MOONS'
moving in better ways

# M2 Series AC Servo

## User Manual


SHANGHAI AMP&MOONS' AUTOMATION CO.,LTD.

# Content

# 1 Introduction

## 1.1 About This Manual

This manual describes the M2 Servo Drive.

It provides the information required for installation, configuration and basic operation of the M2 series AC servo drive.

This document is intended for persons who are qualified to transport, assemble, commission, and maintain the equipment described herein.

## 1.2 Documentation Set for M2 series AC servo

This manual is part of a documentation set. The entire set consists of the following:

- M2 Quick Start Guide. Basic setup and operation of the drive.
- M2 User Manual. Hardware installation, configuration and operation.
- M Servo Suite Software User Manual. How to use the M Servo Suite software.

## 1.3 Safety

Only qualified persons may perform the installation procedures. The following explanations are for things that must be observed in order to prevent harm to people and damage to property.

**The M2 utilizes hazardous voltages. Be sure the drive is properly grounded.**

Before you install the M2, review the safety instructions in this manual.

Failure to follow the safety instructions may result in personal injury or equipment damage.

## 1.4 Safety Symbols

Safety symbols indicate a potential for personal injury or equipment damage if the recommended precautions and safe operating practices are not followed.

The following safety-alert symbols are used on the drive and in the documentation:

Caution

Warning. Dangerous voltage.

Protective earth

Caution, Hot surface

## 1.5 Safety Instructions

### Installation

| | |
|---|---|
| ⚠ | DO NOT subject the product to water, corrosive or flammable gases, and combustibles. |
| | DO NOT use the motor in a place subject to excessive vibration or shock. |
| | Never connect the motor directly to the AC power supply. |
| | DO NOT use cables soaked in water or oil. |
| | DO NOT extrude or pull-off the cable, nor damage the cables as electrical shocks, damages may result |
| | DO NOT block the heat dissipating holes. Please prevent any metal filings drop into the drive when mounting. |
| | DO NOT switch the power supply repeatedly. |
| | DO NOT touch the rotating shaft when the motor is running. |
| | DO NOT strike the motor when mounting as the motor shaft or encoder may be damaged. |
| | In order to prevent accidents, the initial trial run for servo motor should be conducted under no load conditions (separate the motor from its couplings and belts). |
| | Starting the operation without matching the correct parameters may result in servo drive or motor damage, or damage to the mechanical system. |
| | DO NOT Touch either the drive heat sink or the motor and regenerative resister during operation as they may become hot. |
| | DO NOT hold the motor cable during the transportation or mounting. |

### Wiring

| | |
|---|---|
| ⚠ | DO NOT connect any power supplies to the U,V,W terminals. |
| | Install the encoder cable in a separate conduit from the motor power cable to avoid signal noise. |
| | Use multi-stranded twisted-pair wires or multi-core shielded-pair wires for signal, encoder cables. |
| | As a charge may still remain in the drive with hazardous voltage even after power has been removed, Do not touch the terminals when the charge led is still light. |
| | Please observe the specified voltage. |
| | Make sure both the drive and the motor connect to a class 3 ground. |
| | Please ensure grounding wires are securely connected when power up. |

## 1.6 Standards Compliance

The M2 Series AC servo drive has been designed according to standards:

* Electromagnetic compatibility
  Standard EN 61800-3 (2004)
* Electrical Safety: Low voltage directive
  Standard IEC 61800-5-1 (2007)

# 2. Product Description

## 2.1 Unpacking Check

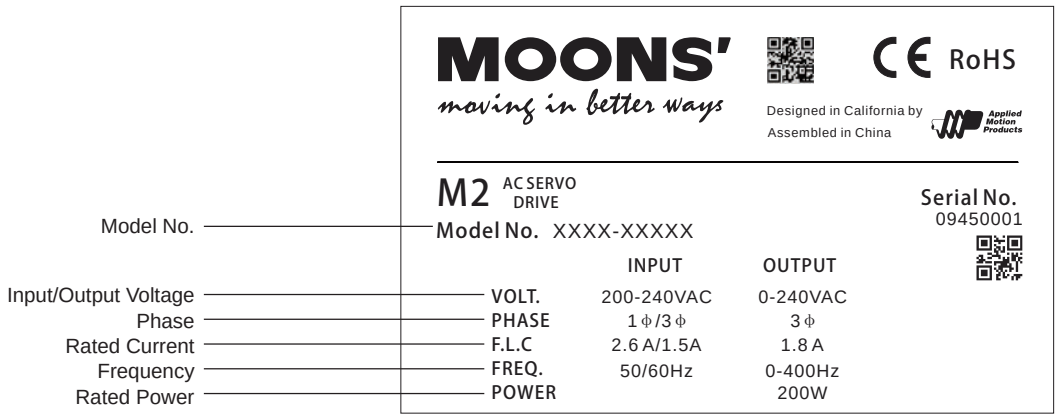
Please refer to this section to confirm the model of servo drive and servo motor .

A complete and workable AC servo system should include the following parts:

1. Matched Servo drive and Servo motor
2. A power cable connect the drive to the servo motor(Optional)
3. An feedback encoder cable connect the drive to the motor (Optional)
4. A mini USB cable  connect the port CN1 to PC for communication.(Optional)
5. 50-PIN connector (For I/O connections, Port CN2) (Optional)
6. 26-PIN connector(For encoder feedback, Port CN3 ) (Optional)
7. 6-PIN connector(IEEE1394, Port CN4, Port CN5)(Optional)
8. RJ-45 connectors (For RS-485 or CANopen communication, Port CN6 and CN7)(Optional)
9. 5-PIN connector (For L1,L2,L3,L1C,L2C)
10. 6-PIN connector(For U,V,W,B1+,B2,B3)

## 2.2 Servo Drive Model Introduction

### 2.2.1 Drive Name Plate Description



## 2.2.2 Drive Model Description

**M2DV - □ □ □ 2 □ ***

M2 Series AC Servo Drive

| Current Code | Continuous Current (RMS) | Boost Current (RMS) |
|---|---|---|
| 1D8 | 1.75A | 5.25A |
| 3D0 | 3.00A | 9.00A |
| 4D5 | 4.50A | 13.50A |

| Voltage Code | Input Voltage |
|---|---|
| 2 | Single/Three-Phases200~240VAC±10%, 50/60Hz |

Customized Specification(If Applicable)

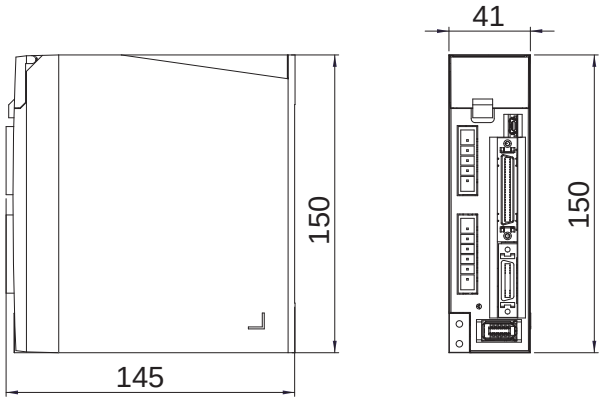
| Communication Type | Configuration | Description | Communication |
|---|---|---|---|
| S | Mini USB | Basic Type | - - - |
| Q | | Q Type | RS-232 |
| R | | Q Type(Modbus/RTU Type) | RS-485 |
| C | | CANopen Type | CANBus |
| IP | | EtherNet/IP Type | EtherNet |
| E | | eSCL Type | EtherNet |

## 2.2.3 Drive specification

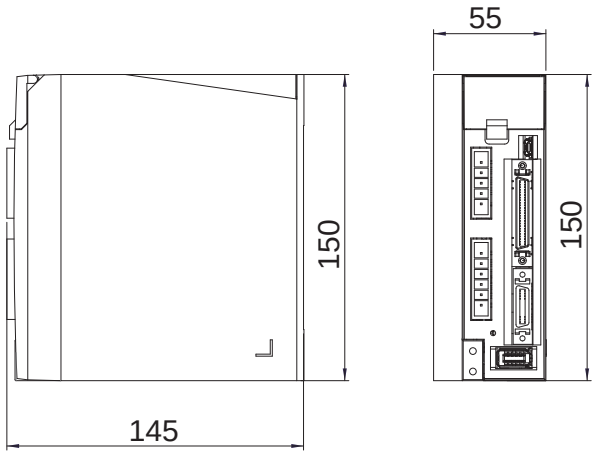
| | | | | |
|---|---|---|---|---|
| Basic Specification | Input Power | 200W | Main Circuit | Single/3-phase, 200 - 240V ±10%, 50/60Hz |
| | | | Control Circuit | Single phase, 200 - 240V ±10%, 50/60Hz |
| | | 400W | Main Circuit | Single/3-phase, 200 - 240V ±10%, 50/60Hz |
| | | | Control Circuit | Single phase, 200 - 240V ±10%, 50/60Hz |
| | | 750W | Main Circuit | Single/3-phase, 200 - 240V ±10%, 50/60Hz |
| | | | Control Circuit | Single phase, 200 - 240V ±10%, 50/60Hz |
| | Withstand voltage | | | Primary to earth: withstand 1500 VAC, 1 min, (sensed current: 20 mA) [220V Input] |
| | Environment | Temperature | | Ambient temperature:0°C to 50°C(If the ambient temperature of servo drive is greater than 45°C, please install the drive in a well-ventilated location)<br>Storage temperature: -20°C to 65°C |
| | | Humidity | | Both operating and storage : 10 to 93%RH or less |
| | | Altitude | | Lower than 1000m |
| | | Vibration | | 1g |
| | Control method | | | IGBT PWM Sinusoidal wave drive |
| | Encoder feedback | | | 2500 line incremental encoder 15-wire or 9-wire |
| | I/O | Control Signal | Input | 8 Configurable Optically isolate digital general inputs, 5-24VDC, max input current 20mA<br>4 Configurable Optically isolate digital high speed inputs, 5-24VDC, max input current 20mA |
| | | | Output | 5 Configurable optically isolated digital outputs, 30VDC, max output current 30mA<br>One motor brake control output, 30VDC 100mA max |
| | | Analog signal | Input | 2 inputs (12Bit A/D:2 input) |
| | | Pulse signal | Input | 2 inputs (Photo-coupler input, Line receiver input)<br>Photocoupler input is compatible with both line driver I/F and open collector I/F.<br>Line receiver input is compatible with line driver I/F. |
| | | | Output | 4 outputs ( Line driver: 3 outputs, open collector: 1 outputs) |
| | Communication | USB Mini | | Connection with PC or 1:1 communication to a host. |
| | | RS232 | | RS-232 Communication |
| | | RS485 | | RS-485 Communication |
| | | CAN bus | | CANopen Communication |
| | | Ethernet | | EtherNET/IP, eSCL |
| | Front panel | | | 1. 4 keys (MODE, UP, DOWN, SET) 2. LED (5-digit) |
| | Regeneration Resistor | | | Built-in regenerative resistor (external resistor is also enabled.) |
| | Control mode | | | (1) Position mode<br>(2) Analog Velocity mode<br>(3) Analog Position mode<br>(4) Position mode<br>(5) Velocity Change mode<br>(6) Command Torque mode<br>(7) Command Velocity mode |
| | Control input | | | (1) Servo-ON input<br>(2) Alarm clear input<br>(3) CW/CCW Limit<br>(4) Pulse& Direction or CW/CCW input<br>(5) Gain Switch<br>(6) Control mode Switch<br>(7) Pulse Inhibition<br>(8) General Input |
| | Control output | | | (1) Alarm output<br>(2) Servo-Ready output<br>(3) External brake release<br>(4) Speed arrival output<br>(5) Torque arrival output<br>(6) Tach Out<br>(7) General Output<br>(8)Position arrival output |

