ratio between the encoder and the motor. The Multiplier and Divisor parameter each have a range of 1 to 32,767. It is possible to enter a ratio greater than one when programming these values. The 5034-PTO-AM will then output multiple steps per encoder count.

As with all encoder functions on the 5034-PTO-AM, X4 decoding is used when changing the encoder count register. This fact must be taken into account when calculating the appropriate Multiplier and Divisor values.

Available Move Types (continued)

Encoder Follower Moves (Incremental Encoders Only) (continued)

The maximum encoder input frequency is 250KHz. The maximum motor output frequency is 1 MHz. It is possible for your application to exceed this frequency when the Multiplier/Divisor ratio is greater than one. For example, assume your Multiplier/Divisor ratio is 3, and your encoder input frequency is 125 KHz. Ideally, your motor output frequency would be:

$$125\text{KHz} \times 4\{\text{decoding}\} \times 3\{\text{ratio}\} = 1.5\text{MHz}$$

As this exceeds the 1 MHz limit, the 5034-PTO-AM will output pulses at 1MHz until motor position catches up with the encoder position.

The Linear Acceleration type is the only one available when using the Encoder_Follower AOI. Unlike other moves, the Acceleration and Deceleration values can be set to zero with this move type. If they are zero, the axis will immediately match the encoder speed when a move begins. If this stalls the motor, set the Acceleration and Deceleration parameters to their maximum value of 2000 steps/second/millisecond. If a move still causes the motor to stall, then decrease the Acceleration and Deceleration values until the motor runs correctly.

NOTE

- 1) The 5034-PTO-AM will always output the correct number of steps when operating in this mode. However, the use of the Acceleration and Deceleration parameters, especially low values, can cause the motor's motion to lag behind the encoder's motion.
- 2) If the Acceleration and Deceleration parameters are set to zero, electrical noise on the encoder inputs may cause the motor to oscillate when there is no encoder motion.

Control Inputs

	DC Digital Input Types							Backplane Bits		
	General Purpose	CW L.S.	CCW L.S.	Home L.S.	Capture	External	E-Stop	Hold Move	Resume Move	Immediate Stop
Encoder Follower Move		1	1		15		4	12		4

Table R2.7 Encoder Follower Move Control Inputs

See numbered notes below

A blank cell means that the state of the input has no effect on the move.

- 1) An active limit switch input will immediately stop all motion, and prevent further motion.
- 4) An inactive-to-active transition on an Emergency Stop Input, or an active Immediate_Stop AOI will immediately stop all pulse train output. The Position_Invalid bit will be set if motion was occurring when either of these conditions became true.
- 12) Jog, Registration, and Encoder Follower moves cannot be held. If the Hold AOI is triggered during one of these moves, the module will set the Command Error bit in the network input data, immediately begin to decelerate the move and bring the move to a controlled stop.
- 15) An inactive-to-active transition on a Capture input will copy the encoder value into the Captured Position tag.

Profile Equations

This section allows you to program very precise profiles. Understanding this section is not necessary before programming the 5034-PTO-AM and it can be considered optional.

The equations in this section allow you to calculate the number of steps and time needed to accelerate and decelerate as well as the time required for the complete move. You will also be able to determine if your move will generate a Trapezoidal or Triangular Profile.

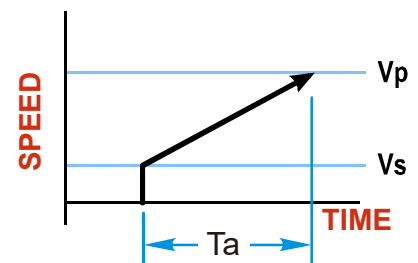
The equations in the rest of this chapter use a unit of measure of steps/second/second (steps/second^2) for acceleration and deceleration. However, when programming the 5034-PTO-AM, all acceleration and deceleration values must be programmed in the unit of measure of steps/second/millisecond.

- To convert from steps/second^2 to $\text{steps/second/millisecond}$, divide the value by 1000. This must be done when converting from a value used in the equations to a value programmed into the 5034-PTO-AM.
- To convert from $\text{steps/second/millisecond}$ to steps/second^2 , multiply the value by 1000. This must be done when converting from the value programmed into the 5034-PTO-AM to the value used in the equations.

Acceleration Equations

The following variables are used in these equations:

- **a** = Acceleration/deceleration value. Must be in the units of steps/second^2
- **T_A or T_D** = Time needed to complete the acceleration or deceleration phase of the move
- **D_A or D_D** = Number of Steps needed to complete the acceleration or deceleration phase of the move
- **V_S** = Configured Starting Speed of the move
- **V_P** = Programmed Speed of the move



Acceleration Type	T _A or T _D (Time to Accelerate or Decelerate)	D _A or D _D (Distance to Accelerate or Decelerate)	a (Acceleration value based on T _A)
Linear	$T_A = (V_P - V_S)/a$	$D_A = T_A * (V_P + V_S)/2$	$a = (V_P - V_S)/T_A$
Triangular S-Curve	$T_A = 2((V_P - V_S)/a)$	$D_A = T_A * (V_P + V_S)/2^{\ddagger}$	$a = (V_P - V_S)/T_A^{\ddagger}$
Trapezoidal S-Curve	$T_A = 4/3((V_P - V_S)/a)$	$D_A = T_A * (V_P + V_S)/2^{\ddagger}$	$a = (V_P - V_S)/T_A^{\ddagger}$

a. For these equations, $T_A = 2((V_P - V_S)/a)$

‡ For these equations, $T_A = 4/3((V_P - V_S)/a)$

Table 0.1 Acceleration Equations

If the sum of the D_A and D_D values for of the move is *less than* the total number of steps in the move, your move will have a Trapezoidal profile.

If the sum of the D_A and D_D values for of the move is *equal to* the total number of steps in the move, your move will have a Triangular profile and your move will reach the Programmed Speed before it begins to decelerate.

Profile Equations (continued)**Acceleration Equations (continued)**

If the sum of the D_A and D_D values for of the move is *greater than* the total number of steps in the move, your move will have a Triangular profile and your move *will not* reach the Programmed Speed before it begins to decelerate. You can determine your maximum running speed by substituting your T_A equation into your D_A equation and solving for V_P . The value of D_A that you use will depend on the ratio of the acceleration and deceleration values. If both values are the same, use a value of $D_A/2$ in your equation. Once you have determined your maximum running speed, you can determine your T_A and T_D values.

Total Time Equations

For Trapezoidal Profiles you must first determine the number of counts that you are running at the Programmed Speed. This value, (D_P below), is equal to your D_A and D_D values subtracted from your total travel. You can then calculate your total profile time, (T_T below), from the second equation.

$$D_P = (\text{Total Number of Steps}) - (D_A + D_D)$$

$$T_T = T_A + T_D + D_P/V_P$$

For Triangular Profiles, the total time of travel is simply:

$$T_T = T_A + T_D$$

HOMING A 5034-PTO-AM

This chapter explains the various ways of homing a 5034-PTO-AM unit. Inputs used to home the unit are introduced and diagrams that show how the unit responds to a homing command are given.

Definition of Home Position

The Home Position is any position on your machine that you can sense and stop at. Once at the Home Position, the motor position register of a 5034-PTO-AM must be set to an appropriate value. If you use the unit's Machine_Axis_Home (MAH) AOI, the motor position register will automatically be set to zero once the home position is reached. The Encoder Position register will also be reset to zero if the encoder is enabled.

NOTE

Defining a Home Position is completely optional. Some applications, such as those that use a 5034-PTO-AM for speed control, don't require position data at all.

The 5034-PTO-AM module has one position status bit, the Position_Invalid bit. This bit is set when the reported motor position may not correspond to the actual machine position. The reported motor position is a bi-directional counter that tracks the number, and direction, of the output pulses. The actual machine position is the physical position of the axis on the machine.

Absolute Moves cannot be run while the Position_Invalid bit is set. All other move types can be run while the Position_Invalid bit is set.

Position Preset

One way to define the Home Position is to use the Motion_Redefine_Position (MRP) AOI. The encoder position can be preset using the module's Preset_Encoder AOI. The motor and encoder position values can be preset anywhere in the range of -8,388,607 to +8,388,607.

NOTE

The 5043-PTO-AM does not scale the encoder data and has no control over how many steps per turn is used by the motor drive attached to the 5034-PTO-AM. If the encoder counts per turn is not equal to the motor steps per turn, then you will not be able to directly compare the two positions to see if a move completed successfully. You will have to scale the encoder position or the motor position in your PLC code before comparing the two.

Motion_Axis_Home (MAH) AOI

The other choice is to use the Motion_Axis_Home (MAH) AOI to command the 5034-PTO-AM to find the homing sensor on the machine that is wired into the unit. The starting motion direction is set as one of the parameter of the AOI. A *PositiveCW* setting begins the search by outputting clockwise pulses and ends when the home sensor triggers while the 5034-PTO-AM is outputting clockwise pulses *at the starting speed*. The *NegativeCCW* setting operates in the same way but starts and ends with motion in the counter-clockwise direction.

Homing Inputs

These DC inputs are used when homing the position.

- **Home Input:** This input is used to define the actual home position of the machine.
- **CW Limit Switch Input:** This input is used to prevent overtravel in the clockwise direction.
- **CCW Limit Switch Input:** This input is used to prevent overtravel in the counter-clockwise direction.

Homing Configurations

A 5034-PTO-AM must have one of its DC inputs configured as the home input and one of its inputs configured as a limit switch before one of the *Find Home* commands can be issued.



The Motion_Axis_Home (MAH) AOI cannot be started with a clockwise starting direction unless a CW Limit Switch is defined in the configuration data. The Motion_Axis_Home (MAH) AOI cannot be started with a counter-clockwise starting direction unless a CCW Limit Switch is defined in the configuration data.

Home to an End Stop

In order to use the Motion_Axis_Home (MAH) AOI, the machine must be able to move beyond the homing sensor *in both directions*. Some machines can only be homed to a hard stop at one end of travel. The 5034-PTO-AM can be homed on these machines by using one of the end limit switches. The following steps can be used.

- 1) Jog at low speed towards the hard stop. If possible reduce the motor's current setting to the lowest value that achieves motion.
- 2) Monitor the InputError status bit from the 5034-PTO-AM. The Jog ends when this bit is set to "1".
- 3) Issue the Reset Error command and wait for the InputError status bit to be reset to "0"
- 4) Use the MRP AOI to set the motor position to your desired value. This will reset the Position_Invalid status bit.
- 5) If you are using an encoder, use the Preset_Encoder command if you want the motor and encoder positions to be the same.
- 6) Issue a jog command in the opposite direction.
- 7) Use the appropriate Input1Active through Input4Active status bit from the 5034-PTO-AM to monitor the state of the activated end limit switch. Stop the jog move once the bit becomes a "0".

Homing Profiles



NOTE The Motion_Axis_Home (MAH) AOI with a *PositiveCW* starting direction is used in all of these examples. The Motion_Axis_Home (MAH) AOI with a *NegativeCCW* starting direction will generate the same profiles in the opposite direction.

Home Input Only Profile

Figure R3.1 below shows the move profile generated by the Motion_Axis_Home (MAH) AOI when the Home Input is reached without encountering the CW Limit Switch .

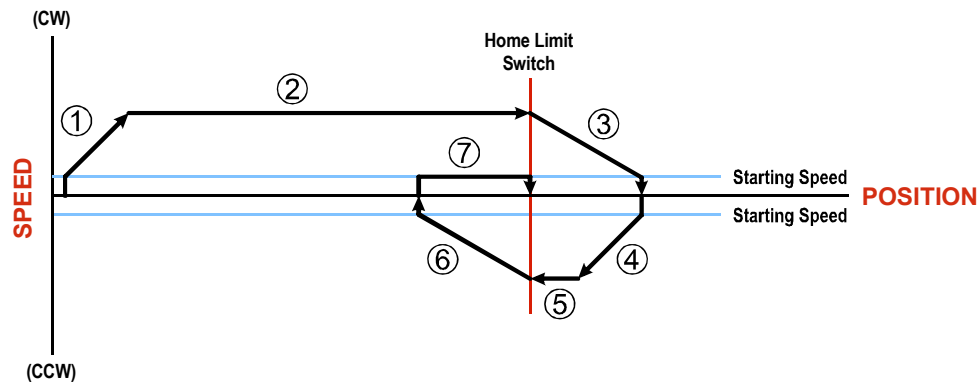


Figure R3.1 Home Input Profile

- 1) Accelerate from the configured Starting Speed to the Programmed Speed.
- 2) Run at the Programmed Speed until the Home Input activates.
- 3) Decelerate to the Starting Speed and stop, followed by a two second delay.
- 4) Accelerate to the Programmed Speed opposite to the requested direction.
- 5) Run opposite the requested direction until the Home Input transitions from Active to Inactive.
- 6) Decelerate to the Starting Speed and stop, followed by a two second delay.
- 7) Return to the Home Input at the configured Starting Speed. Stop when the Home Input transitions from inactive to active.



NOTE If the Home Input is active when the command is issued, the move profile begins at step 5 above.

