Control
Technology
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Installation Guide

Model 2206 Stepping Motor Control Module

For Use with the 2600XM series Automation Controllers

This document is current as of the following revision levels:

- Controller Firmware – R 2.3
- Controller Hardware – B
- Board Hardware – B

This guide shows how to install your model 2206 Stepping Motor Control Module. This module provides fully programmable control over stepping motor functions. It uses an independent on-board microprocessor that provides superior performance in multi-axis systems, without degrading the response of the controller's main processor.

All motion parameters for the stepping motors are programmable, providing flexibility when initially installing the system and during operation. The 2206 Stepping Motor Control Module provides dedicated inputs for many commonly-used functions, such as jog inputs.

This guide is divided into the following sections:

- Inserting the 2206 Stepping Motor Control Module into your Controller
- 2206 Stepping Motor Control Module Specifications
- Special Purpose Registers
- Programming Your 2206 Stepping Motor Control Module
- Connecting the 2206 Stepping Motor Control Module to a Stepping Motor Drive

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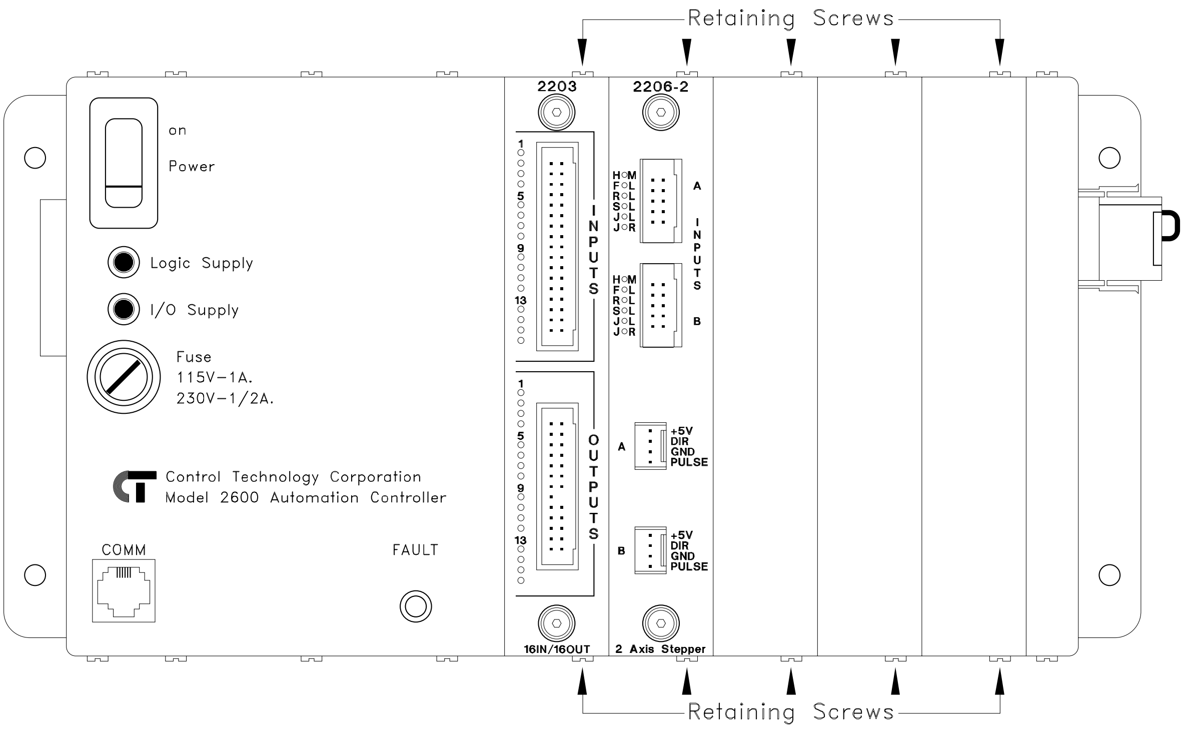
Inserting the 2206 Module into Your Controller

The model 2206 Stepping Motor Module must be inserted into one of the slots of your automation controller. Any combination of modules may be inserted into the controller, subject to system limits. You may insert them in any order; the controller's CPU dynamically assigns motor numbers, input numbers, output numbers, etc., each time power is reapplied to the controller. These numbers are assigned from left to right across the controller. For example, from slot No. 1 to slot No. 5 in the controller shown on the next page.

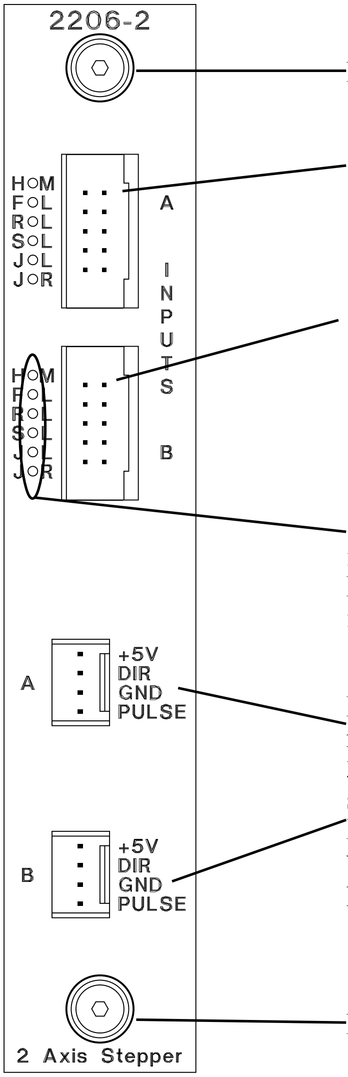
To install a module into the automation controller:

1. Insure that all A.C. and D.C. power to the controller has been removed. This includes any external supplies which may be connected to the controller.
2. Remove the retaining screws from the top and bottom of the cover plate in the position to be used for the new module. Save these screws to re-install the new module.
3. Slide the module into the slot, insuring that the circuit board slides into the nylon guides at top and bottom, and that the card is oriented properly (labelling should read right-side-up).
4. Press the module firmly into the controller; when properly seated, the faceplate of the module should be flush with the adjacent sheet metal surface.
5. Reinstall the retaining screws in the top and bottom of the new module.



Model 2600 Automation Controller shown with a model 2203 Combination I/O Module in the first position, and a model 2206 Stepping Motor Control Module in the second position.

Front View Model 2206 Stepping Motor Control Module



Module Extraction Handle – Do Not Detach!

Auxiliary Input Connectors – These 10 pin connectors provide access to the 6 dedicated inputs (per axis) of the model 2206, as well as providing +24 for powering external sensors. To connect to the inputs use a model 2270 Pigtail Cable which has a mating connector and 6-foot unterminated wires. You can also create your own cable with an AMP #87922-1 housing and #87523-6 contacts.

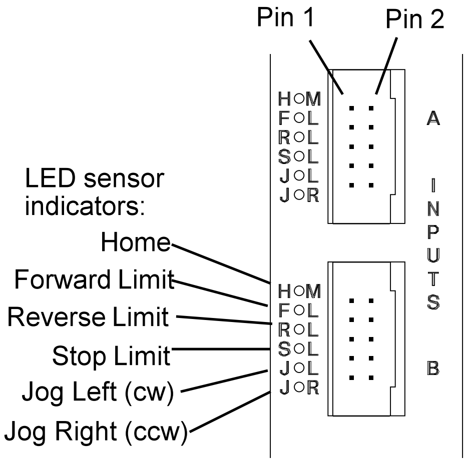
Sensor Indicators – Six LED indicators (per axis) are provided to indicate the status of the Home, Forward Limit, Reverse Limit, Soft Limit (Soft Stop), Jog Left (cw), and Jog Right (cww) dedicated inputs.

External Drive Connector – This connector allows you to connect to model 3921and 3922 drives with a model 3973 Cable and model 3924 drives with a 3973-K Cable. It provides pulse and direction signals to the drive. For other stepping motor drives, use a 2287 Pigtail Cable.