## 2.2.4 Drive Dimensions (Unit: mm)

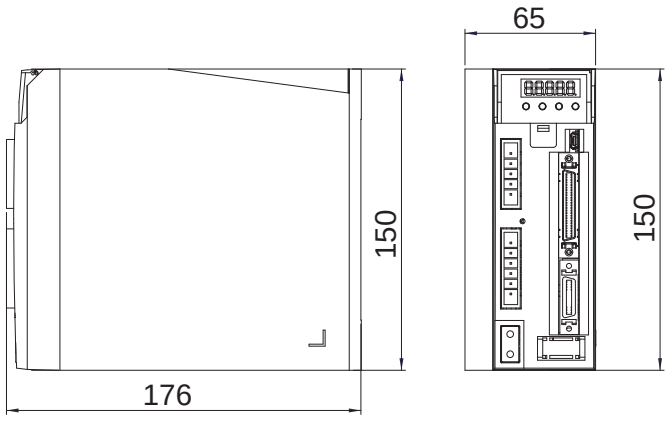
### 2.2.4.1 50W 100W 200W Type




### 2.2.4.2 400W Type

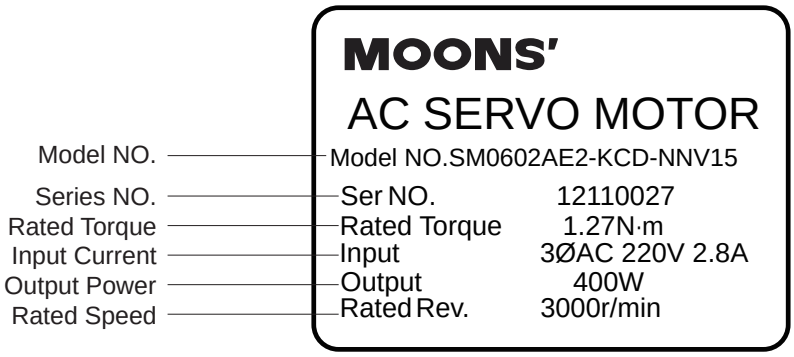



### 2.2.4.3 750W Type

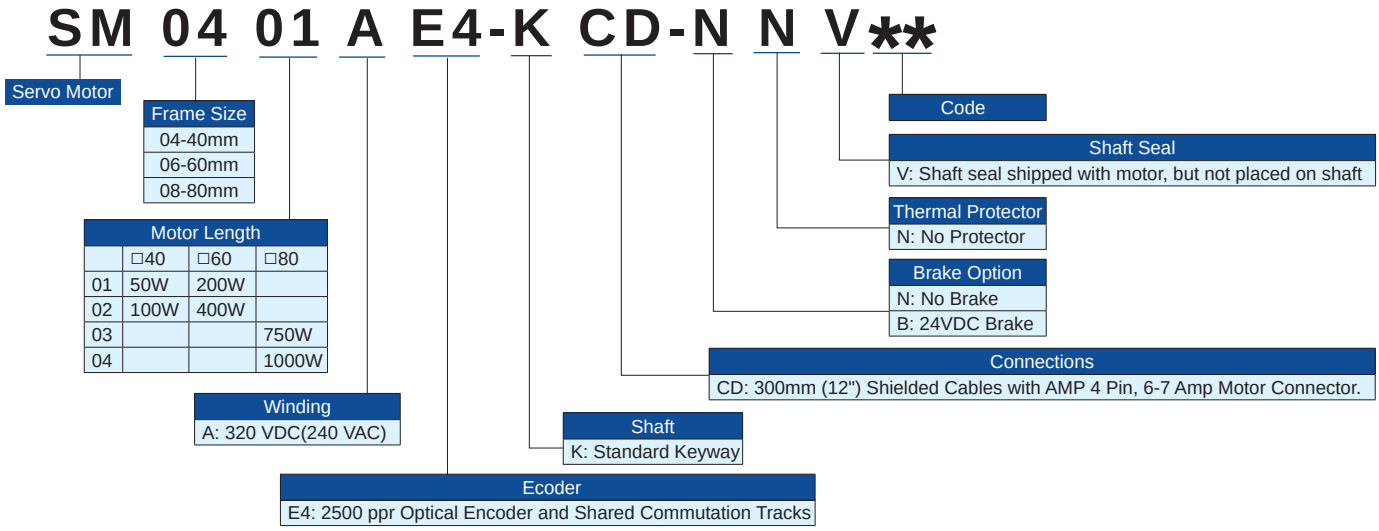


## 2.3 Servo Motor Model Introduction

### 2.3.1 Motor Name Plate Description




### 2.3.2 Motor Model Description



## 2.3.3 Motor Specification And Dimension

### 2.3.3.1 □40mm Specification and Dimension

□ 40mm Series

| | |
|---|---|
| UL File | E465363 |
| Insulation Class | Class B(130℃) |
| IP rating | IP65 (except shaft through hole and cable end connetor) |
| Installation location | Indoors, free from direct sunlight, corrosive gas, inflammable gas |
| Ambient temperature | Operating 0 to 40°C, Storage -20 to 65°C |
| Ambient humidity | 85%RH or lower (free from condensing) |
| Altitude (maximum) | Operating 1,000m |
| Vibration Resistance | 49 $m/s^2$ |
| Rotor Poles | 8 |

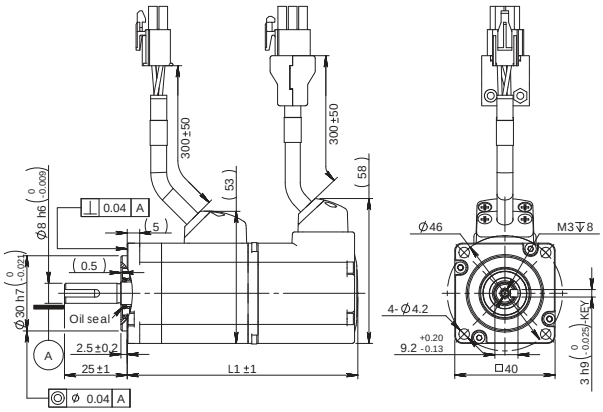
□ 40mm Series

| Series | | SM0401 - 50 Watt | SM0402 - 100 Watt |
|---|---|---|---|
| ^ Preferred Model & Winding Letter | | ^ A | ^ A |
| Base Model Number (with 2500 PPR incremental encoder non-sealed plastic connectors, no brake) | | SM0401 AE2-KCD-NNV | SM0402 AE2-KCD-NNV |
| Rated Output Power | watts | 50 | 100 |
| Rated Speed | rpm | 3000 | 3000 |
| Max. Mechanical Speed | rpm | 6000 | 6000 |
| Rated Torque | Nm | 0.19 | 0.32 |
| Continuous Stall Torque | Nm | 0.2 | 0.34 |
| Peak Torque | Nm | 0.48 | 0.93 |
| Rated Current | A (rms) | 0.7 | 1.2 |
| Continuous Stall Current | A (rms) | 1.75 | 1.27 |
| Peak Current | A (rms) | 1.7 | 3.6 |
| Voltage Constant ±5% | V (rms) / K rpm | 17 | 16.6 |
| Torque Constant ±5% | Nm / A (rms) | 0.283 | 0.271 |
| Winding Resistance (Line-Line) | Ohm ±10% @25°C | 27 | 9.7 |
| Winding Inductance (Line-Line) | mH (typ.) | 26 | 11.5 |
| Inertia (with encoder) | kg m^2 | $0.0232 \times 10^{-4}$ | $0.0428 \times 10^{-4}$ |
| Inertia - With Brake Option | kg m^2 | $0.0298 \times 10^{-4}$ | $0.0494 \times 10^{-4}$ |
| Thermal Resistance (mounted) | °C / W | 2.9 | 2.4 |
| Thermal Time Constant | Minutes | 12 | 14.5 |
| Heat Sink Size | mm | 120 x 120 x 5 Alumnum | 120 x 120 x 5 Alumnum |
| Shaft Load - Axial | (max.) | 50 N / 11 Lb | 50 N / 11 Lb |
| Shaft Load - Radial (End of Shaft) | (max.) | 50 N / 11 Lb | 60 N / 13.5 Lb |
| Weight (with std. encoder) | | 0.4 kg / 0.9 Lb | 0.55 kg / 1.2 Lb |
| Weight - With Brake Option | | 0.65 kg / 1.4 lb | 0.8 kg / 1.8 lb |

Shaft Load: ($L_{10}$ life, 20,000 hours, 2,000 RPM)

