YASKAWA

GA800 DRIVE

CUSTOM SOFTWARE SUPPLEMENT

MOTION CONTROL

DRIVE MODELS:

GA80Uxxxxxxx
Three-Phase 200 V Class: 1 to 150 HP
Three-Phase 400 V Class: 1 to 600 HP
6-Phase/12-Pulse 400 V Class: 75 to 600 HP
Three-Phase 600 V Class: 125 to 500 HP

SOFTWARE NUMBER:

VSAA10040

DOCUMENT NUMBER: TM.GA800SW.117

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Refer to the GA800 Technical Reference for content not described in this document.

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1 Preface and Safety

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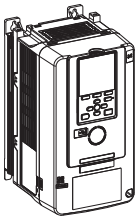
◆ Applicable Documentation

The following manuals are available for the GA800 Drive:

Custom Software Supplement

	**Yaskawa AC Drive - Motion Control GA800 Custom Software Supplement** **Manual No: TM.GA800SW.117**
	Read this manual first. This supplement is an addendum to the GA800 Installation & Primary Operation Manual and Technical Reference. It lists the effects of this custom software on the parameters in the drive and function descriptions in the manual. To obtain the supplement access this site: U.S: http://www.yaskawa.com

Yaskawa Drive

	**Yaskawa AC Drive - GA800 Installation & Primary Operation (TOEPC7061737)**	To obtain instruction manuals for the GA800 AC Drive access this site: U.S.: http://www.yaskawa.com/ga800manuals Other areas: contact a Yaskawa representative. For questions, contact the local Yaskawa sales office or the nearest Yaskawa representative.
	Yaskawa AC Drive - GA800 Technical Reference (SIEPC71061737)	

◆ Supplemental Safety Information

Read and understand this manual and the GA800 Installation & Primary Operation Manual before installing, operating, or servicing this option unit. Install the drive according to the GA800 Installation & Primary Operation Manual and local codes. Observe all cautions and warnings in this document and the standard drive technical manuals.

Refer to the GA800 Installation & Primary Operation Manual and Technical Reference for safety information and to install and start-up the drive.

This document is a supplement to the standard drive Technical Reference. It describes the effects on the drive parameters and functions with the software installed.

- Custom software is provided to add functionality to a standard drive to enhance or enable use in a specific application.
- The software is loaded to the flash ROM area of the control board, and replaces the standard drive software.

◆ Obtaining Support

When seeking support for a drive with custom software, it is imperative to provide the unique part number shown on the drive nameplate. The software is flashed to the control board memory and the operation of parameters, functions, and monitors are different than the standard drive software, as described herein.
Refer to Yaskawa office locations listed on the back cover of this manual.

2 Product Overview

◆ About This Product

This custom software is designed specifically for use in Traverse applications.

◆ Applicable Models

This custom Traverse application software is available for the GA800 drive models listed in ***Table 1***.

Table 1 Applicable Models

Voltage Class	Models	Software Version <1>
200 V Three-Phase	GA80U2004□□□ to GA80U2415□□□	VSAA10060
400 V Three-Phase	GA80U4002□□□ to GA80U4720□□□	VSAA10060
400 V 6-Phase/12-Pulse	GA80UT103□□□ to GA80UT720□□□	VSAA10060
600 V Three-Phase	GA80U5125□□□ to GA80U5472□□□	VSAA10060

<1> See “PRG” on the drive nameplate for the software version number.

3 Application Selection

◆ Motion Control

■ Overview

This function gives the GA800 simple position control capability.

■ Basic Concept

By using incremental quadrature encoder feedback to control the drive's frequency reference, the drive acts as a simple position regulator.

Motion Control Types:

- Linear Absolute Motion
- Rotary Absolute Motion
- Relative Motion without Memory
- Relative Motion with Memory

Motion Control Features:

- Move command type can be set to maintained or edge triggered
- Variety of Homing routines
- 16 Preset destination positions
- Commands, parameters, and monitors relating to position can be presented in engineering units
- Dual or Single incremental quadrature encoders are supported
- Motion Control features can be read/set via serial communications and communication Option PCBs

■ Changes from Standard Product

- 3-Wire control is not allowed when Motion Control is enabled (P1-01 > 0).
- When Motion Control is enabled, the following are disabled:
  - b1-01 (Reference Source) and b1-15 (Reference Source 2)
  - Acceleration/Deceleration Time Selection 1 (H1-xx = 7 or 107) and 2 (H1-xx = 1A or 11A)
  - C1-11 (Acceleration/Deceleration Time Switchpower Freq)
- Motor 2 Selection has been removed.
  - Parameters relating to Motor 2 have been disabled/re-purposed.
- d2-02 (Frequency Reference Lower Limit) and d2-03 (Analog Frequency Ref Lower Limit) are disabled.

◆ Control Modes, Symbols, and Terms

The table below lists terms and symbols used in this section to indicate which parameters are available in which control modes.

	Description
All Modes	Parameter is available in all control modes.
V/f	Parameter is available when operating the drive in V/f Control.
V/f w PG	Parameter is available when operating the drive in V/f with PG Control.
OLV	Parameter is available when operating the drive in Open Loop Vector.
CLV	Parameter is available when operating the drive in Closed Loop Vector.
OLV/PM	Parameter is available when operating the drive in Open Loop Vector for PM motors.
AOLV/PM	Parameter is available when operating the drive in Advanced Open Loop Vector for PM motors.
CLV/PM	Parameter is available when operating the drive in Closed Loop Vector for PM motors.

■ Limitations

- Motion Control can only be enabled when A1-02 = 3 (Control Method Selection: Closed Loop Vector).
- This is not a safety device and cannot be used for safety critical applications.
- If the drive is in Local Mode, Motion Control Move and Home routines are disabled. Position is tracked. Local Mode includes the following:
  - Setting the drive to Local mode via the “LO/RE” button on the keypad.
  - Setting b1-02 = 0 (Run Command Selection 1: Keypad)
  - H1-xx = 1 (MFDI Function Selection: Local/Remote Selection) and the MFDI is closed.
- The position from Home cannot exceed 10^9 quadrature encoder counts in either direction.
- Values on monitors U7-02 (Current Position) through U7-07 (Cmd Dest Pos C) are clamped. The GA800 keypad can only display a limited number of digits and Memobus monitors are limited to 16 bits.
  - Monitors U7-02, U7-03, and U7-04 represent the position up to 2 decimal places, with a range of -99.99 to 327.67 units. Monitors U7-05, U7-06, and U7-07 represent the position without decimal places, with a range of -9999 to 32767 units. Note that when the range is exceeded, the values are clamped.
  - Adjusting P1-09 (Encoder Counts Per Unit)
  - Reading Motion Control information via the following Memobus registers (in quadrature encoder counts):
    - Current Position - using 06E0H - 06E1H
    - Distance to Go - using 06E3H - 06E4H
    - Commanded to Destination Position - using 06D0H - 06D1H when P1-02 = 3 (Destination Position Source: Memobus/Modbus Comms (32-bit))
  - **Warning, enabling the following features may cause inconsistent Motion Control behavior:**
    - L3-04 (Stall Prevention)
    - b5-01 (PID Mode Setting)

4 Encoder Setup

Motion Control software utilizes position feedback from an incremental encoder.

- Encoder Option PCBs supported are PG-X3 and PG-B3
- Only Incremental Quadrature Encoders are supported
- If P2-01 = 4 or 5 (Homing Type: Negative with Marker or Positive with Marker), connect Z+ and Z- (Encoder Marker Pulse) to the Option Card.
- If P1-01 = 2 (Motion Type: Rotary Absolute), program parameters P3-07 (Encoder Revs Per Machine Rev) and/or P3-08 (Encoder Cnts per Machine Rev) using the following equation: *One Revolution* = (F1-01 x 4 x P3-07) + P3-08. If P3-01 = 1 (Position Encoder Source: CN5-B (PG CH2)), use F1-31 instead of F1-01 in this calculation. One revolution is limited to 2,147,483,648 encoder counts.

Single Incremental Encoder

Parameter Setup:

- F1-01 (Encoder 1 Pulse Count)
- P3-01 = 0 (Position Encoder Source: CN5-C)

Mechanical Setup: Connect the encoder directly to the motor shaft

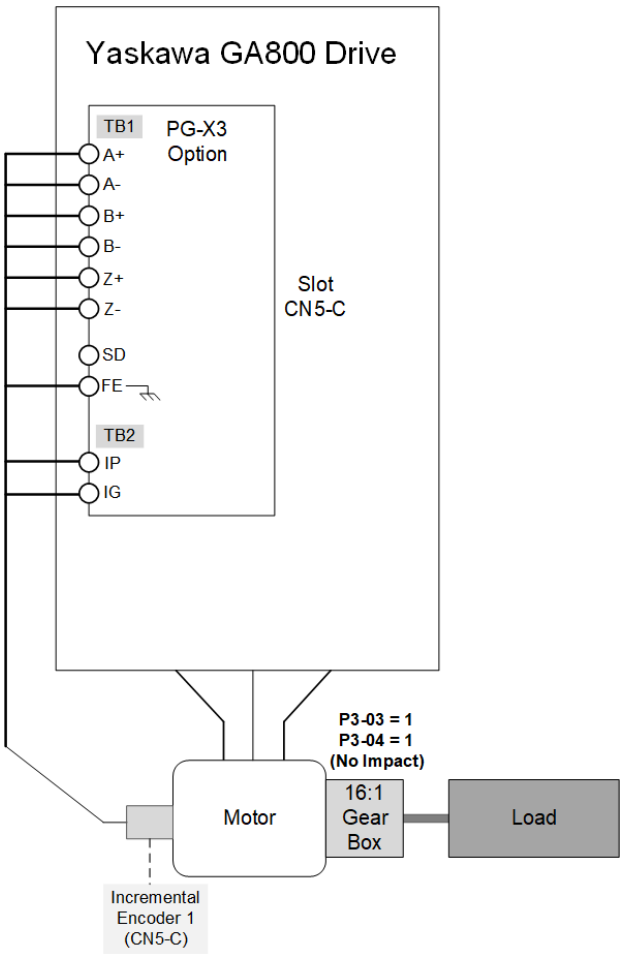


Figure 1 Single Encoder Wiring (P3-01 = 0)

Dual Incremental Encoder

Parameter Setup:

- F1-01 (Encoder 1 Pulse Count) for the encoder directly mounted to the motor shaft
- F1-31 (Encoder 2 Pulse Count) for the encoder mounted to the machine
- F3-32 (Encoder 2 Rotation Selection)
- P3-01 = 1 (Position Encoder Source: CN5-B)
- P3-03 (P3-03 (2nd Encoder Numerator) and P3-04 (2nd Encoder Denominator). Refer to Mechanical Setup below.

Mechanical Setup: Attach the encoder to the machine, not directly to the motor. A positive drive setup is not required but recommended. If a gearbox is used, program P3-03 (2nd Encoder Numerator) and P3-04 (2nd Encoder Denominator) accordingly. These parameters set the ratio of motor revolutions (P3-04) to 2nd encoder revolutions (P3-03) and adjust the the point at which deceleration begins.

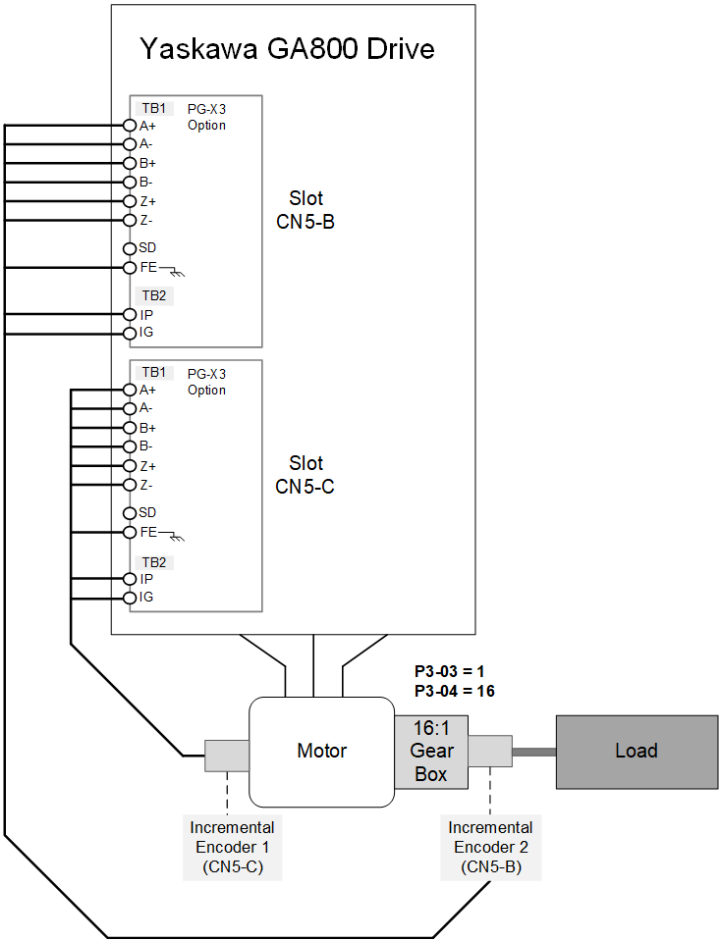


Figure 2 Dual Encoder Wiring (P3-01 = 1)

5 Related Parameters and Functions

The following parameters are used to set up the drive for operation with the software. Available parameter settings are listed based upon which drive control modes are active.

Confirm proper setting of the parameters beginning with ***Table 2***.