You can create your own cable using a Molex #22-01-3047 housing with #08-50-0114 contacts.

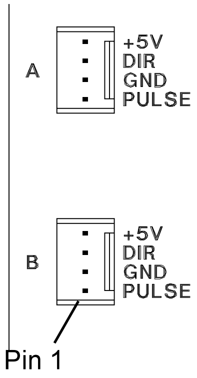
Module Extraction Handle – Do Not Detach!

For a connector kit that supplies pins and connectors for the entire module, use a 2256-1 Connector Kit for single axis modules and a 2256-2 Connector Kit for dual axis modules.



The following list shows the pin connections for the Auxiliary Input Connectors:

- Pin #1 – Home
- Pin #2 – Forward Limit
- Pin #3 – Reverse Limit
- Pin #4 – Stop Limit
- Pin #5 – Jog Left
- Pin #6 – Jog Right
- Pin #7 – 24 V Return
- Pin #8 – 24 V Return
- Pin #9 – +24 VDC
- Pin #10 – +24 VDC



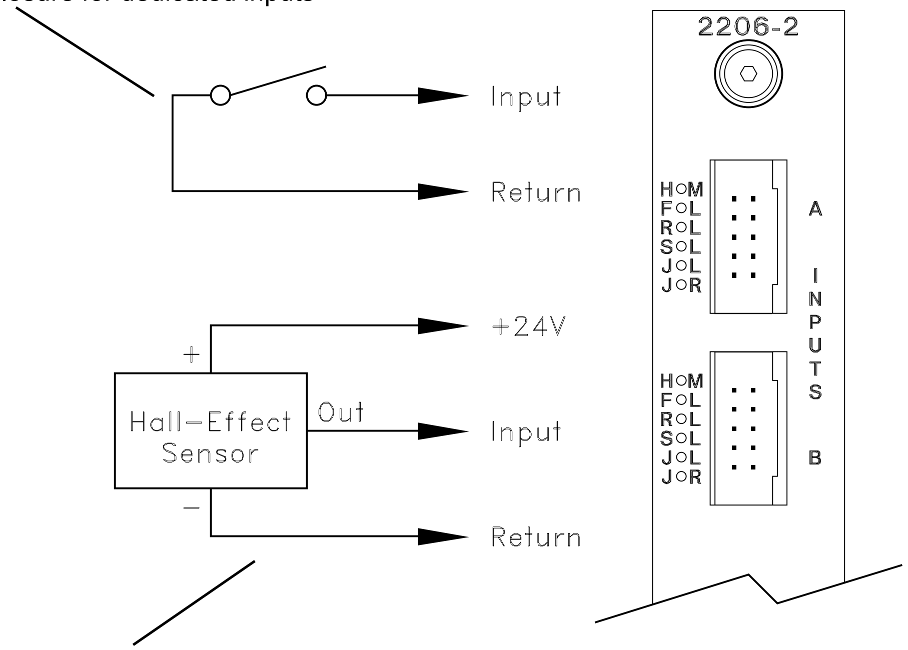
The following list shows the pin connections for the External Drive Connectors:

- Pin #4 – + 5 VDC
- Pin #3 – Direction
- Pin #2 – Return
- Pin #1 – Pulse

Connecting the Model 2206 Dedicated Inputs

The six dedicated inputs on the model 2206 require only a switch closure to return (the common for the controller's 24 volt supply) to be actuated. Each input is internally self-powered from the controller's 24 volt power supply through a current limiting resistor and is opto-isolated from the controller's logic. The following illustration is an example of the switch closure for the dedicated inputs.

Switch closure for dedicated inputs



How to connect a solid state sensor

Using Solid State Sensors

You can connect many types of electronic sensors to the dedicated inputs. You can connect three wire Hall-effect sensors, proximity sensors, and phototransistors with out any additional circuitry. These devices should be specified as having sinking-type open-collector outputs (NPN) and must be capable of withstanding at least +24 volts on their output terminals when in the off state. The sensor must also be able to sink the required input current, i.e., 2.4 mA, when on.

NOTE: Do not use two-wire solid state sensors.

Electronic sensors typically require an external power source for powering their internal circuitry. If the sensor chosen requires a power supply voltage equal to the controller's built-in auxiliary supply (24 volts), it can be powered directly by the controller, eliminating the need for an additional external supply. The illustration above shows how to connect a solid state sensor

2206 Stepping Motor Control Module Specifications

Absolute Maximum ratings	**Min**	**Typ**	**Max**	
+ 5 VDC Power Supply[1] (for powering external drive inputs)			96	mA
Ambient Temperature (operating)	0		50	C
Specification	**Min**	**Typ**	**Max**	
Pulse and Directional Output				
Low V_{OL} (I_{OL} = 24 mA)	0.36		0.44	VDC
High V_{OH} (I_{OH} = 24 mA)	4.44		5.25	VDC
Pulse Width (Jumper configurable)				
For microstepping motor drives		1.3		µs
For half-step and full-step motor drives		34		µs
Auxiliary Inputs				
Off Voltage[2] (I_I = 0 mA)		24.0	26.4	VDC
On Current (I_I = 0 V)		2.1	2.5	mA
Threshold				
low-to-high		8.5		VDC
high-to-low		7.5		VDC
Performance Specifications				
Maximum Velocity Setting	4		250,000	steps/sec
Resolution of Maximum Velocity		3.9		steps/sec
Acceleration and Deceleration Settings			130,000,000	steps/sec^2
Resolution of Acceleration and Deceleration Settings		15.3		steps/sec^2
Position range	-2,147,483,648		2,147,483,647	steps
Relative Motion Command Range	-2,147,483,648		2,147,483,647	steps
Power Supply Requirements (from controller)				
Logic Supply (5 V)		245	300	mA
Auxiliary Supply (24 V)		22	80	mA

1. Powered from controller's 24 V supply
2. Dependent on controller auxiliary supply voltage (24 V typ)

Special Purpose Registers

Group access special purpose registers display the same parameters for all of the 16 axes together. Individual access special purpose registers display all the parameters for a single axis.

Group Access:

Registers 13701 - 13716	Stores Soft Stop position
Registers 13801 - 13816	Specifies Start option
Registers 14001 - 14016	Current position
Registers 14201 - 14216	Current velocity in steps/sec
Registers 14301 - 14316	Status 0 = Uninitialized 1 = Stopped 2 = Waiting for Start 3 = Accelerating 4 = At Speed 5 = Decelerating to new maximum speed 6 = Decelerating to stop 7 = Soft Stop (Transition mode to initiate deceleration)
Registers 14601 - 14616	Deceleration value in steps/sec^2

Individual Access:

Axis No. 1

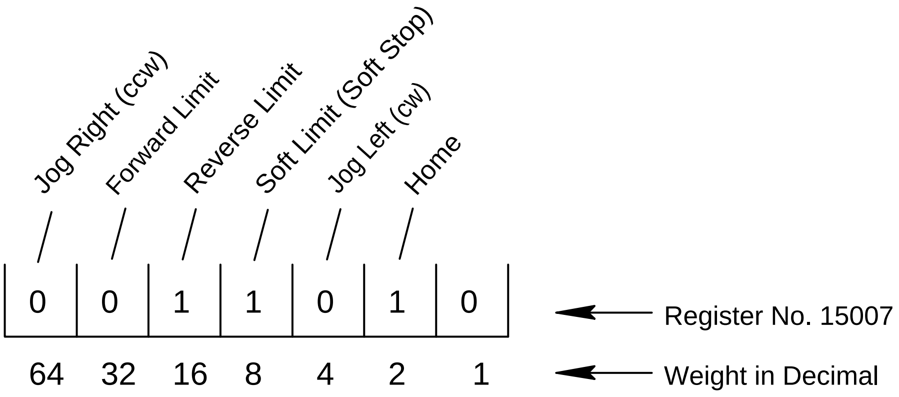
Register 15000	Current position
Register 15002	Current velocity
Register 15003	Current status (same as above)
Register 15006	Deceleration value steps/sec2
Register 15007	Monitoring Dedicated Inputs (using a bit map)* Home = 2 Jog CCW = 4 Soft Limit = 8 (for Soft Stop) Reverse Limit = 16 Forward Limit = 32 Jog CW = 64

* See the explanation on the following page.

