YASKAWA

Orientation
F7 Drive Software
Technical Manual

Software Number: VSF11006X, Drive Models: CIMR-F7UXXXXXX-063
Document Number: TM.F7SW.063, Date: 03/03/06, Rev: 06-03

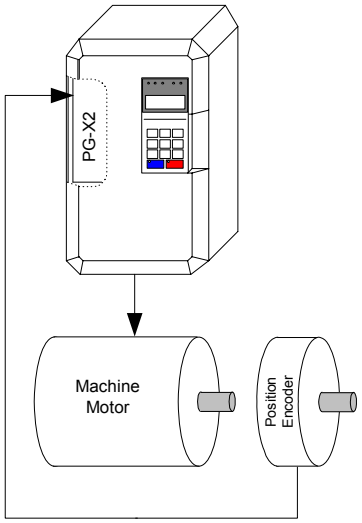
This document is intended to provide proper installation and use of the Yaskawa drive with custom software. This document is a supplement to the standard drive technical manual. It describes the effects on the drive parameters and functions with the software installed. Read and understand this document and the standard drive technical manuals before attempting to install, adjust, operate, inspect or maintain the drive. ***Observe all cautions and warnings in this document and the standard drive technical manuals.*** *Custom software is written to add functionality to a standard AC 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. Custom software can add new functions, modify standard functions, or even inhibit standard functions. It can be used to modify display text or parameter names. Custom software is usually loaded to the drive before delivery. The control board and drive nameplate are assigned unique part numbers and the software is registered, archived, and retrievable.*

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 has been flashed to the control board memory and the operation of parameters, functions, and monitors are different than the standard drive software, as described herein.

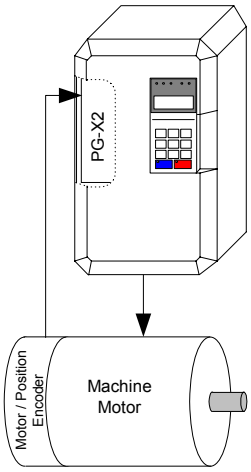
1.0 Overview

This orientation software allows an F7 drive to repeatedly stop a machine at a certain point in its rotational cycle. This is accomplished by means of an orientation (positioning) encoder directly coupled to the machine part to be positioned. A simple example is to think of the hands on a clock. If the orientation encoder is mounted to the motor shaft, this software can stop the motor so that the keyway in the motor shaft stops, at say 3 o'clock, every time. The target applications are equipment that must stop in specific positions including tool changing for machine tool spindles and die changing for punch/stamping presses. This F7 software is meant to replace the G5 custom software and MC5 option board versions of the orientation function. Example configurations include:

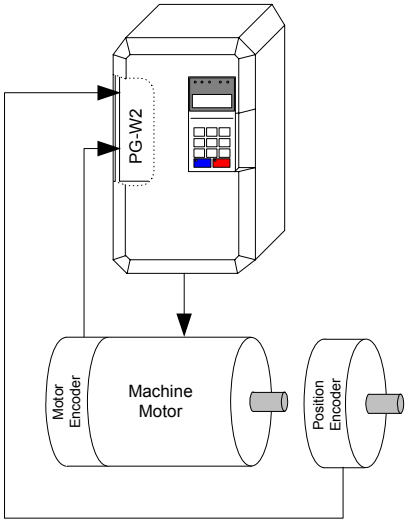
1. Open Loop Control



2. Closed Loop Control



3. Closed Loop Control
With Orientation Encoder



Example Machine Configurations

1.1 Open Loop Control

The open loop V/Hz or open loop vector control method (A1-02 = 0 or 2) may be used when the motor and the machine part to be oriented (positioned) are connected through a drive train with a constant ratio. A PG-X2 encoder feedback option card is required to interface with the orientation encoder attached to the machine part that is being orientated.

1.2 Closed Loop Vector Control

The closed vector loop control method (A1-02 = 3) should be used for the best speed and orientation characteristics when the drive motor directly drives the machine part being oriented (positioned). When using this method, the motor encoder is used for both flux vector control and for orientation. A PG-X2 encoder feedback option card is required. This method will provide superior performance than the open loop method.

1.3 Closed Loop Vector Control with Position Encoder

The closed loop vector control method (A1-02 = 3) can also be used when the motor and the machine part to be oriented (positioned) are connected through a drive train with a constant ratio. This requires 2 encoders, one mounted on the driven motor, and the other on the machine part to be oriented. A PG-W2 dual encoder feedback option card is required. This method will provide superior performance than the open loop method.

2.0 Changes from Standard Product

The orientation function is added. The function is active in all control modes (A1-02) and visible in the advanced access level (A1-01 = 2).

3.0 Limitations

a. The multi-function digital input function Motor 2 Select (H1-XX = 16) cannot be used in all applications of this software. See parameter P1-01.
b. When any of the 3 multi-function digital input Orientation Command (H1-XX = 80 ~ 82) functions are programmed, the standard software functions DC Injection Command (H1-XX = 60) and Zero-Servo Command (H1-XX = 72) are disabled.
c. The orient function is disabled when the drive is in "local" mode by pressing the local/remote button on the keypad, or by activating the local/remote multi-function digital input, or by setting B1-02 = 0 (drive sequence from the keypad).