◆ Modified Parameters

Table 2 Related and Modified Parameters

No. (Addr. Hex)	Parameter Name	Description	Default (Range)
b2-01 (0189)	DC Injection/Zero Speed Threshold	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency to start DC Injection Braking, Short Circuit Braking, or Zero Servo near the end of a stop ramp. **Note:** This parameter is available when b1-03 = 0 [Stopping Method Selection = Ramp to Stop].	Determined by A1-02 (0.0 - 10.0 Hz)
C1-01 (0200) RUN	Acceleration Time 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	2.0 sec (0.0 - 6000.0 sec <1>)
C1-02 (0201) RUN	Deceleration Time 1	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	2.0 sec (0.0 - 6000.0 sec <1>)
C1-03 (0202) RUN	Acceleration Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	2.0 sec (0.0 - 6000.0 sec <1>)
C1-04 (0203) RUN	Deceleration Time 2	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	2.0 sec (0.0 - 6000.0 sec <1>)
C1-05 (0204) RUN	Acceleration Time 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	2.0 sec (0.0 - 6000.0 sec <1>)
C1-06 (0205) RUN	Deceleration Time 3	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	2.0 sec (0.0 - 6000.0 sec <1>)
C1-07 (0206) RUN	Acceleration Time 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.	2.0 sec (0.0 - 6000.0 sec <1>)
C1-08 (0207) RUN	Deceleration Time 4	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.	2.0 sec (0.0 - 6000.0 sec <1>)
C2-01 (020B)	S-Curve Time @ Start of Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the S-curve acceleration time at start.	0.00 sec <2> (0.00 - 10.00 sec)
C2-02 (020C)	S-Curve Time @ End of Accel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the S-curve acceleration time at completion.	0.00 sec (0.00 - 10.00 sec)
C2-03 (020D)	S-Curve Characteristic @ Start of Decel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the S-curve deceleration time at start.	0.00 sec (0.00 - 10.00 sec)
d1-09 (0288) RUN	Reference 9	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from o1-03 (Frequency Display Unit Selection). <3>	6.09 Hz (0.00 - 590.00 Hz)

No. (Addr. Hex)	Parameter Name	Description	Default (Range)
d1-10 (028B) RUN	Reference 10	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 (Frequency Display Unit Selection.)* <3>	6.10 Hz (0.00 - 590.00Hz <1>)
d1-11 (028C) RUN	Reference 11	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 (Frequency Display Unit Selection.)* <3>	6.11 Hz (0.00 - 590.00Hz <1>)
d1-12 (028D) RUN	Reference 12	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 (Frequency Display Unit Selection.)* <3>	6.12 Hz (0.00 - 590.00Hz <1>)
d1-13 (028E) RUN	Reference 13	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 (Frequency Display Unit Selection.)* <3>	6.13 Hz (0.00 - 590.00Hz <1>)
d1-14 (028F) RUN	Reference 14	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 (Frequency Display Unit Selection.)* <3>	6.14 Hz (0.00 - 590.00Hz <1>)
d1-15 (0290) RUN	Reference 15	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 (Frequency Display Unit Selection.)* <3>	6.15 Hz (0.00 - 590.00Hz <1>)
d1-16 (0291) RUN	Frequency Reference 16	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference in the units from *o1-03 (Frequency Display Unit Selection.)* <3>	6.16 Hz (0.00 - 590.00Hz <1>)
F1-31 (03B0)	Encoder 2 Pulse Count (PPR)	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of output pulses for each motor revolution for encoder 2.	1024 ppr (1 - 60000 ppr)
F1-32 (03B1)	Encoder 2 Rotation Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the output sequence for the A and B pulses from encoder 2. This parameter assumes that the motor is operating in the forward direction. 0: Pulse A leads in FWD Direction 1: Pulse B leads in FWD Direction	0 (0 - 1)
F1-37 (03BD)	Encoder 2 Signal Selection	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the number of channels for the signal to the encoder option card for encoder 2. 0: A Pulse Direction 1: AB Pulse Direction	0 (0, 1)
L3-04 (0492)	Stall Prevention Selection during Decel	V/f CL-V/f OLV CLV AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the method that the drive will use to prevent overvoltage faults when decelerating. <4> 0: Disable 1: General Purpose 2: Intelligent (Ignore Decel Ramp) 3: General Purpose w/ DB resistor 4: Overexcitation/High Flux 1 5: Overexcitation/High Flux 2	0 (0 - 5) <5>

<1> When C1-10 = 0 (Acceleration/Deceleration Time Setting Units: 0.01 sec), the setting range is 0.00 to 600.00 s.
<2> Default setting is determined by A1-02. The default of 0.00 sec is only applicable for CLV (A1-02 = 3).
<3> When A1-02 = 6, 7 (Control Method Selection: AOLV/PM, CLV/PM), the drive changes o1-03 = 1 (0.01% (100% = E1-04)).
<4> To connect a dynamic braking option (braking resistor or braking resistor unit) to the drive, set this parameter to 0 or 3. Parameter values 1, 2, 4, and 5 will enable Stall Prevention function during deceleration, and the dynamic braking option will not function.
<5> The setting range changes when the A1-02 (Control Method Selection) value changes:
- When A1-02 = 5 (OLV/PM), the setting range is 0 to 2.
- When A1-02 = 6, 7, 8 (AOLV/PM, CLV/PM, EZOLV), the setting range is 0, 1.

Table 3 Additional Parameters

No. (Addr. Hex)	Parameter Name	Description	Default (Range)
P1-01 (0600)	Motion Control Type	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects Motion Control Type. 0: Disabled 1: Linear Absolute 2: Rotary Absolute 3: Relative Memory Off 4: Relative Memory On	0 (0 - 4)
P1-02 (0601)	Destination Position Source	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects the source of the destination position value. <1> 0: P4-01 (Position 1) 1: Memobus/Modbus Comms (16-bit) <2> 2: Option PCB <3> 3: Memobus/Modbus Comms (32-bit)	0 (0 - 3)
P1-03 (0602)	Move Command Type	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Selects whether the Move command is maintained or edge-triggered. 0: Maintained 1: Rising Edge 2: Falling Edge	0 (0 - 2)
P1-04 (0603) RUN	Position Regulator Gain	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV This value is a proportional gain that adjusts how aggressively the position regulator responds to position error during the final phase of the Move routine. If at the end of a move, the motor is unstable and oscillates, lower this gain. If the motor is slow to resolve the position error at the end of a move and is sluggish in reaching the final position, raise it.	1.0 (1.0 - 20.0)
P1-05 (0604) RUN	Decel Start Compensation	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV If the Move routine overshoots, the calculated start deceleration position can be shifted earlier by setting this parameter to a higher value.	0 cts (0 - 65535 cts)
P1-06 (0605) RUN	Positioning Freq Compensation	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Provides fine adjustment for the automatically calculated positioning frequency. If there is an undershoot, increase this parameter value. If it is causing an overshoot, decrease the parameter value. Usually, it is not necessary to change this setting.	100.0% (10.0 - 200.0%)
P1-07 (0606) RUN	Triangle Move Compensation	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Determines response for a triangle move. (Refer to ***Figure 15***) If the Move routine is performing a triangle move and overshooting, increase the compensation value. If undershooting, decrease the compensation.	1.0 (0.0 - 100.0)
P1-08 (0607) RUN	In Position Window	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV The +/- offset from the selected destination position <4> in quadrature encoder counts. Controls when the “Move Complete” digital output turns on, in addition to motor speed being below b2-01 (DJ Injection/ZeroSpeed Threshold). This value also determines when another edge-triggered move will be accepted.	200 cts (0 - 65535 cts)
P1-09 (0608)	Encoder Counts Per Unit	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV The number of quadrature encoder counts per unit specified in P1-10 (Position Display Units).	4096 cts (1 - 65535 cts)

No. (Addr. Hex)	Parameter Name	Description	Default (Range)
P1-10 (0609)	Position Display Units	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the display units for position related parameters and monitors. 0: None 1: Inches (in) 2: Feet (ft) 3: Centimeters (cm) 4: Meters (m) 5: Degrees (°) 6: Revolutions (rev)	0 (0 - 6)
P2-01 (060A)	Homing Type	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the homing type. 0: Negative 1: Negative with Backup 2: Positive 3: Positive with Backup 4: Negative with Marker 5: Positive with Marker 6: Manual	0 (0 - 6)
P2-02 (060B) RUN	Homing Frequency	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference for the “Find Home Switch” stage of the Homing Routine.	10.0 Hz (0.0 - 590.0 Hz)
P2-03 (060C) RUN	Homing Backup Frequency	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference for the “Backup” phase of the Homing Routine. This is only applicable when P2-01 = 1 or 3 (Homing Type: Negative with Backup or Positive Backup).	2.00 Hz (0.00 - 20.00 Hz)
P2-04 (060D) RUN	Backup Return Frequency	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the frequency reference for returning home (the “Return” phase of the Homing Routine. This is only applicable when P2-01 = 1 or 3 (Homing Type: Negative with Backup or Positive Backup).	1.00 Hz (0.00 - 20.00 Hz)
P2-06 (060F)	Home Offset	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV This parameter will shift the Home position away from the physical position of the Home switch by the set value.	0.00 Units <5> (-99.99 - 99.99 Units)
P2-08 (0611) RUN	Pre-Action Distance	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV The distance from P1-08 (In Position Window) where the multifunction digital output H2-xx = 46 (Pre-Action) closes.	0.00 Units <5> (0.00 - 500.00 Units)
P3-01 (0614)	Position Encoder Source	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV The encoder channel to be used for positioning. This parameter should only be changed if using a dual encoder setup. 0: CN5-C (PG CH1) 1: CN5-B (PG CH2)	0 (0 - 1)
P3-03 (0616)	2nd Encoder Numerator	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Machine mounted encoder ratio numerator that is used in conjunction with P3-04 in the following equation: $One\ Revolution = F1-31 \times 4 \times \frac{P3-03}{P3-04}$. This is effective only when a 2nd machine-mounted encoder is used (P3-01 = 1). Refer to ***Figure 2*** for more information.	1 (1 - 65535)

No. (Addr. Hex)	Parameter Name	Description	Default (Range)
P3-04 (0617)	2nd Encoder Denominator	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Machine mounted encoder ratio denominator used in conjunction with P3-03 in the following equation: $One\ Revolution = F1-31 \times 4 \times \frac{P3-03}{P3-04}$. Effective only when a 2nd machine-mounted encoder is used (P3-01 = 1). Refer to ***Figure 2*** for more information.	1 (1 - 65535)
P3-07 (061A)	Encoder Revs Per Machine Rev	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV The number of encoder revolutions of one complete revolution of the rotary machine. Only applicable when P1-01 = 2 (Motion Type: Rotary Absolute). Used in conjunction with P3-08 (Encoder Cnts Per Machine Rev) in the following equation <6>: *One Revolution* = (F1 - 01) x 4 x P3 - 07 + P3 - 08	0 (0 - 9999 rev)
P3-08 (0619)	Encoder Cnts Per Machine Rev	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV The distance, in quadrature encoder counts, of one complete revolution of the rotary machine. Only applicable when P1-01 = 2 (Motion Type: Rotary Absolute). <6> *One Revolution* = (F1 - 01) x 4 x P3 - 07 + P3 - 08	0 (0 - 60000 cts)
P4-01 (0620) RUN	Position 1	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-01 = the position in encoder counts. Uses C1-01 (Acceleration Time 1), C1-02 (Deceleration Time 1), and d1-09 (Reference 9) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-02 (0621) RUN	Position 2	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-02 = the position in encoder counts. Uses C1-03 (Acceleration Time 2), C1-04 (Deceleration Time 2), and d1-10 (Reference 10) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-03 (0622) RUN	Position 3	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-03 = the position in encoder counts. Uses C1-05 (Acceleration Time 3), C1-06 (Deceleration Time 3), and d1-11 (Reference 11) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-04 (0623) RUN	Position 4	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-04 = the position in encoder counts. Uses C1-07 (Acceleration Time 4), C1-08 (Deceleration Time 4), and d1-12 (Reference 12) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-05 (0624) RUN	Position 5	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-05 = the position in encoder counts. Uses C1-01 (Acceleration Time 1), C1-02 (Deceleration Time 1), and d1-13 (Reference 13) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-06 (0625) RUN	Position 6	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-06 = the position in encoder counts. Uses C1-03 (Acceleration Time 2), C1-04 (Deceleration Time 2), and d1-14 (Reference 14) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)

No. (Addr. Hex)	Parameter Name	Description	Default (Range)
P4-07 (0626) RUN	Position 7	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-07 = the position in encoder counts. Uses C1-05 (Acceleration Time 3), C1-06 (Deceleration Time 3), and d1-15 (Reference 15) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-08 (0627) RUN	Position 8	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-08 = the position in encoder counts. Uses C1-07 (Acceleration Time 4), C1-08 (Deceleration Time 4), and d1-16 (Reference 16) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-09 (0628) RUN	Position 9	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-09 = the position in encoder counts. Uses C1-01 (Acceleration Time 1), C1-02 (Deceleration Time 1), and d1-09 (Reference 9) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-10 (0629) RUN	Position 10	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-10 = the position in encoder counts. Uses C1-03 (Acceleration Time 2), C1-04 (Deceleration Time 2), and d1-10 (Reference 10) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-11 (062A) RUN	Position 11	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-11 = the position in encoder counts. Uses C1-05 (Acceleration Time 3), C1-06 (Deceleration Time 3), and d1-11 (Reference 11) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-12 (062B) RUN	Position 12	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-12 = the position in encoder counts. Uses C1-07 (Acceleration Time 4), C1-08 (Deceleration Time 4), and d1-12 (Reference 12) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-13 (062C) RUN	Position 13	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-13 = the position in encoder counts. Uses C1-01 (Acceleration Time 1), C1-01 (Deceleration Time 1), and d1-13 (Reference 13) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-14 (062D) RUN	Position 14	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-14 = the position in encoder counts. Uses C1-03 (Acceleration Time 2), C1-04 (Deceleration Time 2), and d1-14 (Reference 14) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)
P4-15 (062E) RUN	Position 15	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-15 = the position in encoder counts. Uses C1-05 (Acceleration Time 3), C1-06 (Deceleration Time 3), and d1-15 (Reference 15) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)

No. (Addr. Hex)	Parameter Name	Description	Default (Range)
P4-16 (062F) RUN	Position 16	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Sets the destination position. P1-09 (Encoder Counts Per Unit) x P4-16 = the position in encoder counts. Uses C1-07 (Acceleration Time 4), C1-08 (Deceleration Time 4), and d1-16 (Reference 16) to complete Move.	0.00 Units <5> (0.00 - 655.35 Units)

<1> The H1-xx = 87-8A (MFDI Function Selection: Dest. Position Select A-D) is programmed and closed, this parameter will be overridden, and the selected P4-xx parameter will be the destination position source.
<2> The Move frequency reference is set via Memobus address 06D0H.
<3> When P1-02 = 2 (Option Card), the frequency reference register is used as the destination position source. The range of this register is expanded to 0 - 655.35 units whenever Motion Control is enabled. When Motion Control is disabled, the range is not expanded.
<4> The destination position source is selected via P1-02 (Destination Position Source) or H1-xx = 87- 8A (MFDI Function Selection: Dest. Position Select A-D). Note that if preset positions P4-xx or the Option Card are used, the acceleration time, deceleration time, and Move frequency reference are different for each.
<5> The parameter units text displayed is determined by parameter P1-10 (Position Display Units).
<6> If P3-01 = 1 (Position Encoder Source: CN5-B (CH2), One revolution = (F1-31 x 4 x P3-07) + P3-08).