Axis No. 2	Register 15010 - 15017
Axis No. 3	Register 15020 - 15027
Axis No. 4	Register 15030 - 15037
Axis No. 5	Register 15040 - 15047
Axis No. 6	Register 15050 - 15057
Axis No. 7	Register 15060 - 15067
Axis No. 8	Register 15070 - 15077
Axis No. 9	Register 15080 - 15087
Axis No. 10	Register 15090 - 15097
Axis No. 11	Register 15100 - 15107
Axis No. 12	Register 15110 - 15117
Axis No. 13	Register 15120 - 15127
Axis No. 14	Register 15130 - 15137
Axis No. 15	Register 15140 - 15147
Axis No. 16	Register 15150 - 15157

Monitoring Dedicated Inputs

Registers 15007, 15017, etc. can return a bit pattern that indicates which, if any, of the Dedicated Inputs are activated. The number of the Dedicated Input is stored as a binary representation (of the input number) in the register. Each input has its own binary value.



In the illustration above, the Home, Reverse Limit, and Soft Stop inputs are shown as active. Register 15007 (for axis No. 1) would return a value of 26, because the respective weights of the inputs are 2, 8, and 16. To test any individual input, the bitwise AND instruction may be used to apply a mask to the register. The following instruction applies a bit mask that test to see if the Home input is active:

```
[1]  TEST_FOR_HOME_AXIS1
    ;;; Home = 2
    ________________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>
    ________________________________________

    store reg#15007 and 2 to reg#10
    if reg#10 = 2 goto FOUND_HOME
    goto TEST_FOR_HOME_AXIS1
```

Programming Your 2206 Stepping Motor Module

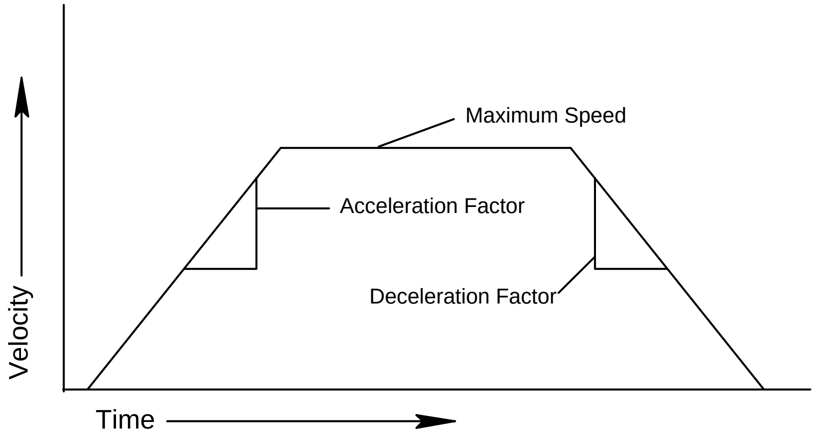
The following section describes how to program your model 2206 Stepping Motor Module. When programing the 2206 Stepping Motor Module, use the Quickstep instructions for Servos:

- Profile Servo
- Turn Servo
- Monitor Servo
- Zero Servo
- Search and Zero Servo
- Stop Servo
- If Servo
- Store Servo

Setting Up Stepping Motor Operating Parameters

Before the controller can turn your stepping motor, it must have a set of operating parameters. These parameters must be specified using the PROFILE SERVO instruction. Operating parameters for the motor are as follows:

- Max Speed – Establishes the maximum speed of the motor.
- Accel Rate – Specifies the acceleration rate of the motor. The deceleration rate is the same as the acceleration rate. See the section on *Setting Acceleration and Deceleration Parameters* for information on setting a different deceleration rate.



NOTE: You can use only the Max and Accel parameters of the Profile Servo instruction with the 2206 module. The controller ignores the other parameters.

The maximum speed is expressed in units of steps-per-second (steps/sec). Your programmed maximum speed has a resolution of about 4 steps/sec. The acceleration and deceleration is expressed in units of steps-per-second-per-second (steps/sec^2) with a granularity of about 16 steps/sec^2.

The PROFILE SERVO instruction must appear before the first TURN SERVO instruction in your Quickstep program. If it is not executed prior to the first TURN SERVO instruction, a software fault stating, “Servo not ready,” results. Additional PROFILE SERVO instructions are only necessary when you want to change the motor’s operating parameters.

Re-profiling on-the-fly, which allows the stepping motor to take on new settings during a motor motion, is possible. To re-profile the stepping motor, program another PROFILE SERVO instruction with a new maximum speed or acceleration value. You do not have to re-specify a value that does not change.

NOTE: Adjustments to the ramping (acceleration and deceleration) parameters while the motor is accelerating or decelerating causes an instantaneous change in the ramp that may be undesirable. To avoid this, make changes to the ramping parameters when the motor is stopped or turning at maximum speed. You can view the status of the motor by checking the appropriate special registers. For example, check register number 14301 for the current status of the first motor. Refer to the list of special registers for additional information.

Setting Acceleration and Deceleration Values

The PROFILE SERVO instruction acceleration parameter sets both the acceleration and deceleration values. If you want the acceleration and deceleration values to be different, use a special purpose register after the profile instruction to set a different value for the deceleration value. For example:

```
profile servo#1 max=50000 accel=100000
store 20000 to reg#15006 (axis #1 deceleration register)
```

Result:

Acceleration = 100000 steps/sec^2
Deceleration = 20000 steps/sec^2

Refer to the list of special purpose registers for the appropriate register number for each axis.

NOTE: If you specify a new acceleration rate, the deceleration rate in register 15006 is overwritten by the new acceleration rate. You must respecify the deceleration rate.

Searching for Home

Each stepping motor axis has a dedicated Home input. This is most often used in conjunction with the instruction to set a home position for the axis. When the controller executes the SEARCH AND ZERO instruction, the following occurs:

- If the Home input does not have a switch closure, the motor turns in a counterclockwise (ccw) direction until the switch closes (changes state). If the home input has a switch closure on it, the motor turns in a clockwise (cw) direction until the switch opens (changes state). In either case, the Home input is checked every millisecond, which offers very good repeatability. The motion will be at the profiled maximum speed and acceleration values.
- When Home is sensed, the motor stops and the position is set to zero.

HINT 1: Make sure the maximum speed of the motor is low enough that the motor can stop instantly or the motor may overrun its intended position.

HINT 2: To get the motor in the home position consistently, Search and Zero the motor once at a relatively high speed. Then Search and Zero the motor again at a slow speed. The following example shows how to Search and Zero a motor:

```
[1]  COARSE_HOME
    ;;;Commence initial home sequence for axis # 1
    ____________________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>

    ____________________________________________

    profile servo#1 maxspeed=2000 accel=2000
    search and zero servo#1
    monitor servo#1 stopped goto next

[2]      MOVE_OFF_HOME
   ;;;Move motor off home switch
    ____________________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>

    ____________________________________________

    turn servo#1 cw 500 steps
    monitor servo#1 stopped goto next

[3]  FIND_HOME
   ;;;Re-profile for slower homing speed, then
   ;;;re-home motor
    ____________________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>

    ____________________________________________

    profile servo#1 maxspeed=500 accel=500
    search and zero servo#1
    monitor servo#1 stopped goto next
```

Turning a Motor

There are three modes of turning the motor:

1. Absolute Positioning – In Absolute Positioning the 2206 Stepping Motor Module always references the home (or zero) position in a turn instruction and moves a specified distance from home position. For example, the following instruction

   ```
   turn servo#12 to 50000 instruction
   ```

   causes the motor to position itself 50000 steps from home. The motor automatically turns in the correct direction to reach the new position.