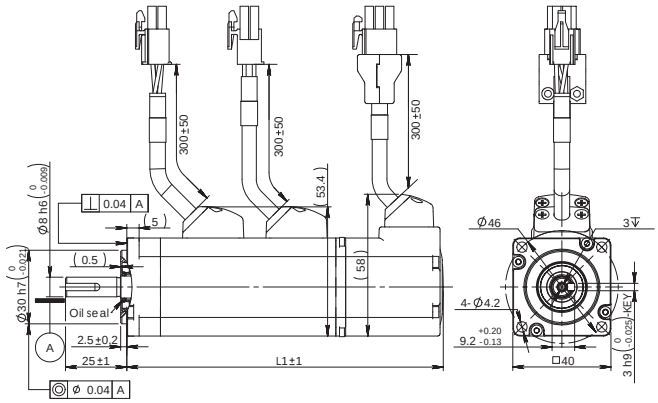
## □ 40mm Dimension

### 1) Motor Dimensions – No Brake: mm



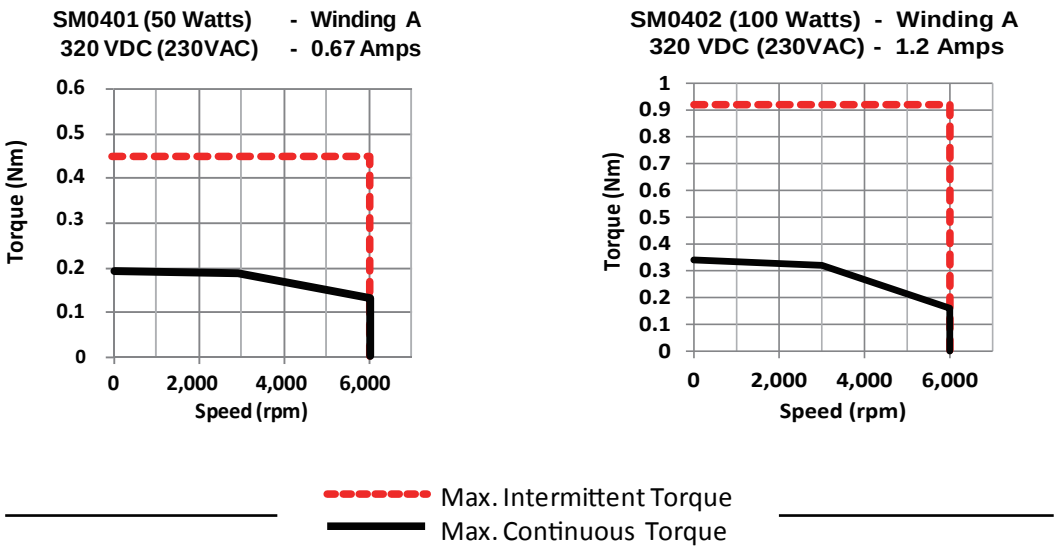

| Without Brake | L1 |
|---|---|
| SM0401AE*-KCD-NNV | 92 |
| SM0402AE*-KCD-NNV | 109 |

### 2) Motor Dimensions – Brake: mm




| With Brake | L1 |
|---|---|
| SM0401AE*-KCD-BNV | 129 |
| SM0402AE*-KCD-BNV | 147 |

## □ 40mm Torque curve



## 2.3.3.2 □60mm Specification and Dimension

### □ 60mm Series

| | |
|---|---|
| UL File | E465363 |
| Insulation Class | Class B(130℃) |
| IP rating | IP65(except shaft through hole and cable end connetor) |
| Installation location | Indoors, free from direct sunlight, corrosive gas, inflammable gas |
| Ambient temperature | Operating 0 to 40°C, Storage -20 to 65°C |
| Ambient humidity | 85%RH or lower (free from condensing) |
| Altitude (maximum) | Operating 1,000m |
| Vibration Resistance | 49 $m/s^2$ |
| Rotor Poles | 8 |

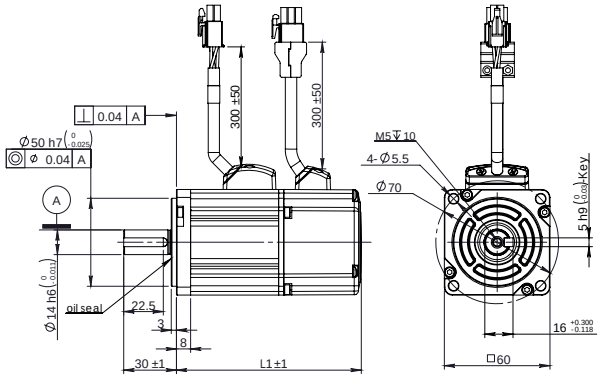
### □ 60mm Series

| Series | | SM0601 - 200 Watt | SM0602 - 400 Watt |
|---|---|---|---|
| ^ Preferred Model & Winding Letter | | ^ A | ^ A |
| Base Model Number (with 2500 PPR incremental encoder non-sealed plastic connectors, no brake) | | SM0601 AE2-KCD-NNV | SM0602 AE2-KCD-NNV |
| Rated Output Power | watts | 200 | 400 |
| Rated Speed | rpm | 3000 | 3000 |
| Max. Mechanical Speed | rpm | 6000 | 6000 |
| Rated Torque | Nm | 0.64 | 1.27 |
| Continuous Stall Torque | Nm | 0.68 | 1.27 |
| Peak Torque | Nm | 1.9 | 3.8 |
| Rated Current | A (rms) | 1.5 | 2.7 |
| Continuous Stall Current | A (rms) | 1.5 | 2.7 |
| Peak Current | A (rms) | 4.5 | 8.1 |
| Voltage Constant ±5% | V (rms) / K rpm | 27.2 | 29 |
| Torque Constant ±5% | Nm / A (rms) | 0.432 | 0.484 |
| Winding Resistance (Line-Line) | Ohm ±10% @25°C | 8.6 | 3.7 |
| Winding Inductance (Line-Line) | mH | 25 | 12.9 |
| Inertia (with encoder) | kg m^2 | $0.165 \times 10^{-4}$ | $0.1272 \times 10^{-4}$ |
| Inertia - With Brake Option | kg m^2 | $0.22 \times 10^{-4}$ | $0.326 \times 10^{-4}$ |
| Thermal Resistance (mounted) | °C / W | 1.9 | 1.43 |
| Thermal Time Constant | Minutes | 15 | 21 |
| Heat Sink Size | mm | 180 x 180 x 5 Alumnum | 180 x 180 x 5 Alumnum |
| Shaft Load - Axial | (max.) | 70 N / 15 Lb | 70 N / 15 Lb |
| Shaft Load - Radial (End of Shaft) | (max.) | 200 N / 45 Lb | 240 N / 54 Lb |
| Weight (with std. encoder) | | 1.1 kg / 2.3 lb | 1.4 kg / 3.1 lb |
| Weight - With Brake Option | | 1.6 kg / 3.5 lb | 1.9 kg / 4.2 lb |

Shaft Load: ($L_{10}$ life, 20,000 hours, 2,000 RPM)

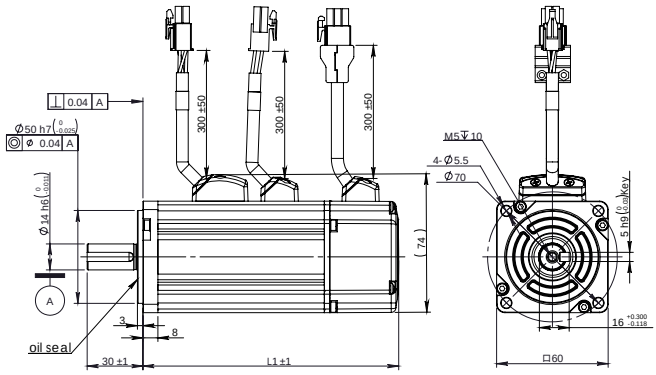
## □ 60mm Dimension

### 1) Motor Dimensions – No Brake: mm



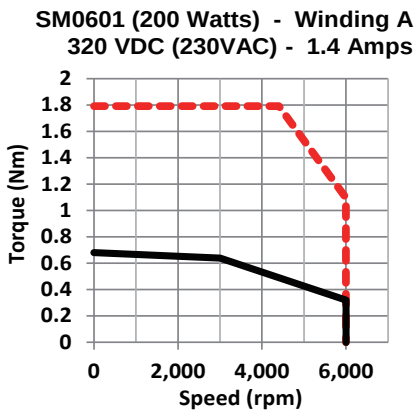

| Without Brake | L1 |
|---|---|
| SM0601AE*-KCD-NNV | 105 |
| SM0602AE*-KCD-NNV | 118 |

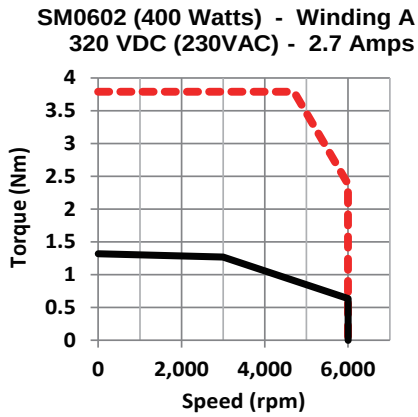
### 2) Motor Dimensions – Brake: mm




| With Brake | L1 |
|---|---|
| SM0601AE*-KCD-BNV | 145 |
| SM0602AE*-KCD-BNV | 158 |

## □ 60mm Torque curve

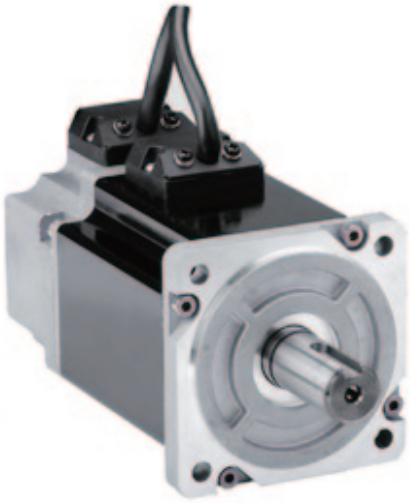



Max. Intermittent Torque
Max. Continuous Torque

### 2.3.3.3 □80mm Specification and Dimension

#### □ 80mm Series



| | |
|---|---|
| UL File | E465363 |
| Insulation Class | Class B(130℃) |
| IP rating | IP65(except shaft through hole and cable end connetor) |
| Installation location | Indoors, free from direct sunlight, corrosive gas, inflammable gas |
| Ambient temperature | Operating 0 to 40°C, Storage -20 to 65°C |
| Ambient humidity | 85%RH or lower (free from condensing) |
| Altitude (maximum) | Operating 1,000m |
| Vibration Resistance | 49 $m/s^2$ |
| Rotor Poles | 8 |

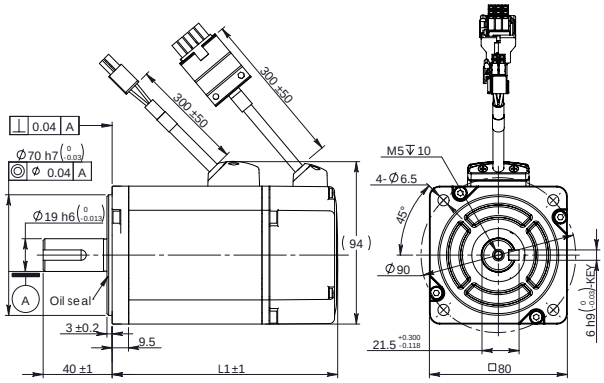
#### □ 80mm Series

| Series | | SM0803 - 750 Watt |
|---|---|---|
| ^ Preferred Model & Winding Letter | | ^ A |
| Base Model Number (with 2500 PPR incremental encoder non-sealed plastic connectors, no brake) | | SM0803 AE2-KCD-NNV |
| Rated Output Power | watts | 750 |
| Rated Speed | rpm | 3000 |
| Max. Mechanical Speed | rpm | 5500 |
| Rated Torque | Nm | 2.4 |
| Continuous Stall Torque | Nm | 2.6 |
| Peak Torque | Nm | 6.9 |
| Rated Current | A (rms) | 4.5 |
| Continuous Stall Current | A (rms) | 4.9 |
| Peak Current | A (rms) | 13.5 |
| Voltage Constant ±5% | V (rms) / K rpm | 36.6 |
| Torque Constant ±5% | Nm / A (rms) | 0.543 |
| Winding Resistance (Line-Line) | Ohm ±10% @25°C | 1.47 |
| Winding Inductance (Line-Line) | mH | 8.2 |
| Inertia (with encoder) | kg m^2 | $0.89 \times 10^{-4}$ |
| Inertia - With Brake Option | kg m^2 | $0.97 \times 10^{-4}$ |
| Thermal Resistance (mounted) | °C / W | 1.04 |
| Thermal Time Constant | Minutes | 22 |
| Heat Sink Size | mm | 240 x 240 x 6 Alumnum |
| Shaft Load - Axial | (max.) | 90 N / 20 Lb |
| Shaft Load - Radial (End of Shaft) | (max.) | 270 N / 60 Lb |
| Weight (with std. encoder) | | 2.6 kg / 5.8 lb |
| Weight - With Brake Option | | 3.4 kg / 7.6 lb |