Table 4 Class Function Text

Function Group	Keypad Display
P	Motion Control
P1	Motion Setup
P2	Homing Setup
P3	Advanced Motion Setup
P4	Preset Position Setup

6 Monitors

Table 5 Monitors

No. (Addr. Hex)	Name	Description	MFAO Signal Level
U7-02 (0661)	Current Position	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the current position <2>, which is the distance from Home with offset. If the monitor value is beyond -99.99 to +327.67, the monitor value without decimal can be found via U7-05 (Current Pos Coarse). Unit: 0.01 P1-10 <1> (Position Display Units)	No Signal Output Available
U7-03 (0662)	Distance To Go	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the distance from the destination position. If the monitor value is beyond -99.99 to +327.67, the monitor value without decimal can be found via U7-06 (Dist To Go Coarse). Unit: 0.01 P1-10 <1> (Position Display Units)	No Signal Output Available
U7-04 (0663)	Cmd Dest Position	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the value of the destination position selected. If the monitor value is beyond -99.99 to +327.67, the monitor value without decimal can be found via U7-07 (Cmd Dest Pos Coarse). Unit: 0.01 P1-10 <1> (Position Display Units)	No Signal Output Available
U7-05 (0664)	Current Pos Coarse	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the current position <2>, which is the distance from Home with offset, in coarse units (without decimal). If the monitor value is within -99.99 to +327.67, U7-02 (Current Position) can be used for more precise measurement. If the monitor value is beyond -9999 -to +32767, neither of the mentioned monitors will display an accurate reading. Unit: 1 P1-10 <1> (Position Display Units)	No Signal Output Available
U7-06 (0665)	Dist to Go Coarse	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the distance from the destination position in coarse units (without decimal). If the monitor value is within -99.99 to +327.67, U7-03 (Distance To Go) can be used for a more precise measurement. If the monitor value is beyond -9999 to +32767, neither of the mentioned monitors will display an accurate reading. Unit: 1 P1-10 <1> (Position Display Units)	No Signal Output Available
U7-07 (0666)	Cmd Dest Pos Coarse	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the destination position selected in coarse units (without decimal). If the monitor value is within (-99.99 to +327.67), U7-04 (Cmd Dest Position) can be used for a more precise measurement. If the monitor value is beyond -9999 to +32767, neither of the mentioned monitors will display an accurate reading. Unit: 1 P1-10 <1> (Position Display Units)	No Signal Output Available
U7-08 (0667)	Move Frequency Ref	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Shows the frequency reference for the Move routine. Unit: 0.01 Hz	No Signal Output Available

<1> The units displayed are determined by parameter P1-10 (Position Display Units).
<2> If P1-01 = 1 or 2 (Motion Type: Linear or Rotary Absolute), the value is in reference to Home Switch (H1-xx = 83) + Home Offset (P2-06), and if P2-01 = 4 or 5 (Homing with Marker), plus the offset of the home switch position from the marker pulse of the encoder as well. This value is referred to as “Home”. If P1-01 = 3 or 4 (Relative Memory Off or Relative Memory On), the value is in reference to the start of the Move routine.

7 Memobus Registers

Table 6 Memobus Registers

Register No. (Hex)	Name	Description	Read / Write
06D0	Memobus Move Frequency Reference Command	This register is the frequency reference for a Move routine if P1-02 = 1 (Destination Position Source: Memobus/Modbus Comm (16-bit)). 1 = 0.01 Hz	R/W
	Memobus Destination Position Command (Low Word)	If P1-02 = 3 (Destination Position Source: Memobus/Modbus Comms (32-bit)), this register becomes the low word of the signed 32-bit destination position in quadrature encoder counts. The Move frequency reference is sourced from parameter d1-09. 1 = 1 quadrature encoder count *Destination Position = (Register 06D1H x 65536) + Register 06D0H*	
06D1	Memobus Destination Position Command	If P1-02 = 1 (Destination Position Source: Memobus/Modbus Comms (16-bit)), this register becomes the unsigned destination position. 1 = 0.01 Units (defined in parameter P1-10 (Position Display Units))	R/W
	Memobus Destination Position Command (High Word)	If P1-02 = 3 (Destination Position Source: Memobus/Modbus Comms (32-bit)), this register becomes the high word of the signed 32-bit destination position in quadrature encoder counts. The destination position as set in registers 06D1h and 06D0h are internally limited to 1 billion encoder counts. 1 = 65536 quadrature encoder counts *Destination Position = (Register 06D1H x 65536) + Register 06D0H*	
06E0	Memobus Current Position <1> (Low Word)	This register is the current position <2> in quadrature encoder counts. 1 = 1 quadrature encoder count *Distance to Go = (Register 06E3H x 65536) + Register 06E4H*	R
06E1	Memobus Current Position <1> (High Word)	This register is the current position <2> in quadrature encoder counts. 1 = 65536 quadrature encoder counts *Distance to Go* = (Register 06E3H x 65536) + Register 06E4H	
06E2	Motion Control Status	bit 0: Terminals M1-M2 bit 1: Terminals M3-M4 bit 2: Terminals M5-M6 bit 3: Not Used (normal value of 0) bit 4: Not Used (normal value of 0) bit 5: Not Used (normal value of 0) bit 6: Not Used (normal value of 0) bit 7: Fault relay MA/MB-MC bit 8: During Move bit 9: Move Complete bit A: Homing Complete bit B: Homing Needed bit C: At Home bit D: Learn Successful bit E: Pre-Action Output bit F: Not Used (normal value of 0)	R

Register No. (Hex)	Name	Description	Read / Write
06E3	Memobus Distance To Go <1> (Low Word)	This register is the current distance from the destination position. 1 = 1 quadrature encoder count *Distance to Go = (Register 06E3H x 65536) + Register 06E4H*	R
06E4	Memobus Distance To Go <1> (High Word)	This register is the current distance from the destination position. 1 = 65536 quadrature encoder counts *Distance to Go = (Register 06E3H x 65536) + Register 06E4H*	

<1> It is recommended to use Function Code 0x03 (Read Multiple Holding Registers) to read both the high and low word registers simultaneously.
<2> If P1-01 = 1 or 2 (Motion Type: Linear or Rotary Absolute), the value is in reference to Home Switch (H1-xx = 83) + Home Offset (P2-06), and if P2-01 = 4 or 5 (Homing with Marker), plus the offset of the home switch position from the marker pulse of the encoder as well. This value is referred to as “Home”. If P1-01 = 3 or 4 (Relative Memory Off or Relative Memory On), the value is in reference to the start of the Move routine.

8 Multi-Function Digital Inputs / Outputs

Table 7 Multi-function Input Settings

Setting Value	Name	Description
80	Move	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: Begin the Move routine to the destination position.
81	Inverse Move	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: Begin the Move backwards to the destination position (negative).
82	Home Command	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: A maintained command to run the Homing Routine.
83	Home Switch (N.O.)	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: Sets the Home Switch position.
84	Positive Overtravel Switch (N.O.) <1> <2>	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: Activates the positive overtravel condition and alarm POSOT.
85	Negative Overtravel Switch (N.O.) <2> <3>	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: Activates the negative overtravel condition and alarm NEGOT.
86	Learn Position	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: If the destination position source is selected via H1-xx = 87 - 8A (MFDI Function Selection: Destination Position Select A-D) and the switch is maintained for 1 second, the current position is written to the digital preset parameter selected (P4-xx). If the source is not selected via MFDI inputs, the current position is written to P4-01.
87	Destination Position Select A	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: Used to select destination position sources P4-xx. <4> Closed: Used to select destination position sources P4-xx. <4>
88	Destination Position Select B	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: Used to select destination position sources P4-xx. <4> Closed: Used to select destination position sources P4-xx. <4>
89	Destination Position Select C	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: Used to select destination position sources P4-xx. <4> Closed: Used to select destination position sources P4-xx. <4>
8A	Destination Position Select D	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: Used to select destination position sources P4-xx. <4> Closed: Used to select destination position sources P4-xx. <4>
8B	Disable Motion Control	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: Motion Control is disabled. <5>

Setting Value	Name	Description
183	Home Switch (N.C.)	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: Sets the Home Switch position. Closed: -
184	Positive Overtravel Switch (N.C.) <1> <2>	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: Activates the positive overtravel condition and alarm POSOT. Closed: -
185	Negative Overtravel Switch (N.C.) <2> <3>	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: Activates the negative overtravel condition and alarm NEGOT. Closed: -

<1> It is recommended that a digital input be programmed to “Jog Reverse” in order to get the machine out of the over-travel condition.
<2> When using either of the over-travel switches / inputs, it is strongly recommended that the switch is maintained beyond the trigger point of the switch, all the way to the end of the mechanical limit. If this cannot be accomplished, an External Fault input would be a better choice.
<3> It is recommended that a digital input be programmed to “Jog Forward” in order to get the machine out of the over-travel condition.
<4> The combined state of MFDI selections 87-8A select a parameter P4-xx (Position xx) as the source of the destination position. If this method of selecting a destination position source is used, P1-02 (Position Ref Source) is overridden unless all are open. Refer to *Table 12 Profile Selection Information on page 32* for more information.
<5> All position information is cleared, requiring another Homing Routine once re-enabled.

Table 8 Multifunction Digital Output Settings

Setting	Name	Description
40	During Move	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: The Move routine is in progress.
41	Move Complete	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: The Move routine is complete. The current position is within +/- P1-08 (In Position Window) of the destination position and the motor speed is less than b2-01 (DC Injection/ Zero Speed Threshold)
42	Homing Complete	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: The Homing routine has run successfully. The Home position has been stored and the current position is at Home.
43	Homing Needed	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: Homing is required but not completed.
44	At Home	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: The current position is within +/- P1-08 (In Position Window) of Home.
45	Learn Successful	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: The current position has been saved to the digital preset parameter selected (P4-xx).
46	Pre-Action	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: - Closed: The current position lies between P2-08 (Pre-Action) and P1-08 (In Position Window) of the destination position during a Move routine.

Setting	Name	Description
140	!During Move	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: The Move routine is in progress. Closed: -
141	!Move Complete	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: The Move routine is complete. The current position is within +/- P1-08 (In Position Window) of the destination position and the motor speed is less than b2-01 (DC Injection/ Zero Speed Threshold). Closed: -
142	!Homing Complete	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: The Homing Routine has run successfully. The Home position has been stored and the current position is at Home. Closed: -
143	!Homing Needed	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: Homing is required but not completed. Closed: -
144	!At Home	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: The current position is within +/- P1-08 (In Position Window) of Home. Closed: -
145	!Learn Successful	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: The current position has been saved to the digital preset parameter selected (P4-xx). Closed: -
146	!Pre-Action	V/f CL-V/f OLV **CLV** AOLV OLV/PM AOLV/PM CLV/PM EZOLV Open: The current position lies between P2-08 (Pre-Action) and P1-08 (In Position Window) of the destination position during a Move routine. Closed: -

9 Faults, Alarms, and Errors

Table 9 Faults

Fault Code (Hex) Auto-Restart	Name	Cause	Possible Solutions
2ENFL (003C) No	2nd Encoder Fault	The incremental encoder connected to PG-X3 or PG-B3 card in slot CN5-B has opposite rotation from the motor encoder during a Move or Home routine.	Switch the polarity of the incremental encoder connected to the 2nd channel, by swapping terminals A+ and A- on the PG-X3 or PG-B3 card in slot CN5-B. Alternatively, change the setting of parameter F1-32 (Encoder 2 Rotation Selection).
POSOF (003D) No	Position Overflow	The position from Home has exceeded 10^9 encoder counts.	Perform a Homing routine and verify position of moving equipment.

Table 10 Alarms

Alarm Code (Hex)	Name	Cause	Possible Solutions
HRN (002C)	Homing Routine Needed	H1-xx = 80, 81, or 86 (MFDI Function Select: Move, Inverse Move, or Learn Position) was closed before a required Homing routine was completed. A Homing routine is required if P1-01 = 1 or 2 (Motion Type: Linear Absolute or Rotary Absolute).	Close H1-xx = 82 (MFDI Function Select: Home Command) to perform a Homing routine, or set P1-01 = 0, 3, or 4 (Motion Type: Disabled, Relative Memory Off, or Relative Memory On).
POSOT (002D)	Positive Over Travel	H1-xx = 84 or 184 (MFDI Function Select: Positive Overtravel Switch) is programmed and has been triggered.	Use H1-xx = 13 (MFDI Function Select: Reverse Jog) to move out of Overtravel.
NEGOT (002E)	Negative Over Travel	H1-xx = 85 or 185 (MFDI Function Select: Negative Overtravel Switch) is programmed and has been triggered.	Use H1-xx = 12 (MFDI Function Select: Forward Jog) to move out of Overtravel.
POSOR (002F)	Learn Position Out of Range	H1-xx = 86 (MFDI Function Select: Learn Position) was closed while the position exceeded the range of P4-xx parameters (Position X), 0.00 to 655.35 units.	Open H1-xx = 86 (MFDI Function Select: Learn Position) and move to a position within range.
LNPOS (0030)	Learning Position	H1-xx = 86 (MFDI Function Select: Learn Position) is programmed and has been closed. The current position is being saved to the selected parameter P4-xx (Position X).	Open H1-xx = 86 (MFDI Function Select: Learn Position) to cancel the Learn routine. When the routine is complete, the display will clear and LNCMP alarm will appear.
LNCMP (0099)	Learn Position Complete	The current position has been stored in the selected parameter P4-xx (Position X).	Open H1-xx = 86 (MFDI Function Select: Learn Position).

Table 11 Errors

Error Code (Hex)	Name	Cause	Possible Solutions
oPE03 (0003)	Multi-Function Input Setting Error	The settings for these parameters do not agree: • F3-10 to F3-25 (Terminal D1 to DF Function Selection) • H1-01 to H1-08 (Terminals S1 to S8 Function Selection) • H7-01 to H7-04 (Virtual Multi-Function Inputs 1 to 4)	Correct the parameter settings.
		P1-01 > 0 (Motion Control Type: Enabled) and H1-xx = 0 (MFDI Function Select: 3-Wire Sequence)	Set P1-01 = 0 (Disabled) or correct the MFDI function selection.

Error Code (Hex)	Name	Cause	Possible Solutions
oPE12 (000C)	Motion Control Setup Error	P3-03 (Second Encoder Numerator) > 100 x P3-04 (Second Encoder Denominator).	Correct the parameter settings.
		P3-01 = 1 (Position Encoder Source: CN5-B (PG CH2)) but a PG-X3 or PG-B3 is not installed on CN5-B.	Install a PG-X3 or PG-B3 on CN5-B or set P3-01 = 0 (Position Encoder Source: CN5-C (PG CH1)).

10 Motion Control Functions

■ Overview

Motion Control uses encoder feedback data to move the motor a set amount of encoder counts away from zero (home), called a “Move Routine”. By setting the Move digital input (H1-xx = 80) while a Run command is present, the motor will accelerate to the set frequency reference until the current position (encoder count accumulation) reaches the point at which deceleration should begin, referred to as the “decel start point”. At this point, the drive will decelerate to a frequency referred to as the “positioning frequency”. Once the motor speed reaches that frequency, the frequency reference is calculated based on the distance left until the destination position is reached (dist to go). The move is considered complete once the motor speed is below b2-01 (Zero Speed Threshold) and the current position is within the window set by P1-08 (In Position Window). To support this function, there are multiple methods for setting the home position, destination position, and overtravel alarms, as well as different Motion types to support specific applications. If P1-01 = 1 or 2 (Motion Type: Linear or Rotary Absolute), “Home” is in reference to Home Switch (H1-xx = 83) + Home Offset (P2-06), and if P2-01 = 4 or 5 (Homing with Marker), plus the offset of the home switch position from the marker pulse of the encoder as well. If P1-01 = 3 or 4 (Relative Memory Off or Relative Memory On), “Home” is in reference to the start of the Move routine.

◆ Types of Motion

Absolute

With Absolute Motion, all position values are relative to home and require a Homing Routine.

Linear

The direction of the move is dependent on whether the current position is greater than or less than the destination position. When an inverse move is commanded, the destination position is negative. This type of motion would be applicable in use cases such as ball screws, linear slides, and transfer stations.