2. Relative Positioning – In Relative Positioning, the direction of the turn, either cw or ccw, is specified in the turn instruction along with a defined number of steps to turn. For example, the following instruction

   ```
   turn servo#1 cw 12340 steps
   ```

   turns the motor 12340 steps clockwise from its current position.

3. Velocity Control – In this case, you establish a direction and begin continuous operation . The maximum speed and acceleration are based on the current profile instruction and can be changed. For example, the following instruction

   ```
   turn servo#1 cw
   ```

   starts the motor turning clockwise at its current maximum speed and acceleration. The motor will continue to turn until the controller issues a Stop Servo instruction or until a Limit or Stop input is activated.

Once a motor is in motion do not initiate another turn instruction until the motion is complete, or a software fault, “servo not ready,” results. Use the Monitor Servo instruction to check the current status (running/stopped) of the motor.

The model 2206 Stepping Motor Module tracks the position of the motor through all three types of instructions, allowing you to use all three types of positioning and control in the same program.

NOTE: Quickstep instructions specifying cw or ccw operations assume the following:

- The stepping motor is wired according to manufacturer’s recommendations.
- The logical sense of the direction output of the 2206 Stepping Motor Module agrees with the logical sense expected by the motor’s drive.

Stopping the Motor

There are two instructions that terminate the motion of a motor already in motion:

- Stop (soft) Servo causes the motor to stop at the deceleration rate specified in the last profile instruction.
- Stop (hard) Servo causes the 2206 Stepping Motor Module to try to stop the motor instantly. However, because of momentum, the motor does not stop instantly and consequently the absolute position may be lost.

In either case, you should use a Monitor Servo Stopped instruction before issuing another turn instruction.

Monitoring and Changing Other Motor Parameters

There are a number of special purpose registers available that allow you to monitor and change the motor parameters. For more information, refer to the list of special purpose registers for the 2206 Stepping Motor Module and your automation controller.

Hardware Considerations

Dedicated Inputs

All dedicated inputs on the 2206 Stepping Motor Module are internally pulled-up to 24 VDC, requiring a contact closure to 24V Return to actuate. The contact closure can be supplied by a mechanical switch or by certain types of solid state open-collector outputs.

- Forward Limit – If the motor is moving cw, disables all cw movement, attempting to stop the motor instantaneously. The home position of the motor may be lost, requiring you to re-home it.
- Reverse Limit – If the motor is moving ccw, disables all ccw movement, attempting to stop the motor instantaneously. The position of the motor may be lost, requiring you to re-home it.
- Stop Limit (Soft Stop) – Stops the motor using the deceleration rate programmed in the PROFILE SERVO instruction, terminating the motion.
- Jog Left (cw) – Starts the motor turning clockwise at the acceleration rate programmed in the PROFILE SERVO instruction. The motor reaches velocity and continues to turn until the jcw input is turned off. The motor then decelerates to a stop at the programmed deceleration rate.
- Jog Right (ccw) – Starts the motor turning counterclockwise at the acceleration rate programmed in the PROFILE SERVO instruction. The motor reaches velocity and continues to turn until the jccw input is turned off. The motor then decelerates to a stop at the programmed deceleration rate.
- Home – Refer to *Searching for Home*.

If you have chosen the Start option, it replaces the Jog cw dedicated input with an Start input and Jog cw is not available. To use the Start dedicated input you must program your TURN SERVO instruction using the ON START parameter. The 2206 checks the On Start input every millisecond, which improves the repeatability of the start motion. The motion will not commence until the Start switch is activated.

To choose this option store the number 1 in register 13801 for the first axis 1, 13802 for the second axis, up to 13816 for the 16th axis. Once you store the number 1 to this register, you do not have to store it again in your program.

NOTE: If a motor has been stopped by any of the above stop inputs, the programmed instruction MONITOR SERVO STOPPED becomes true and your program proceeds to the step specified.

Not all of the dedicated inputs are active at the same time. The following list describes when the dedicated inputs are active and inactive.

- Forward Limit input – This input is active only when the motor is moving in the cw direction. This allows the motor to backed of a limit switch, because you can still move ccw.

  For example, if the Forward Limit input is connected to a limit switch for a linear table and the table hits the limit switch, the table can still move ccw and return to the home position.
- Reverse Limit input – This input is active only when the motor is moving in the ccw direction.

- Soft Stop input – This input is not active when searching for home or when jogging under control of the jog inputs. Because there are some instances where the Soft Stop input does not stop motion, you should not use this input for any limit switch intended to prevent damage to a machine.

  The Soft stop input has the additional advantage of storing the position at which the input signal occurred. The position is accessible via a special purpose register, 13701 for the first axis, 13702 for the second axis, up to 13716 for the 16th axis. You can take advantage of this feature in applications where Soft Stop is used to synchronize a repetitive motor motion to some external event, such as, a registration mark being sensed on a continuous web of material.

- Jog cw and Jog ccw inputs – The Jog inputs are active only when the motor is stopped. Following a PROFILE SERVO instruction, a Jog input will commence a cw or ccw motion, depending on the input.

  If both the Jog cw and Jog ccw inputs are applied simultaneously, the first one sensed by the 2206 Stepping Motor Module prevails and the other is ignored. When the Jog input signal is removed, the motor decelerates to a stop at the profiled deceleration rate.

  The following list describes when the Jog inputs are inactive:

  - Once a motion is triggered by other means, applying and/or removing a Jog input has no effect.
  - The Jog cw input is inactive when the Forward Limit switch is active. However, the Jog ccw input is active.
  - The Jog ccw input is inactive when the Reverse Limit switch is active. However, the Jog cw input is active.
  - Both Jog inputs are inactive when the Soft Stop input is active.

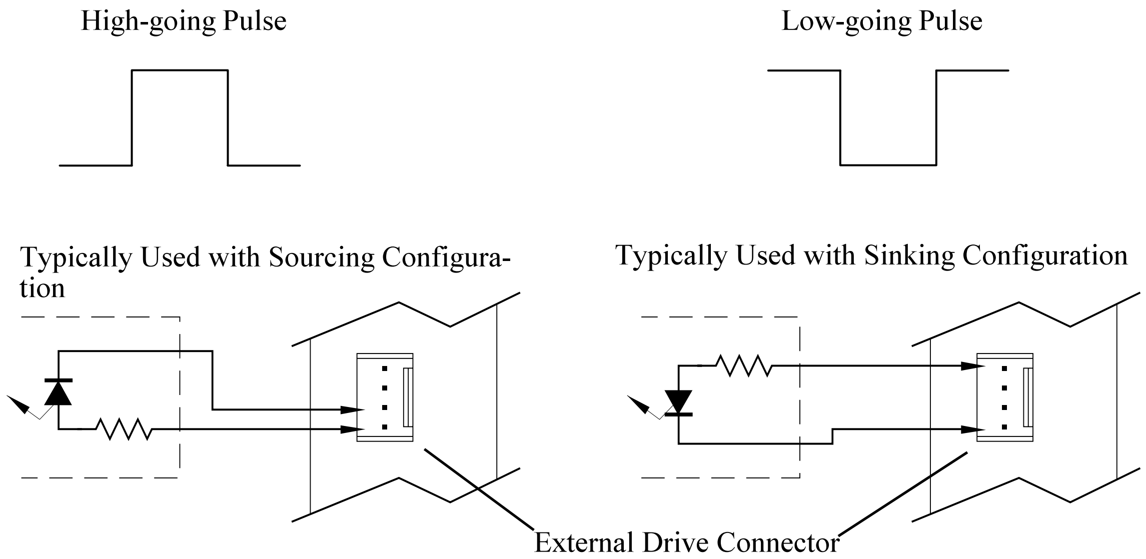
- Home input – The Home input is only active when the 2206 Stepping Motor Module is searching for home. Otherwise, it does nothing at all.