Shaft Load: ($L_{10}$ life, 20,000 hours, 2,000 RPM)

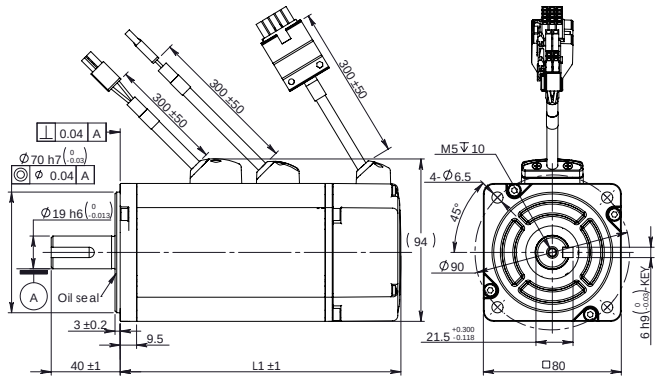
## □ 80mm Dimension

### 1) Motor Dimensions – No Brake: mm



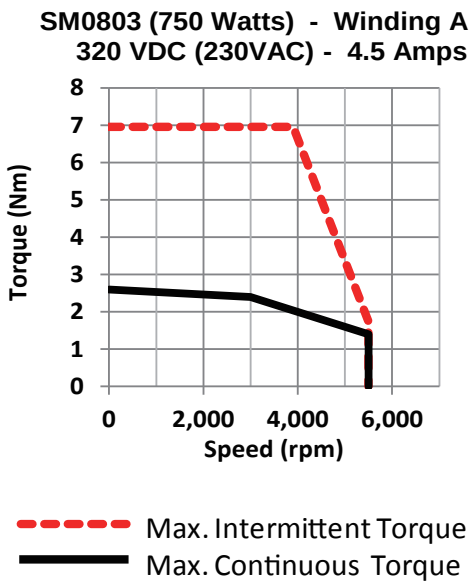

| Without Brake | L1 |
|---|---|
| SM0803AE★-KCD-NNV | 131 |

### 2) Motor Dimensions – Brake: mm




| With Brake | L1 |
|---|---|
| SM0803AE★-KCD-BNV | 178 |

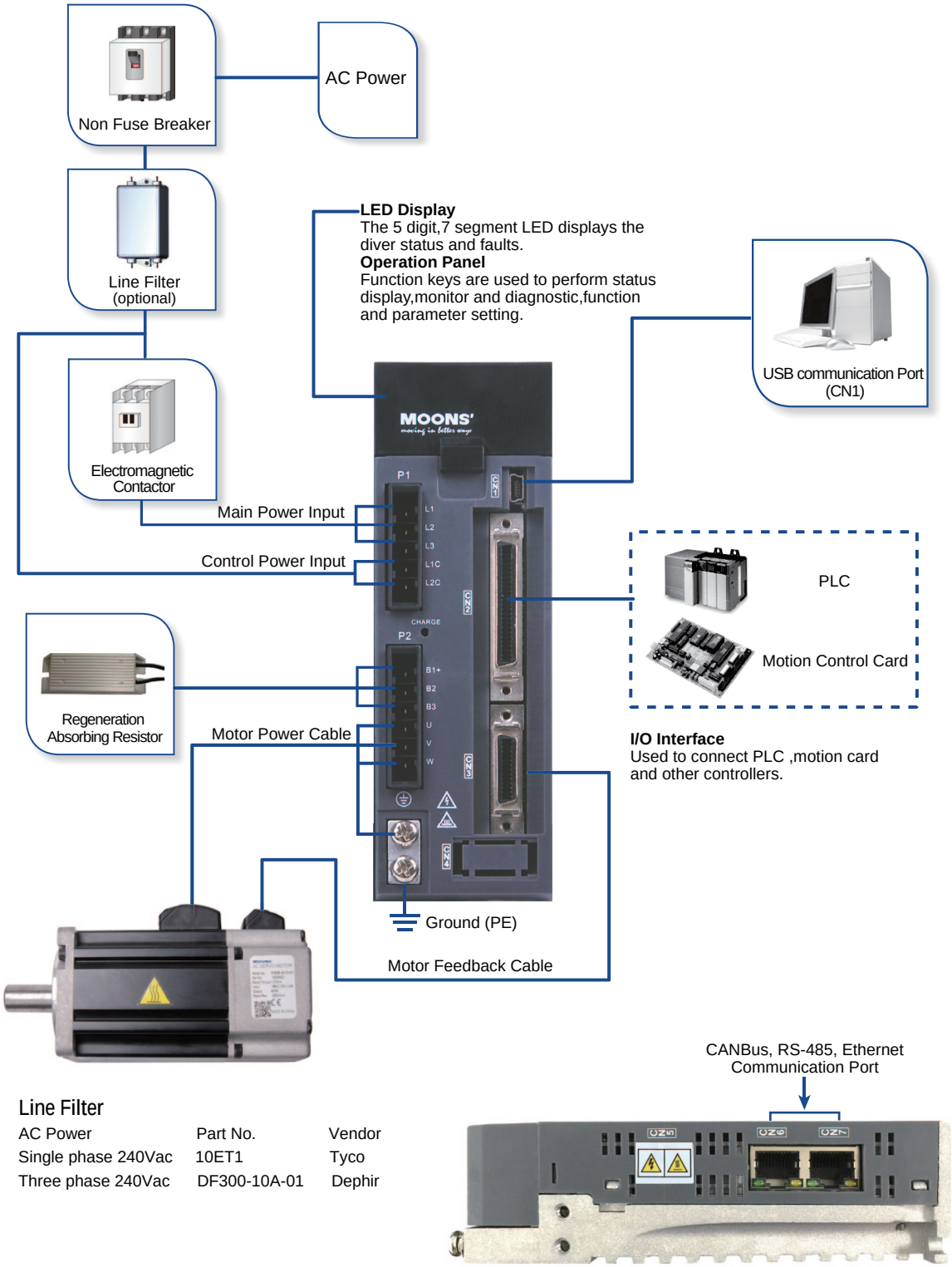
## □ 80mm Torque Curve



## 2.4 Servo Drive and Servo Motor Combinations

| | | Specificatioon | | 50W | 100W | 200W | 400W | 750W |
|---|---|---|---|---|---|---|---|---|
| | | | | Motor Model Numbers | | | | |
| AC Servo Motor | | 2500ppr Increment Encoder (9PIN AMP connector) | Without Brake | SM0401AE4-KCD-NNV09 | SM0402AE4-KCD-NNV09 | SM0601AE4-KCD-NNV09 | SM0602AE4-KCD-NNV09 | SM0803AE4-KCD-NNV09 |
| | | | With Brake | SM0401AE4-KCD-BNV09 | SM0402AE4-KCD-BNV09 | SM0601AE4-KCD-BNV09 | SM0602AE4-KCD-BNV09 | SM0803AE4-KCD-BNV09 |
| | | Rated Speed | (RPM) | 3000 | | | | |
| | | Maximum Speed | (RPM) | 6000 | | | | |
| | | Rated Torque | (N•m) | 0.19 | 0.32 | 0.64 | 1.27 | 2.4 |
| | | Maximum Torque | (N•m) | 0.48 | 0.93 | 1.9 | 3.8 | 6.9 |
| | | Rated Current | (A) | 0.7 | 1.2 | 1.5 | 2.75 | 4.5 |
| | | Maximum Current | (A) | 1.75 | 3.6 | 4.5 | 8.3 | 13.5 |
| | | Rotor Inertia | $Kg•m^2$ | $0.0232\times10^{-4}$ *$0.0298\times10^{-4}$ (*With Brake) | $0.0428\times10^{-4}$ *$0.0494\times10^{-4}$ (*With Brake) | $0.165\times10^{-4}$ *$0.22\times10^{-4}$ (*With Brake) | $0.272\times10^{-4}$ *$0.326\times10^{-4}$ (*With Brake) | $0.89\times10^{-4}$ *$0.97\times10^{-4}$ (*With Brake) |
| | | Insulation Class | | Class B | | | | |
| | | Protection Class | | IP65(except shaft through hole and cable end connetor) | | | | |
| | | Oil Seal | | With Oil seal | | | | |
| AC Servo Drive | | | | Drive Model Numbers | | | | |
| | Pulse&Direction Type | USB Mini | Basic Type | M2DV-1D82S | M2DV-1D82S | M2DV-1D82S | M2DV-3D02S | M2DV-4D52S |
| | | | Q Type | M2DV-1D82Q | M2DV-1D82Q | M2DV-1D82Q | M2DV-3D02Q | M2DV-4D52Q |
| | Fieldbus Type | RS-485 | SCL | M2DV-1D82R | M2DV-1D82R | M2DV-1D82R | M2DV-3D02R | M2DV-4D52R |
| | | | Modbus RTU | | | | | |
| | | CAN | CANopen | M2DV-1D82C | M2DV-1D82C | M2DV-1D82C | M2DV-3D02C | M2DV-4D52C |
| | | Ethernet | Ethernet/IP | M2DV-1D82IP | M2DV-1D82IP | M2DV-1D82IP | M2DV-3D02IP | M2DV-4D52IP |
| | | | eSCL | M2DV-1D82E | M2DV-1D82E | M2DV-1D82E | M2DV-3D02E | M2DV-4D52E |

## 2.5 System Configuration




### Line Filter

| AC Power | Part No. | Vendor |
|---|---|---|
| Single phase 240Vac | 10ET1 | Tyco |
| Three phase 240Vac | DF300-10A-01 | Dephir |

# 3. Installation

## 3.1 Storage Conditions

Some Storage suggestions are followed:

- Correctly packaged and store in a clean and dry ,avoid direct sunlight
- Store within an ambient temperature range of -20℃ to +65℃
- Store within a relative humidity rang of 10% to 85% and non-condensing
- DO NOT store in a place subjected to corrosive gasses

## 3.2 Installation Conditions

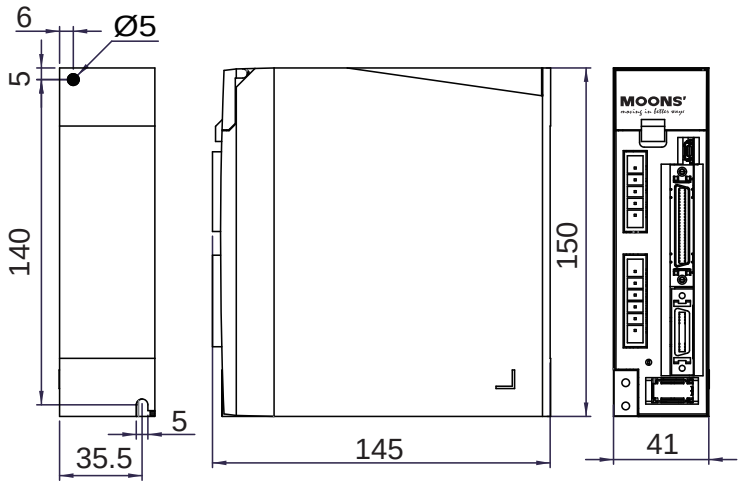
The operation ambient conditions are followed:

- Temperature range of 0℃ to 50℃. If the ambient temperature of servo drive is greater than 45℃, please install the drive in a well-ventilated location.