4.0 Related Parameters and Functions

4.1 Parameters

Parameter Number	Modbus Address	Parameter Name ***Digital Operator Display***	Description	Range	Default	Change During Run	Access Level For All Control Modes *1
P1-01	600H	PG Channel Selection ***PG Channel Sel***	This parameter selects whether channel 1 or channel 2 of the encoder feedback card will be used for orientation. 0: Channel 1 1: Channel 2 *Note: When using a PG-X2 card, set P1-01 = 0.* *Note: This software does not fully support the multi-function digital input function Motor 2 Select (H1-0X = 16). When using a PG-W2 card, it is possible to run 2 different motors/encoders and switch between them using the programmed digital input. However, P1-01 will not automatically switch. Therefore, only 1 orientation encoder can be used for an application.*	0 ~ 1	0	No	A
P1-02	601H	Position Encoder PPR ***Pos. Encoder PPR***	This parameter sets the PPR (pulses per revolution) of the orientation encoder. The PPR is the number of actual pulses for one revolution of the orientation (positioning) encoder. *Note: When operating in closed loop vector (A1-02 = 3) and P1-01 = 0, set P1-01 = F1-01.* *Note: This parameter is set in encoder PPR,* ***not quadrature encoder counts*** *(counts = PPR x 4).*	0 ~ 8192 PPR	1024	No	A

*1: Access Level (A1-01): Q = “Quick Start”, A = “Advanced”, F = “Factory”.

4.1 Parameters (continued)

Parameter Number	Modbus Address	Parameter Name ***Digital Operator Display***	Description	Range	Default	Change During Run	Access Level For All Control Modes *1
P1-03	602H	Orient Offset Distance ***Marker Offset***	This parameter, along with parameters P2-02, P2-03, and P2-04, sets the orientation (or stopped) position of the machine. P2-01 governs when P1-03 is active. See section 5.1 for details. When P1-03 = 0 and P2-01 = 0, the drive will position the machine at the marker pulse (referred to as the Z or C pulse). When P1-03 is set greater than 0, the machine will stop at P1-03 quadrature counts past the marker pulse. The desired offset can be found by setting P1-03 = 0 and P2-01 = 0, running the drive, and then closing an Orient Command. When the drive stops, open both the run and orient inputs. Rotate the machine to the desired position by hand or by the using the run inputs. Read the value of U1-90 (Marker Offset) and enter the value in P1-03. *Note: Counts = Encoder PPR x 4.*	0 ~ 8192 Counts	0	No	A
P1-04	603H	Position Speed ***Position Speed***	This parameter sets the minimum speed that will be used during orientation. This speed is also used in conjunction with parameter P1-05 (Position Count).	0.00 ~ 10.00 Hz	0.10	No	A
P1-05	604H	Position Count ***Position Count***	This parameter sets the number of quadrature encoder counts prior to reaching the desired orientation position that the drive will decelerate to the speed set in P1-04 (Position Speed). The drive will then complete orientation at the P1-04 speed. This can be thought of as a creep function to prevent large inertia loads from over-shooting. *Note: Counts = Encoder PPR x 4.*	0 ~ 4096 Counts	0	No	A
P1-06	605H	Orientation Complete Detection Set Count ***ORT Set Count***	This parameter sets, in quadrature encoder counts, the initial window (bandwidth) around the orientation position that defines the Orient Complete digital output. The Orient Complete digital output (H2-0X = 40) will close when the encoder quadrature count is within the P1-06 window of the orientation position and after the P1-09 delay timer has expired. The drive will also switch into zero-servo position control when the P1-06 window is reached. (For control methods other than closed loop vector, the drive will use DC injection). After the Orient Complete output closes, the window for keeping the function closed is defined by parameter P1-07. *Note: The setting in P1-06 must be less than or equal to the P1-07 setting for the Orient Complete digital output function to work properly.* *Note: Counts = Encoder PPR x 4.*	0 ~ 100 Counts	5	No	A

*1: Access Level (A1-01): Q = “Quick Start”, A = “Advanced”, F = “Factory”.