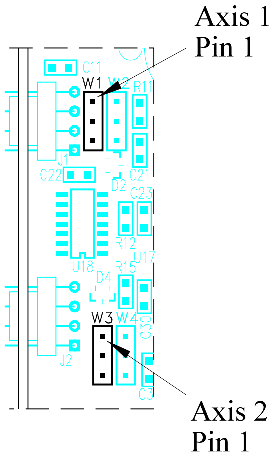
Connecting the 2206 to a Stepping Motor Drive

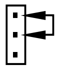
Jumper Cable Connections

The 2206 has four sets of wire jumpers, W1, W2, W3, and W4. Each set of jumpers consists of three wire pins.

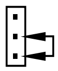
Jumpers W1 and W3 determine the logical sense of the pulse. How you connect these jumpers depends on your stepping motor drive.


High-going Pulse
Low-going Pulse
Typically Used with Sourcing Configuration
Typically Used with Sinking Configuration
External Drive Connector





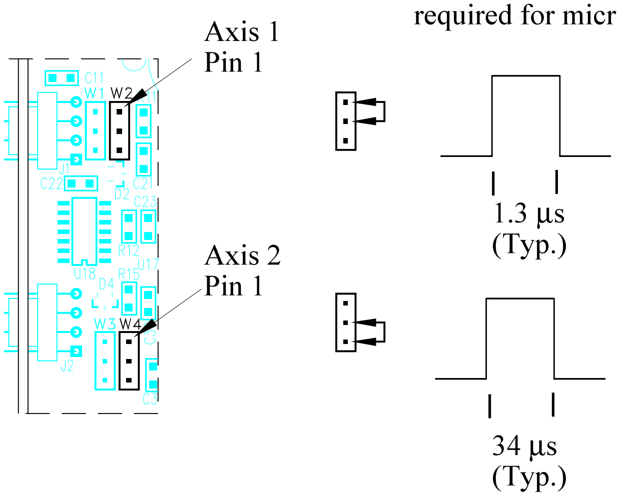
Connect to pins 1 and 2 for the sourcing configuration.



Connect to pins 2 and 3 for the sinking configuration.

Jumpers W2 and W4 determine the width of the output pulse.

Selecting jumpers 1 and 2 produces a pulse with a width of ≅ 1.3 µs. This pulse width is typically required for micro-step stepping motor drives.



Selecting jumpers 2 and 3 produces a pulse with a width of ≅ 34 µs. This pulse width is typically required for full step and half-step stepping motor drives.

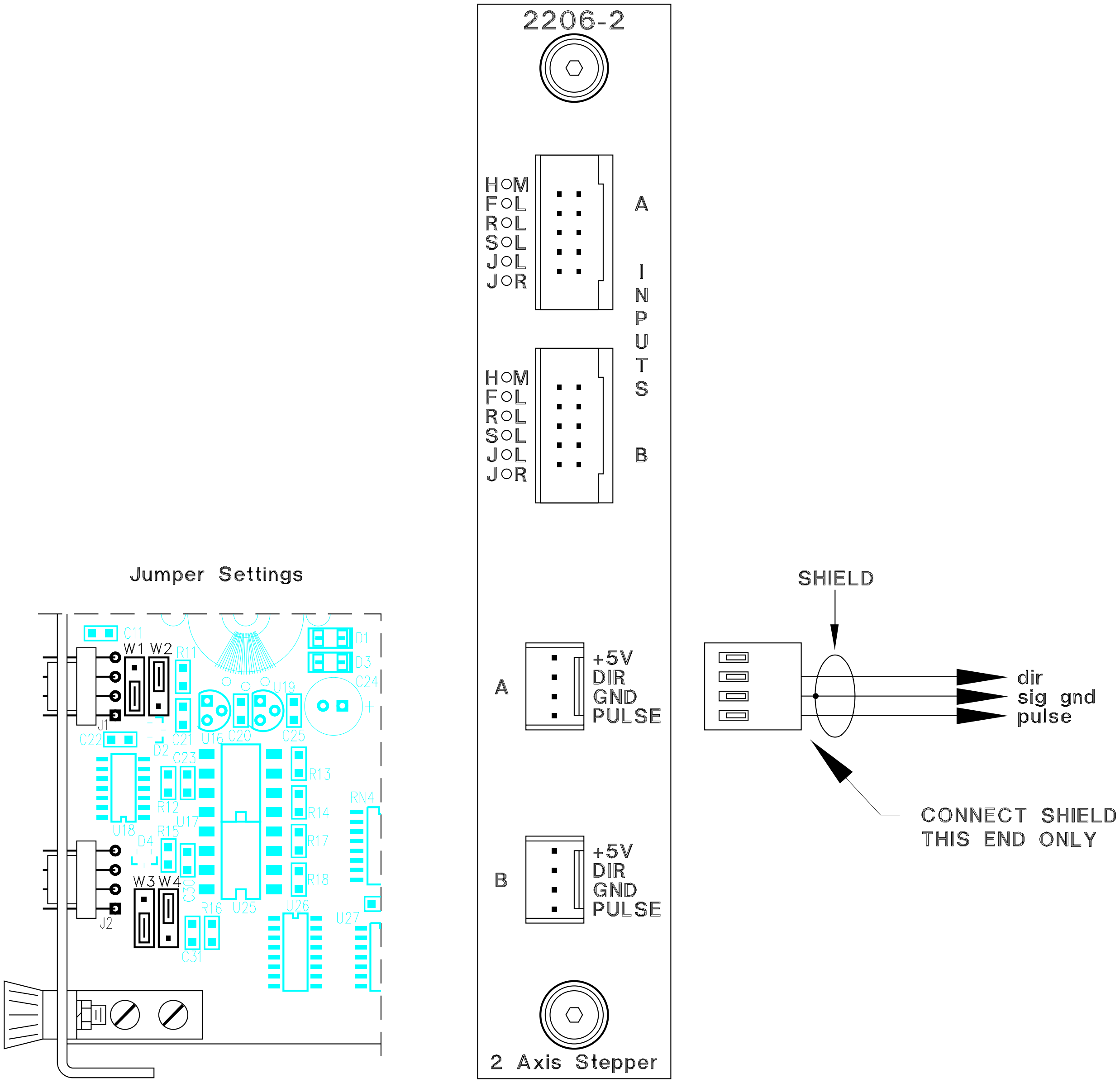
Connecting the 2206 to a Stepping MotorDrive

The illustrations on the following pages show how to connect your 2206 Stepping Motor Module to these stepping motor drives:

- Applied Motion Products (AMP) – 235 drive series, 335 drive series, and 556 drive series stepping motors
- Compumotor – OEM 350 and OEM 650 stepping motors
- Centent – CNO 142 and CNO 143 stepping motors
- Intelligent Motion Systems (IMS) – IM483 stepping motors
- Oriental – VDX series and VPD series stepping motors