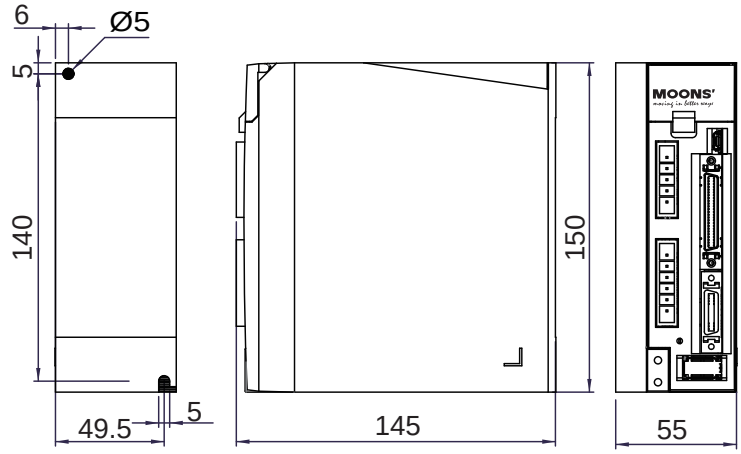
  The ambient temperature of servo dive for long-term reliability should be under 45℃.
- The servo drive and motor will generate heat. If they are installed in a control panel, please ensure sufficient space around the units for heat dissipation.
- Operation within a relative humidity rang of 10%to 93% and non-condensing
- The vibration 1g
- DO NOT mount the servo drive and motor in a location subjected to corrosive gasses or flammable gases, and combustibles.
- Please mount the servo drive and motor to an indoor electric control cabinet without liquid and direct sunlight
- DO NOT mount the servo drive and motor in a location subjected to airborne dust.

## 3.3 Drive Dimensions (Unit: mm)

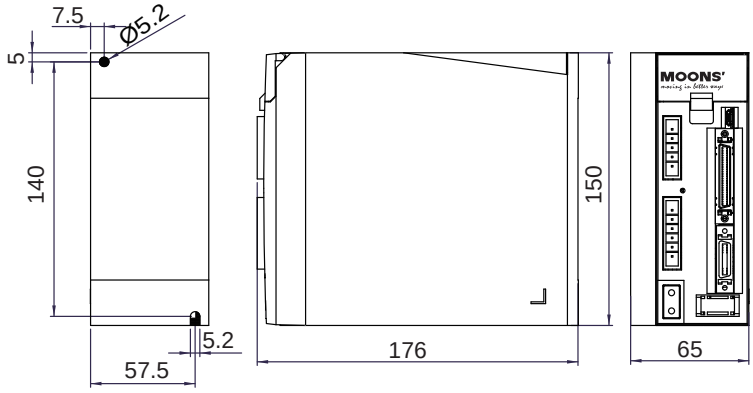
### 3.3.1 50W 100W 200W Type




### 3.3.2 400W Type

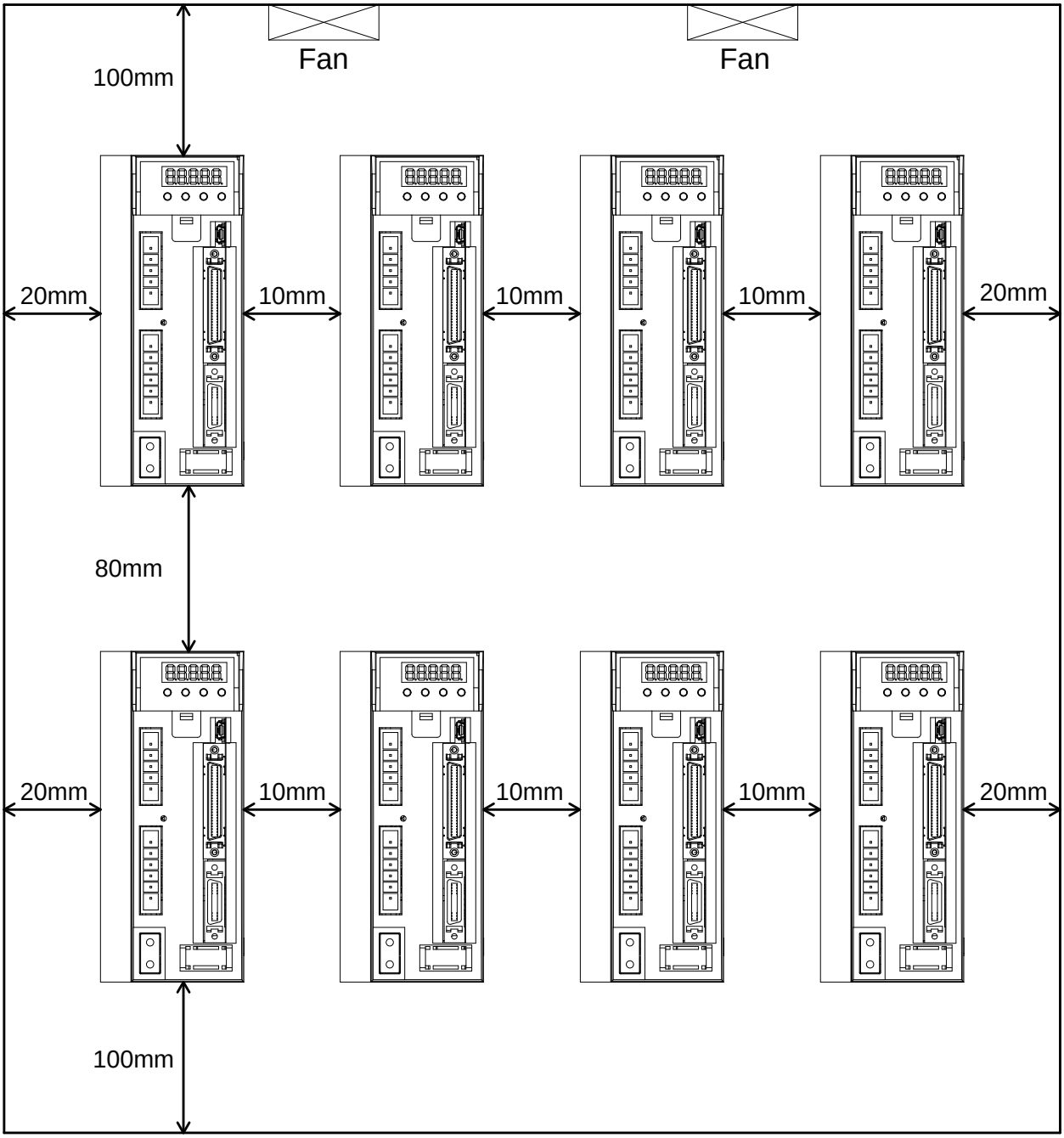



### 3.3.3 750W Type



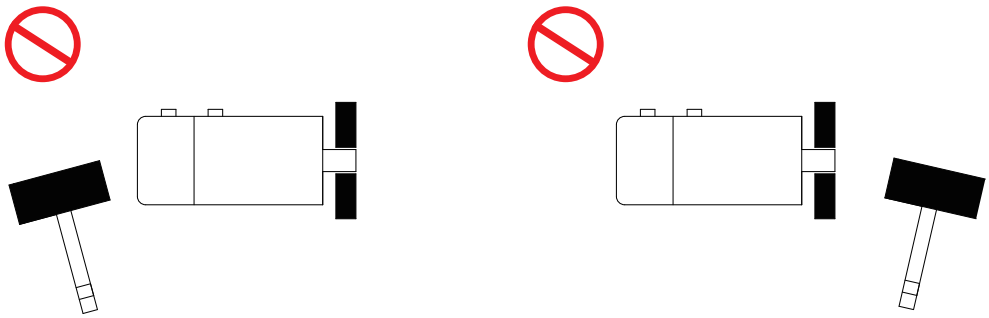
## 3.4 Installation Space

- Incorrect installation may result in a drive malfunction or premature failure of the drive and or motor. Please follow the guidelines in this manual when installing the servo drive and motor.
- The M2 servo drive should be mounted perpendicular to the wall or in the control panel.
- In order to ensure the drive is well ventilated, ensure that the all ventilation holes are not obstructed and sufficient free space is given to the servo drive, and a cooling fan is mounted in the control panel.
- Please ensure grounding wires are securely connected



## 3.5 Motor Installation

- DO NOT strike the motor when mounting as the motor shaft or encoder may be damaged.