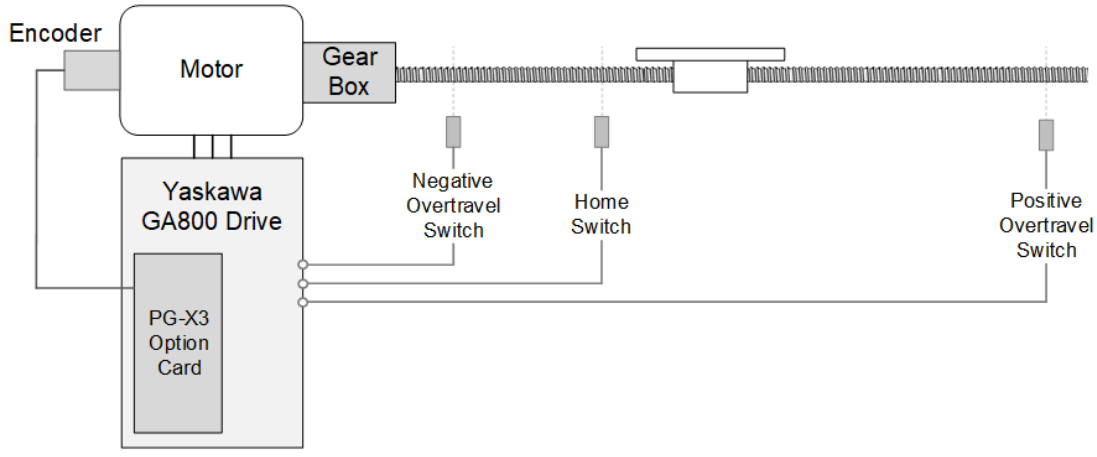


Figure 3 Linear Absolute Motion Example – Ball Screw

Rotary

Parameters P3-07 (Encoder Revs Per Machine Rev) and P3-08 (Encoder Cnts Per Machine Rev) are only used in Rotary Absolute Motion. The direction is not dependent on whether the current position is greater than or less than the destination position, it is just forward if the Move MFDI is set, or in reverse if the Inverse Move MFDI is set (H1-xx = 80 or 81). Rotary Motion would be applicable in use cases such as index turntables, turret winders, and dial tables.

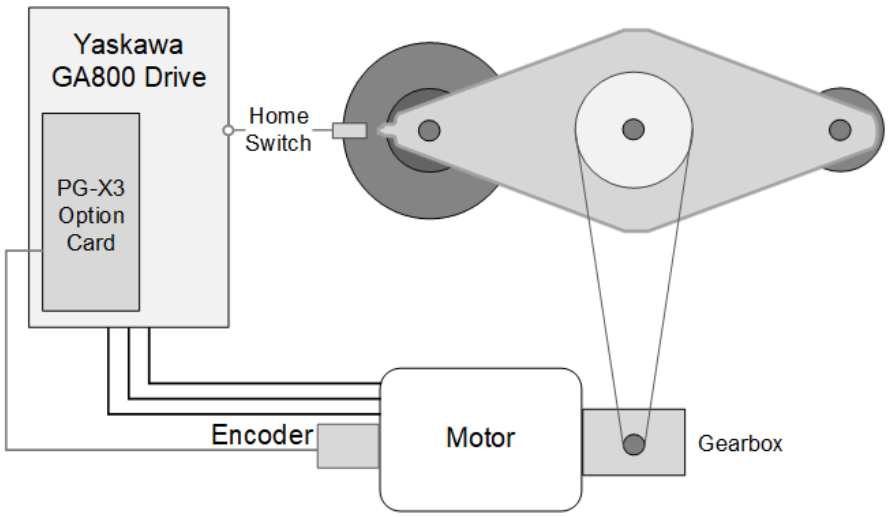


Figure 4 Rotary Absolute Motion Example – Turret Winder

Relative

With Relative Motion, all position values are relative to the position at which the Move command is given. A Homing Routine is not required.

Without Memory

When a Move command is given, the current position is reset to zero and the drive moves the distance set by the destination position reference. This type of motion would be applicable in use cases such as cut-to-length and metering pumps.

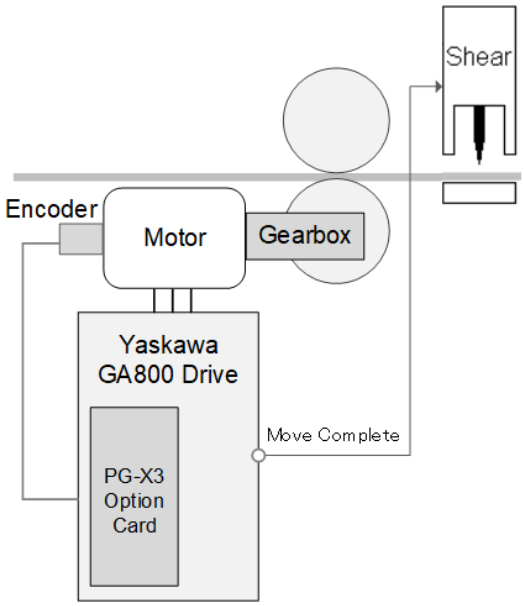


Figure 5 Relative Motion Example - Cut To Length

With Memory

Relative Motion with Memory is for when a Move command is given after a Move routine was interrupted, or if there is some positioning error. By considering the positioning error (distance left to go), this motion type prevents positioning drift. This type of motion would be applicable in use cases such as a conveyor with pockets or “flights” that are being indexed.

The Move routine behavior depends on which of the following are true:

1. The current position **is not within** In Position Window (P1-08) of the destination position and has not yet arrived at the destination

position.
2. The current position **is not within** In Position Window (P1-08) of the destination position and has passed the destination position.
3. The current position **is within** In Position Window (P1-08) but not at the destination position.
   - The current position is after the destination position (**overshoot**).
   - The current position is before the destination position (**undershoot**).
4. The current position **is at** the destination position.

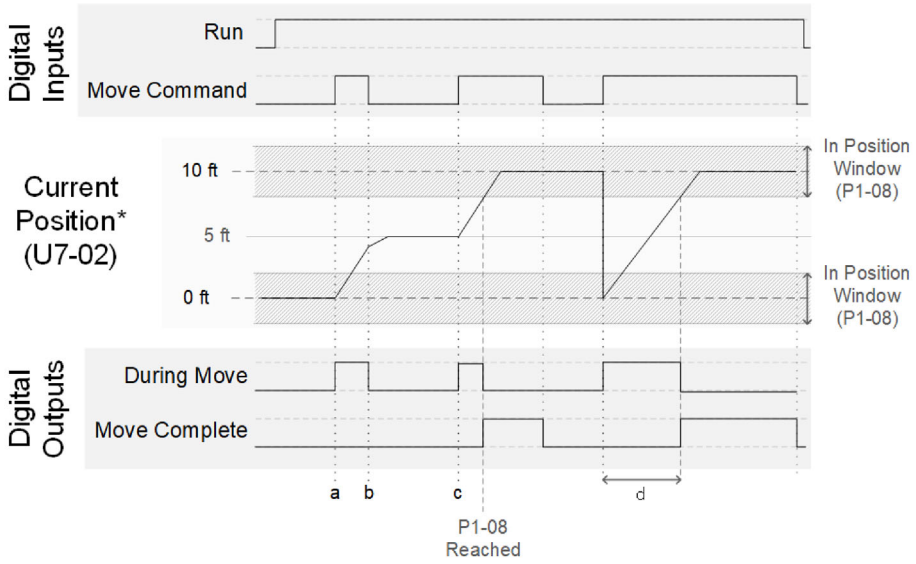
■ Examples

These examples assume the following parameter values:

- P1-02 = 0 (Destination Position Source: P4-01)
- P4-01 = 10 feet (Position 1)
- P1-08 = 8192 (2 feet x 4096) (In Position Window)
- P1-03 = 0 (Move Command Type: Maintained)
- P1-03 = 4 (Motion Type: Relative Memory On)

EXAMPLE 1: The current position **is not within** In Position Window (P1-08) of the destination position and has not reached it.

a. A Move command is given: The current position was at the destination position, so the position is reset to zero and the drive begins the Move to the destination position
b. The Move command is removed: The Move routine is cancelled and the drive ramps to a stop at five feet.
c. Another Move command is given: The current position is not within In Position Window (P1-08), so the Move routine completes the Move to 10 ft.
d. For comparison, this section is an uninterrupted Relative Move routine.



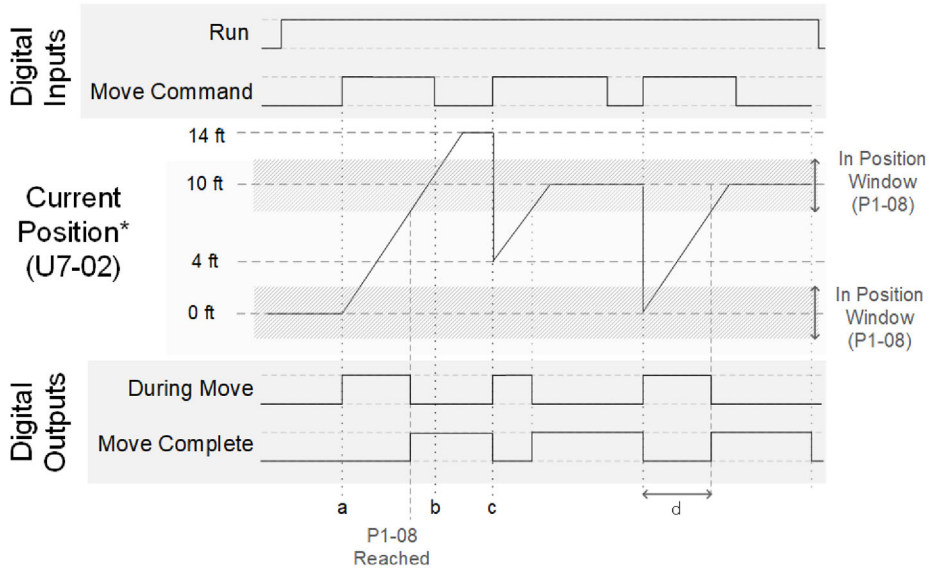
The current position over time is shown as linear in this diagram for conceptual understanding **only.*

Figure 6 [EXAMPLE 1] Move with Memory Example – Not Within In Position Window, Before Destination is Reached

EXAMPLE 2: The current position **is not within** In Position Window of the destination position and has passed it. For this example, b2-01 = 5.00 Hz (Zero Speed Threshold), so the motor does not need to be stopped for the Move to be considered complete.

a. A Move command is given: The position is reset to zero and the drive begins the Move to the destination position.
b. The Move command is removed so that the position is not resolved (comes to a stop and reverses to reach the destination position). Since the motor will now coast to stop, the current position can reach outside the In Position Window (P1-08).
c. Another Move command is given: The current position is within In Position Window (P1-08) but has not reached the destination position. The start position is set to the difference between the current position and destination position, in this case, -0.8 ft. The Move is then completed to 10 ft.

d. For comparison, this section is an uninterrupted Relative Move routine.



*The current position over time is shown as linear in this diagram for conceptual understanding **only**.

Figure 7 [EXAMPLE 2] Relative Move with Memory – Not Within In Position Window, Past the Destination

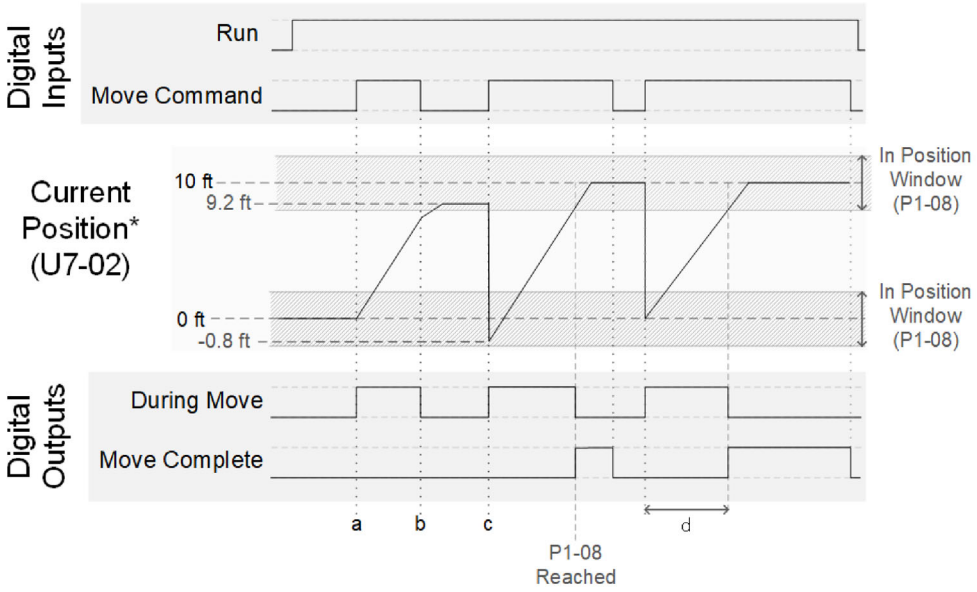
EXAMPLE 3: The current position **is within** In Position Window (P1-08) but is before the destination position (**undershoot**):

a. A Move command is given: The position is reset to zero and the drive begins the Move to the destination position.

b. The Move command is removed: The Move routine is cancelled and the drive ramps to a stop at 9.2 feet.

c. Another Move command is given: The current position is not within In Position Window (P1-08), but has not reached the destination position. The start position is set to the difference between the current position and destination position, in this case, -0.8 ft. The Move is then completed to 10ft.

d. For comparison, this section is an uninterrupted Relative Move routine.



*The current position over time is shown as linear in this diagram for conceptual understanding **only**.