4.1 Parameters (continued)

Parameter Number	Modbus Address	Parameter Name ***Digital Operator Display***	Description	Range	Default	Change During Run	Access Level For All Control Modes *1
P1-07	606H	Orientation Complete Detection Reset Count ***ORT Reset Count***	This parameter sets, in quadrature encoder counts, the window (bandwidth) around the orient position that will keep the Orient Complete digital output (H2-0X = 40) closed. See parameter P1-06. The P1-09 delay timer does not apply to this parameter. If the actual positions deviates from the orientation position by more than P1-07 counts, the Orient Complete digital output will open and the process starts over as outlined in parameter P1-06. The setting in P1-06 must be less than or equal to the P1-07 setting for the Orient Complete digital output function to work properly. *Note: Counts = Encoder PPR x 4.*	0 ~ 100 Counts	10	No	A
P1-08	607H	Stop Speed ***Stop Speed***	This parameter sets the orientation encoder frequency at which the orientation (positioning) algorithm takes control of motor deceleration (as opposed to the standard deceleration time (C1-0X). Multiply this parameter by the active motor gear ratio (P2-05 ~ P2-07) to determine the driven motor frequency at which orientation will begin. This setting will effect the overall deceleration time of the motor. The orientation algorithm will bring the motor to a stop in the orient position within 2 revolutions of the motor shaft after the P1-08 frequency is reached.	0.00 ~ 30.00 Hz	5.00	No	A
P1-09	608H	Orientation Set Time ***ORT Set Time***	This parameter sets the delay time from when the P1-06 Orient Complete window is satisfied and the Orientation Complete digital output (H2-0X = 40) will close. The delay time is determined by the following formula: Delay Time = P1-09 x 5ms	1 ~ 200	2	No	A
P1-10	609H	Channel 2 Orient PG Rotation ***PG Rotation Ch2***	This parameter sets the polarity of the orientation encoder feedback when channel 2 is used (P1-01 = 1). Counter-clockwise polarity is defined as the "A+" encoder feedback signal leading the "B+" feedback signal when the drive is running in the forward direction. 0: C.C.W (counter-clockwise) 1: C.W. (clockwise) *Note: When channel 1 is used (P1-01 = 0), parameter F1-05 sets the encoder polarity.* *Note: If this parameter is incorrectly set, the orientation process will not complete properly. Therefore, use caution the first time a machine orientation is attempted.*	0 ~ 1	0	No	A

*1: Access Level (A1-01): Q = "Quick Start", A = "Advanced", F = "Factory".

4.1 Parameters (continued)

Parameter Number	Modbus Address	Parameter Name ***Digital Operator Display***	Description	Range	Default	Change During Run	Access Level For All Control Modes *1
P2-01	60AH	Marker Offset Selection ***Control Select***	This parameter determines how the orientation position offset from the marker pulse is determined. See section 5.1 for details. 0: Use P1-03 for the orientation position offset from the marker pulse. 1: Use P1-03, P2-02, P2-03, and P2-04 sequentially. The offset parameter used changes each time the Orientation Command is cycled. 2: Use P1-03, P2-02, P2-03, and P2-04 according to the status of the multi-function digital input functions 84 and 85 (Offset 1 and Offset 2). 3: Use the network communication offset (Modbus Register 00AH). See monitor U1-94. When this setting is selected, parameters P1-03, P2-02, P2-03, and P2-04 are ignored.	0 ~ 3	0	No	A
P2-02	60BH	Offset 1 ***Offset1***	This parameter is active when P2-01 is set to a 1 or 2. This parameter is used in conjunction with parameters P1-03, P2-03, and P2-04 to determine the orientation position offset from the marker pulse. See section 5.1 for details. *Note: Counts = Encoder PPR x 4.*	0 ~ 8192 Counts	0	No	A
P2-03	60CH	Offset 2 ***Offset2***	This parameter is active when P2-01 is set to a 1 or 2. This parameter is used in conjunction with parameters P1-03, P2-02, and P2-04 to determine the orientation position offset from the marker pulse. See section 5.1 for details. *Note: Counts = Encoder PPR x 4.*	0 ~ 8192 Counts	0	No	A
P2-04	60DH	Offset 3 ***Offset3***	This parameter is active when P2-01 is set to a 1 or 2. This parameter is used in conjunction with parameters P1-03, P2-02, and P2-03 to determine the orientation position offset from the marker pulse. See section 5.1 for details. *Note: Counts = Encoder PPR x 4.*	0 ~ 8192 Counts	0	No	A

*1: Access Level (A1-01): Q = “Quick Start”, A = “Advanced”, F = “Factory”.

4.1 Parameters (continued)

Parameter Number	Modbus Address	Parameter Name ***Digital Operator Display***	Description	Range	Default	Change During Run	Access Level For All Control Modes *1
P2-05	60EH	Motor Gear Ratio 1 ***Motor Ratio 1***	This parameter sets gear ratio 1 between the driven motor shaft and the orientation encoder. A setting of 2.0000 means that there are 2 motor shaft revolutions for every one revolution of the orientation encoder. The exact ratio must be able to be expressed by this parameter. If not, over time the machine will drift away from the desired orient position as error builds up from the mis-expressed ratio. This parameter is used in conjunction with parameters P2-06 and P2-07 to determine the active motor gear ratio. See section 5.2 for details. If neither of the multi-function input functions 86 or 87 (Motor Gear Ratio Selection 1 or 2) are programmed, P2-05 is the active parameter.	0.0400 ~ 2.5000	1.0000	No	A
P2-06	60FH	Motor Gear Ratio 2 ***Motor Ratio 2***	This parameter sets gear ratio 2 between the driven motor shaft and the orientation encoder. A setting of 2.0000 means that there are 2 motor shaft revolutions for every one revolution of the orientation encoder. The exact ratio must be able to be expressed by this parameter. If not, over time the machine will drift away from the desired orient position as error builds up from the mis-expressed ratio. This parameter is used in conjunction with parameters P2-05 and P2-07 to determine the active motor gear ratio. See section 5.2 for details.	0.0400 ~ 2.5000	1.0000	No	A
P2-07	610H	Motor Gear Ratio 3 ***Motor Ratio 3***	This parameter sets gear ratio 3 between the driven motor shaft and the orientation encoder. A setting of 2.0000 means that there are 2 motor shaft revolutions for every one revolution of the orientation encoder. The exact ratio must be able to be expressed by this parameter. If not, over time the machine will drift away from the desired orient position as error builds up from the mis-expressed ratio. This parameter is used in conjunction with parameters P2-05 and P2-06 to determine the active motor gear ratio. See section 5.2 for details.	0.0400 ~ 2.5000	1.0000	No	A