Homing Profiles (continued)

Profile with Overtravel Limit

Figure R3.2 below shows the move profile generated by the Motion_Axis_Home (MAH) AOI when it encounters a CW Limit Switch before the Home Limit Switch

NOTE

If you configure both the CW Limit Switch and the CCW Limit Switch, the 5034-PTO-AM will stop and issue a *Home Invalid* error to your host if you activate the overtravel limit associated with travel that is the opposite of the starting direction. i.e. Activating the CCW limit during an MAH that is programmed to start in the clockwise direction. This can occur if the overtravel limits are not wired to the unit correctly, not configured correctly, or a wiring error in the home sensor stops it from triggering.

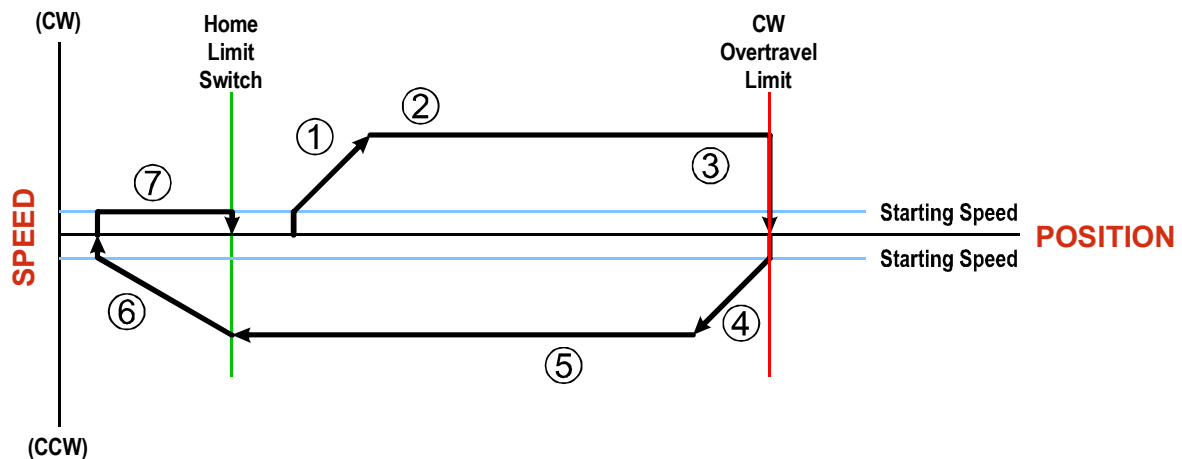


Figure R3.2 Profile with Overtravel Limit

- 1) Accelerate from the configured Starting Speed to the Programmed Speed.
- 2) Run at the Programmed Speed.
- 3) Hit CW Limit and immediately stop, followed by a two second delay.
- 4) Accelerate to the Programmed Speed opposite to the requested direction.
- 5) Run opposite the requested direction until the Home Input transitions from Active to Inactive.
- 6) Decelerate to the Starting Speed and stop, followed by a two second delay.
- 7) Return to the Home Input at the configured Starting Speed. Stop when the Home Input transitions from Inactive to Active.

NOTE

If the overtravel limit is active when the MAH AOI is started, the profile will begin at step 4.

Controlling Find Home Commands In Progress

Motion Status Bits

The motion status bits function as described in the [Motion Status Bits](#) section on page 17.

Control Inputs

	DC Digital Input Types							Backplane Bits		
	General Purpose	CW L.S.	CCW L.S.	Home L.S.	Capture	External	E-Stop	Hold Move	Resume Move	Immediate Stop
CW Find Home		6	7	8	2		4	9		4
CCW Find Home		7	6	8	2		4	9		4

Table R3.1 Control Inputs

See numbered notes below.

A blank cell means that the state of the input has no effect on the move.

- 2) An inactive-to-active transition on a Capture input will copy a position value into the Captured Position tag. If an encoder is not configured, the captured position is the motor position. If an encoder is configured, the captured position is the encoder value.
- 4) An inactive-to-active transition on an Emergency Stop Input, or an active Immediate_Stop AOI will immediately stop all pulse train output. The PositionInvalid bit will be set if motion was occurring when either of these conditions became true.
- 6) An inactive-to-active transition on a limit switch input will immediately stop all motion. The controller will wait for two seconds, and then begin motion in the opposite direction while searching for the Home Input.
- 7) An inactive-to-active transition on this limit switch input will immediately stop all motion. The module will set the HomeInvalid, PositionInvalid, and InputError bits and abort the Find Home command.
- 8) Transitions on a Home Limit Switch input type will cause the controller to finish its homing sequence. Detailed explanations of the homing sequences can be found in the [Homing a 5034-PTO-AM](#) chapter, starting on page 33.
- 9) A Motion_Axis_Home (MAH) AOI cannot be held. If the Hold AOI is triggered during a MAH sequence, the module will respond by setting the Command Error bit in the network input data. The MAH command will continue to run.

Notes

TASK 1

HARDWARE INSTALLATION

This section is intended for the engineer or technician responsible for physically installing the 5034-PTO-AM module.

1.1 Satisfy Environmental and Power Requirements

1.1.1 Module Location

The 5034-PTO-AM module is suitable for use in industrial environments that meet the following criteria:

- Only non-conductive pollutants normally exist in the environment, but an occasional temporary conductivity caused by condensation is expected.
- Transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

Note that these criteria apply to the system as a whole. These criteria are equivalent to the *Pollution Degree 2* and *Over Voltage Category II* designations of the International Electrotechnical Commission (IEC).

Refer to PointMax I/O documentation from Rockwell Automation for information on environmental requirements for the PointMax I/O system as a whole.



Because of their on-board microprocessors, the 5034-PTO-AM modules will become warmer than most PointMax I/O modules. The Rockwell Automation defined spacing around the PointMax I/O system is all that is required for convection cooling. Additional spacing or cooling is not required.

1.1.2 Power Requirements

A 5034-PTO-AM module requires 0.96W (40mA @ 24Vdc) to operate. All power is drawn from the supply attached to the SA PWR pins on the PointMax-I/O network adapter.

When using the General Purpose Output on the 5034-PTO-AM or the SA_Power pin on the module to power an absolute encoder, the maximum current that can be drawn from the pin is 460mA @ 24Vdc. The actual power draw depends on the load attached to the General Purpose Output pin or the absolute encoder. This power draw must be added to the module's operating current when sizing the power supply for the RA PointMax-I/O network adapter.

1.1.3 Safe Handling Guidelines

Prevent Electrostatic Damage



Electrostatic discharge can damage an 5034-PTO-AM module if you touch the rear bus connector pins. Follow these guidelines when handling the module.

- 1) Touch a grounded object to discharge static potential before handling the module.
- 2) Work in a static-safe environment whenever possible.
- 3) Wear an approved wrist-strap grounding device.
- 4) Do not touch the pins of the bus connector or the I/O connector.
- 5) Do not disassemble the module
- 6) Store the module in its anti-static bag and shipping box when it is not in use.

1.1 Satisfy Environmental and Power Requirements (continued)

1.1.3 Safe Handling Guidelines (continued)

Prevent Debris From Entering the Module



During DIN rail mounting of all devices, be sure that all debris (metal chips, tapping liquid, etc.) is prevented from falling into the module. Debris may cause damage to the module or unintended machine operation with possible personal injury. The DIN rail for the modules should be securely installed and grounded before the modules are mounted on it.

Remove Power Before Servicing in a Hazardous Environment



Remove power before removing or installing any modules in a hazardous environment.

1.2 Install the Mounting Base

PointMax I/O terminal base assemblies are Rockwell Automation products and RA literature should be considered the authority on installing these products. Steps are given here as a convenience. If you have any questions, refer to RA documentation for additional information.

- 1) Align the interlocking guides on the left side of the mounting base with the interlocking guides on the right side of the installed adapter.
- 2) Slide the mounting base towards the DIN rail until the mounting base locks on the DIN rail.
- 3) Slide the side latch of the mounting base to the locked position. The side latch secures the installed mounting base to the adapter.
- 4) If this the last mounting base in the block, install the safety end cap to protect the exposed pins.

1.3 Install the 5034-PTO-AM Module

The 5034-PTO-AM installs into the selected wiring base in the same fashion as all other PointMax I/O modules. The 5034-PTO-AM module can be installed in the mounting base before or after the mounting base is installed on the DIN rail.

1.3.1 Remove Power

Power should be removed from the system before installing the 5034-PTO-AM.

1.3.2 Installation

Install the 5034-PTO-AM module by inserting it into the mounting base and pressing straight down. The module will lock into place.

1.4 Install the Removable Terminal Block (RTB)

1.4.1 RTB Keying

The 5034-PTO-AM module supports RTB keying to prevent the wrong removable terminal block from being inserted into the module. For the 5034-PTO-AM module, the keying slots are 3, 9, and 11. Note that the use of the keys is optional, but can prevent the wrong terminal block from being inserted into the module during initial commissioning or maintenance.

1.4.2 Remove Power

Power should be removed from the system before the RTB is installed or removed. This is to prevent the possibility of creating an electrical arc when the installation or removal is performed.

1.4.3 Installation

- 1) Hook the RTB pivot clip to the I/O module's mounting base.
- 2) Pivot the RTB handle until it locks onto the 5034-PTO-AM module

NOTE The PointMax I/O system includes optional colored markers for an RTB as well as shield clamps and wire holders. Refer to RA literature for further information on these products.

1.5 Power Wiring

The 5034-PTO-AM receives all of its power from the PointMax I/O system. Power for the backplane communications section of the module comes from the PointMax I/O network adapter. Power for all I/O points comes from the power supply attached to the $\pm$ SA pins on the PointMax I/O network adapter. Refer to RA documentation to properly size the power supply for your system and connect it to the PointMax I/O network adapter.

For information on power supply sizing, see section 1.1.2, *Power Requirements* on page 39.

1.6 PTO Output Wiring

Differential outputs are low voltage, low current outputs that require shielded, twisted pair cable to carry the signals. A suggested cable is the Belden 9729, which supports a 1 MHz pulse frequency to over 1000 feet of cable length; but any quality, shielded, twisted pair cable should suffice. A simple wiring diagram is shown below. Note that the cable shields should be grounded at the module end only.

PTO Outputs from 5043-PTO-AM

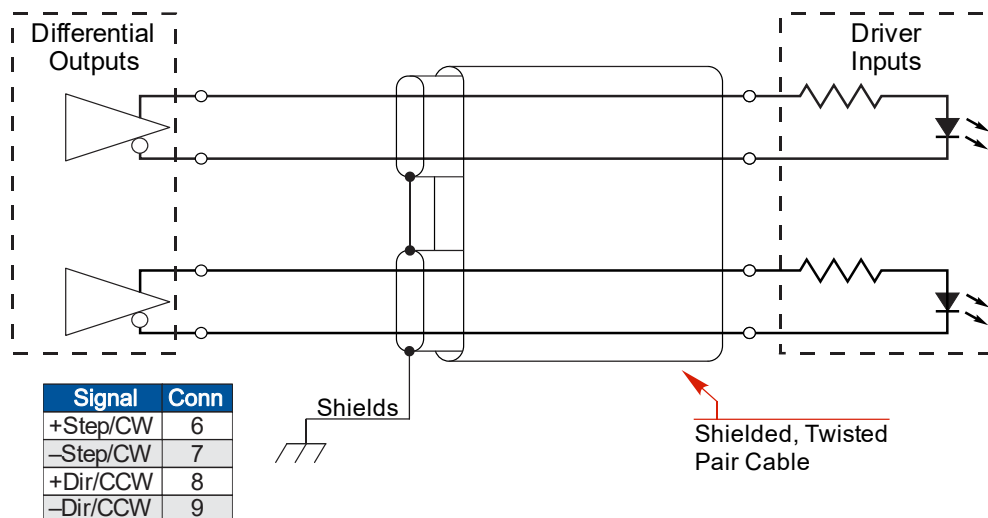
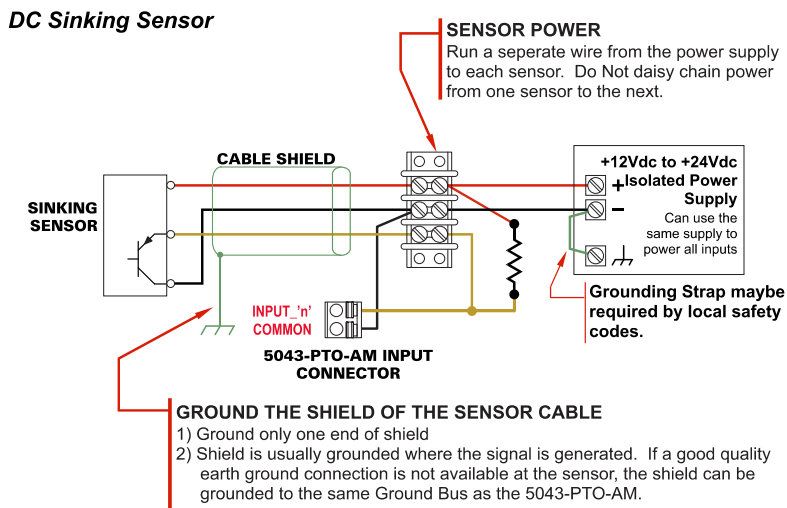
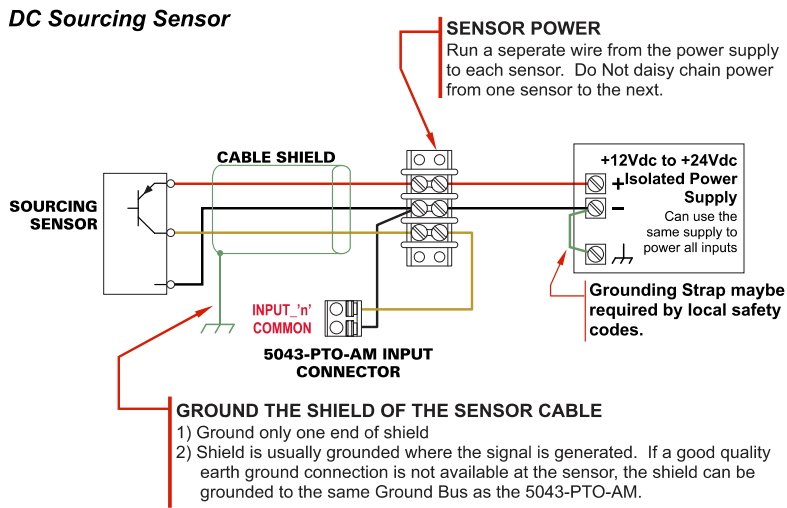


Figure T1.1 PTO Driver Wiring

1.7 Discrete Input Wiring

Figure T1.2 below shows how to wire discrete DC sourcing and sinking sensors to the open collector sinking inputs of the 5034-PTO-AM module.