Figure 8 [EXAMPLE 3] Move with Memory Example – Within In Position Window (Undershoot)

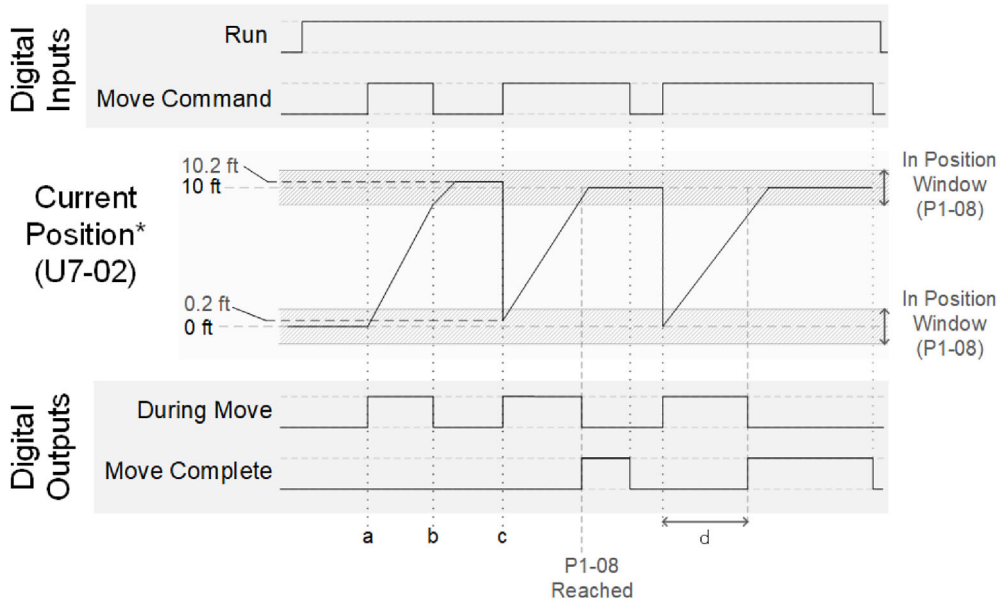
EXAMPLE 4: The current position **is within** In Position Window (P1-08) but is after the destination position (**overshoot**)

a. A Move command is given: The current position was at the destination position, so the position is reset to zero and the drive begins the Move to the destination position.

b. The Move command is removed: The Move routine is cancelled before all position error can be resolved, resulting in an overshoot by 0.2 ft. (The position at the end of this stage is 10.2 ft.)

c. Another Move command is given: The current position is within In Position Window (P1-08) but has overshot the destination position. The start position is set to the difference between the current position and destination position, in this case, 0.2 ft. The Move is then completed to 10 ft.

d. For comparison, this section is an uninterrupted Relative Move routine.



The current position over time is shown as linear in this diagram for conceptual understanding **only.*

Figure 9 [EXAMPLE 4] Move with Memory Example – Within In Position Window (Overshoot)

◆ Destination Position

There are three options for setting a destination position:

- Preset Position parameters P4-xx
- 32-bit and 16-bit Memobus registers
- A communication option card

To select sources other than P4-01 (Position 1), modify parameter P1-02 (Destination Position Source) or program the Destination Position Source multi-function inputs (H1-xx = 87 - 8A). It's important to note that if these multi-function inputs are programmed and closed, they will override parameter P1-02.

■ Digital Preset

Parameters P4-01 - P4-16 store up to 16 destination positions between 0.00 - 655.35 units and can be manually programmed by using the Learn function (H1-xx = 86). The Destination Position Source (P1-02) defaults to digital preset P4-01. To select a digital preset Position (P4-xx), program Destination Position Source multi-function inputs (H1-xx = 87 - 8A) and open/close them according to ***Table 12 Profile Selection Information on page 32***. Each parameter preset uses different acceleration, deceleration, and Move frequency reference parameters outlined in ***Table 12***.

■ Memobus Distance

The position is set using a 16-bit or 32-bit register, determined by parameter P1-02 (Destination Position Source). If P1-02 = 1 (Destination Position Source: Memobus/Modbus comms (16 bit)) the Destination Position (0.01 Units) can be written to via register 06D1H, and the Move frequency reference (0.01 Hz) will be sourced via register 06D0H. If P1-02 = 3 (Destination Position Source: Memobus/Modbus comms (32 bit)), registers 06D0H and 06D1H are combined as the destination position in quadrature encoder counts. The Move frequency reference will be sourced from parameter d1-09 (Reference 9). These registers can be written to using the drive's built-in Memobus communications, or any serial communications Option PCB (DeviceNet, Ethernet/IP, etc.).

■ Option PCB

For communication Option PCBs, the frequency reference register is repurposed as the destination position. The range of this register is expanded to 0 - 655.35 units whenever Motion Control is enabled. The value within the register is converted to quadrature encoder counts by multiplying the value with P1-09 (Encoder Counts Per Unit). For example, if P1-09 = 4096 counts and the value set to the frequency reference from the Option PCB is 15.00, the destination position would be 61440 encoder counts (4096 x 15.00 = 61440).

Table 12 Profile Selection Information

Dest Position Select D	Dest Position Select C	Dest Position Select B	Dest Position Select A	P1-02 Setting	Destination Position Source	Acceleration & Deceleration Parameters	Move Frequency Reference
Open	Open	Open	Open	0	P4-01	C1-01 & C1-02	d1-09
				1	Memobus 06D1h		Memobus 06D0h
				2	Option PCB		d1-09
				3	Memobus 06D0h & 06D1h		
Open	Open	Open	Closed	N/A	P4-02	C1-03 & C1-04	d1-10
Open	Open	Closed	Open	N/A	P4-03	C1-05 & C1-06	d1-11
Open	Open	Closed	Closed	N/A	P4-04	C1-07 & C1-08	d1-12
Open	Closed	Open	Open	N/A	P4-05	C1-01 & C1-02	d1-13
Open	Closed	Open	Closed	N/A	P4-06	C1-03 & C1-04	d1-14
Open	Closed	Closed	Open	N/A	P4-07	C1-05 & C1-06	d1-15
Open	Closed	Closed	Closed	N/A	P4-08	C1-07 & C1-08	d1-16
Closed	Open	Open	Open	N/A	P4-09	C1-01 & C1-02	d1-09
Closed	Open	Open	Closed	N/A	P4-10	C1-03 & C1-04	d1-10
Closed	Open	Closed	Open	N/A	P4-11	C1-05 & C1-06	d1-11
Closed	Open	Closed	Closed	N/A	P4-12	C1-07 & C1-08	d1-12
Closed	Closed	Open	Open	N/A	P4-13	C1-01 & C1-02	d1-13
Closed	Closed	Open	Closed	N/A	P4-14	C1-03 & C1-04	d1-14
Closed	Closed	Closed	Open	N/A	P4-15	C1-05 & C1-06	d1-15
Closed	Closed	Closed	Closed	N/A	P4-16	C1-07 & C1-08	d1-16

◆ Moving

A Move allows the attached motor shaft or load to rotate a specific amount (Destination Position) using incremental encoder feedback. Each destination position source has a unique combination of Move frequency reference, acceleration, and deceleration parameters. Please refer to *Table 12 Profile Selection Information on page 32* to determine the exact parameters used and *Destination Position on page 31* for more information regarding the destination position.
Prior to running a Move routine, a RUN command (not from keypad) must be present. If P1-01 = 1 or 2 (Motion Type: Linear Absolute or Rotary Absolute), a Homing routine must be completed prior to a Move. The Move command will only be accepted if the Move command switch is closed according to the setting of P1-03 (Move Command Type).

■ Move Routine

The following actions will occur when a Move command is given:

1. **Begin Accel:** Accelerate to the Move frequency reference. As soon as the motor begins to move the drive will start calculating the following two items.
   a. **Positioning Max Frequency:** The positioning max frequency is calculated based on the maximum frequency (E1-04) and deceleration rate selected. This value can be adjusted via a gain parameter P1-06 (Positioning Freq Compensation).
   b. **Decel Ramp Start Point:** The position at which at which deceleration should begin is calculated (based on the current position, motor speed, and deceleration rate selected. Can be adjusted via parameter P1-05 (Decel Start Compensation).
2. **Begin Decel:** The current position has reached the Decel Ramp Start Point and deceleration to the calculated positioning frequency has begun. Once that frequency has been reached, the frequency reference is determined by the distance left to travel.
3. **Positioning:** Once the current position is within +/- P1-08 (In Position Window) of the destination position, the drive will decelerate to 0 Hz. If H2-xx = 41 (MFDO Function Selection: Move Complete) is programmed, it will close once the motor speed is below b2-01 (DJ Injection/ZeroSpeed Threshold). Positioning error will continue to be resolved until the Move command is removed. This an be adjusted via parameter P1-04 (Position Regulator Gain). Positioning error will continue to be resolved until the Move command is removed. This can be adjusted via parameter P1-04 (Position Regulator Gain).

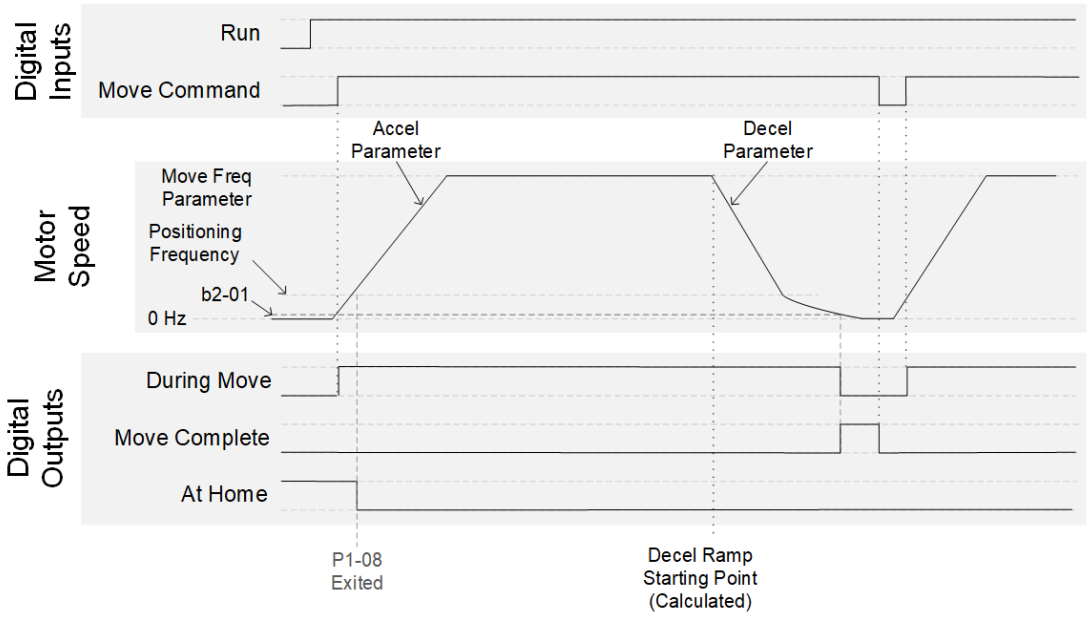


Figure 10 Move from Home to a Positive Destination Position
P1-03 = 0 (Move Command Type: Maintained)

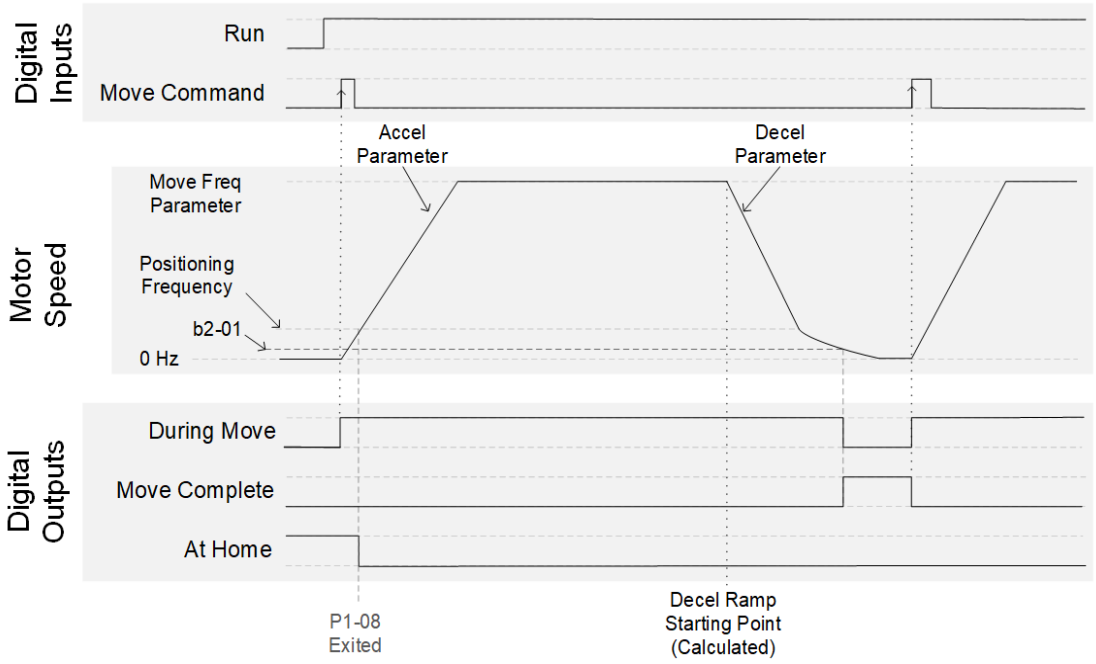


Figure 11 Move from Home to a Positive Destination Position
P1-03 = 1 (Move Command Type: Rising Edge)

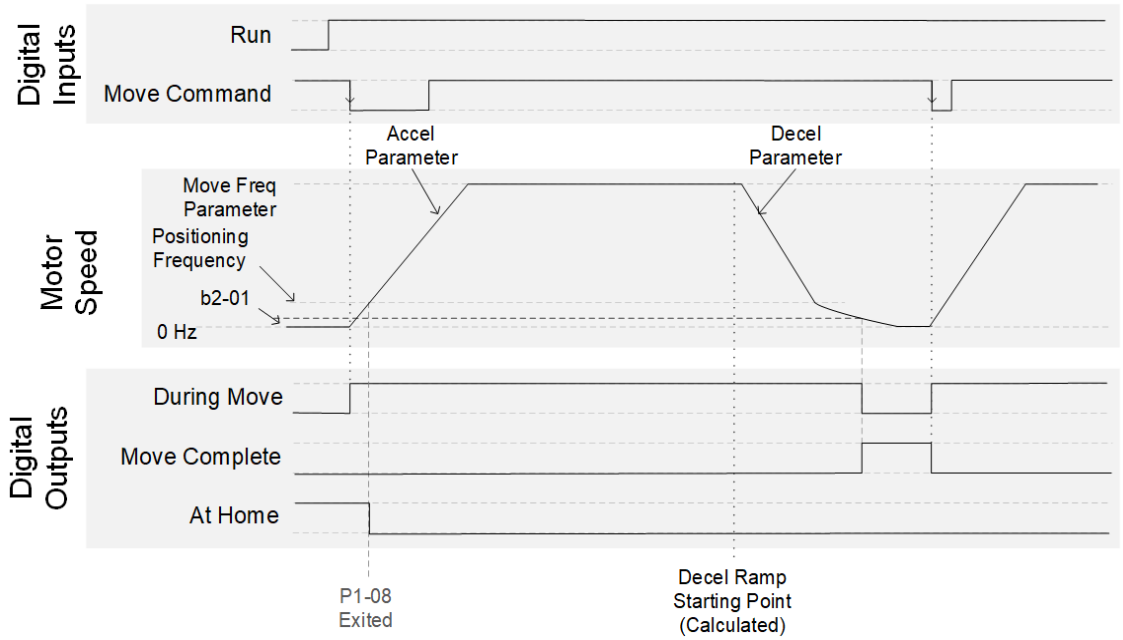


Figure 12 Move from Home to a Positive Destination Position
P1-03 = 2 (Move Command Type: Falling Edge)

■ Special Cases: Alternative Frequency Reference During a Move

If a Jog or Multi-Step Speed Reference is commanded via multi-function inputs during a Move routine, the drive will run at the frequency selected until the multi-function input is no longer activated, at which time the move will be canceled, and the drive will ramp to 0 Hz using the default drive deceleration. The position is still being tracked.