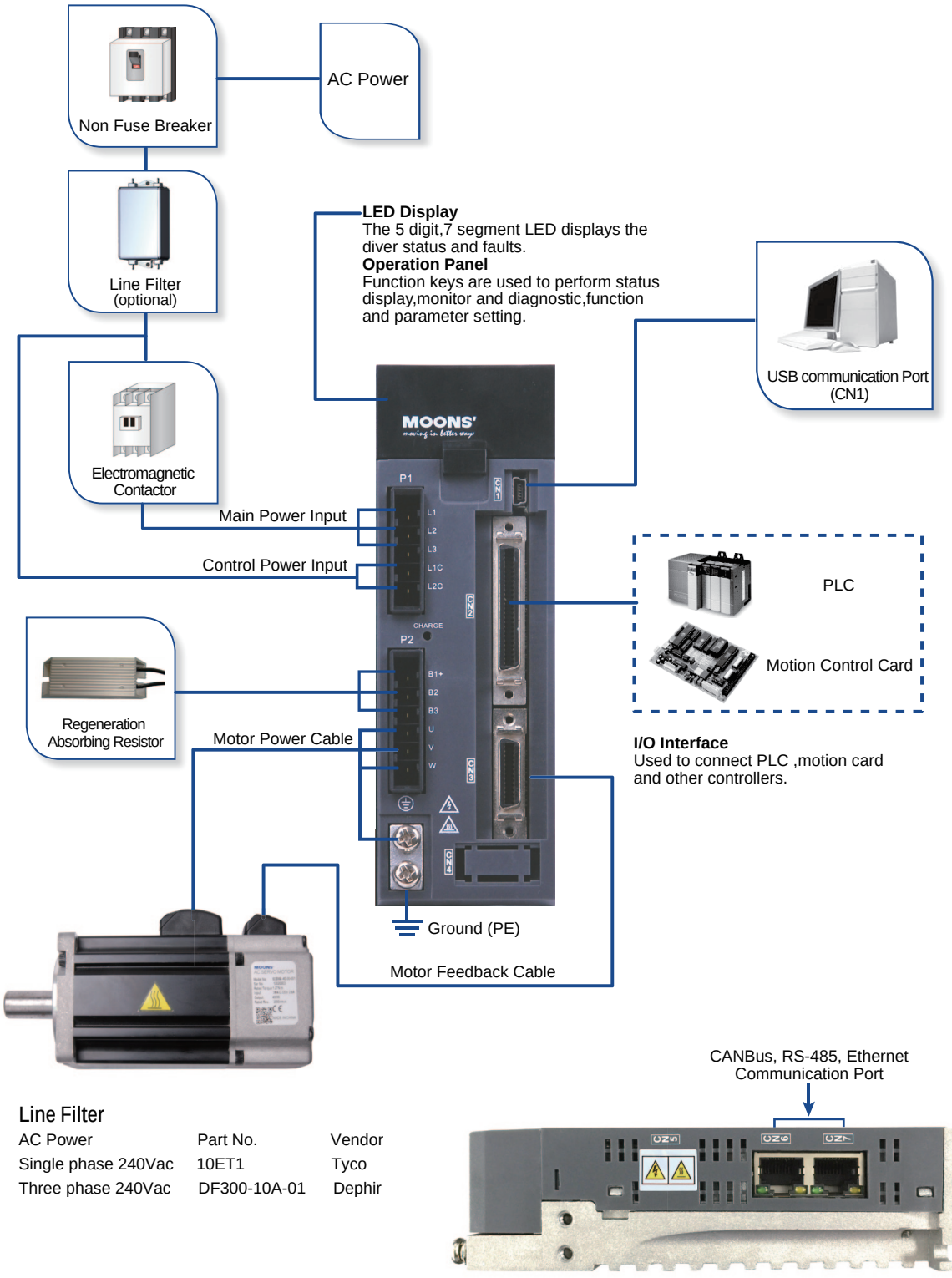


- DO NOT use cables soaked in water or oil.
- Avoid a stress application to the cable outlet and connecting portion by bending.
- Please use flexible cables when using cable carrier, make sure the minimum cable bending diameter is 200mm.
- The shaft through hole and cable end connector is not IP65 design. Make sure to prevent any liquid or oil into the motor from these parts.

# 4. Connections and Wiring

## 4.1 Connecting to Peripheral Devices

### 4.1.1 System Configuration




**Line Filter**

| AC Power | Part No. | Vendor |
|---|---|---|
| Single phase 240Vac | 10ET1 | Tyco |
| Three phase 240Vac | DF300-10A-01 | Dephir |

### 4.1.2 Servo Drive Connectors and Terminals

<table>
<tr><th>Terminal Identification</th><th>Description</th><th colspan="3">Details</th></tr>
<tr><td rowspan="2">P1</td><td>L1、L2、L3</td><td colspan="3">Used to connect three-phase AC main circuit power</td></tr>
<tr><td>L1C、L2C</td><td colspan="3">Used to connect single-phase AC for control circuit power</td></tr>
<tr><td rowspan="6">P2</td><td rowspan="4">U、V、W</td><td colspan="3">Used to connect servo motor</td></tr>
<tr><td>Terminal Symbol</td><td>Wire color</td><td>Description</td></tr>
<tr><td>U</td><td>Red</td><td rowspan="3">Connecting to three-phase motor main circuit cable</td></tr>
<tr><td>V</td><td>Yellow</td></tr>
<tr><td>W</td><td>Blue</td></tr>
<tr><td rowspan="2">B1+、B2、B3<br>Regenerative resister terninals</td><td>Internal Resister</td><td colspan="2">Ensure the circuit is closed between B2 and B3, and the circuit is open between B1+ and B3.</td></tr>
<tr><td>External Resister</td><td colspan="2">Ensure the circuit is open between B2 and B3, and connect the external regenerative resister between B1+ and B2.</td></tr>
<tr><td>CN1</td><td>Communication Port</td><td colspan="3">User to connect personal computer</td></tr>
<tr><td>CN2</td><td>I/O Connector</td><td colspan="3">Used to connect external controllers.</td></tr>
<tr><td>CN3</td><td>Encoder Feedback Connector</td><td colspan="3">Used to connect encoder of servo motor.</td></tr>
<tr><td>CN4</td><td>Reserved</td><td colspan="3"></td></tr>
<tr><td>CN5</td><td>Reserved</td><td colspan="3"></td></tr>
<tr><td>CN6</td><td>RS-485/CANopen<br>*RS-232 Communication Port</td><td colspan="3">RJ45 connector, Daisy Chain, Used for RS-485/CANopen<br>*RS-232 Communication Port (-Q Type Only)</td></tr>
<tr><td>CN7</td><td>RS-485/CANopen<br>Communication Port</td><td colspan="3">RJ45 connector, Daisy Chain, Used for RS-485/CANopen Communication</td></tr>
</table>

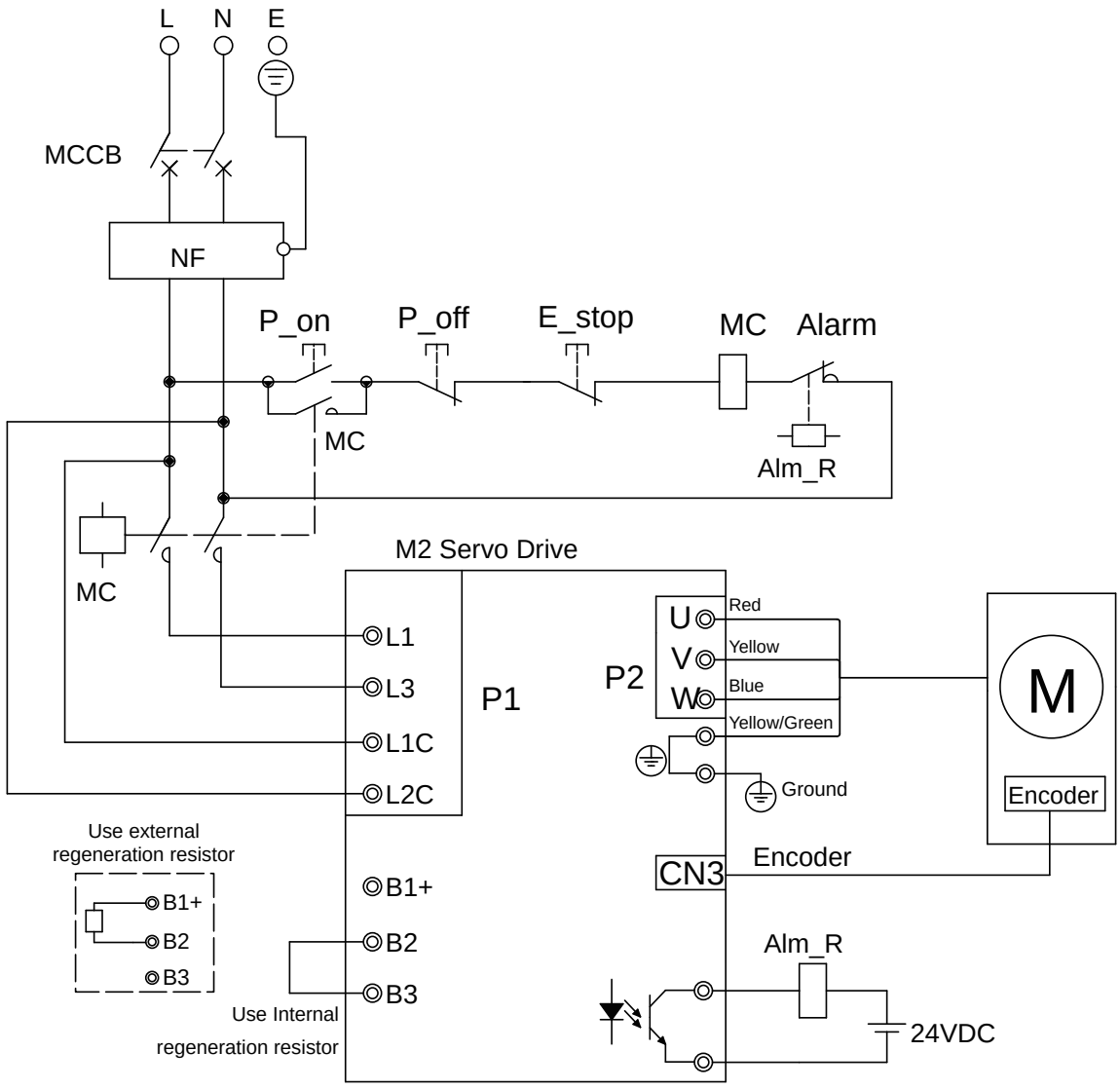
### 4.1.3 Connections and Wiring Notes

- Please ensure grounding wires are securely connected, wires with more than 2.0mm$^2$ on sectional area is recommended.
- Grounding method must be single point grounding.
- Ensure L1/L2/L3 and L1C/L2C are correctly wired, and voltage supplies are within the specification range.
- Ensure U/V/W is following the order of RED/YELLOW/BULE. Wrong connections will cause motor stop rotation, or wrong rotatory directions.
- Isolation transformer or EMI filter is recommended on drive's power supply to ensure drive's safety and improve its anti-interference level.
- Please setup an emergence stop circuitry to switch off the power supply when fault occurs.
- Please DO NOT touch drive or motor's connector terminals 5 minutes after drive and motor is powered off. There are electrical charge components in the circuitry. Therefore, even power is off, there might still be hazardous voltages within the circuitry, before its total discharge.
- Install the encoder cables in a separate conduit from the motor power cables to avoid signal noise. Separate the conduits by 30cm (11.8inches) above.
- Use multi-stranded twisted-pair wires or multi-core shielded-pair wires for signal, encoder feedback cables.
- The maximum length of signal input/output cable is 5 meters, and the maximum length of encoder (PG) feedback cables is 15 meters.