Input Pins

Signal	Pin
Input_1	12
Input_2	13
Input_3	14
Input_4	15
Common	16
Chassis	17

Figure T1.2 Input Wiring

Input Specifications:

Single Ended. Accepts 8 to 27Vdc without the need for an external current limiting resistor.

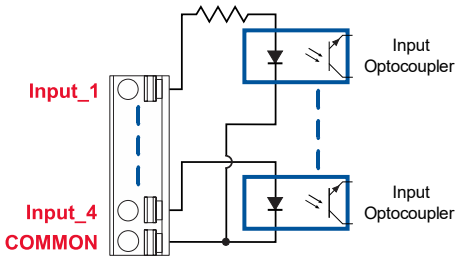


Figure T1.3 DC Input Schematic

Because they are low power signals, cabling from the sensor to the 5034-PTO-AM should be done using a twisted pair cable with an overall shield. The shield should be grounded at the end when the signal is generated, which is the sensor end. If this is not practical, the shield should be grounded to the same ground bus as the 5034-PTO-AM as close to the module as possible.

Sinking Output Sensors Require a Pull Up Resistor

Sinking output sensors require an external pull up resistor because the input to the 5034-PTO-AM also sinks current. Table T1.1 below shows the values of pull up resistors that will allow the 5034-PTO-AM input to activate along with the current that the sensor must be able to sink when it is active.

Input Voltage	Pull Up Resistor	Sensor Current When Active
12	1.4K	8.6mA
24	3.8K	6.3mA

Table T1.1 Pull Up Resistor

The logical states of the sensor and 5034-PTO-AM input will be reversed. The 5034-PTO-AM input is off when the sensor is active. You can set the logic state of the 5034-PTO-AM input when you configure the unit.

1.8 Encoder Wiring

1.8.1 Incremental Encoder - Differential Wiring

The encoder inputs on the 5034-PTO-AM accept 5Vdc differential signals from your incremental encoder. Figure T1.4 below shows a typical encoder installation using an AMCI optical encoder.

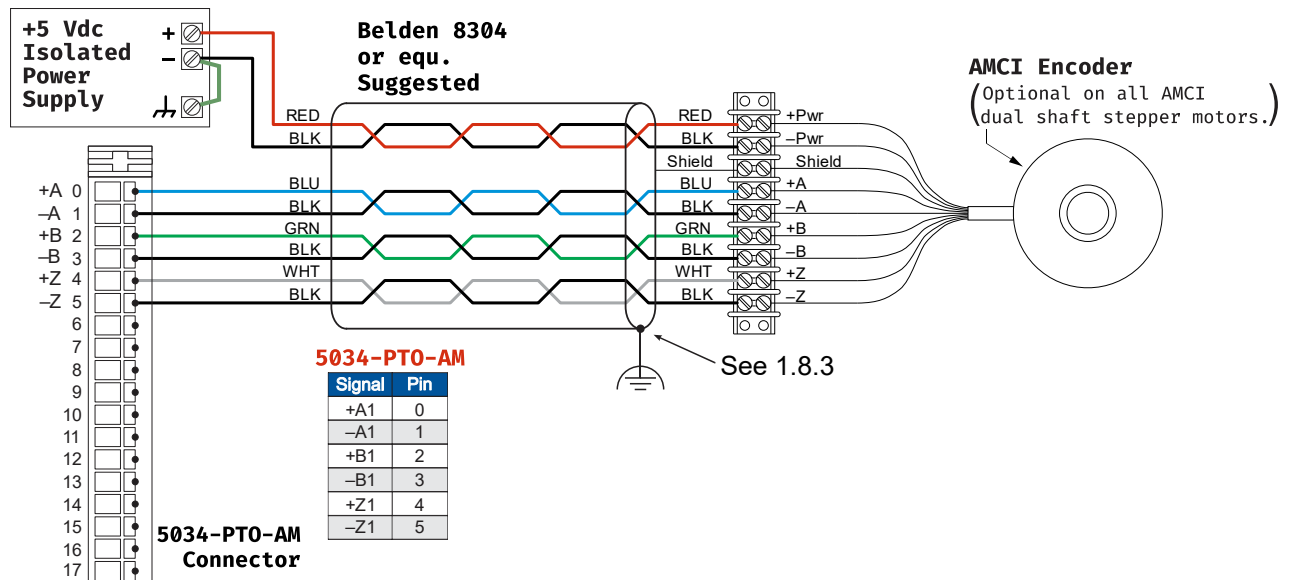


Figure T1.4 Incremental Encoder - Differential Wiring

The table below lists the wire color code for the AMCI encoder used at the time this manual was released. These encoders have an eighteen inch integral cable. Note that there is no single color coding standard in the encoder market so you must refer to your encoder's documentation if you are not using an AMCI optical encoder.

Function	Wire Color
+Pwr (+5 Vdc)	Red
-PWR (Gnd)	Black
+A	Brown
-A	White
+B	Blue
-B	Green
+Z	Orange
-Z	Yellow

Table T1.2 AMCI Incremental Encoder Wire Color Chart



NOTE The $\pm Z$ inputs on the incremental encoder are not used by the 5034-PTO-AM module. They do not have to be connected for normal module operation. If your encoder has $\pm Z$ outputs, use the pins if it will keep wiring more neat.

1.8 Encoder Wiring (continued)

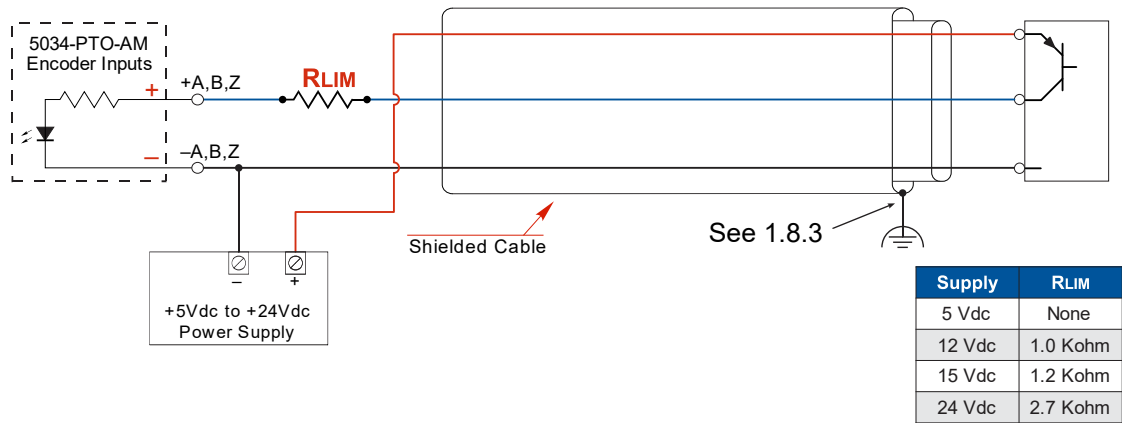
1.8.2 Incremental Encoder - Single Ended Wiring

Figure T1.5 below shows how to wire the encoder inputs to both a single ended sourcing and single ended sinking incremental encoders.

 **CAUTION**

The encoder inputs on the 5034-PTO-AM are rated for 5Vdc only. You must use a current limiting resistor on each input if the outputs of your encoder are greater than 5Vdc. Appropriate current limiting resistors are shown in the figure below.

5034-PTO-AM Encoder Input Connection to Sourcing Encoder Output



The inputs are designed to accept 5Vdc but can use any voltage up to 24Vdc with the appropriate current limiting resistor. See the table above for the required resistor based on the supply voltage.

5034-PTO-AM Encoder Input Connection to Sinking Encoder Output

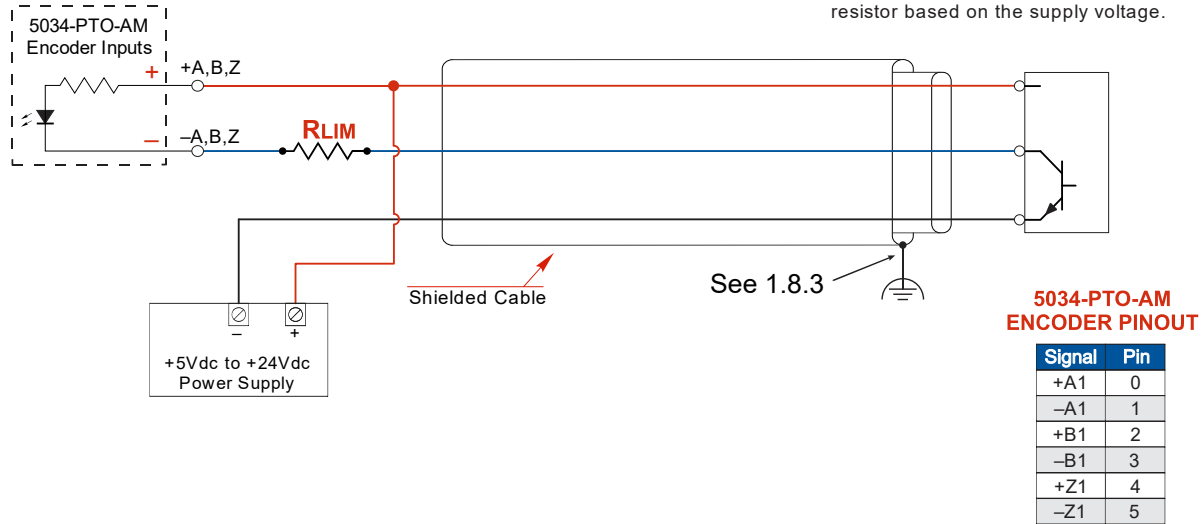


Figure T1.5 Incremental Encoder - Single Ended Wiring

1.8.3 Cable Shields

Because they are low power signals, cabling from the encoder to the 5034-PTO-AM should be done using a twisted pair cable with an overall shield. The shield should be grounded at the end when the signal is generated, which is the encoder end. If this is not practical, the shield should be grounded to the same ground bus as the 5034-PTO-AM.

1.8 Encoder Wiring (continued)

1.8.4 Absolute Encoder Wiring

The encoder inputs on the 5034-PTO-AM accept 5Vdc differential signals from your absolute encoder. Figure T1.4 below shows a typical encoder installation using an AMCI DC25 SSI encoder.

NOTE When configured for an absolute encoder, the general purpose output is not available. The GPO/SA_Power pin is configured as the power pin for the SSI encoder. The SA_Power and SA_Gnd pins are internally connected to the power supply pins of the PointMax I/O power adapter when the 5034-PTO-AM is configured to use an absolute encoder.

CAUTION The SA_Power and SA_Gnd are available to power the encoder *only*. They are not to be used to power the Auxiliary Inputs or the device connected to the PTOs.