*1: Access Level (A1-01): Q = “Quick Start”, A = “Advanced”, F = “Factory”.

4.1 Parameters (continued)

Parameter Number	Modbus Address	Parameter Name ***Digital Operator Display***	Description	Range	Default	Change During Run	Access Level For All Control Modes *1
P2-08	611H	ASR P Gain 3 ***ASR P Gain 3***	This parameter sets the ASR Proportional Gain used for orientation and becomes active whenever an Orientation Command (H1-0X = 80 ~ 82) is present. This parameter automatically overrides C5-01 and C5-03. The active proportional gain (C5-01 or C5-03) is ramped to the P2-08 value using the P2-09 time setting. When the Orient Complete function is satisfied (P1-06) and the drive goes into zero-servo positioning mode, b9-01 (zero-servo gain) is also active in trying to maintain the orientation position. *Note: The setting range is 1.00 - 300.00 when A1-02 = 3 (closed loop vector).* *Note: This parameter is not available for the Open Loop V/Hz and Open Loop Vector control modes (A1-02 = 0 or 2).*	0.00 ~ 300.00	20.00	Yes	A
P2-09	612H	ASR I Time 3 ***ASR I Time 3***	This parameter sets the ASR Integral Time used for orientation and becomes active whenever an Orientation Command (H1-0X = 80 ~ 82) is present. This parameter automatically overrides C5-02 and C5-04. *Note: This parameter is not available for the Open Loop V/Hz and Open Loop Vector control modes (A1-02 = 0 or 2).*	0.000 ~ 10.000 sec	0.500	Yes	A

*1: Access Level (A1-01): Q = “Quick Start”, A = “Advanced”, F = “Factory”.

4.2 Monitors (U1-XX)

Monitor Number	Modbus Address	Monitor Name ***Digital Operator Display***	Description	Scaling for Multi-function Analog Output Terminals FM and AM (H4-01, H4-04)	Unit	Access Level For All Control Modes *1
U1-90	720H	Marker Offset ***Marker Offset***	Displays the current number of quadrature orientation encoder counts the machine is past the marker pulse. See parameter P1-02. The display range is 0 ~ 32,768 counts. *Note: Counts = Encoder PPR x 4.*	NA	Counts	A
U1-91	721H	Shaft Angle ***Shaft Angle***	Displays the angle in degrees the machine is away from the active orientation position offset. The display range is 0.0 ~ 359.9º.	NA	º	A
U1-92	722H	Sequence Offset ***Seq Offset***	Displays the active value of the orientation offset from the marker pulse. See parameter P2-01 and section 5.1. The display range is 0 ~ 8192 counts. *Note: Counts = Encoder PPR x 4.*	NA	Counts	A
U1-93	723H	Sequence Step ***Sequence step***	Displays the active orientation offset parameter. See parameter P2-01 and section 5.1 for more information. The display range is 0 ~ 3. 0: P1-03 1: P2-02 2: P2-03 3: P2-04	NA	-	A
U1-94	724H	Serial Offset ***Serial Offset***	Displays the orientation position offset from the marker pulse when P2-01 = 3. This monitor reflects the data in Modbus register 000AH. See parameter P2-01 and section 5.1 for details. The display range is 0 ~ 8192 counts.	NA	Counts	A

*1: Access Level (A1-01): Q = “Quick Start”, A = “Advanced”, F = “Factory”.