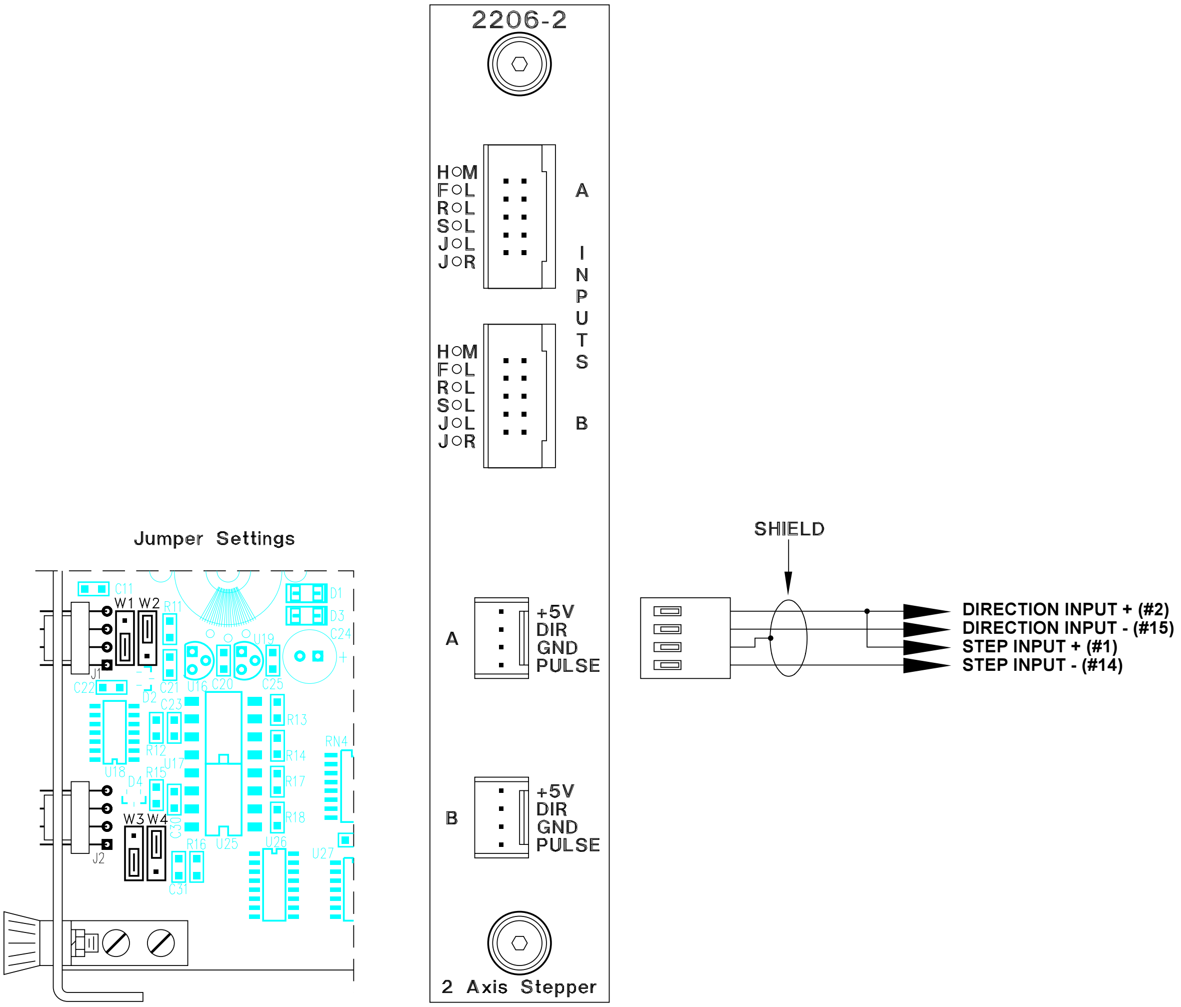
Connecting to an Applied Motion Products Stepping Motor Drive

The following figure show how to connect the 2206 Stepping Motor Module to the 235 drive series, 335 drive series, and 556 drive series stepping motors.



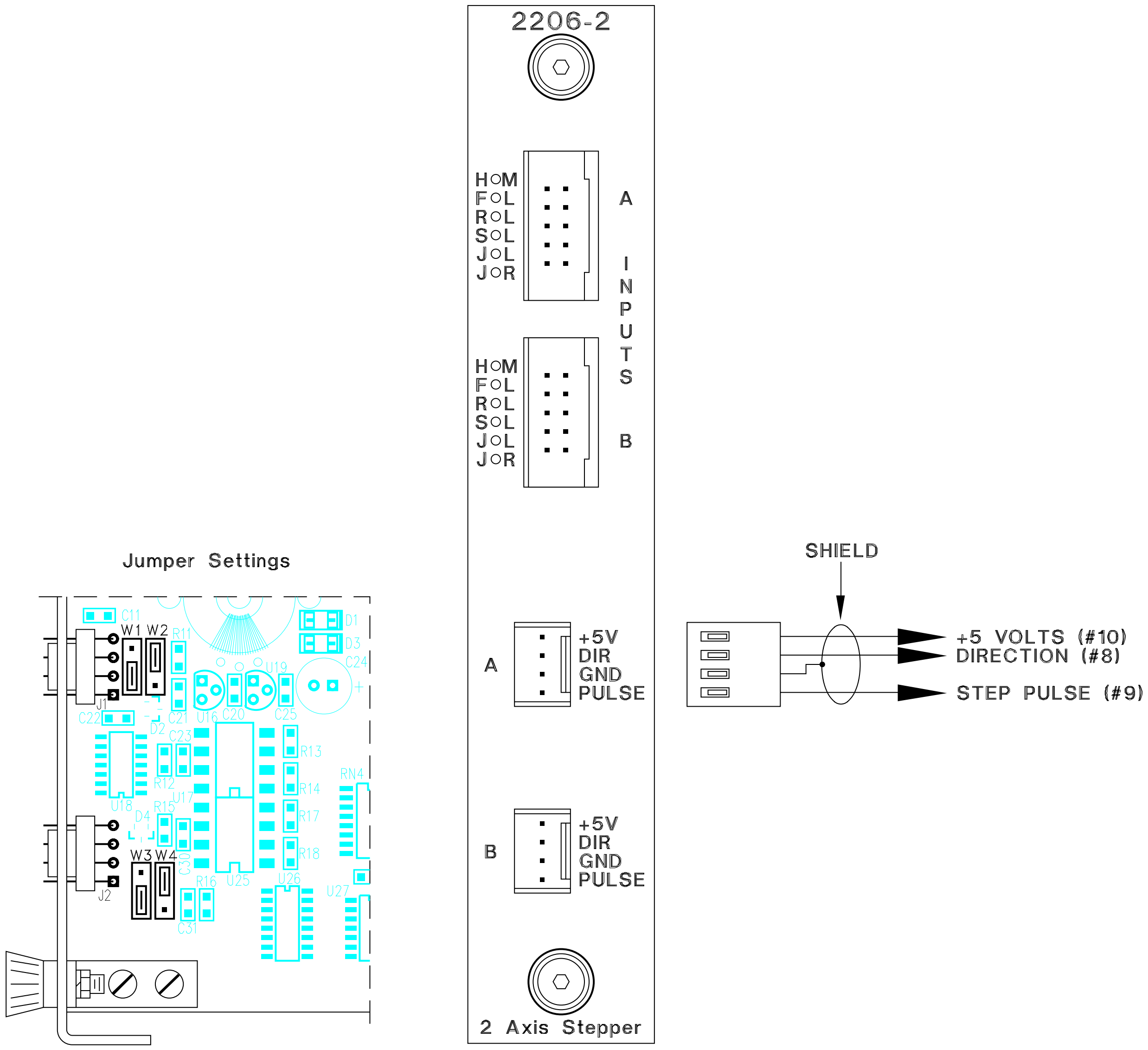
Connecting to a Compumotor Stepping Motor Drive

The following figure show how to connect the 2206 Stepping Motor Module to the OEM 350 and OEM 650 stepping motors.