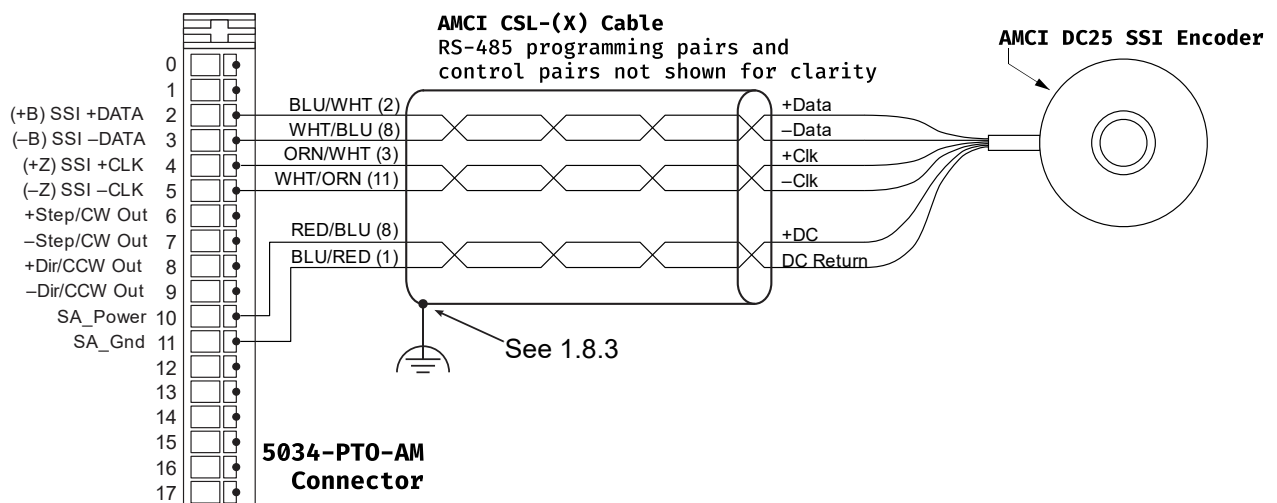


Figure T1.6 SSI Encoder Wiring

1.9 General Purpose Output Wiring

NOTE ⚠ The General Purpose Output is not available when the 5034-PTO-AM is configured to use an absolute encoder. When using an absolute encoder, the output is used to power the encoder.

As shown in the figure below, the load draws its power from the supply attached to the PointMax-I/O Network Adapter through a driver in the 5034-PTO-AM. This current draw has considered when sizing the power supply.

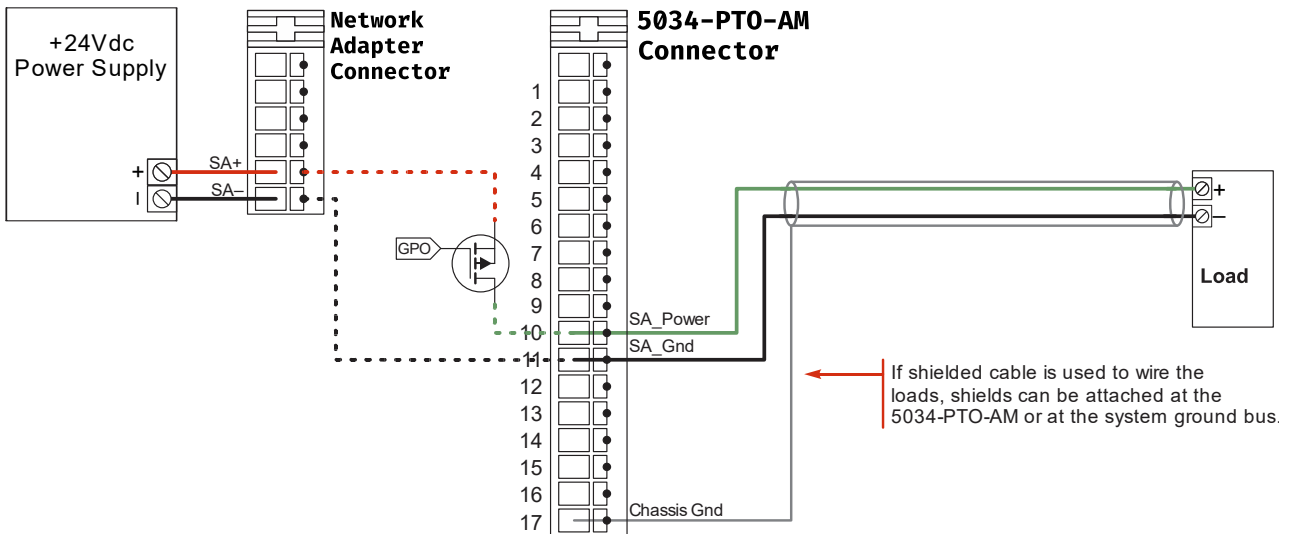


Figure T1.7 General Purpose Output Wiring

TASK 2

SOFTWARE CONFIGURATION

This chapter explains how to add the 5034-PTO-AM module to your PLC project and configure it for your application.

2.1 Add-On Profile Installation

Systems that support PointMax-I/O should have all necessary Add-On Profiles (AOP) installed as part of the Studio 5000 software installation or update. Early adopters of PointMax-IO may have to install the AOP's manually.

The AOP for the AMCI 5034-PTO-AM was created by Rockwell Automation and is installed as part of their software update. Contact Rockwell Automation for assistance in installing the AOP update if needed.

2.2 Sample System

The screen captures in this chapter use Studio 5000 v37.0, a 5069-L310ERM processor, and a 5034-AENTR/A PointMax-IO base. This is the same setup used in the sample program which is available from AMCI. Your screens may be different if you are using a different system.

2.3 Add the PointMax-IO Base

- 1) Right click on the processor's Ethernet port that is attached to the PointMax-IO base. Click on "New Module..." in the pop-up menu that opens.
- 2) In the resulting Select Module Type screen, type "5034" into the search bar.
- 3) Select the appropriate base in the resulting list.
- 4) Click on the [Create] button to create the module.
- 5) Enter the appropriate information for the base, such as Name and Ethernet Address, and Chassis Size.
- 6) Click on the [OK] button to accept the base.
- 7) Click on [Close] if necessary to close the Select Module Type screen.

2.4 Add the 5034-PTO-AM Module

- 1) Right click on the PointMax-IO base. Click on "New Module..." in the pop-up menu that opens.
- 2) In the resulting Select Module Type screen, type "5034" into the search bar.
- 3) Select the 5034-PTO-AM module in the resulting list.
- 4) Click on the [Create] button to create the module.
- 5) Enter the appropriate information for the 5034-PTO-AM module.
 - Name: This is a required field. In the sample program, the module is named "AMCI_5034_PTO_AM"
 - Description: This is an optional field.
 - Slot: The slot number occupied by the module.
 - Revision: Leave at its default value.
 - Electronic keying: Set to "Compatible Module".
- 6) Click on the [OK] button to accept the definition of the 5034-PTO-AM module.
- 7) Click on [Close] if necessary to close the Select Module Type screen.

2.5 Set the 5034-PTO-AM Module Properties

Right click on the 5034-PTO-AM module that you need to configure. Click on “Properties” in the pop-up menu that opens.

2.5.1 Connection Settings

- 1) In the left hand menu, click on “Connection” to bring up the connection parameters.

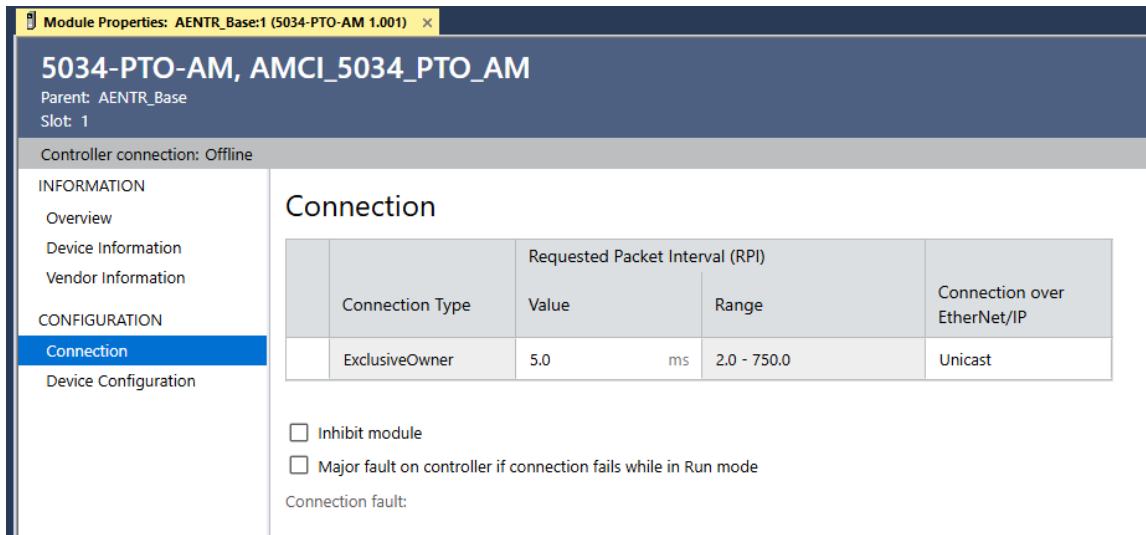


Figure T2.1 Network Connection Configuration

- 2) If you need to change the RPI time of the 5034-PTO-AM module, click in the “Value” field and change the value. The range of values is 2.0 to 75.0 milliseconds with a default of 5 milliseconds.
- 3) Click on the “Inhibit Module” checkbox if you need to inhibit the module during machine testing and commission.
- 4) If you want the processor to issue a Major fault if the connection to this module fails while in Run mode, click on the appropriate checkbox.
- 5) Click on the [Apply] button to apply changes to these connection parameters.

2.5 Set the 5034-PTO-AM Module Properties (continued)

2.5.2 Configuration Settings

- 1) In the left hand menu, click on “Device Configuration” to bring up the configuration parameters.

Module Properties: AENTR_Base:1 (5034-PTO-AM 1.001) x

5034-PTO-AM, AMCI_5034_PTO_AM
 Parent: AENTR_Base
 Slot: 1

Controller connection: Offline

INFORMATION
 Overview
 Device Information
 Vendor Information

CONFIGURATION
 Connection
Device Configuration

Device Configuration

Starting Speed
 50 steps/s

Block 2 Digital Inputs		
Input 1 Function	rw	General Purpose Input
Input 2 Function	rw	General Purpose Input
Input 3 Function	rw	General Purpose Input
Input 4 Function	rw	General Purpose Input
Input 1 Active Level	rw	Active High
Input 2 Active Level	rw	Active High
Input 3 Active Level	rw	Active High
Input 4 Active Level	rw	Active High
General Purpose Output When Connection Lost	rw	Disabled

OutputPulseType
 CW/CCW

Figure T2.2 Module Parameters (1 of 2)

Starting Speed: This is the speed that all moves begin and end at. Fifty steps/second is a reasonable default. This value can be tuned based on motor loading and the number of steps per turn output by the motor drive attached to the 5034-PTO-AM. Note that the inverse of the starting speed is equal to the time needed to output the first pulse in seconds. See *A Simple Move* on page 21 for an example of how the Starting Speed is used.

Input 1-4 Function: Click inside the box to access a drop down menu. This menu allows you to set the function of the input. See *How to Control Moves in Progress* starting on page 19 for information on how the different input functions affect the moves types of the 5034-PTO-AM. If the input is not used in your applications, leave it set to its default “General Purpose Input” function. A general purpose input has no effect on the module, but the input’s state is reported through the processor’s input data.

Input 1-4 Active Level: Click inside the box to access a drop down menu. This menu allows you to set the active state of input. When set to Active High, the input is considered active when current is flowing through the input. This input active level is typically used with normally-open switches and sensors. When set to Active Low, the input is considered active when current is not flowing through the input. This input active level is typically used with normally-closed switches and sensors. When an input is active, its state is reported as a “1” in the processor’s input data.

General Purpose Output When Connection Lost: Click inside the box to access a drop down menu. This menu allows you to choose the state of the GP Output if the network connection to processor is lost. The choices are “Disabled” and “Current State”. The output turns off, (stops conducting current) if disabled.

2.5 Set the 5034-PTO-AM Module Properties (continued)

2.5.2 Configuration Settings (continued)

Output Pulse Type: This drop down menu allows you to choose the type of PTO output generated by the 5034-PTO-AM. The choices are Step/Direction and CW/CCW. See *Pulse Train Output* on page 11 for a diagram showing the difference between the two output types.