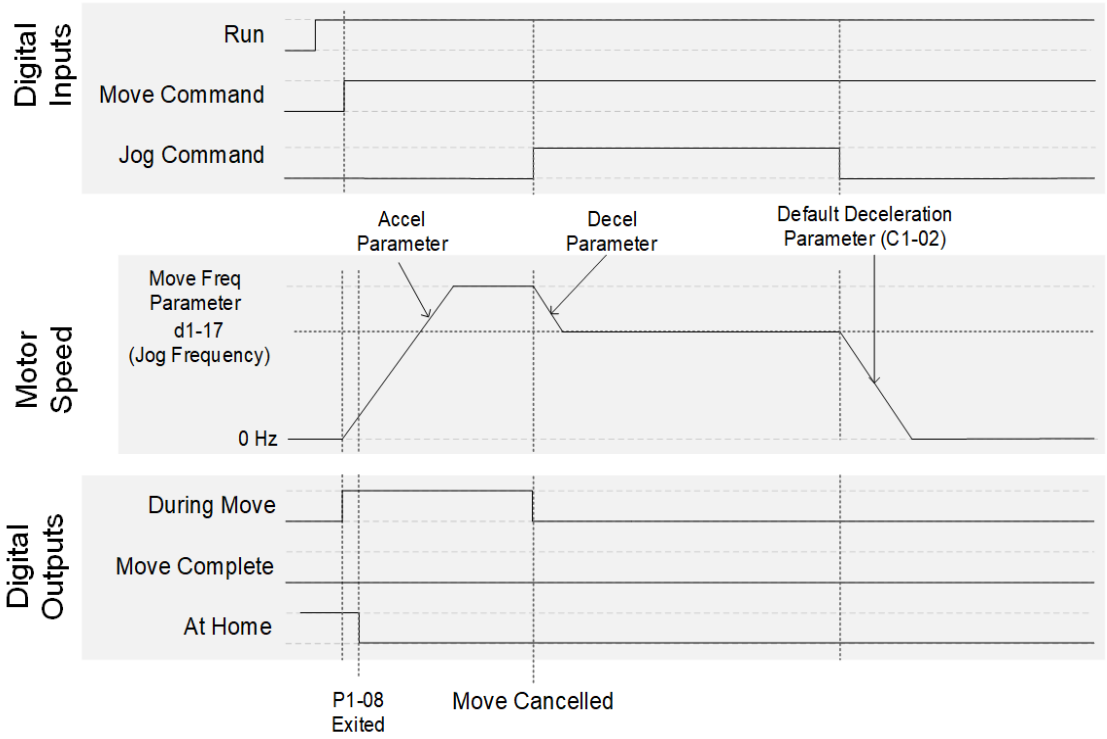


Figure 13 Jog Interrupting a Move Routine

■ Special Cases: Triangle Move

In some cases, the deceleration start position can be reached before the motor speed reaches the Move frequency reference, referred to as a “Triangle Move”. If a Triangle Move is desired and the drive is overshooting, increase P1-07 (Triangle Move Compensation). If undershooting, decrease P1-07.

If a Triangle Move is not desired, the following settings can be altered:

- Increase the destination position
- Lower Move frequency reference
- Shorten acceleration/deceleration times

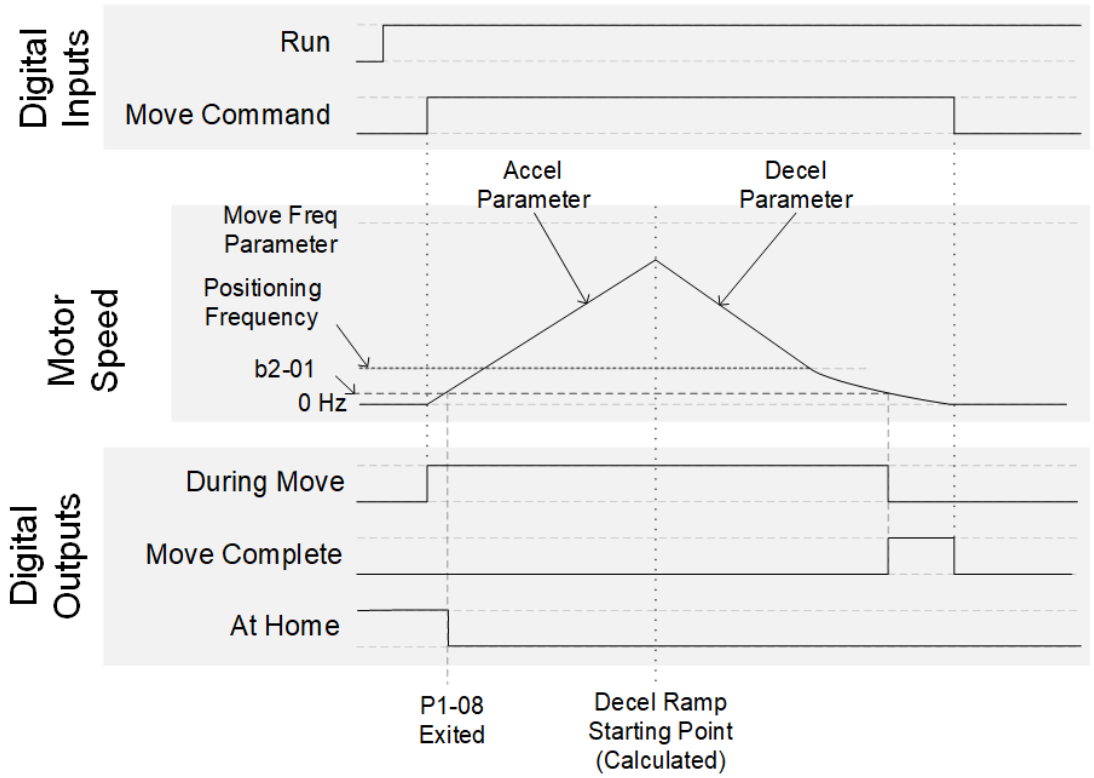


Figure 14 Move Routine - Triangle Move

■ Notes and Warnings

- The destination position, Move frequency, acceleration rate and deceleration rate are latched at the beginning of the Move routine. Changes to any of these values are ignored until the Move is complete.
- If the RUN command is removed during a Move the standard drive deceleration time is used.
- When P1-03 = 0 (Move Command Type: Maintained) and the Move (or Inverse Move) command is opened, the Move Complete MFDO will open.
- When P1-03 = 1 or 2 (Move Command Type: Rising Edge or Falling Edge), any changes to the current move command are ignored until the Move is complete.
- Commanding an Inverse move during a Move routine or commanding a Move during an Inverse move routine will cancel the move.

◆ Position Tracking

The reference point for position tracking is either sourced via Homing, or, if P1-01 = 3 or 4 (Motion Type: Relative Memory Off, Relative Memory On), the position when the Move was commanded.

- The current position will reset if:
  - Motion Control is disabled (P1-01 = 0 (Motion Type: Disabled) or H1-xx = 8B (Motion Control Disabled) is closed)
  - P1-01 (Motion Type) is changed
  - Auto-tuning
  - On power cycle
- The current position will **not** reset and will still track if:
  - An alternate frequency reference, such as jog, is commanded
  - The drive is in Local mode

◆ Homing

Homing establishes a reference point for the drive's position and requires a digital input (H1-xx = 83 (Home Switch)) to detect when the reference point is reached. The reference point can then be offset by P2-06 (Home Offset) if desired. Note that when P1-01 = 2 (Motion Type: Rotary Absolute), all "Move to Home" phases are completed in the forward

direction regardless of Homing type.
Using P2-01 (Homing Type), seven different Homing routines can be selected:

- Negative
- Negative with Backup
- Positive
- Positive with Backup
- Negative with Marker
- Positive with Marker
- Manual

■ Homing Type: Negative

1. **Find Home Switch:** Accelerates to - P2-02 (Homing Frequency) when the H1-xx = 82 (MFDI Function Select: Home Command) is closed and maintained.
2. **Save Home Position:** When the H1-xx = 83 (MFDI Function Select: Home Switch) is closed, the Home switch position is recorded and the drive decelerates to 0 Hz.
3. **Move to Home:** When the drive has decelerated, a Move routine to the recorded reference point + P2-06 (Home Offset) is completed with a Move frequency of d1-16 (Reference 16), acceleration rate of C1-01 (Acceleration Time 1) and deceleration rate of C1-02 (Deceleration Time 1).

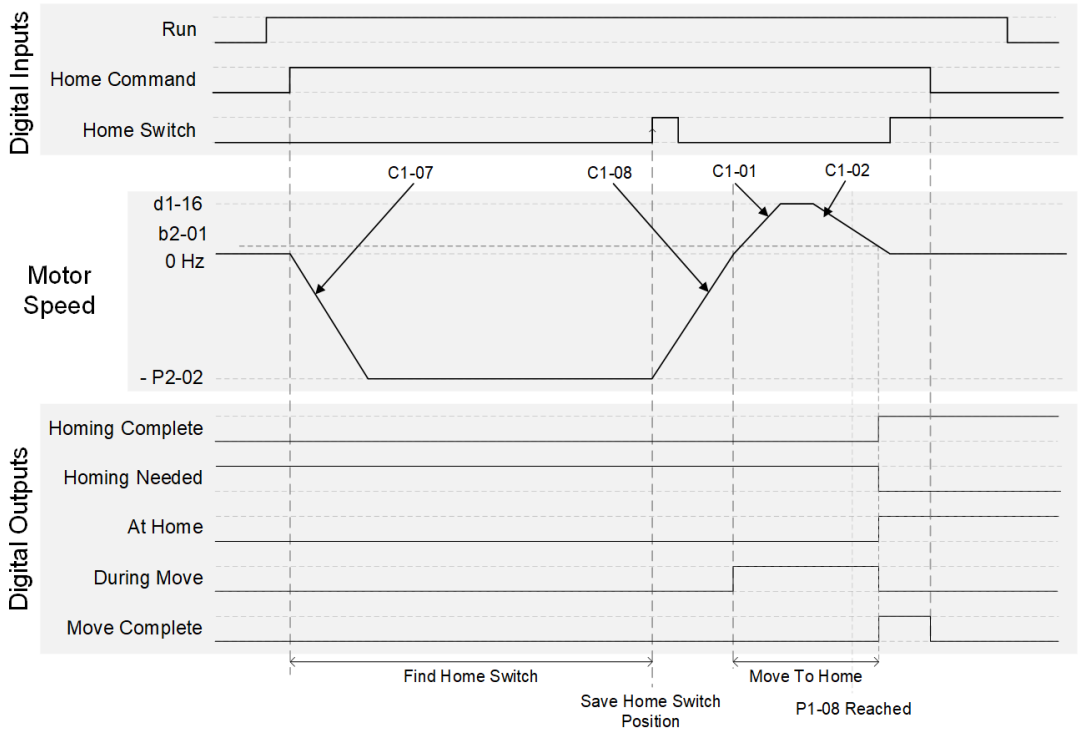


Figure 15 Negative Homing Type (P2-01 = 0) Timing Chart

■ Homing Type: Negative with Backup

1. **Find Home Switch:** Accelerates to - P2-02 (Homing Frequency) when the H1-xx = 82 (MFDI Function Select: Home Command) is activated and maintained.
2. **Save Home Position:** When the H1-xx = 83 (MFDI Function Select: Home Switch) is activated:
   (a). **Backup:** The drive will change direction and the frequency reference is changed now P2-03 (Homing Backup Frequency). The drive will continue to move until the falling edge of Homing Switch is detected.
   (b). **Return:** Changing directions again, the frequency reference is set to - P2-04 (Backup Return Frequency) until the Homing switch is activated again. The Home switch position is recorded, and the drive decelerates to 0 Hz.
3. **Move to Home:** When the drive has decelerated, a Move routine to the recorded reference point + P2-06 (Home Offset) with a max frequency of d1-16 (Reference 16), acceleration rate of C1-01 (Acceleration Time 1) and deceleration rate of C1-02 (Deceleration Time 1) is completed.

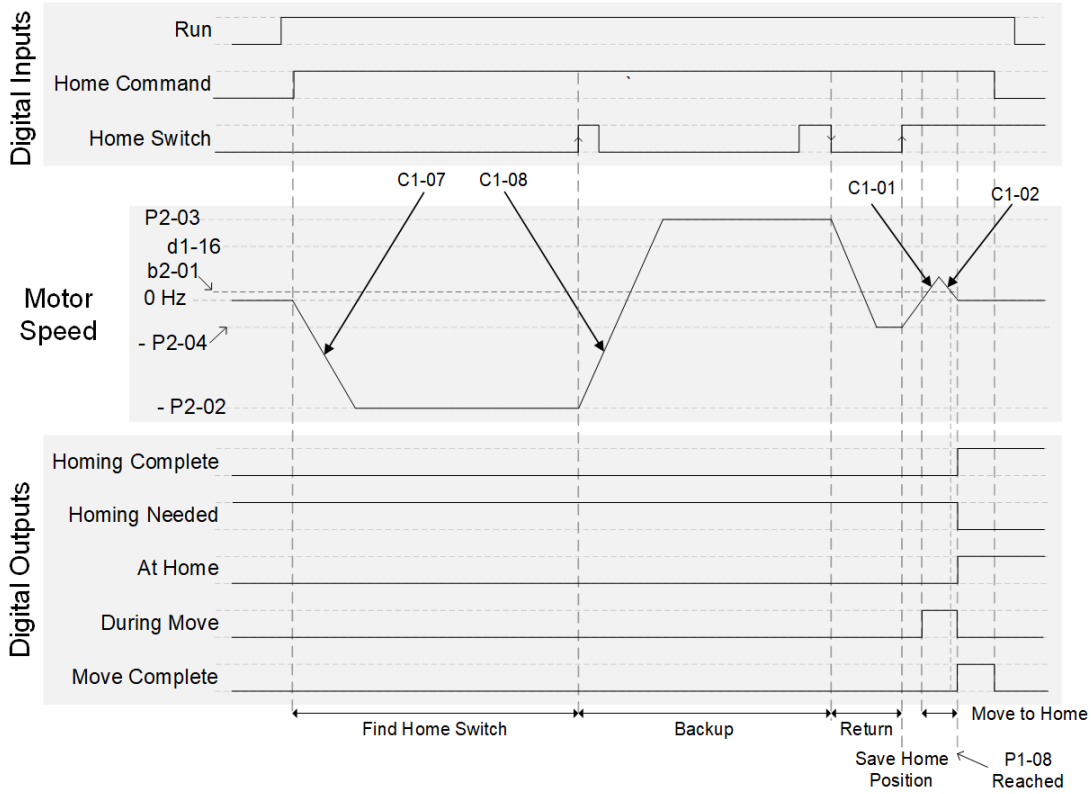


Figure 16 Negative Homing Type with Backup (P2-01 = 1) Timing Chart

■ Homing Type: Positive

1. **Find Home Switch:** Accelerates to P2-02 (Homing Frequency) when the H1-xx = 82 (MFDI Function Select: Home Command) is closed and maintained.
2. **Save Home Position:** When the H1-xx = 83 (MFDI Function Select: Home Switch) is closed, the Home switch position is recorded and the drive decelerates to 0 Hz.
3. **Move to Home:** When the drive has decelerated, a Move routine to the recorded reference point + P2-06 (Home Offset) with a max frequency of - d1-16 (Reference 16), acceleration rate of C1-01 (Acceleration Time 1) and deceleration rate of C1-02 (Deceleration Time 1) is completed.