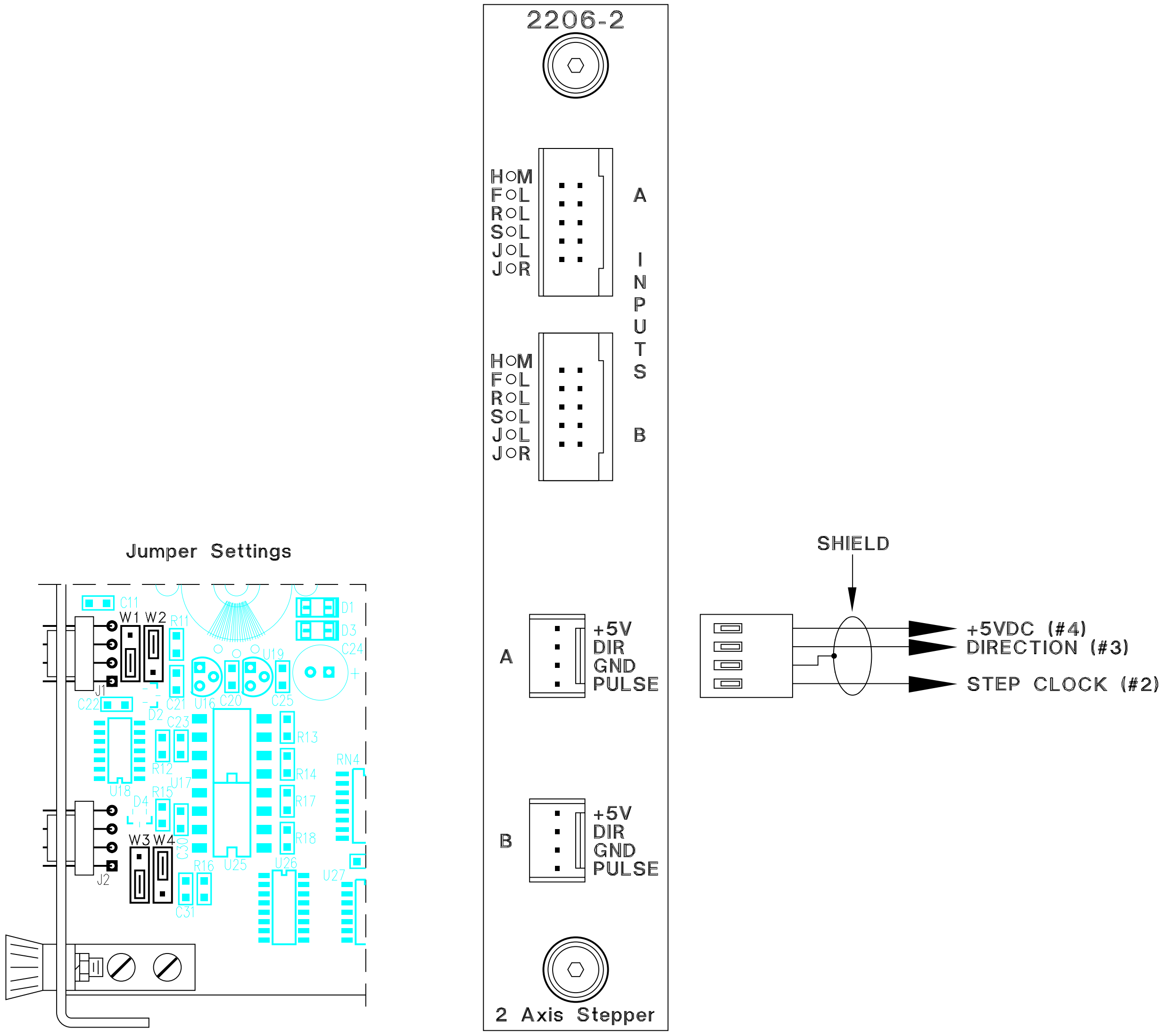
Connecting to a Centent Stepping Motor Drive

The following figure show how to connect the 2206 Stepping Motor Module to the CNO 142 and CNO 143 stepping motors.



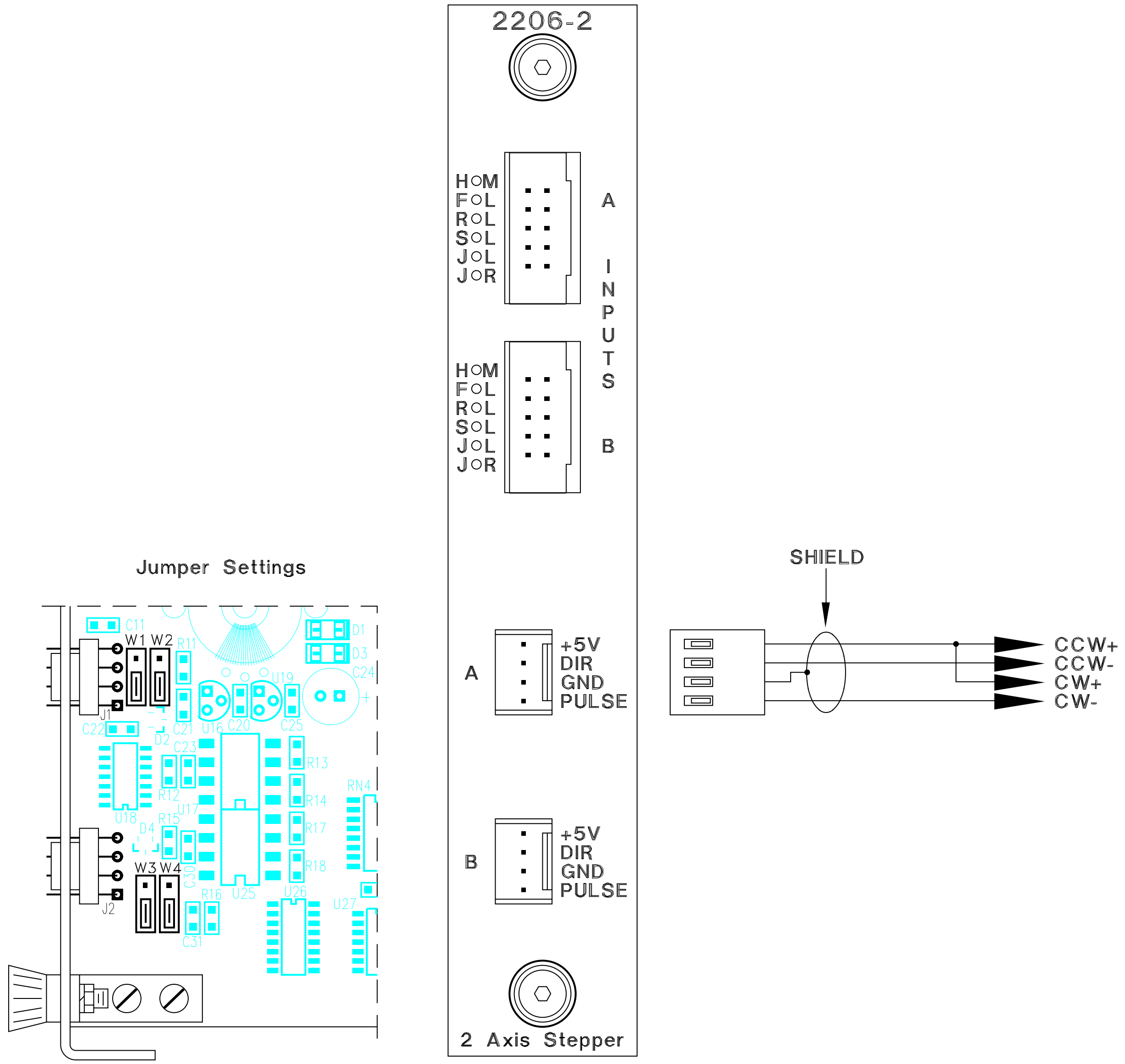
Connecting to an Intelligent Motion Systems (IMS) Stepping Motor Drive

The following figure show how to connect the 2206 Stepping Motor Module to an IMS model IM483 stepping motor.



Connecting to an Oriental Stepping Motor Drive

The following figure shows how to connect the 2206 Stepping Motor Module to a VDX series and VPD series stepping motors.



Sample Quickstep Programs

The following pages contain sample quickstep programs.

Example 1 – Absolute Move of One Stepping Motor

This example shows a stepping motor moving 100,000 steps from its home position. The MONITOR SERVO#1:STOPPED instruction causes the controller's program to remain in this step until the motor completes the move.

Maxspeed units are in steps per second. Acceleration units are in steps per second^2.

```
[1]     ONE_AXIS_ABSOLUTE_MOVE
    ;;; This program will commence an absolute move
    ;;; on axis one based on the parameters in the
    ;;; profile instruction.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>

    _____________________________________

    profile servo#1 maxspeed=50000 accel=100000
    turn servo#1 to 100000
    monitor servo#1:stopped goto next
```

Example 2 – Relative Move of One Stepping Motor

This example shows a stepping motor moving clockwise 100,000 steps from its current position. The MONITOR SERVO#1:STOPPED instruction causes the controller's program to remain in this step until the motor completes the move.