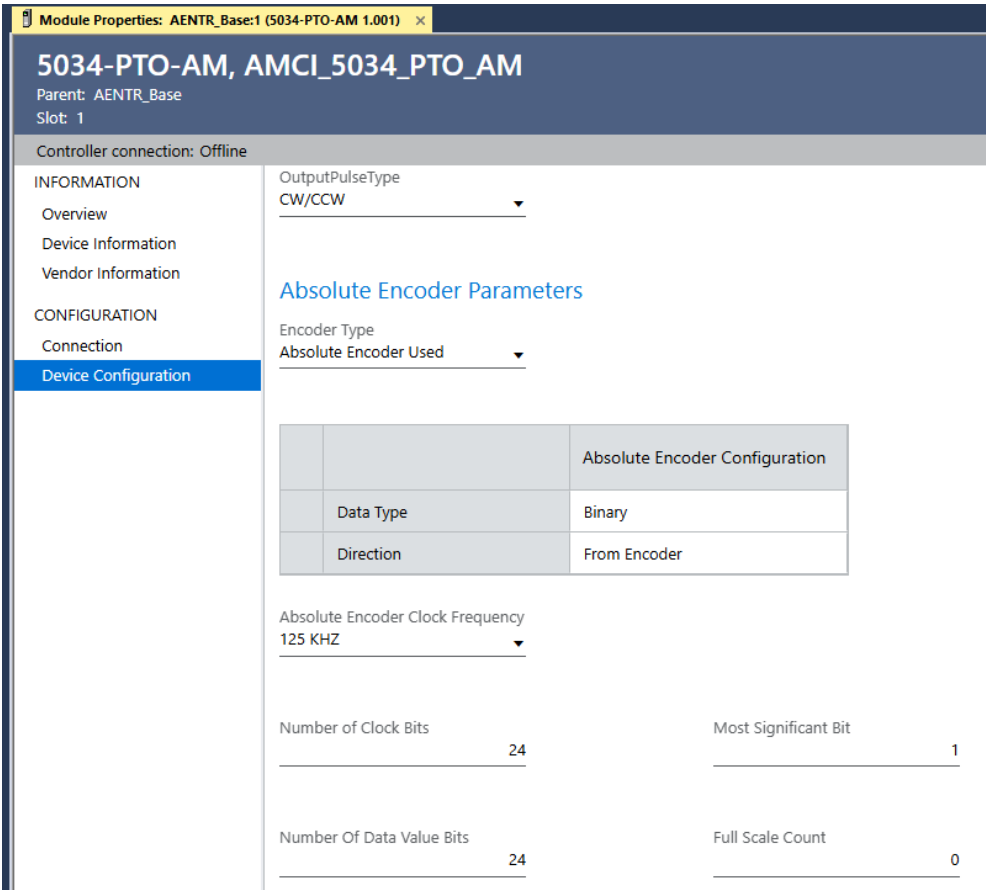


Figure T2.3 Module Parameters (2 of 2)

Encoder Type: This drop down menu has three choices: “Encoder Not Used”, “Incremental Encoder Used”, and “Absolute Encoder Used”. If “Absolute Encoder Used” is selected, the remaining parameters are enabled so that the SSI interface can be configured.

The remaining parameters are briefly explained below. There are fully explained in the [Absolute Encoders](#) section starting on page 12.

Data Type: Allows you to choose between Binary and Gray Code data types. From a trouble shooting point of view, it’s always easier to use Binary encoders when you can.

Direction: Allows you to change the direction of increasing counts. If you select “Reversed Encoder” and you are using a rotary encoder, then you must set the Full Scale Count parameter correctly. If you do not, then the count direction reversal will not work correctly.

Absolute Encoder Clock Frequency: Sets the frequency of the SSI clock. Leave at its default 125 kHz unless the absolute encoder does not support this clock frequency.

Number of Clock Bits: Number of clock bits needed to transfer the complete set of SSI data.

2.5 Set the 5034-PTO-AM Module Properties (continued)

2.5.2 Configuration Settings (continued)

Most Significant Bit & Number of Data Value Bits: These two parameters tell the 5034-PTO-AM where the Data Value is embedded in the SSI data stream. The Most Significant Bit parameter specifies the location of the first bit of the Data Value in the SSI data stream. The Number of Data Value Bits parameter specifies the length of the Data Value. The default value of the Most Significant Bit parameter is one. The default value for the Number of Data Value Bits parameter is twenty-four. The default values will work with AMCI multi-turn SSI DuraCoders as well as many other multi-turn rotary SSI encoders and linear sensors

Full Scale Count: The Full Scale Count parameter is important only if you are using a rotary absolute encoder. If you have a linear device, such as a magneto-restrictive linear displacement sensor or a laser range finder, leave this parameter at its default value of *zero*. If you are using a rotary encoder, the Full Scale Count parameter sets the number of counts the module can expect before the position rolls over to zero. If this value is not set, or set incorrectly, the 5034-PTO-AM will not be able to reverse count direction or roll over the position value between its maximum value and zero correctly.

Notes

TASK 3

CONTROLLING THE 5034-PTO-AM

This chapter lists the format of the input and output tags assigned to the 5034-PTO-AM.

3.1 Download the Sample Program

The AMCI sample program is available as a ZIP file on our website www.amci.com. At the time this manual was written, the direct link to the sample program page is <https://www.amci.com/industrial-automation-support/sample-programs/>. The ZIP file contains the AMCI User-Defined Data Types, the Add-On Instructions and the ladder logic sample program.

Once the ZIP file has downloaded, extract the files to a separate directory.

3.2 Import the AMCI Data Types

AMCI has created User-Defined Data Types for use with the 5034-PTO-AM module. These data types will be used to create buffers for the I/O data from the module. These AMCI custom data types should be used instead of the RA Module Defined tags assigned to the module when it was added to the project. The RA tags are AM:5034_PTO:I and AM:5034_PTO:O Using the AMCI user-defined data types allows you to access any new feature that may be added to the 5034-PTO-AM without the need to update the AOP in your Studio 5000 software.

- 1) From the main menu of Studio 5000, select “File” → “Import Component”→ “Data Type...”
- 2) In the window that opens, navigate to the folder that contains the unzipped AMCI sample program.
- 3) Navigate to the “Data_Types” folder.
- 4) Select the “AMCI_5034_PTO_AM_Input_Data_DataType.L5X” and click on the [Open] button.
- 5) The “Import Configuration” window opens. If needed, change the name of the data type in your project. Use the “Final Name:” text field for this purpose.

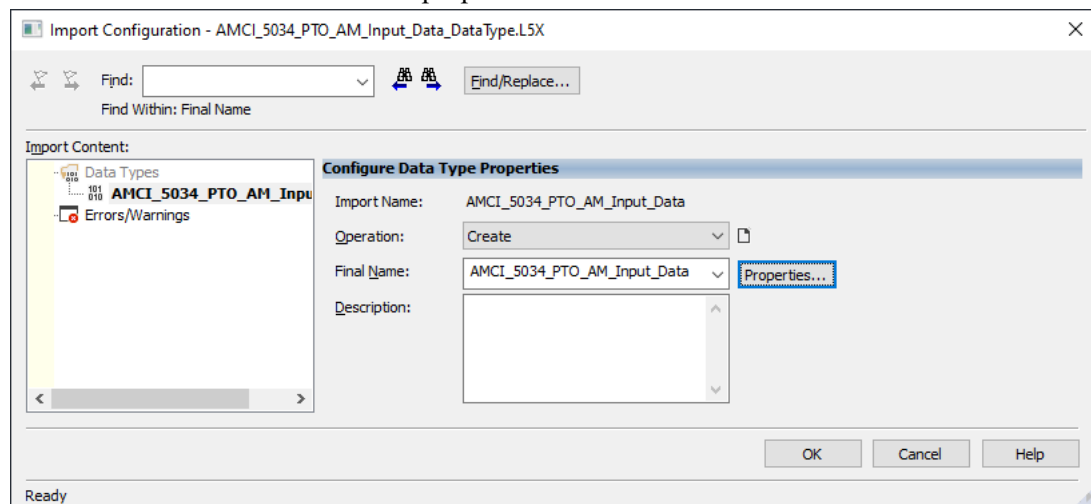


Figure T3.1 Import Data Types

- 6) Click on the [OK] button to import the data type.
- 7) Repeat this section to import the Output Data Type. The name of the file used in step 4 is “AMCI_5034_PTO_AM_Output_Data_DataType.L5X”.

3.3 Import the Add-On Instructions

AMCI has written Add-On Instructions that covers all of the functionality offered by the 5034-PTO-AM. If needed, complete step 3.6 above to download the AMCI sample program for the 5034-PTO-AM module. Add-On Instructions are located in the “AOI” sub-folder of the directory where you un-zipped the AMCI sample program.

The following table lists all of the instructions and gives descriptions of their uses.

AOI Name	Description
AMCI_5034_PTO_AM_MAFR	(Motion Axis Fault Reset) Use this instruction to recover from command faults. This instruction can also be run when the module is not in a fault state to clear the MoveComplete bit.
AMCI_5034_PTO_AM_MAH	(Motion Axis Home) Use this instruction to command a Find Home CW and Find Home CCW move.
AMCI_5034_PTO_AM_MAJ	(Motion Axis Jog) Use this instruction to command a Jog CW and Jog CCW move.
AMCI_5034_PTO_AM_MAM	(Motion Axis Move) Use this instruction to command an Absolute or Relative Move.
AMCI_5034_PTO_AM_MRP	(Motion Redefine Position) Use this instruction to initiate a Motor Position Preset command.
AMCI_5034_PTO_AM_Preset_Encoder	Use this instruction to initiate an Encoder Position Preset command.
AMCI_5034_PTO_AM_Immediate_Stop	Use this instruction to initiate an Immediate Stop command.
AMCI_5034_PTO_AM_Stop_Jog	Use this instruction to bring a Jog, Registration, or Blend Move to a controlled stop.
AMCI_5034_PTO_AM_Hold	Use this instruction to bring an absolute or relative move to a controlled stop and place it in its Hold State.
AMCI_5034_PTO_AM_Resume	Use this instruction to resume an absolute or relative move that is in its Hold State.
AMCI_5034_PTO_AM_Prog_Min_Reg_Dist	Use this instruction to program the Minimum Registration Distance for a future Registration Move.
AMCI_5034_PTO_AM_Registration	Use this instruction to command a Registration CW or Registration CCW move.
AMCI_5034_PTO_AM_Program_Blend_Move	Use this instruction to program the parameters of a future Blend Move.
AMCI_5034_PTO_AM_Run_Blend	Use this instruction to command a Blend Move CW or Blend Move CCW move.
AMCI_5034_PTO_AM_Encoder_Follower	Use this instruction to command an Encoder Follower Move.

Table T3.1 AMCI Add-On Instructions

The Add-On Instructions are completely independent of each other. You can import only the AOIs you need for your program instead of importing all of them.

To import an AOI:

- 1) From the main menu of Studio 5000, select “File” → “Import Component” → “Add-On Instruction...”
- 2) In the window that opens, navigate to the folder that contains the unzipped AMCI sample program.
- 3) Navigate to the “AOI” folder.
- 4) Select one of the AOI’s that you need to import and click on the [Open] button.

3.3 Import the Add-On Instructions (continued)

- 5) The “Import Configuration” window opens. If needed, change the name of the AOI in your project. Use the “Final Name:” text field for this purpose.

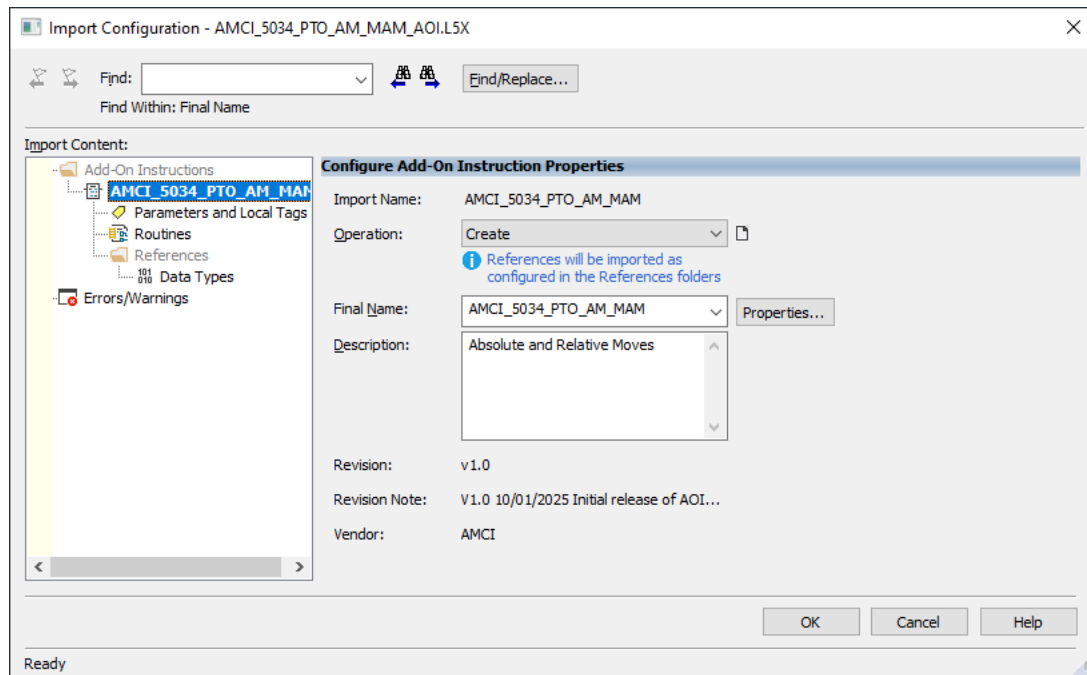


Figure T3.2 Import Add-ON Instructions

- 6) Click on the [OK] button to import the AOI.
- 7) Repeat this section to import the remaining AOI's needed for your program.

3.4 Create the Input and Output Buffers

NOTE You must complete step 3.2, *Import the AMCI Data Types* on page 53 before creating the I/O buffers.

The add-on instructions require that the input data remain stable while the instructions are scanned. Systems that are programmed with the Studio 5000 software update I/O asynchronously to the program scan. Therefore, the input data from the 5034-PTO-AM must be buffered before any AMCI add-on instructions are scanned.

- 1) In the main menu of the Studio 5000 program, click on “Logic” → “Edit Tags”.
- 2) Enter a name for the input buffer tags.
- 3) Click in the Data Type field and then click on the [...] button.