4.3 Multi-function Digital Inputs (H1-0X)

Setting	Display	Description	Available For All Control Modes
80	***Orient CMD***	Closed: Causes the drive to stop and orient the motor to the current orientation position offset from the marker pulse. See section 6. The motor will orient in the direction of the run command. The run command must be maintained closed throughout the orientation process. If the run command is removed during orientation, the drive will stop according to the B1-03 setting and not complete orientation. If the run command is present during orientation and the orientation command is removed, the drive will resume normal operation at the current speed reference. Both the run command and orient command must be present for the drive to remain in zero-servo after orientation is complete.	√
81	***Orient CMD FWD***	Closed: Causes the drive to run in the forward direction and orient the motor to the current orientation position offset from the marker pulse. See section 6. A run command is not necessary. If a run command is present during orientation, and the orientation command is removed, the drive will resume normal operation at the current speed reference. If the run command is not present during orientation and the orientation command is removed, the drive will stop according to the B1-03 setting and not complete orientation.	√
82	***Orient CMD REV***	Closed: Causes the drive to run in the reverse direction and orient the motor to the current orientation position offset from the marker pulse. See section 6. A run command is not necessary. If a run command is present during orientation, and the orientation command is removed, the drive will resume normal operation at the current speed reference. If the run command is not present during orientation and the orientation command is removed, the drive will stop according to the B1-03 setting and not complete orientation.	√
83	***Orient HOME***	Closed: Sets the active orientation offset parameter to P1-03 (sequence 0). This function is only active if P2-01 = 1. See section 5.1 and parameter P2-01.	√
84	***Offset Sel 1***	Orientation Position Offset Selection 1. See section 5.1 and parameters P1-03, P2-02, P2-03, and P2-04.	√
85	***Offset Sel 2***	Orientation Position Offset Selection 2. See section 5.1 and parameters P1-03, P2-02, P2-03, and P2-04.	√
86	***Gear Ratio Sel 1***	Motor Gear Ratio Selection 1. See section 5.2 and parameters P2-05, P2-06, and P2-07.	√
87	***Gear Ratio Sel 2***	Motor Gear Ratio Selection 2. See section 5.2 and parameters P2-05, P2-06, and P2-07.	√

√: Available.

4.4 Multi-function Digital Outputs (H2-0X)

Setting	Display	Description	Available For All Control Modes
40	***Orient Complete***	Closed: The machine is within the orient position bandwidth established by P1-06 and the P1-09 delay timer has expired. Once this condition is met, the output will stay closed as long as the machine is within the P1-07 bandwidth.	√
41	***Home Position***	Closed: The active orientation position offset is P1-03 (sequence 0). Parameter P2-01 indirectly affects this function as it determines when P3-01 will be used as the active offset.	√

√: Available.

4.5 Network Communication Functions

Modbus Register	Function	Description
00AH	Orientation Offset	When P2-01 = 3, this Modbus register defines the orientation offset from the marker pulse. The setting range is 0 – 8192 counts. The data is volatile and is not saved upon power loss. Register 000AH does not require the use of an Enter or Accept command. The written data is immediately active.

4.6 Faults

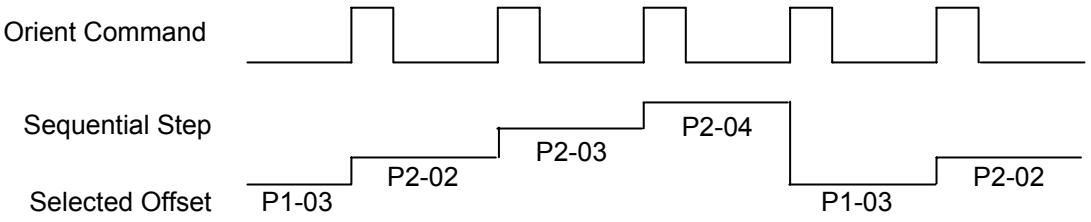
Fault Display	Description	Cause	Countermeasures
ZDEV	Marker Pulse Detection Error	The drive monitors the number of A and B channel encoder pulses between each marker pulse (Z or C channel). There should be P1-02 (Encoder PPR) A and B channel pulses between each marker pulse. If the pulse count exceeds P1-02 x 2, the drive will trip and coast to a stop on a ZDEV fault.	-Check the wiring of the encoder, especially the Z pulse. -Check for noise on the encoder feedback signals.

5.0 Function Description

5.1 Orient Position Offset Selection Using Parameter P2-01

a. P2-01 = 0 (Offset = P1-03)

b. P2-01 = 1 (Offset = P1-03, P2-02, P2-03, or P2-04 by Sequential Orientation Command)



Sequential Offset by Successive Orientation Command

c. P2-01 = 2 (Offset = P1-03, P2-02, P2-03, or P2-04 by MFDI selection)

Parameter Number	Step	Multi-function Digital Input (H1-0X) Selection	
		85: Offset Selection 2	84: Offset Selection 1
P1-03: Marker Offset	0	Open	Open
P2-02: Offset 1	1	Open	**Closed**
P2-03: Offset 2	2	**Closed**	Open
P2-04: Offset 3	3	**Closed**	**Closed**

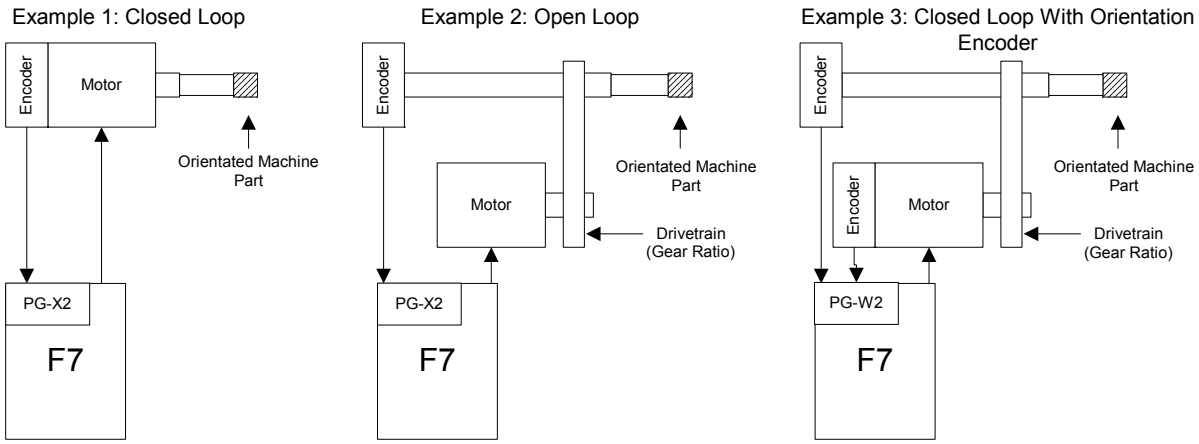
d. P2-01 = 3 (Offset = Serial Offset: Modbus register 000AH)