### 4.1.4 Wiring Methods For Power supply P1

220V AC servo drive supports single phase or three phase wiring method. Three phase wiring method for 750W or above drives is recommended.

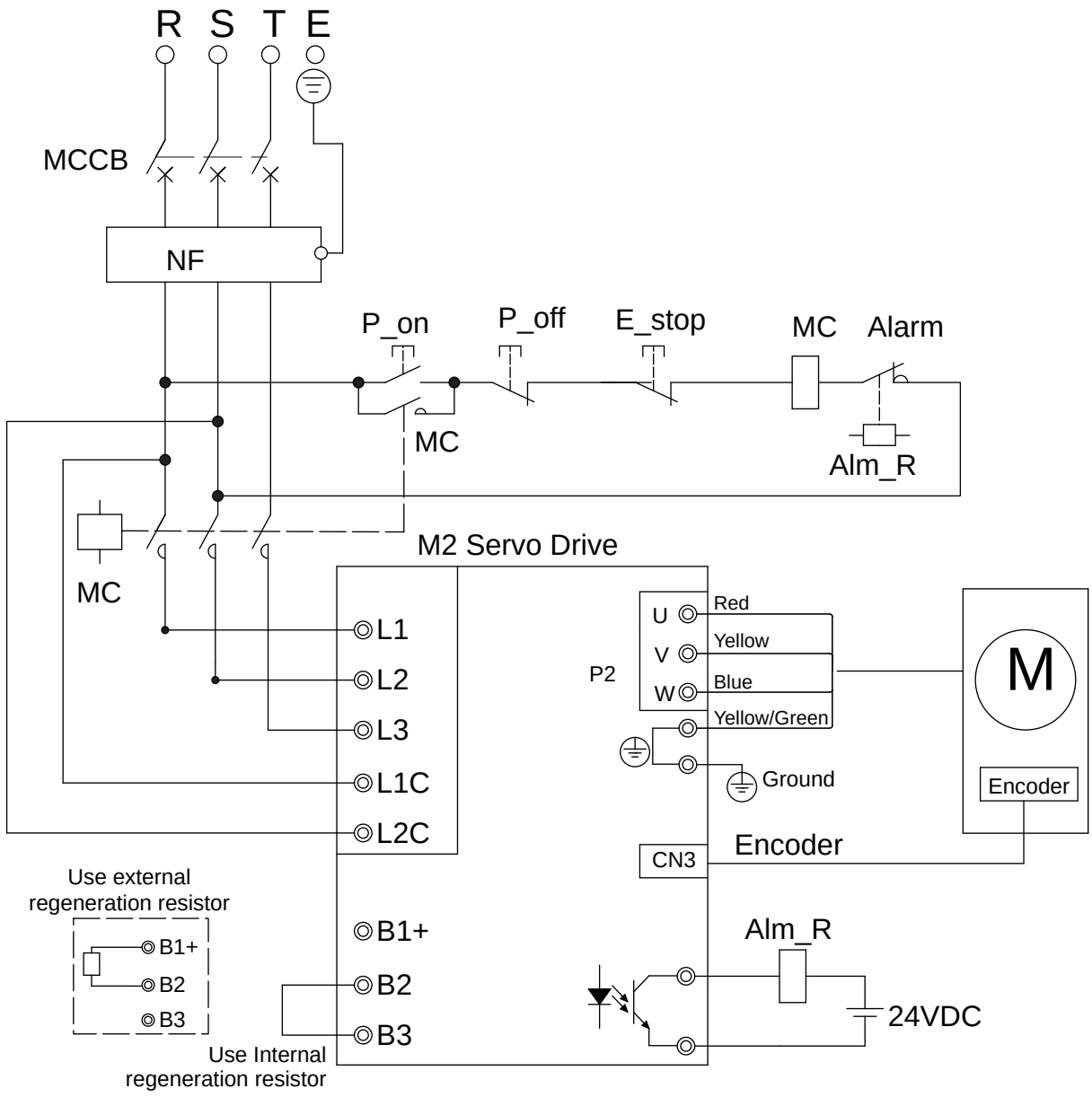
#### 4.1.4.1 Single-Phase Power Supply Connection (AC220V)




Note:

| Symbol | Description |
|---|---|
| MCCB | Circuit Breaker |
| NF | Noise Filter |
| P_on | Power On Switch |
| P_off | Power Off Switch |
| E_stop | Emergency Stop Switch |
| MC | Magnetic Contactor |
| Alm_R | Alarm Relay |
| Alarm | Alarm Relay Contactor |

### 4.1.4.2 Three-Phase Power Supply Connection (AC220V)

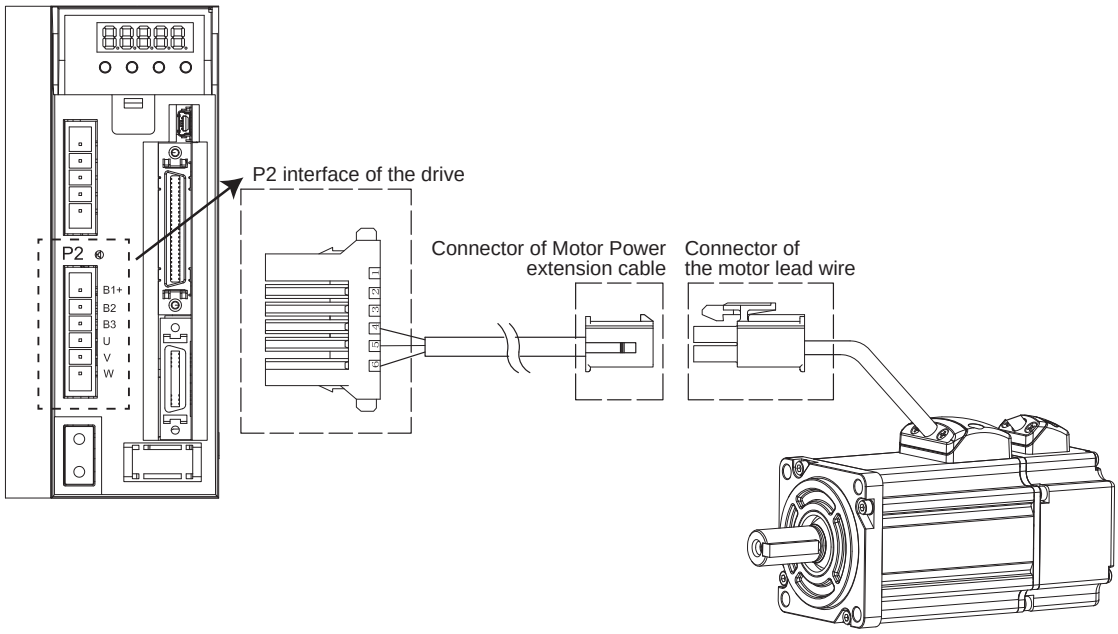



Note:

| Symbol | Description |
|---|---|
| MCCB | Circuit Breaker |
| NF | Noise Filter |
| P_on | Power On Switch |
| P_off | Power Off Switch |
| E_stop | Emergency Stop Switch |
| MC | Magnetic Contactor |
| Alm_R | Alarm Relay |
| Alarm | Alarm Relay Contactor |

## 4.2 Wiring to the Connector, P2

### 4.2.1 Motor Power Cable Configuration

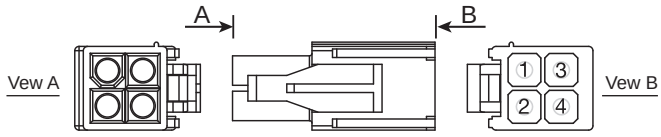



| PIN | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Signal | U | V | W | PE |
| Colour | Red | Yellow | Blue | Yellow/Green |

**NOTE: Please refer to section 4.2.2 Motor Power Cable Connector Specifications for details**

### 4.2.2 Motor Power Cable Connector Specifications

◆ PIN Assignment

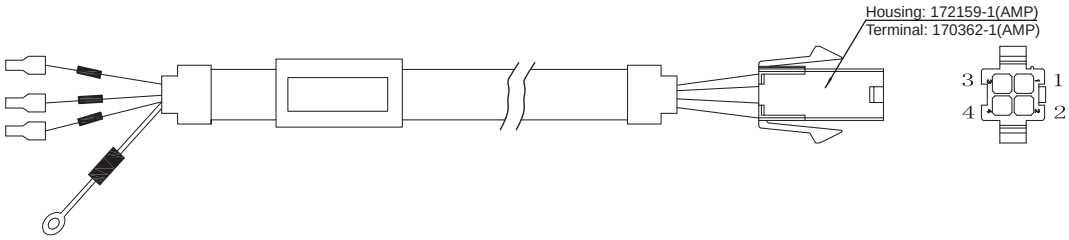



| Type | Motor Side(Plug) | Plug-in(Housing) |
|---|---|---|
| Housing | AMP 172167-1 | AMP 172159-1 |
| Terminal | AMP 170360-1 | AMP 170362-1 |

◆ Model of Motor Connector

| Drive Side(P2) | Signal | Colour | Motor Side(Housing) |
|---|---|---|---|
| (JST) S06B-F32SK-GGXR | | | AMP 172159-1 |
| 4 | U | Red | 1 |
| 5 | V | Yellow | 2 |
| 6 | W | Blue | 3 |
| Grounding Screw | PE | Yellow/Green | 4 |

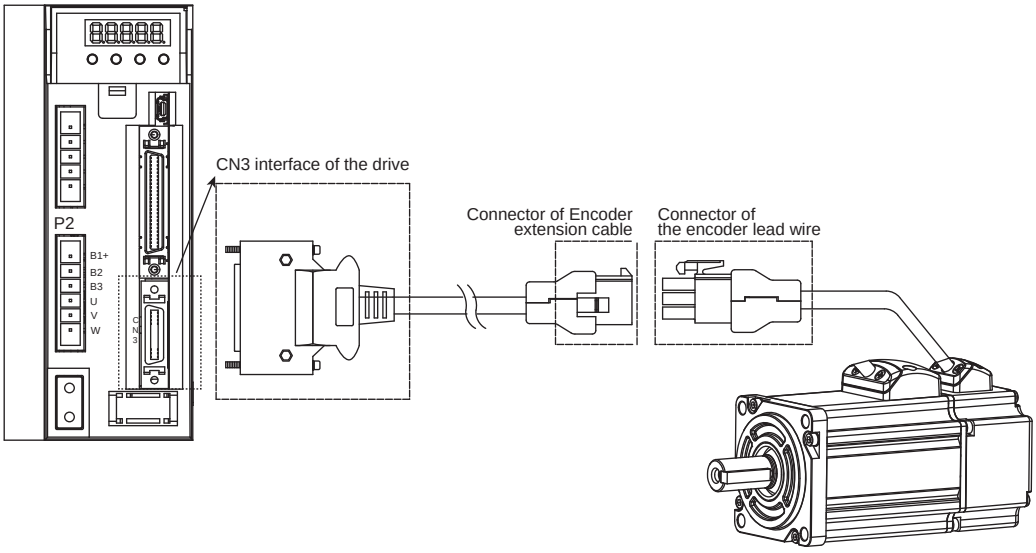
### 4.2.3 Wiring Diagram Of Motor Extend Cable