3.4 Create the Input and Output Buffers (continued)

- 4) As shown in the figure below, select the AMCI_5034_PTO_AM_Input_Data data type.

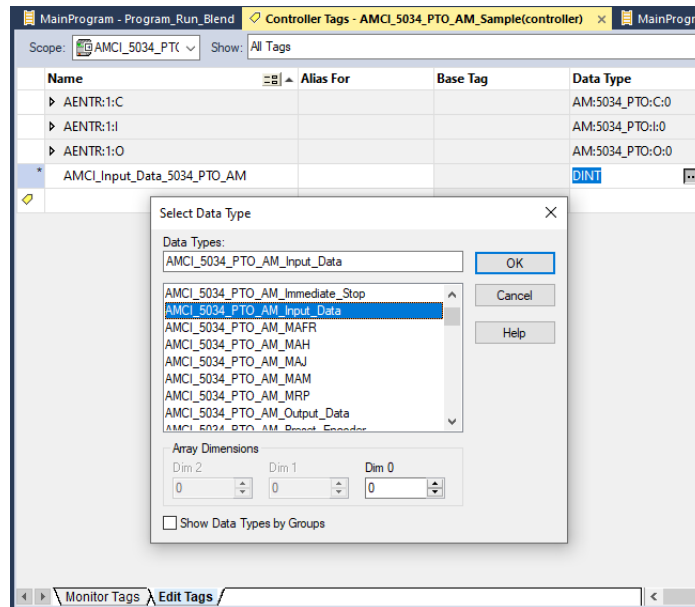


Figure T3.3 Create Input Data Buffer

- 5) Click on the [OK] button to set the Data Type.
6) Click inside the next row to accept the new data tags.

The 5034-PTO-AM requires that all output data be updated at the same time. Therefore, the program must write to an output buffer during the program scan. This buffer must be copied to the module's output registers after all AMCI add-on instructions are scanned.

- 7) Enter a name for the output buffer tags.
8) Click in the Data Type field and then click on the [...] button.
9) In the "Select Data Type" window that opens, select the AMCI_5034_PTO_AM_Output_Data data type.
10) Click on the [OK] button to set the Data Type.
11) Click inside the next row to accept the new data tags.

3.5 Add Code to Update the Buffers

The input and output buffers should be updated in your code using unconditional CPS (Copy Synchronous) instructions. This ensures that the module is not updated during the copy. Input data from the 5034-PTO_AM is buffered at the top of the ladder logic, and the output buffer is written to the module tags at the bottom of the ladder logic. The figure below shows the two CPS instructions and a single AMCI add-on instruction that triggers a relative move.

NOTE The two CPS instructions do not have to be the first and last rungs of your ladder logic, but all logic associated with the AMCI add-on instructions must occur between the two CPS rungs.

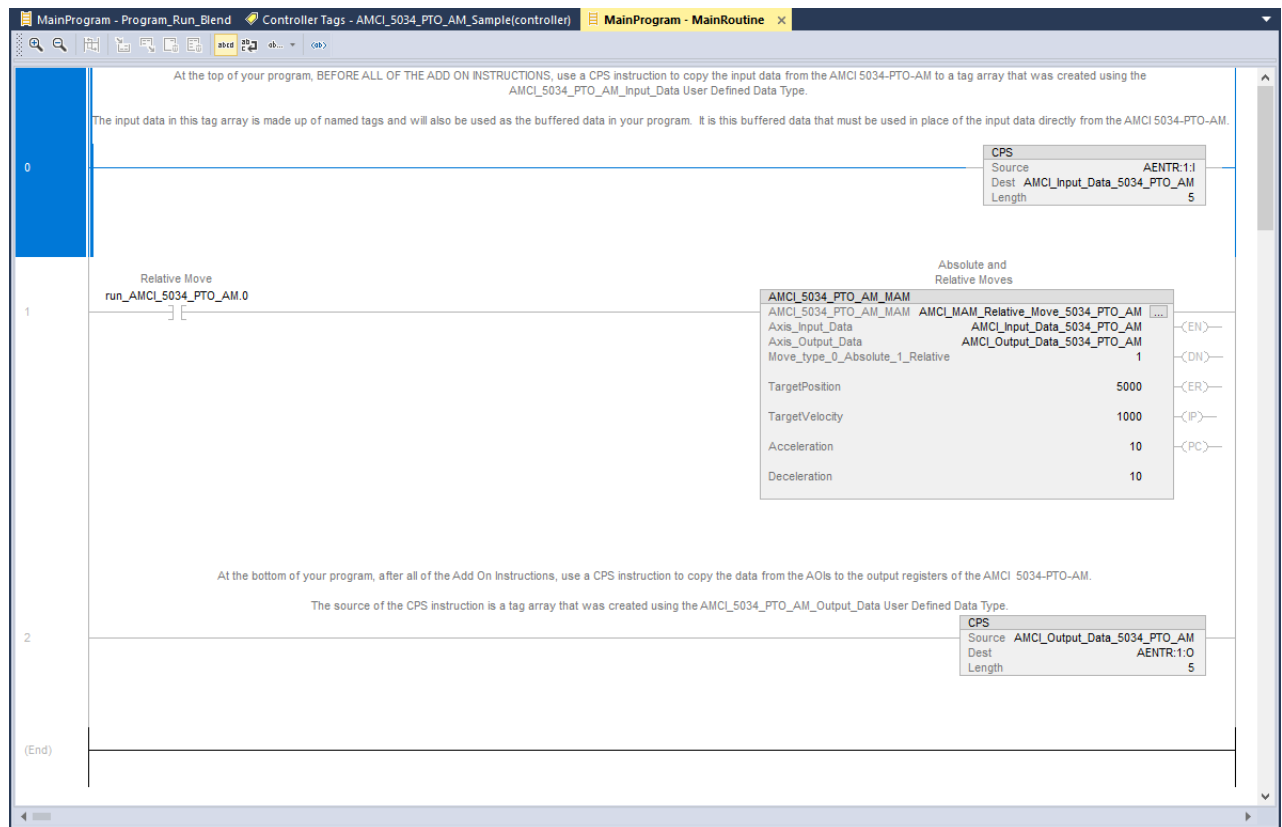


Figure T3.4 Sample Ladder Logic

Format of Input Data Tags

The format of the buffered input data available from the 5034-PTO-AM is shown below. To access this data, start from the Studio 5000 software's main menu, click on "Logic" and then click on "Monitor Tags". The data is listed under the name of the buffer you created in step 3.4 above. In the image below the name of the buffer is "AMCI_Input_Data_5034_PTO_AM".

The ConnectionFaulted register is controlled by the processor and will equal "2" when there is a communication fault between the processor and the 5034-PTO-AM.

Name	Value	Force Mask	Style	Data Type
AMCI_Input_Data_5034_PTO_AM	{...}	{...}		AMCI_5034_PTO_AM_Input_Data
AMCI_Input_Data_5034_PTO_AM.ConnectionFaulted	0		Decimal	DINT
AMCI_Input_Data_5034_PTO_AM.MovingCW	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.MovingCCW	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.InHoldState	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.Stopped	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.AtHome	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.Accelerating	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.Decelerating	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.MoveComplete	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.HomeInvalid	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.InvalidProfile	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.PositionInvalid	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.InputError	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.CommandError	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.ConfigurationError	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.ModuleOK	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.GeneralPurposeOutputStatus	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.Input1Active	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.Input2Active	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.Input3Active	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.Input4Active	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.bit_20_reserved	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.bit_21_reserved	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.bit_22_reserved	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.EncoderFollowerMode	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.BlendMoveRunning	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.BlendMoveAcknowledge	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.MinimumRegistrationProgrammed	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.EncoderMotionDirection	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.MultipleInputsWithSameFunction	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.FSCExceedsNumberOfDataBits	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.AbsoluteEncoderSetupError	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.bit_31_reserved	0		Decimal	BOOL
AMCI_Input_Data_5034_PTO_AM.CurrentPosition	0		Decimal	DINT
AMCI_Input_Data_5034_PTO_AM.EncoderPosition	0		Decimal	DINT
AMCI_Input_Data_5034_PTO_AM.CapturedPosition	0		Decimal	DINT

Figure T3.5 Buffered Input Tag Layout

Format of Input Data Tags (continued)

Boolean Input Bits

All of the boolean bits shown in the figure above are located in word 1 of the buffered input data. The figure below shows the layout of the bits within the word.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
bit_31_reserved	AbsoluteEncoderSetupError	FSCExceedsNumberOfDataBits	MultipleInputsWithSameFunction	EncoderMotionDirection	MinimumRegistrationProgrammed	BlendMoveAcknowledge	BlendMoveRunning	EncoderFollowerMode	bit_22_reserved	bit_21_reserved	bit_20_reserved	Input4Active	Input3Active	Input2Active	Input1Active	GeneralPurposeOutputStatus	ModuleOK	ConfigurationError	CommandError	InputError	PositionInvalid	InvalidProfile	HomeInvalid	MoveComplete	Decelerating	Accelerating	AtHome	Stopped	InHoldState	MovingCCW	MovingCW

Figure T3.6 Status Word Input Register

- Bit 0: MovingCW:** Set while the 5034-PTO-AM module outputs clockwise pulses.
- Bit 1: MovingCCW:** Set while the 5034-PTO-AM module outputs counter-clockwise pulses.
- Bit 2: InHoldState:** Set while Absolute or Relative Moves are in their Hold State.
- Bit 3: Stopped:** Set at the end of a Jog or Registration Move, when any move is brought to an immediate stop, or after exiting Encoder Follower Mode. See the [Stopped Bit](#) section on page 75 for a complete description.
- Bit 4: AtHome:** Set when the 5034-PTO-AM module successfully completes a Find Home move to a physical home sensor.
- Bit 5: Accelerating:** Set while a move is in its acceleration phase and the frequency of the pulses is increasing.
- Bit 6: Decelerating:** Set while a move is in its deceleration phase and the frequency of the pulses is decreasing.
- Bit 7: MoveComplete:** Set when an Absolute, Relative, or Blend move command completes successfully.
- Bit 8: HomeInvalid:** Set if there is an error in a homing command or its execution. See the [HomeInvalid Bit](#) section on page 75 for a complete description.
- Bit 9: InvalidProfile:** A general error bit set when there is an error in a command or its execution. See the [InvalidProfile Bit](#) section starting on page 75 for a complete description.
- Bit 10: PositionInvalid:** Set to “1” if the motor position may not correspond to an actual position on the machine. Reset to “0” after the motor position has been set with a MAH or a MRP AOI. Must be reset to “0” for Absolute Moves. All other moves can be executed while this bit is in either state.
- Bit 11: InputError:** Set to “1” if the Emergency Stop input or a Limit Switch input is activated. See the [InputError Bit](#) section on page 76 for a complete description.
- Bit 12: CommandError:** Set to “1” if there is an error in the last command. See the [CommandError Bit](#) section starting on page 77 for a complete description.
- Bit 13: ConfigurationError:** Set to “1” if there is an error in the module’s configuration data. See [Software Configuration](#) starting on page 47 for information on setting the module’s configuration.
- Bit 14: ModuleOK:** Set to “1” when the module’s hardware is operating correctly.

Format of Input Data Tags (continued)**Boolean Input Bits (continued)**

- Bit 15: GeneralPurposeOutputStatus:** Mirrors the state of the general purpose output. Reset to “0” when the output is off and not conducting current. Set to “1” when the output is on and conducting current. Set to “0” if the module is configured to use an absolute encoder.
- Bit 16: Input1Active:** Reset to “0” when the input is in its inactive state. Set to “1” when the input is in its active state. The input’s active state is set with the Input 1 Active State configuration parameter. See *Configuration Settings* on page 49 for more information on this parameter.
- Bit 17: Input2Active:** Reset to “0” when the input is in its inactive state. Set to “1” when the input is in its active state. The input’s active state is set with the Input 2 Active State configuration parameter. See *Configuration Settings* on page 49 for more information on this parameter.
- Bit 18: Input3Active:** Reset to “0” when the input is in its inactive state. Set to “1” when the input is in its active state. The input’s active state is set with the Input 3 Active State configuration parameter. See *Configuration Settings* on page 49 for more information on this parameter.
- Bit 19: Input4Active:** Reset to “0” when the input is in its inactive state. Set to “1” when the input is in its active state. The input’s active state is set with the Input 4 Active State configuration parameter. See *Configuration Settings* on page 49 for more information on this parameter.
- Bit 20: bit_20_reserved:** This bit is reserved, and always reset to “0”.
- Bit 21: bit_21_reserved:** This bit is reserved, and always reset to “0”.
- Bit 22: bit_22_reserved:** This bit is reserved, and always reset to “0”.
- Bit 23: EncoderFollowerMode:** Set to “1” when the module is in Encoder Follower Mode. Reset to “0” under all other conditions.
- Bit 24: BlendMoveRunning:** Set to “1” when the module is running a Blend Move. Reset to “0” under all other conditions.
- Bit 25: BlendMoveAcknowledge:** Used as a handshaking bit while programming a blend move. The code needed to use this bit correctly is included in the Program_Blend_Move AOI.
- Bit 26: MinimumRegistrationProgrammed:** Set to “1” when a new, non-zero, Minimum Registration Distance is accepted from the Prog_Min_Reg_Dist AOI. Reset to “0” under all other conditions.
- Bit 27: EncoderMotionDirection:** Set to “1” when the encoder count is increasing. Reset to “0” when the count is decreasing. The bit stays in its last state when the encoder shaft is not moving. When the encoder is enabled, this bit may be in either state on power up. This bit is “0” if an encoder is not enabled.
- Bit 28: MultipleInputsWithSameFunction:** Set to “1” if a configuration error is caused by one input type being assigned to more than one of the four inputs. For example, programming Inputs 1 and 2 as Home Inputs. The only exception is the default General Purpose input type.
- Bit 29: FSCExceedsNumberOfDataBits:** Set if the configuration error is caused by the programmed Full Scale Count being greater than the largest number that can fit in the programmed Number of Data Value Bits. This bit can only be set when the module is configured for an absolute encoder.
- Bit 30: AbsoluteEncoderSetupError:** Set if the configuration error is caused by incompatible values in the absolute encoder setup parameters.
- Bit 31: bit_31_reserved:** This bit is reserved, and always reset to “0”.