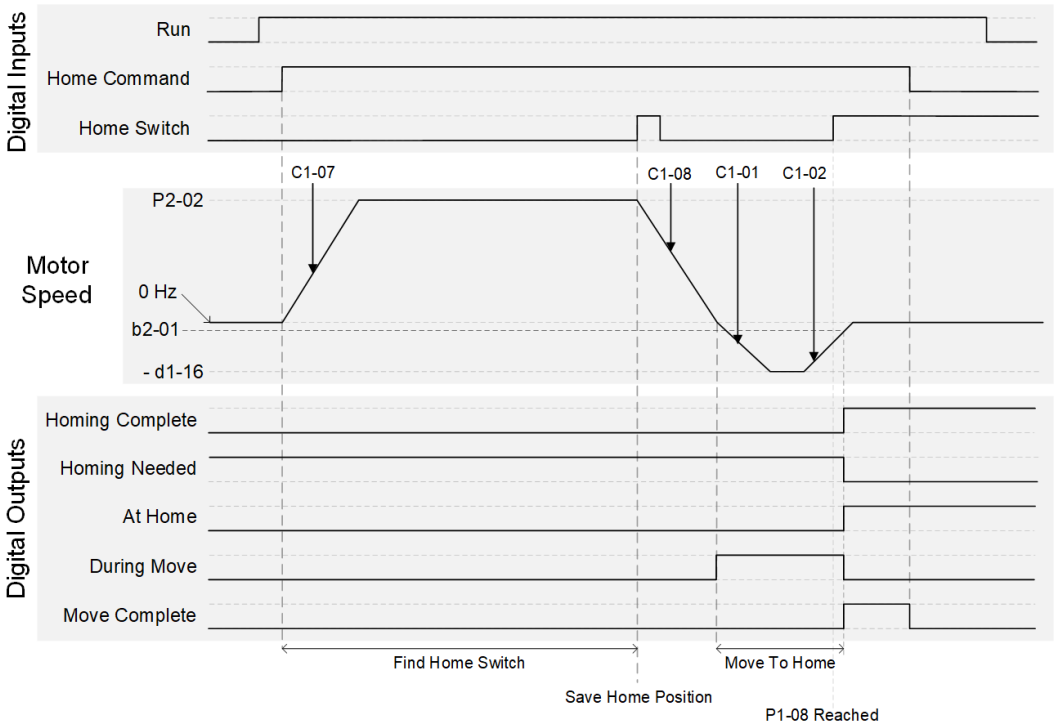


Figure 17 Positive Homing Type (P2-01 = 2) Timing Chart

■ Homing Type: Positive with Backup

1. **Find Home Switch:** Accelerates to P2-02 (Homing Frequency) when the H1-xx = 82 (MFDI Function Select: Home Command) is activated and maintained.
2. **Save Home Position:** When the H1-xx = 83 (MFDI Function Select: Home Switch) is activated:
   (a). **Backup:** The drive will change direction and the frequency reference is changed to - P2-03 (Homing Backup Frequency). The drive will continue to move until the Home Switch digital input is deactivated.
   (b). **Return:** Changing directions again, the frequency reference is set to P2-04 (Backup Return Frequency) until the Home Switch digital input is activated again. The Home switch position is recorded, and the drive decelerates to 0 Hz.
3. **Move to Home:** When the drive has decelerated, a Move routine to the recorded reference point + P2-06 (Home Offset) with a max frequency of - d1-16 (Reference 16), acceleration rate of C1-01 (Acceleration Time 1) and deceleration rate of C1-02 (Deceleration Time 1) is completed.

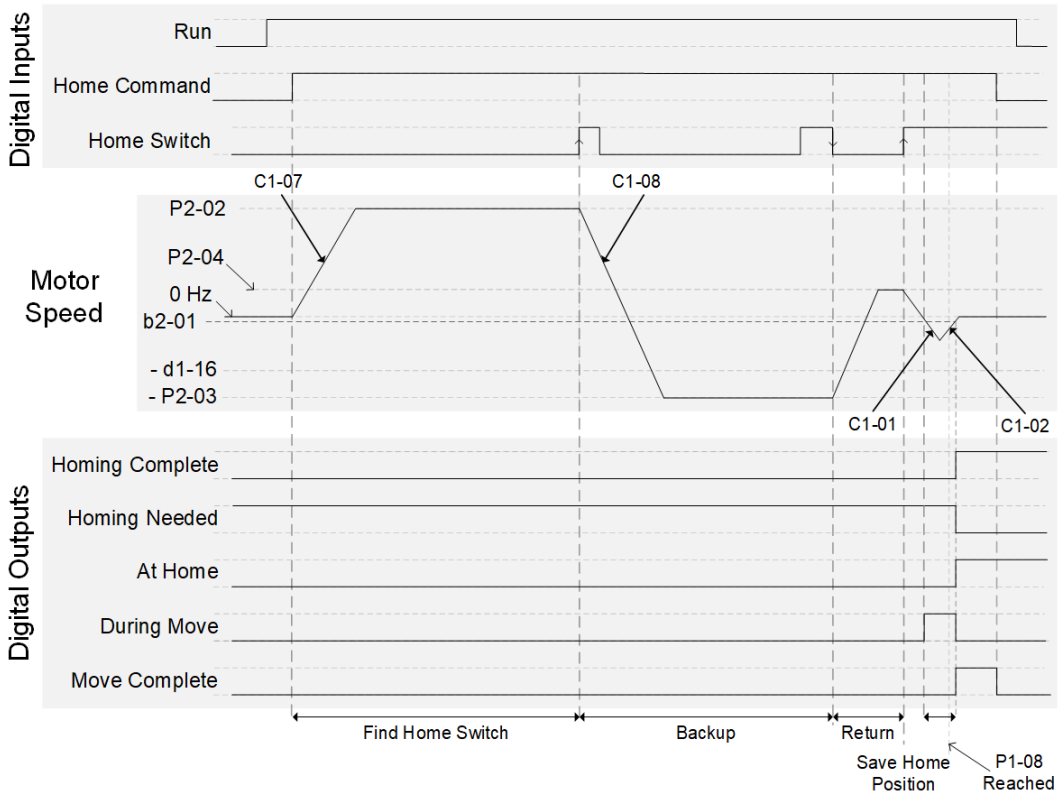


Figure 18 Positive Homing Type with Backup (P2-01 = 3) Timing Chart

■ Homing Type: Negative with Marker

1. **Find Home Switch:** Accelerates to - P2-02 (Homing Frequency) when the H1-xx = 82 (MFDI Function Select: Home Command) is activated and maintained.
2. **Save Home Position:** At the leading edge when the H1-xx = 83 (MFDI Function Select: Home Switch) is activated:
   (a). **Continue Until Encoder Marker Pulse:** The drive continues at - P2-02 until a marker pulse from the positioning encoder is received.
   (b). **Record Position:** Once the marker pulse has been received, the Home switch reference point is recorded and the drive decelerates to 0 Hz.
3. **Move to Home:** When the drive has decelerated, a Move routine to the recorded reference point + P2-06 (Home Offset) with a max frequency of d1-16 (Reference 16), acceleration rate of C1-01 (Acceleration Time 1) and deceleration rate of C1-02 (Deceleration Time 1) is completed.

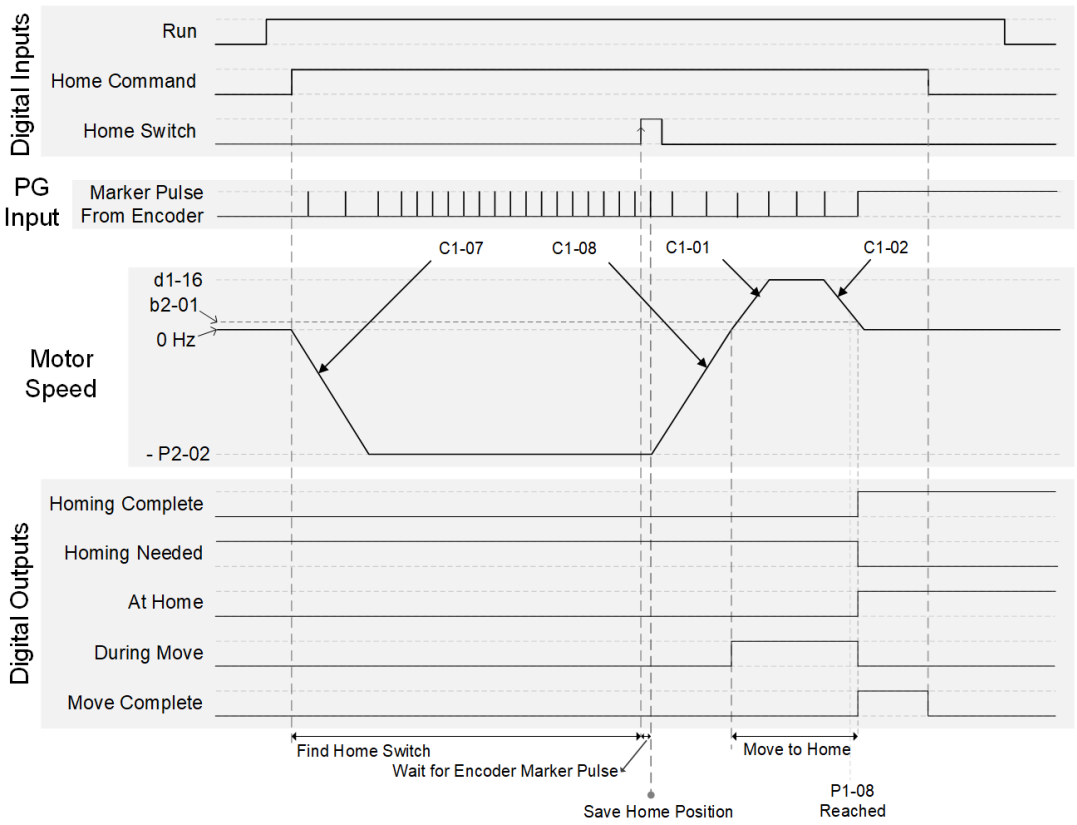


Figure 19 Negative Homing Type with Marker Pulse (P2-01 = 4) Timing Chart

■ Homing Type: Positive with Marker

1. **Find Home Switch:** Accelerates to P2-02 (Homing Frequency) when the H1-xx = 82 (MFDI Function Select: Home Command) is activated and maintained.
2. **Save Home Position:** At the leading edge when the H1-xx = 83 (MFDI Function Select: Home Switch) is activated:
   (a). **Continue Until Encoder Marker Pulse:** The drive continues at P2-02 until a marker pulse from the positioning encoder is received.
   (b). **Record Position:** Once the marker pulse has been received, the Home switch reference point is recorded and the drive decelerates to 0 Hz
3. **Move to Home:** When the drive has decelerated, a Move routine to the recorded reference point + P2-06 (Home Offset) with a max frequency of - d1-16 (Reference 16), acceleration rate of C1-01 (Acceleration Time 1) and deceleration rate of C1-02 (Deceleration Time 1) is completed.

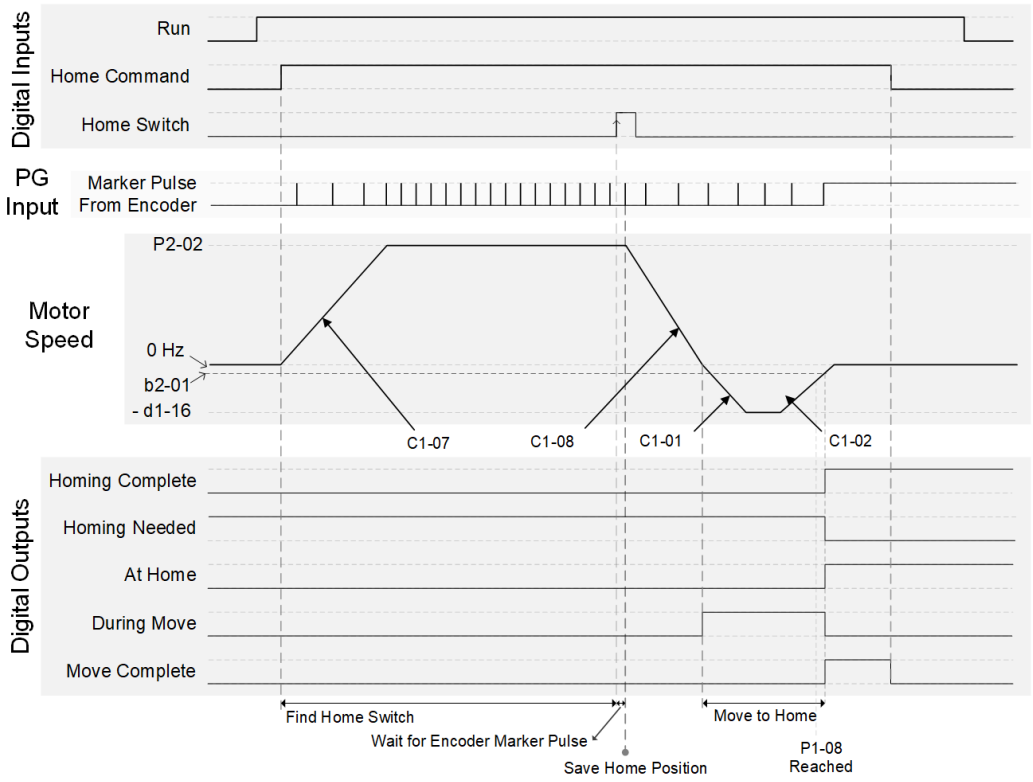


Figure 20 Positive Homing Type with Marker Pulse (P2-01 = 5) Timing Chart

■ Homing Type: Manual

When a rising edge of the home switch is detected, that position is saved as Home. A typical use case would be moving the machine, either via jogging or manually, then closing the Home switch to save the position as Home. If a Move routine is in progress, and the Home switch is activated, the move is cancelled. The Home switch position is recorded, and the drive decelerates to 0 Hz. Note: If P1-01 (Motion Type) = 3 (Relative Memory Off) or 4 (Relative with Memory On), the Homing type is Manual regardless of the P2-01 (Homing Type) setting.

■ Homing Special Cases: P2-06 (Home Offset)

Whenever P2-06 (Home Offset) is not zero, the recorded Home Switch position is shifted by that amount. Whenever the Homing Routine has a "Move to Home" phase, it will move to the Home Switch Position + P2-06 (Home Offset).