5.2 Selecting Motor Gear Ratio Parameters P2-05, P2-06, and P2-07

Parameter Number	Multi-function Digital Input (H1-XX) Selection	
	87: Motor Ratio Selection 2	86: Motor Ratio Selection 1
P2-05: Motor Gear Ratio 1	Open	Open
P2-06: Motor Gear Ratio 2	Open	**Closed**
P2-07: Motor Gear Ratio 3	**Closed**	Open
Not Used	**Closed**	**Closed**

6.0 Application Details

6.1 Application Examples



Examples of Machine Configurations Used for Orientation

These examples show typical applications. In these examples, the encoder marker pulse is used for orientation. An external switch may be used as a substitute for the marker pulse.

6.1.1 Example 1: Closed Loop

This is a direct drive system where the encoder, motor and spindle shafts are directly coupled. This system can use the motor's encoder for orientation and closed loop vector control (A1-02 = 3) of the motor to provide the best performance.

6.1.2 Example 2: Open Loop

This is an indirect drive system where the driven motor and the oriented shaft are connected through a drive train. The motor and oriented shaft must have a fixed ratio between them. The ratio must be able to be entered into the drive using the provided ratio parameters (P2-05, P2-06, P2-07). The orientation encoder is coupled to the oriented shaft. Since there is no motor encoder, the drive must be set to V/F or open loop vector control (A1-02 = 0 or 2). This configuration will not provide the performance of a closed loop system and may have issues finding and holding the orient position as true zero speed control is not available.

6.1.3 Example 3: Closed Loop With Orientation Encoder

This is an indirect drive system where the motor and the spindle shaft are connected through a drive train. The motor and spindle speeds must have a constant ratio between them. The ratio must be entered into the drive using the provided ratio parameters. The position encoder is coupled to the spindle shaft. The motor encoder allows for closed loop vector control. This method will provide the best indirect positioning performance.

6.2 Required Components

The exact application will dictate the required configuration of components. The following table can be used to determine the components needed. All encoders must have quadrature feedback (A and B channels with compliments). The orientation encoder must also have a marker pulse (referred to as the Z or C pulse). If not, an external switch must be used to locate the marker position.