Maxspeed units are in steps per second. Acceleration units are in steps per second^2.

```
[1]     ONE_AXIS_RELATIVE_MOVE
    ;;; This program will commence an relative move
    ;;; on axis one based on the parameters in the
    ;;; profile instruction.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>

    _____________________________________

    profile servo#1 maxspeed=50000 accel=100000
    turn servo#1 cw 100000 steps
    monitor servo#1:stopped goto next
```

Example 3 – Velocity Move of One Stepping Motor

This example shows a stepping motor moving clockwise from its current position. The motor will turn until it receives a Stop Servo instruction or until a stop input is activated. The Monitor Servo#1:Stopped instruction causes the controller’s program to remain in this step until the motor completes the move.

Maxspeed units are in steps per second. Acceleration units are in steps per second^2.

```
[1]     ONE_AXIS_VELOCITY_MOVE
    ;;; This program will commence a velocity move on
    ;;; axis one based on the parameters in the
    ;;; profile instruction.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>
    _____________________________________

    profile servo#1 maxspeed=50000 accel=100000
    turn servo#1 cw
    monitor servo#1:stopped goto next
```

Example 4 – Absolute Move of Two Stepping Motors

This example shows two stepping motors. The motor connected to the first axis moves 100,000 steps from its home position, and the motor connected to the second axis moves 50,000 steps from its home position. The MONITOR (AND SERVO#1:STOPPED SERVO#2:STOPPED) instruction causes the controller's program to remain in this step until both motors complete their moves.

Maxspeed units are in steps per second. Acceleration units are in steps per second^2. So, any ratio between multiple axes may achieved by applying the following formula:

- Velocity = Acceleration * Time
- Acceleration = Velocity / Time

In this example, we are running a 2 to 1 ratio between the two axes. These motions will ramp up and down simultaneously.

You can re-profile either motor at any time to establish a new velocity.

If you want to start two or more axes simultaneously, you can program the TURN SERVO instructions using the ON START SWITCH parameter. The motors' motion will begin once the start input located on each axis is triggered. This will start all motions within one millisecond. Refer to *Hardware Considerations, Dedicated Inputs* for information and instructions on using the On Start Switch parameter and the Start dedicated input.

```
[1]     TWO_AXIS_ABSOLUTE_MOVE
    ;;; This program will commence an absolute move
    ;;; on two motor axes based on the parameters in
    ;;; the profile instructions.
    ;;;
    ;;; Maxspeed units are in steps per second.
    ;;; Acceleration units are in steps per second
    ;;; per second.
    ;;; So, any ratio between multiple axes may
    ;;; achieved by applying the following formula:
    ;;; Velocity  =  Acceleration * Time
    ;;; Acceleration = Velocity / Time

        <NO CHANGE IN DIGITAL OUTPUTS>


    profile servo#1 maxspeed=50000 accel=100000
    profile servo#2 maxspeed=25000 accel=50000
    turn servo#1 to 100000
    turn servo#2 to 50000
    monitor (and servo#1:stopped servo#2:stopped) goto next
```

Example 5 – Staggering the Motion of Two Stepping Motors

This example shows two stepping motors. The motor connected to the first axis moves 100,000 steps from its home position, and the motor connected to the second axis moves 25,000 steps from its home position.

The first motor is put in motion. When the position of the first motor reaches half the travel distance, the program moves on to the next step and begins the motion of the second motor. The Monitor (and servo#1:stopped servo#2:stopped) instruction causes the controller's program to remain in the second step until both motors complete their moves.

Maxspeed units are in steps per second. Acceleration units are in steps per second^2. So, any ratio between multiple axes may achieved by applying the following formula:

- Velocity = Acceleration * Time
- Acceleration = Velocity / Time

In this example, we are running a 2 to 1 ratio between the two axes. These motions will ramp up and down simultaneously.

```
[1]     TWO_AXIS_STAGERED_MOVE
    ;;; This program will commence an absolute move
    ;;; on two motor axes based on the parameters in
    ;;; the profile instructions.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>

    _____________________________________

    profile servo#1 maxspeed=50000 accel=100000
    profile servo#2 maxspeed=25000 accel=50000
    turn servo#1 to 100000
    if servo#1:position >= 50000 goto next

[2]     TRIGGER_SECOND_AXIS
    ;;; Turn the second axis and wait for both axes
    ;;; to be complete before moving on the next part
    ;;; of the program.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>

    _____________________________________

    turn servo#2 to 25000
    monitor (and servo#1:stopped servo#2:stopped) goto next
```

Example 6 – Velocity Move of Two Stepping Motors

This example shows two stepping motors moving clockwise from their current positions. The motors will turn until it receives a Stop Servo instruction or until a stop input is activated. The Monitor (and servo#1:stopped servo#2:stopped) instruction causes the controller's program to remain in this step until both motors complete their moves.

Maxspeed units are in steps per second. Acceleration units are in steps per second^2. So, any ratio between multiple axes may achieved by applying the following formula:

- Velocity = Acceleration * Time
- Acceleration = Velocity / Time

In this example, we are running a 2 to 1 ratio between the two axes. These motions will ramp up and down simultaneously.

You can re-profile either motor at any time to establish a new velocity.

If you want to start two or more axes simultaneously, you can program the Turn Servo instructions using the On Start Switch parameter. The motors' motion will begin once the start input located on each axis is triggered. This will start all motions within one millisecond. Refer to *Hardware Considerations, Dedicated Inputs* for information and instructions on using the On Start Switch parameter and the Start dedicated input.

```
[1]     TWO_AXIS_VELOCITY_MOVE
    ;;; This program will commence a velocity move
    ;;; on two motor axes based on the parameters
    ;;; in the profile instructions.

        <NO CHANGE IN DIGITAL OUTPUTS>


    profile servo#1 maxspeed=50000 accel=100000
    profile servo#2 maxspeed=25000 accel=50000
    turn servo#1 cw
    turn servo#2 cw
    monitor (and servo#1:stopped servo#2:stopped)
    goto next
```

Example 7 – Changing the Velocity of a Stepping Motor During Motion

This sample program positions a stepping motor while generating various velocity profiles throughout the move.

After the initial parameters are set, the motor motion is started. When the position reaches 50000 steps, the program continues to next step.

Maxspeed units are in steps per second. Acceleration units are in steps per second^2.

```
[1]     COMPLEX_PROFILE
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>
    _____________________________________

    profile servo#1 maxspeed=10000 accel=200000
    turn servo#1 to 500000
    if servo#1:position >= 50000 goto next

[2]     SECOND_PROFILE
    ;;; Re-profile the motor for the a new velocity.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>
    _____________________________________

    profile servo#1 maxspeed=20000
    if servo#1:position >= 70000 goto next

[3]     THIRD_PROFILE
     ;;; Re-profile the servo for a new velocity.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>
    _____________________________________

    profile servo#1 maxspeed=50000
    if servo#1:position >= 110000 goto next

[4]     FOURTH_PROFILE
    ;;; Re-profile the servo for a new velocity.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>
    _____________________________________

    profile servo#1 maxspeed=100000
    if servo#1:position >= 300000 goto next
```

(Example 7 Con’d)

```
[5]     FIFTH_PROFILE

    ;;; Re-profile the servo for the next velocity.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>
    _____________________________________

    profile servo#1 maxspeed=80000
    if servo#1:position >= 420000 goto next

[6]     SIXTH_PROFILE

    ;;; Re-profile the servo for the final velocity and

    ;;; wait for the move to complete.
    _____________________________________

        <NO CHANGE IN DIGITAL OUTPUTS>
    _____________________________________

    profile servo#1 maxspeed=30000
    monitor servo#1:stopped goto PROFILE_COMPLETE
```