Other Input Tags

CurrentPosition: Current motor position value.

EncoderPosition: Current encoder position value

CapturedPosition: Value captured on the last inactive-to-active transition on a Capture Input. If an encoder is enabled in the configuration, the captured value is the encoder position. If there is no encoder, the captured value is the motor position.

Format of Output Data Tags

Viewing output data values is usually only done during troubleshooting, and there is no advantage to looking at the buffer instead of the actual output data assigned to the module. Therefore, the figure below shows the tags of the output data assigned to the 5034-PTO-AM instead of the output buffer tags.

To access this data, start from the Studio 5000 software's main menu, click on "Logic" and then click on "Monitor Tags". The data is listed under the name of the PointMax-IO adapter, followed by the slot number assigned to the 5034-PTO-AM and then the letter "O". In the image below the name of the PointMAX-IO adapter is "AENTR" and the 5034-PTO-AM is assigned to slot 1. The input data from the 5034-PTO-AM is located in the tags that begin "AENTR:1:O".

All of the boolean bits shown in the figure below are located in word 0 of the output data. Most of these bits are directly controlled by the available AOI's. They are shown here to help with troubleshooting.

Name	Value	Force Mask	Style	Data Type
▶ AENTR:1:C	{...}	{...}		AM:5034_PTO:C:0
▶ AENTR:1:I	{...}	{...}		AM:5034_PTO:I:0
▲ AENTR:1:O	{...}	{...}		AM:5034_PTO:O:0
AENTR:1:O.AbsoluteMove	0		Decimal	BOOL
AENTR:1:O.RelativeMove	0		Decimal	BOOL
AENTR:1:O.HoldMove	0		Decimal	BOOL
AENTR:1:O.ResumeMove	0		Decimal	BOOL
AENTR:1:O.ImmediateStop	0		Decimal	BOOL
AENTR:1:O.FindHomePositiveCW	0		Decimal	BOOL
AENTR:1:O.FindHomeNegativeCCW	0		Decimal	BOOL
AENTR:1:O.JogMovePositiveCW	0		Decimal	BOOL
AENTR:1:O.JogMoveNegativeCCW	0		Decimal	BOOL
AENTR:1:O.CurrentPositionPreset	0		Decimal	BOOL
AENTR:1:O.EncoderPreset	0		Decimal	BOOL
AENTR:1:O.ResetErrors	0		Decimal	BOOL
AENTR:1:O.RunBlendMovePositiveCW	0		Decimal	BOOL
AENTR:1:O.RunBlendMoveNegativeCCW	0		Decimal	BOOL
AENTR:1:O.AccelerationType	0		Decimal	BOOL
AENTR:1:O.SCurveAccelerationMode	0		Decimal	BOOL
AENTR:1:O.EncoderFollowerModeEnable	0		Decimal	BOOL
AENTR:1:O.BlendMoveProfileProgramEnable	0		Decimal	BOOL
AENTR:1:O.BlendMoveTransmit	0		Decimal	BOOL
AENTR:1:O.MinimumRegistrationMoveDistanceSave	0		Decimal	BOOL
AENTR:1:O.GeneralPurposeOutputControl	0		Decimal	BOOL
▶ AENTR:1:O.TargetPosition	0		Decimal	DINT
▶ AENTR:1:O.TargetVelocity	0		Decimal	UDINT
▶ AENTR:1:O.Acceleration	0		Decimal	UDINT
▶ AENTR:1:O.Deceleration	0		Decimal	UDINT

Figure T3.7 Output Tag Layout

Format Output Data Tags (continued)**Boolean Control Bits**

The control bits in the output buffer are not listed as named bits. They are listed as bits numbered 0 to 31 of the Command_Word double integer (DINT). The figure below shows the bit numbers and their associated names in the module's output data tags.

0	AbsoluteMove
1	RelativeMove
2	HoldMove
3	ResumeMove
4	ImmediateStop
5	FindHomePositiveCCW
6	FindHomeNegativeCCW
7	JogMovePositiveCCW
8	JogMoveNegativeCCW
9	CurrentPositionPreset
10	EncoderPreset
11	ResetErrors
12	RunBlendMovePositiveCCW
13	RunBlendMoveNegativeCCW
14	0
15	0
16	AccelerationType
17	SCurveAccelerationMode
18	0
19	0
20	0
21	0
22	0
23	EncoderFollowModeEnable
24	BlendMoveProfileProgramEnable
25	BlendMoveTransmit
26	MinimumRegistrationMoveDistanceSave
27	GeneralIPurposeOutputControl
28	0
29	0
30	0
31	0

Figure T3.8 Command_Word Output Bits

In the bit descriptions that follow, the term “Exclusive Bit” is used. When commanding the module, only one of the set of exclusive bits can be set at a time. If two or more of these bits are set at the same time, the “CommandError” bit will be set in the module's input data tags.

Bit 0: AbsoluteMove: Exclusive Bit. Set by the MAM AOI.

Bit 1: RelativeMove: Exclusive Bit. Set by the MAM AOI.

Bit 2: HoldMove: Exclusive Bit. Set by the Hold AOI.

Bit 3: ResumeMove: Exclusive Bit. Set by the Resume AOI.

Bit 4: ImmediateStop: Exclusive Bit. Set by the Immediate_Stop AOI.

Bit 5: FindHomePositiveCCW: Exclusive Bit. Set by the MAH AOI.

Bit 6: FindHomeNegativeCCW: Exclusive Bit. Set by the MAH AOI.

Bit 7: JogMovePositiveCCW: Exclusive Bit. Set by the MAJ AOI.

Bit 8: JogMoveNegativeCCW: Exclusive Bit. Set by the MAJ AOI.

Bit 9: CurrentPositionPreset: Exclusive Bit. Set by the MRP AOI.

Bit 10: EncoderPreset: Exclusive Bit. Set by the Preset_Encoder AOI.

Bit 11: ResetErrors: Exclusive Bit. Set by the MAFR AOI.

Bit 12: RunBlendMovePositiveCCW: Exclusive Bit. Set by the Run_Blend AOI.

Bit 13: RunBlendMoveNegativeCCW: Exclusive Bit. Set by the Run_Blend AOI.

Bit 16: AccelerationType: Bits 16 and 17 are used to set the acceleration type of the move. Both of these bits are hidden variables in the MAM and MAJ AOI's. Their default values program the Linear Acceleration type in the AOI's. If you require S-Curve accelerations, feel free to contact AMCI for assistance.

Format Output Data Tags (continued)

Boolean Control Bits (continued)

- Bit 17: SCurveAccelerationMode:** Bits 16 and 17 are used to set the acceleration type of the move. Both of these bits are hidden variables in the AOI's. Their default values program the Linear Acceleration type in the AOI's. If you require S-Curve accelerations, feel free to contact AMCI for assistance.
- Bit 23: EncoderFollowerModeEnable:** Used along with the JogMove bits numbered 7 and 8, this bit is set by the Encoder_Follower AOI.
- Bit 24: BlendMoveProfileProgramEnable:** Bits 24 and 25 are used to program a blend move. They are controlled by the Program_Blend_Move AOI.
- Bit 25: BlendMoveTransmit:** Bits 24 and 25 are used to program a blend move. They are controlled by the Program_Blend_Move AOI.
- Bit 26: MinimumRegistrationMoveDistanceSave:** Exclusive Bit. Set by the Prog_Min_Reg_Dist AOI.
- Bit 27: GeneralPurposeOutputControl:** Not available when the module is configured to use an Absolute Encoder. This bit is must be set and reset with user supplied code. Do not set this bit directly in the output tags associated with the 5034-PTO_AM module. Set this bit in the output buffer after all AMCI AOIs have been scanned. The corresponding bit in the output buffer is Command_Word.27.

Other Output Tags

- TargetPosition:** The target position or relative offset programmed into a MAM AOI. Also used by other AOI's. One example is the MRP AOI that uses this register to define the position to preset to.
- TargetVelocity:** The target velocity programmed into the AOI.
- Acceleration:** The acceleration programmed into the AOI.
- Deceleration:** The deceleration programmed into the AOI.

3.6 Use the Add-On Instructions

Each AMCI add-on instruction requires the rung to make a false-to-true transition before it operates. Please refer to the sample program for information on using the AMCI AOI's.

The [AOI Reference](#) chapter, which starts on page 65, lists the each AOI, its parameters, and its enumerations.

3.7 Controlling the GP Output

If you are using the General Purpose Output, then you should set or reset the bit in the output buffer instead of directly in the output tags assigned to the 5034-PTO-AM module. If you control it directly in the output tags, then the CPS instruction that copies the output buffer to the output tags will overwrite the state of the bit.

The location of the GP Output bit in the output buffer is Command_Word.27. The ladder logic rung that controls this bit must come after all AMCI AOI's, preferably just before the rung that contains the CPS instruction that copies the output buffer to the module.

Notes

REFERENCE 4

AOI REFERENCE

This chapter lists the AMCI add-on instructions, their parameters, and their Enumerations.

AOI List

AOI Name	Description	Page #
AMCI_5034_PTO_AM_Encoder_Follower	Use this instruction to command an Encoder Follower Move.	66
AMCI_5034_PTO_AM_Hold	Use this instruction to bring an absolute or relative move to a controlled stop and place it in its Hold State.	66
AMCI_5034_PTO_AM_Immediate_Stop	Use this instruction to initiate an Immediate Stop command.	67
AMCI_5034_PTO_AM_MAFR	(Motion Axis Fault Reset) Use this instruction to recover from command faults. This instruction can also be run when the module is not in a fault state to clear the MoveComplete bit.	67
AMCI_5034_PTO_AM_MAH	(Motion Axis Home) Use this instruction to command a Find Home CW and Find Home CCW move.	68
AMCI_5034_PTO_AM_MAJ	(Motion Axis Jog) Use this instruction to command a Jog CW and Jog CCW move.	68
AMCI_5034_PTO_AM_MAM	(Motion Axis Move) Use this instruction to command an Absolute or Relative Move.	69
AMCI_5034_PTO_AM_MRP	(Motion Redefine Position) Use this instruction to initiate a Motor Position Preset command.	69
AMCI_5034_PTO_AM_Preset_Encoder	Use this instruction to initiate an Encoder Position Preset command.	70
AMCI_5034_PTO_AM_Stop_Jog	Use this instruction to bring a Jog, Registration, or Encoder Follower Move to a controlled stop.	73
AMCI_5034_PTO_AM_Resume	Use this instruction to resume an absolute or relative move that is in its Hold State.	72
AMCI_5034_PTO_AM_Prog_Min_Reg_Dist	Use this instruction to program the Minimum Registration Distance for a future Registration Move.	70
AMCI_5034_PTO_AM_Registration	Use this instruction to command a Registration CW or Registration CCW move.	72
AMCI_5034_PTO_AM_Program_Blend_Move	Use this instruction to program the parameters of a future Blend Move.	71
AMCI_5034_PTO_AM_Run_Blend	Use this instruction to command a Blend Move CW or Blend Move CCW move.	73

AMCI_5034_PTO_AM_Encoder_Follower

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
Direction	0 = Motion direction is the same as the encoder. 1 = Motion direction is opposite of the encoder.
Multiplier	1 to 32,767
Divisor	1 to 32,767
Acceleration	0 to 2000 steps/second/millisecond
Deceleration	0 to 2000 steps/second/millisecond

The Multiplier and Divisor set a gear ratio between the incremental encoder inputs and the PTO outputs. Note that the encoder is always decoded using X4 pulse counting. The number of generated PTO pulses equals the (# of encoder pulses * 4) * Multiplier / Divisor.

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration Error	Rung is false
IP (In Process)	Motion is occurring	Motion stops or rung goes false.