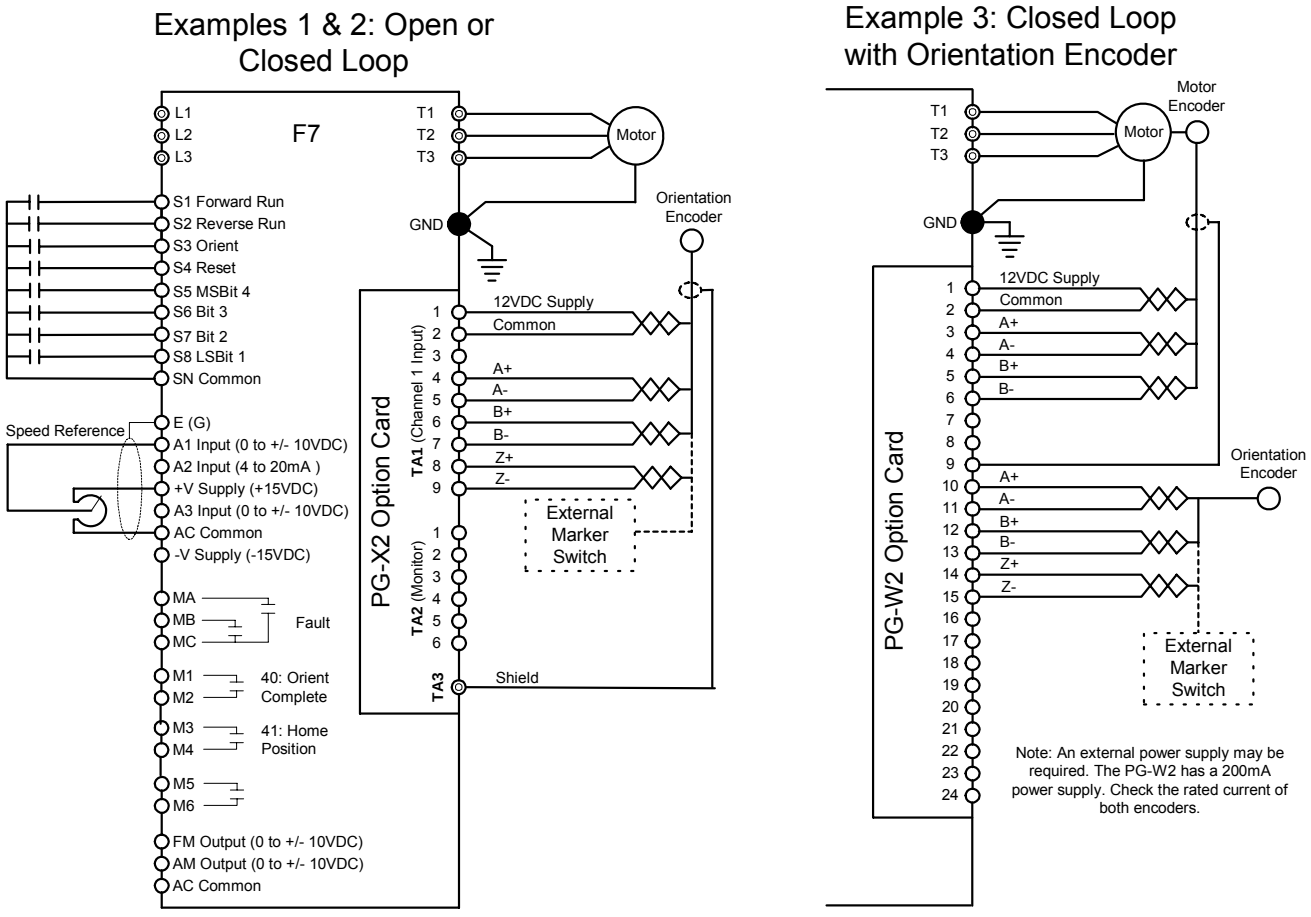
6.2.1 Encoder Feedback Requirements

Example	Encoder Feedback Option Card	Possible Encoder PPR *2	Encoder Power Supply Voltages	Orientation Encoder PPR	Motor Encoder PPR
1	PG-X2	512-8192	5VDC, 12VDC	Yes	No
2	PG-X2	512-8192	5VDC, 12VDC	Yes (same encoder is used for both)	
3	PG-W2 *3	512-8192	12VDC	Yes	Yes

*2 The maximum input frequency of the PG-X2 and PG-W2 option cards is 300kHz. Ensure that the combination of the maximum output frequency (E1-04) and the encoder PPR will not exceed 300kHz. Otherwise, loss of control could occur.

*3 The PG-W2 has a maximum power supply of 200mA. An external power supply may be required for one of the encoders if the combined power draw exceeds 200mA.