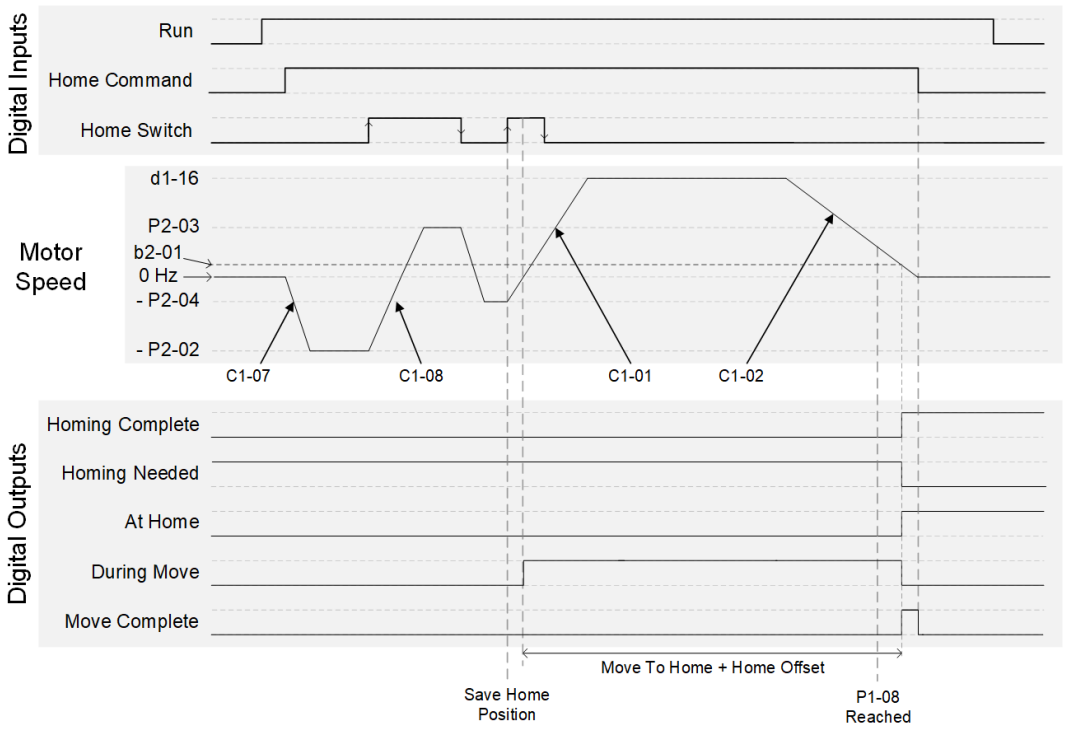


Figure 21 Negative Homing with Backup (P2-01 = 1) and Home Offset (P2-06 > 0) Timing Chart

■ Homing Special Cases: Homing When on Home Switch

When a Home command is given and the current position is at Home, an additional first step is added: if P2-01 = 1 or 3 (Homing Type: Positive or Negative with Backup) this step *replaces* the backup phase.

1. **Back Off Home Switch:** Using the frequency reference P2-03 (Homing Backup Frequency), direction dependent on P2-01 (Homing Type), the drive will run until the falling edge of the H1-xx = 83 (MFDI Function Select: Home Switch), then continue with the Home routine.

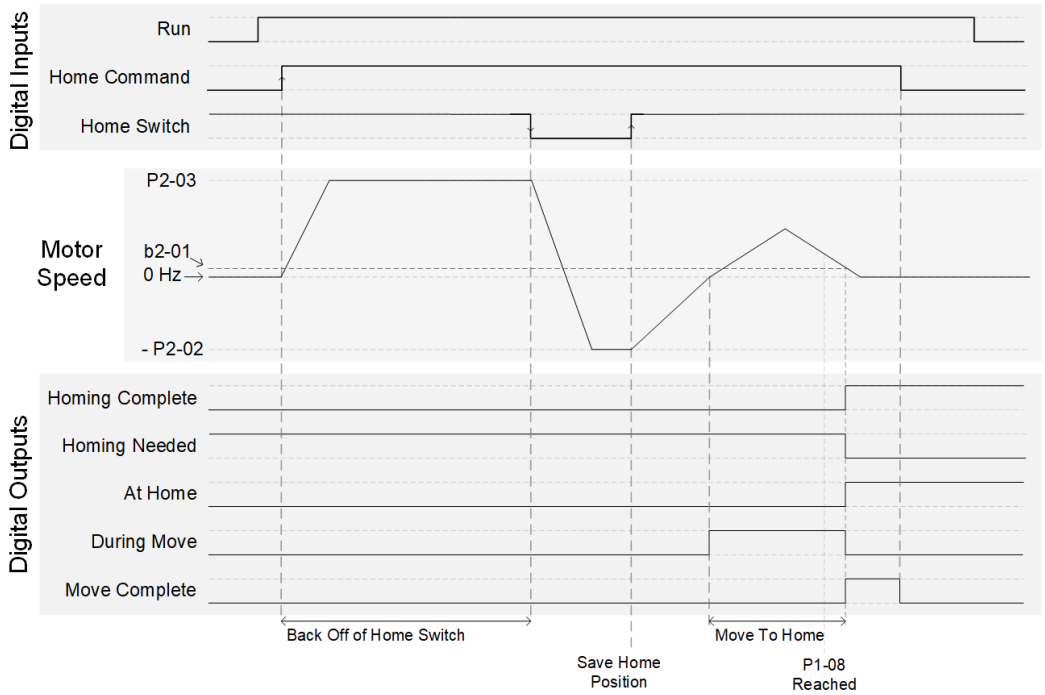


Figure 22 Negative Homing Type (P2-01 = 0) and Starting on Home Switch Timing Chart

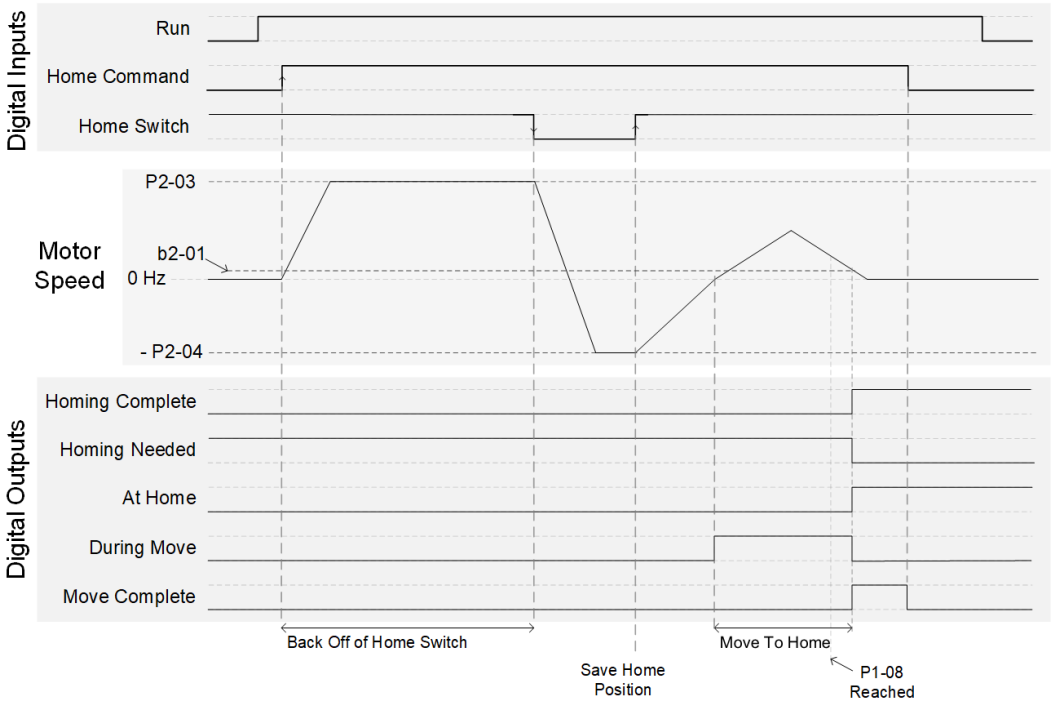


Figure 23 Negative Homing Type (P2-01 = 1) with Backup and Starting on Home Switch Timing Chart

■ Homing Special Cases: b1-04 = 1 (Reverse Operation Selection: Reverse Disabled)

If reverse operation is disabled.

- Only Positive (P2-01 = 2) and Positive with Marker (P2-01 = 5) homing types will complete the homing routine but skip the "Move to Home" phase.
- If a Homing routine requires reverse operation, it will never complete.
- When P1-01 = 2 (Motion Type: Rotary Absolute), "Move to Home" will complete in the forward direction.
- If H1-xx = 83 (MFDI Function Selection: Home Switch) is set at the beginning of a Home Routine, instead of backing up in the reverse direction, it will go forward.

■ Notes and Warnings

- Homing is required if P1-01 = 1 or 2 (Motion Type: Absolute Rotary or Absolute Linear) and will need to be repeated if:
  - P1-01 (Motion Type) is changed
  - Motion Control is disabled
  - P3-01 (Position Encoder Source) is changed
  - On power cycle
  - An overtravel alarm occurs (POSOT and NEGOT)
  - Position overflow (POSOF) occurs
- A Homing routine is not required to be repeated if the drive has been switched into Local Mode:
  - H1-xx = 1 (MFDI Function Selection: Local/Remote Selection)
  - Setting the drive to LOCAL mode via the "LO/RE" button on the keypad
  - Setting b1-02 = 0 (Run Command Selection 1: Keypad)
- If the Home Switch is N.C. (H1-xx = 183), rather than looking for the falling edge, the homing routine will look for the rising edge of the switch, and vice versa.
- When P2-01 = 4 or 5 (Homing Type: Negative with Marker or Positive with Marker) if Z+ / Z- are not connected, the Homing routine will not complete.

◆ Learn

The current position can be saved to a digital preset parameter P4-xx (Position xx) using Learn. The Learn routine can be performed by:

1. Selecting a digital preset parameter (P4-xx) using H1-xx = 87-8A (MFDI Function Select: Destination Position Select)

(a). If not selected via MFDIs, the position value will be saved to P4-01 (Position 1).
2. Using H1-xx = 12 or 13 (MFDI Function Select: Forward Jog or Reverse Jog), jog until the desired position is reached.
3. Close H1-xx = 86 (MFDI Function Select: Learn Position) until LNCMP alarm is present or H2-xx = 45 (MFDO Function Select: Learn Successful) is closed.

■ Notes and Warnings

- Avoid excessive use, as the GA800 EEPROM can only be written 100,000 times
- A Homing routine is required if P1-01 = 1 or 2 (Motion Type: Absolute Rotary or Absolute Linear) and must be performed before using Learn.
- If using serial communications, all parameters that were changed during a Learn routine using a RAM ENTER (0910H) command are written to EEPROM.

◆ Motion Control Disable

When P1-01 = 0 (Motion Type: Disabled) or H1-xx = 8B (MFDI Function Select: Disable Motion Control) is programmed and closed, Motion Control is disabled. All functions of Motion Control are disabled, including Moving, Homing, and Learning. When Motion Control is disabled, the following will be reset:

- Current Position
- Home Position
- Motion Control Related Outputs
  - MFDO states
  - Monitors
- Memobus Registers

◆ Overtravel

If either H1-xx = 84/184, or 85/185 (MFDI Function Selection: Positive Overtravel Switch or Negative Overtravel Switch) are activated, alarm POSOT (Positive Overtravel) or NEGOT (Negative Overtravel) will be displayed. All functions of Motion Control will be disabled and if a Move or Homing routine is in progress, it will be cancelled, and the drive will ramp to 0 Hz. To exit this condition, use H1-xx = 12 or 13 (MFDI Function Selection: Forward Jog or Reverse Jog) until the POSOT or NEGOT alarm is cleared. Once cleared, if P1-01 = 1 or 2 (Motion Type: Linear Absolute or Rotary Absolute), a Homing routine must be repeated.

◆ Pre-Action

Using P2-08 (Pre-Action Distance), H2-xx = 46 or 146 (MFDO Function Selection: Pre-Action) will activate when the current position is within P2-08 and P1-08 (In Position Window) of the destination position and a Move routine is in progress. If the Move routine is cancelled or the current position is within +/- P1-08 (In Position Window), H2-xx = 46 (MFDO Function Selection: Pre-Action) will deactivate.

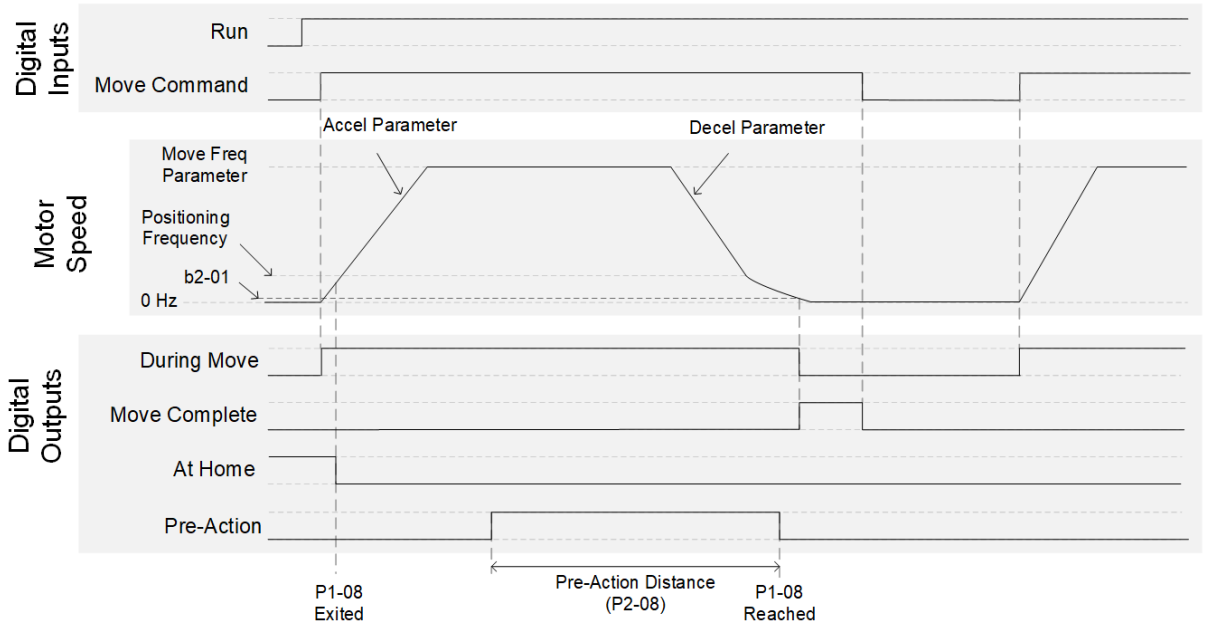
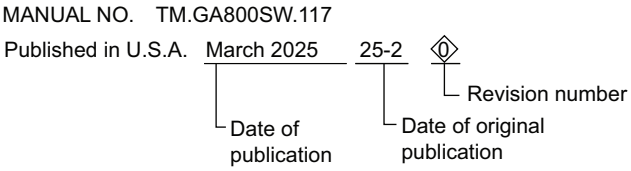


Figure 24 Pre-Action Digital Output

◆ Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.



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In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply.
Specifications are subject to change without notice for ongoing product modifications and improvements.

Original Instructions

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