AMCI_5034_PTO_AM_Hold

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false

AMCI_5034_PTO_AM_Immediate_Stop

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false

AMCI_5034_PTO_AM_MAFR

Motion Axis Fault Reset

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	A command or input error failed to clear.	Rung is false

AMCI-5034_PTO_AM_MAH

Motion Axis Home

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
Direction	0 = Start Motion is Positive (CW) : 1 = Start Motion is Negative (CCW)
TargetVelocity	Maximum speed of the move in steps/second. Range: Configured Starting Speed to 1,000,000
Acceleration	1 to 2000 steps/second/millisecond
Deceleration	1 to 2000 steps/second/millisecond

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false
IP (In Process)	Motion is occurring	Motion stops or rung goes false
PC (Process Complete)	The At_Home status bit is set.	The next time the rung containing the AOI transitions from false to true.

AMCI-5034_PTO_AM_MAJ

Motion Axis Jog

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
Direction	0 = Positive (CW) Motion : 1 = Negative (CCW) Motion
TargetVelocity	Maximum speed of the move in steps/second. Range: Configured Starting Speed to 1,000,000
Acceleration	1 to 2000 steps/second/millisecond
Deceleration	1 to 2000 steps/second/millisecond

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, Invalid Profile or Configuration error	Rung is false
IP (In Process)	Motion is occurring	Motion stops or rung goes false

AMCI-5034_PTO_AM_MAM

Motion Axis Move

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
Move_Type	0 = Absolute Move : 1 = Relative Move
TargetPosition	Target position of Absolute move or distance to move with a Relative move. Range of -8,388,607 to +8,388,607
TargetVelocity	Maximum speed of the move in steps/second. Range: Configured Starting Speed to 1,000,000
Acceleration	1 to 2000 steps/second/millisecond
Deceleration	1 to 2000 steps/second/millisecond

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false
IP (In Process)	Motion is occurring	Motion stops or rung goes false
PC (Process Complete)	Move is complete	The next time the rung containing the AOI transitions from false to true.

AMCI_5034_PTO_AM_MRP

Motion Redefine Position

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
TargetPosition	Range of -8,388,607 to +8,388,607

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false

AMCI_5034_PTO_AM_Preset_Encoder

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
TargetPosition	Range of -8,388,607 to +8,388,607

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false

AMCI_5034_PTO_AM_Prog_Min_Reg_Dist

Program Minimum Registration Distance

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
Minimum_Registration_Distance	Range of 0 to +8,388,607

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false

AMCI_5034_PTO_AM_Program_Blend_Move

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
Number_of_Segments	Number of segments in the blend move. Range of 2 to 16.
Final_Move_Deceleration	Deceleration used to bring the move to a controlled stop. Range of 1 to 2,000 steps/second/millisecond
Segment_'n'_Distance	The distance to travel in the segment. Range of 1 to 8,388,607. Note that 'n' in the name of this variable is a placeholder for the numbers 1 through 16. If 'n' is less than the Number_of_Segments parameter, that parameter's value is ignored.
Segment_'n'_TargetVelocity	The target velocity of the segment. Range of (Configured Starting Speed) to 1,000,000. Note that 'n' in the name of this variable is a placeholder for the numbers 1 through 16. If 'n' is less than the Number_of_Segments parameter, that parameter's value is ignored.
Segment_'n'_AccelDecel	The acceleration used at the beginning of the segment. Range of 1 to 2,000. Note that 'n' in the name of this variable is a placeholder for the numbers 1 through 16. If 'n' is less than the Number_of_Segments parameter, that parameter's value is ignored.

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
ER (Error)	There is an Input, Command, Invalid Profile or Configuration error	Rung is false
IP (In Process)	Programming the segments is in process	Programming the segments is not in process
Assembled_Move_Programmed	All segments of the Assembled Move have been programmed	Rung is false

AMCI-5034_PTO_AM_Registration

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
Direction	0 = Positive (CW) Motion : 1 = Negative (CCW) Motion
Registration_Distance	Distance to travel after the registration input triggers. Range of 1 to +8,388,607
TargetVelocity	Maximum speed of the move in steps/second. Range: Configured Starting Speed to 1,000,000
Acceleration	1 to 2000 steps/second/millisecond
Deceleration	1 to 2000 steps/second/millisecond

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false
IP (In Process)	Motion is occurring	Motion stops or rung goes false

AMCI_5034_PTO_AM_Resume

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false

AMCI-5034_PTO_AM_Run_Blend

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.
Direction	0 = Positive (CW) Motion : 1 = Negative (CCW) Motion

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, Invalid Profile or Configuration error	Rung is false

AMCI_5034_PTO_AM_Stop_Jog

Parameter	Description
Axis_Input_Data	Input data from the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the input tags directly associated with the module.
Axis_Output_Data	Output data to the 5034-PTO-AM. Use the buffered data created in step 3.4 on page 55 instead of the output tags directly associated with the module.

Enumeration	Set When...	Reset When...
EN (Enable)	Rung is true	Rung is false
DN (Done)	Command is sent to the module	Rung is false
ER (Error)	There is an Input, Command, or Configuration error	Rung is false

Notes

REFERENCE 5

INPUT STATUS BITS

This reference lists the available status bits and the conditions under which they are set.

Stopped Bit

- 1) When a Jog or Registration Move operation has completed.
- 2) When an Emergency Stop input has been used to stop a move operation.
- 3) When the Immediate_Stop AOI has been used to stop a move operation
- 4) When either the CW or CCW Limit switches have been reached during any move operation except Homing.
- 5) After exiting Encoder Follower mode.



The Stopped bit will not be set after an Absolute or Relative Move, after a Homing Operation, after a Blend Move, when a move operation is in a Hold State, or when the module is in Encoder follower mode.

MoveComplete Bit

Set after the completion of an Absolute Move, Relative Move, or a Blend Move. The Move Complete bit will be reset when the next move operation is initiated or when an MAFR AOI is accepted.

HomeInvalid Bit

- 1) Triggering a MAH AOI when the instruction's Target Speed is less than the configured Starting Speed.
- 2) Triggering a MAH AOI when the Target Position is not equal to zero.
- 3) Triggering a MAH AOI in a direction that does not have a configured End Limit Switch.
- 4) If the opposite End Limit Switch is reached during a homing operation. For example, if the CCW Limit Switch is first reached during a CW homing operation. Improper wiring or placement of the limit switch would most likely cause this error.
- 5) If both End Limit Switches are reached during a homing operation. This error will only occur when the motor has reversed direction after encountering the first End Limit switch. This could indicate a problem with the Home Limit Switch wiring because it always stayed in its inactive state.

InvalidProfile Bit

Basically, this bit is set if any move instruction parameters are outside their valid ranges when the instruction is triggered.

- 1) With the exception of MAJ jog instructions, set if the instruction's Target Speed is less than the configured Starting Speed.
- 2) Changing the speed of a MAJ jog instruction whose initial Target Speed was less than or equal to the configured Starting Speed.
- 3) If invalid changes are made to the velocity, acceleration, or deceleration parameters of a MAJ jog instruction that is running. When detected, motion will immediately stop. The acceleration and deceleration data are only checked when module detects a change to the velocity data.
- 4) If a value is written to the Target Position output register while a MAJ jog move or Registration move is occurring. Motion will immediately stop.
- 5) If the Registration Move is started with the External Input active.
- 6) Starting a Registration Move if the number of steps programmed into the Target Position is less than the number of steps required to decelerate to the configured Starting Speed. In this case motion will not start.

InvalidProfile Bit (continued)

- 7) If the Target Position of a Registration Move is negative.
- 8) Increasing the speed of a Registration Move while it is occurring. Motion will immediately stop. Please note that it is possible to decrease the speed of Registration Move while it is occurring.
- 9) Changing the acceleration or deceleration parameters while also changing the Programmed Speed during a Registration Move. Motion will immediately stop.
- 10) Setting the number of Blend Move Segments to be less than 2 or greater than 16.
- 11)
- 12) If a Blend Move segment cannot reach its Programmed Speed. That is, if the distance that it takes to accelerate to the segment's Programmed Speed exceeds the length of the segment.
- 13) Two consecutive Blend Move segments with the same Programmed Speed.
- 14) Starting an Encoder Move if the module has not been configured to use an incremental encoder. (The configuration parameter is set to "No Encoder Used" or "Absolute Encoder Used".
- 15) If the move's programmed parameters overflows the internal registers of the 5034-PTO-AM module.

PositionInvalid Bit

- 1) After a power cycle to the module.
- 2) After the module has been re-configured. This will be true even if the position was valid before the configuration operation occurred.
- 3) After an Immediate Stop AOI has been triggered if motion was occurring.
- 4) If the Emergency Stop input has been activated if motion was occurring.
- 5) If either of the End Limit Switches become active during any Absolute, Relative, Blend, or Encoder Follower move.
- 6) If the same end limit is reached during a Jog or Registration move. For example, if the CW Limit Switch is reached during a Jog move in the clockwise direction.
- 7) If the opposite End Limit Switch is reached during a homing operation. For example, if the CCW Limit Switch is the first switch reached during a CW homing operation. Improper wiring or placement of the limit switches are the most likely causes of this error.
- 8) If both End Limit Switches are reached during a homing operation. This error will only occur when the motor has reversed direction after encountering the first End Limit switch. This could indicate a problem with the Home Limit Switch wiring because it stayed in its inactive state across the entire mechanical span of the machine.

InputError Bit

- 1) If an Emergency Stop input is activated while motion was occurring.
- 2) If either of the End Limit Switches become active during any Absolute, Relative, Blend, or Encoder Follower move.
- 3) If the same end limit is reached during a Jog or Registration move. For example, if the CW Limit Switch is reached during a Jog move in the clockwise direction.
- 4) Performing a Jog move in the same direction as the active End Limit Switch. For example, starting a CW Jog when the CW Limit Switch is active.
- 5) If the opposite End Limit Switch is reached during a homing operation. For example, if the CCW Limit Switch is the first switch reached during a CW homing operation. Improper wiring or placement of the limit switches are the most likely causes of this error.
- 6) If both End Limit Switches are reached during a homing operation. This error will only occur when the motor has reversed direction after encountering the first End Limit switch. This could indicate a problem with the Home Limit Switch wiring because it stayed in its inactive state across the entire mechanical span of the machine.

CommandError Bit

General Command Errors

- 1) If a move operation is started before the previous move operation is completed. The current move will run to completion.
- 2) If the Target Position, Target Speed, Acceleration, or Deceleration parameters are outside of their valid ranges.
- 3) If the AOI's Target Speed is less than the configured Starting Speed. This applies to Absolute Moves, Relative Moves, Homing operations, and Blend Moves.
- 4) Performing an Absolute Move when the Current Position is not valid. (The Position_Invalid bit equals "1")
- 5) Triggering a Hold AOI when an Absolute or Relative move is not in progress. Note that Jog moves, Blend moves, Registration moves, Encoder Follower moves, and Homing operations cannot be held.
- 6) Triggering a Resume AOI when the channel is not in a Hold state. The current move will run to completion.
- 7) Triggering a Preset_Encoder AOI when the module has not been configured to use an encoder.
- 8) If more than one Command bit in output word 0 (MSW) is set. This cause should not occur when using the AIO's.

Jog Command Errors

- 9) Changing the speed of a Jog move whose initial Target Speed was less than or equal to the configured Starting Speed.
- 10) If invalid changes are made to the Target Velocity, Acceleration, or Deceleration parameters of a Jog move that is running. When detected, motion will immediately stop. Please note that the Acceleration and Deceleration values are only checked when a change is made to the Target Velocity.

Blend Move Command Errors

- 11) If a Blend Move operation is triggered before the profile was programmed.
- 12) If a Program_Blend_Move AOI is triggered while a blend move operation is in progress. If this occurs, the final segments deceleration will be used to immediately stop the motion.
- 13) If the hold command is issued while a blend move profile is running. If this occurs, the command error bit will be set while the blend move profile runs to completion. When completed, the command error will be reset.

Registration Move Command Errors

- 14) If a Prog_Min_Reg_Dist AOI is triggered with its Minimum_Registration_Distance outside its valid range. Note that negative numbers are not valid.
- 15) If a Hold AOI is triggered while a Registration Move is occurring.
- 16) If a Registration Move is started with the External Input active.
- 17) If a Registration move is triggered and RegistrationDistance parameter is less than the number of steps required to decelerate to the configured Starting Speed. In this case the motion will not start.
- 18) If a Registration move is triggered and the RegistrationDistance parameter is negative.
- 19) If the value of the RegistrationDistance parameter is changed after a Registration Move has been initiated. Motion will immediately stop.
- 20) If the TargetSpeed is increased while motion is occurring. Motion will immediately stop. Please note that it is allowed to decrease the speed while a Registration Move is occurring.
- 21) Changing the acceleration or deceleration parameters while also changing the Programmed Speed during a Registration Move. Motion will immediately stop.

CommandError Bit (continued)**Encoder Follower Command Errors**

- 22) If an Encoder_Follower AOI is triggered while the module is not configured to use an incremental encoder.
- 23) If an Encoder_Follower AOI is triggered before the present move is completed. Please note that even though the command error status bit will be set, the present move operation will run to completion.
- 24) If AOI's Multiplier or Divisor values are outside of the range of 1 to 32767 when the instruction is triggered.
- 25) If the direction of the Encoder Follower motion is changed, by changing which Manual Move command bit is set, without at least one I/O scan where the command word is equal to zero.

Notes



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