6.3 Drive Wiring Examples

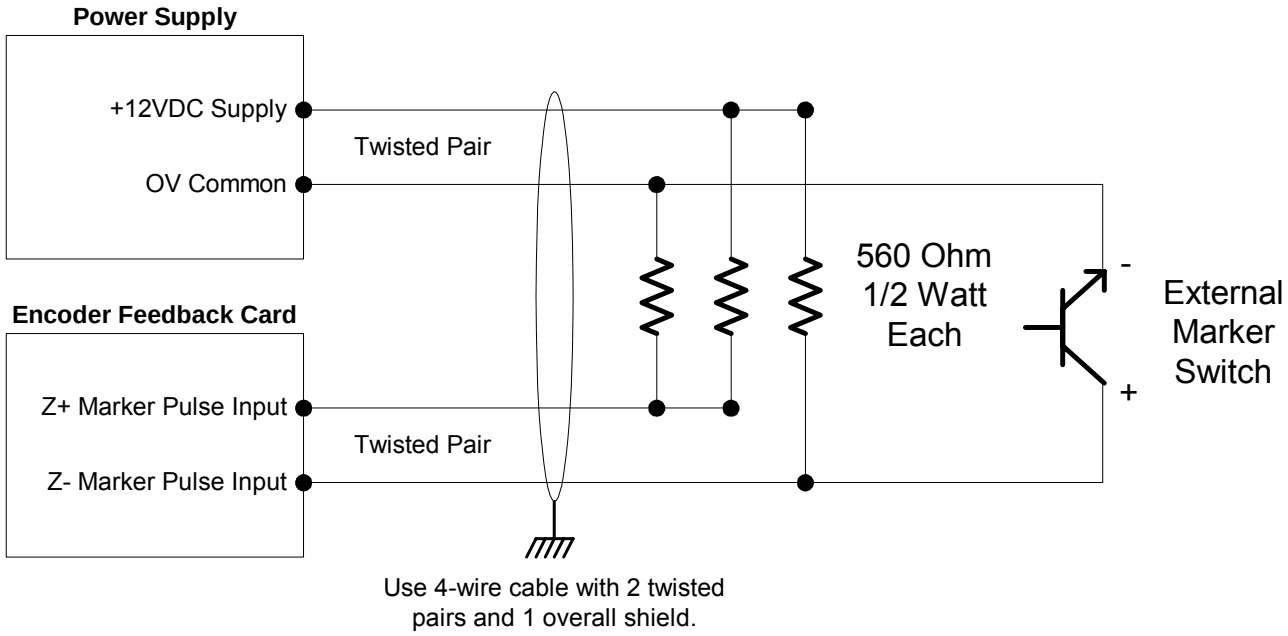


Wiring Examples of PG-X2 and PG-W2 Option Cards

6.4 Using an External Switch Instead of the Marker Pulse

The PG-X2 and PG-W2's marker pulse (Z pulse) input requires a line driver type circuit. The following diagram shows an example of how a +12VDC current sinking (open collector NPN) switch can be used to trigger the marker pulse input of the encoder feedback card. An external power supply may be required. For best noise immunity, locate the resistor network at the switch, not at the encoder feedback card. Please note that the switch must be able to handle at least 22mA of current draw. For exact application wiring, consult Yaskawa Application Engineering with the exact switch specification.

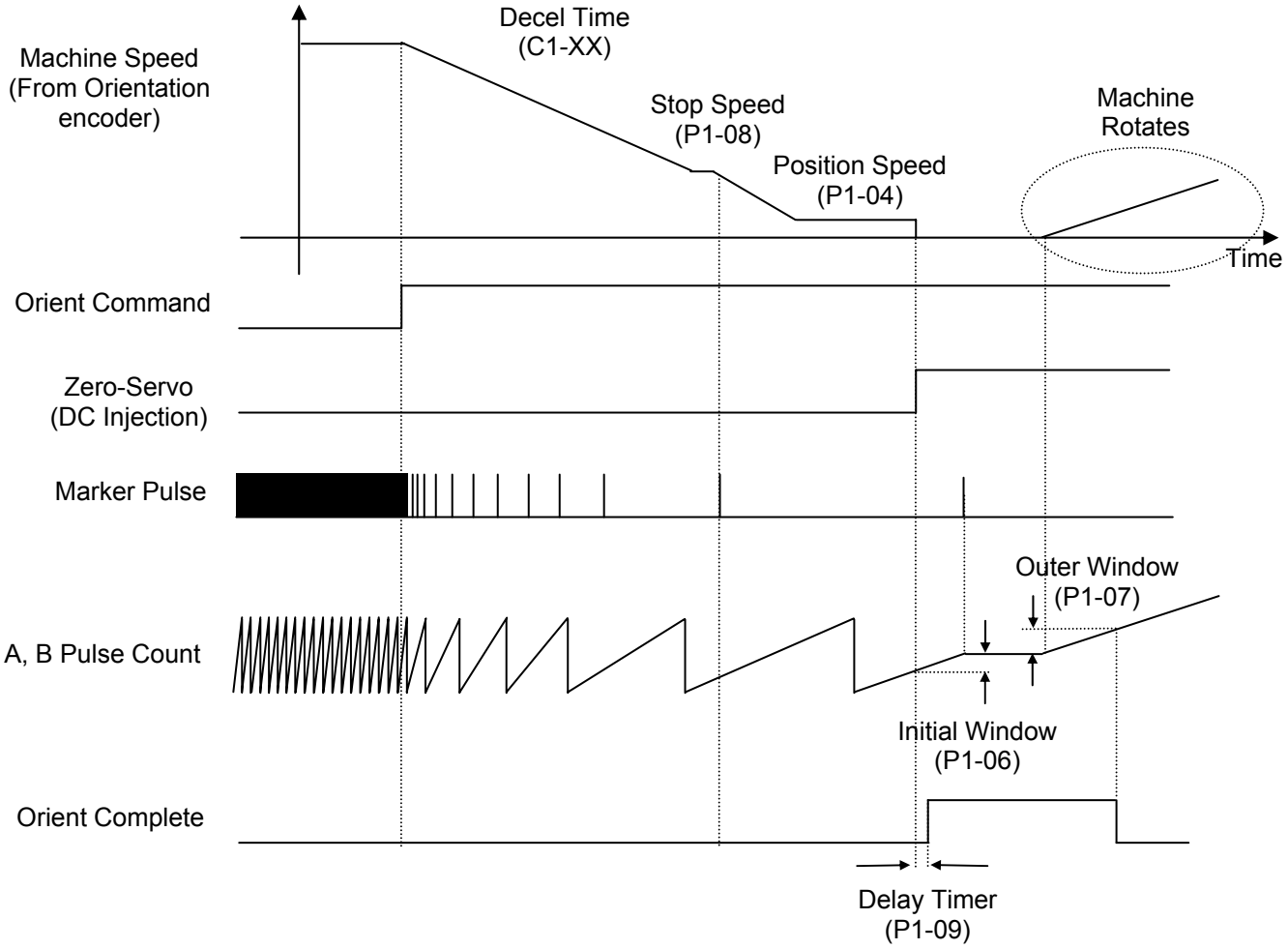
External Marker Pulse Wiring



Wiring Example of External Marker (Orientation) Pulse Sensor

7.0 Timing Diagrams

7.1 Orientation Timing Chart from Normal Operation (P1-03 = 0 and P2-01 = 0)



7.2 Orientation Timing Chart from Zero Speed (P1-03 = 0 and P2-01 = 0)