**NOTE: Ensure U/V/W is following the order of RED/YELLOW/BULE. Wrong connections will cause motor stop rotation, or wrong rotary directions.**

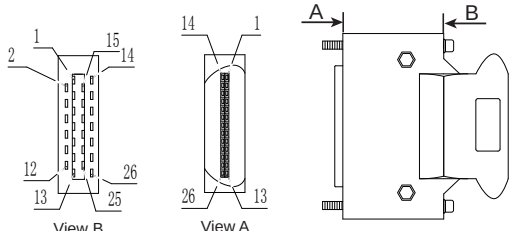
## 4.3 Encoder Connector CN3

### 4.3.1 Motor Encoder Feedback Cable Configuration




**NOTE: Please refer to section 4.1.5.2 Motor Power Cable Connector Specifications for details**

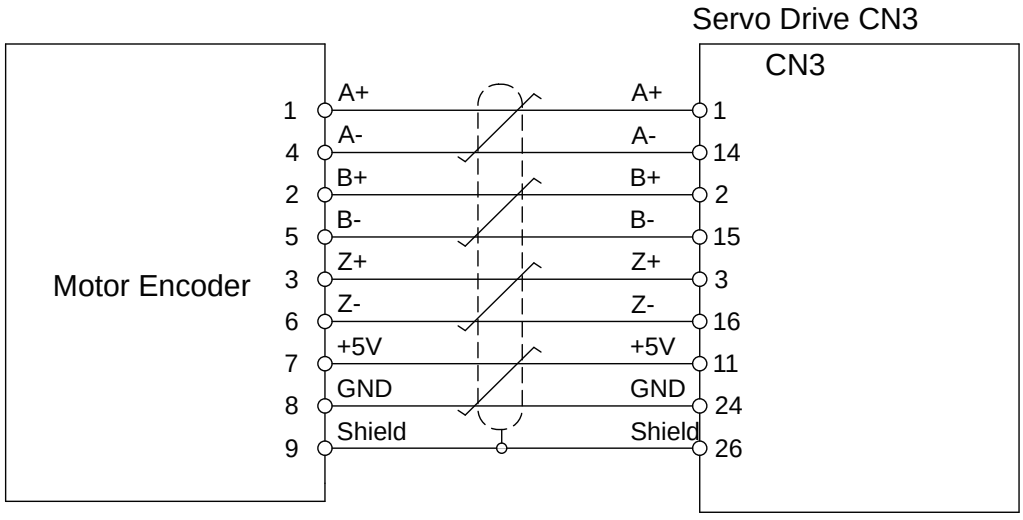
### 4.3.2 The Layout of CN3 Connector




| Pin NO. | Symbol | Description |
|---|---|---|
| 1 | A+ | Encoder A+ |
| 2 | B+ | Encoder B+ |
| 3 | Z+ | Encoder Z+ |
| 4 | U+ | Hall U+ |
| 5 | W+ | Hall W+ |
| 6 | U- | Hall U- |
| 7 | W- | Hall W- |
| 11 | Encoder +5V | Encoder power supply +5V |
| 13 | Encoder +5V | Encoder power supply +5V |
| 14 | A- | Encoder A- |
| 15 | B- | Encoder B- |
| 16 | Z- | Encoder Z- |
| 17 | V+ | Hall V+ |
| 19 | V- | Hall V- |
| 24 | GND | Encoder power supply ground |
| 26 | Shield | Shield |

### 4.3.3 Connect to Motor Encoder

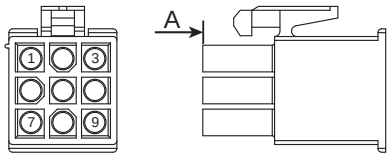
#### A. Connect to 2500ppr Increment Encoder (9PIN AMP connector)



### 4.3.4 Specifications of Encoder Connector

#### A. 9 PIN AMP Connector

PIN Assignment



View A

| PIN# | Signal | Colour |
|---|---|---|
| 1 | U+/A+ | Blue |
| 2 | V+/B+ | Green |
| 3 | W+/Z+ | Yellow |
| 4 | U-/A- | Yellow/Black |
| 5 | V-/B- | Green/Black |
| 6 | W-/Z- | Yellow/Black |
| 7 | +5V | Red |
| 8 | GND | Black |
| 9 | Shield | Shield |

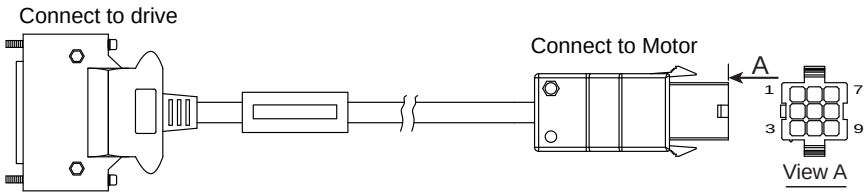
**NOTE: The HALL signal U/V/W ONLY appears for 1.5 second after encoder powered on, it will then covert to A/B/Z signals.**

Specification of 9PIN AMP Connector

| Type | Plug of the Motor | Housing for the motor |
|---|---|---|
| Housing | AMP 172169-1 | AMP 172161-1 |
| Terminal | AMP 770835-1 | AMP 770834-1 |

## 4.3.5 Wiring Diagram of Motor Encoder Extend Cable

### A. Diagram of 9PIN Encoder Cable




| Drive Side | Signal | Colour | Housing for the motor |
|---|---|---|---|
| 3M 26PIN | | | AMP 172161-1 |
| 1 | A+/U+ | Blue | 1 |
| 2 | B+/V+ | Green | 2 |
| 3 | Z+/W+ | Yellow | 3 |
| 14 | A-/U- | Yellow/Black | 4 |
| 15 | B-/V- | Green/Black | 5 |
| 16 | Z-/W- | Yellow/Black | 6 |
| 11 | +5V | Red | 7 |
| 24 | GND | Black | 8 |
| 26 | Shield | Shield | 9 |

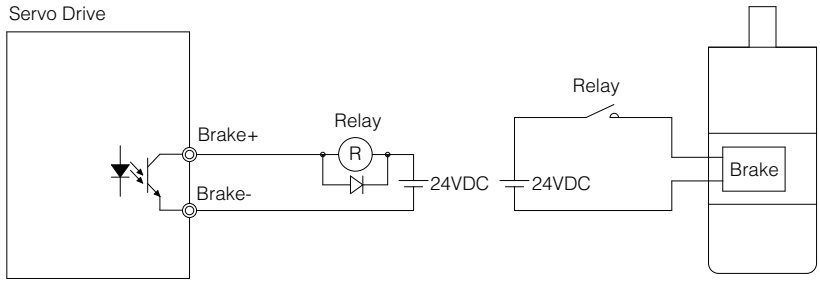
## 4.4 Electromagnetic Brake

When motor drives the vertical axis, brake should be used to hold and prevent the work (moving load) from falling by gravity while the power to servo is shut off.

**NOTE: only use servo motor brake for holding the stalling status, i.e. motor is in disable or power off.**

Never use this for “brake” purpose to stop the load in motion. Wrong use might cause servo motor damages.

### 4.4.1 Wiring Diagram




### 4.4.2 Notice for the Brake Motor

When no power is applied to the electromagnetic brake, it is in locked position. Therefore, the motor shaft will not be able to rotate.

The brake coil has no polarity.

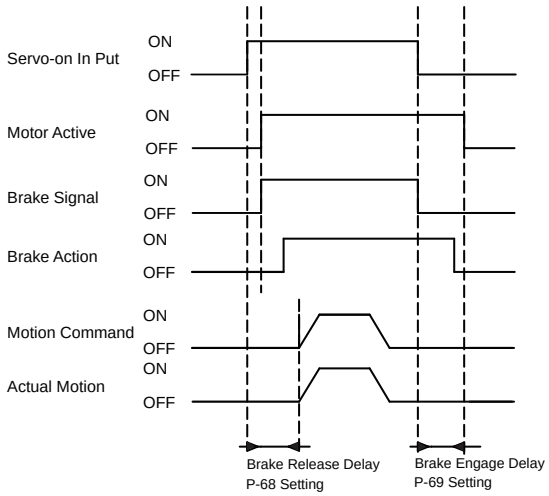
During the brake/release action, there might be “Ka-Da” sounds occurring, this does not affect the use of brake.

Specification of brakes are as follows:

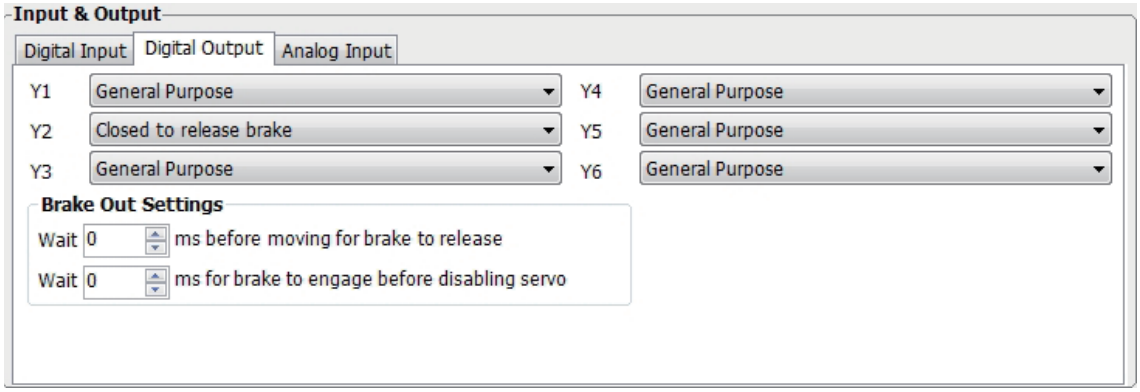
| | Motor Power | | | | |
|---|---|---|---|---|---|
| Type | 50W | 100W | 200W | 400W | 750W |
| Holding Torque (N•m) | 0.35 | | 2 | | 4.5 |
| Working Current (A) | 0.25 | | 0.38 | | 0.61 |
| Rated Voltage (V) | 24V±10% | | | | |
| Release Time | <25ms | | | | |
| Engage Time | <25ms | | | | |
| Release Voltage (V) | Release Voltage 18.5VDC | | | | |

### 4.4.3 The Timing Charts Of The Electromagnetic Brake

In order to prevent damage to the brake, there are delay sequences during the brake operation. Please be cautious with brake operation sequence.

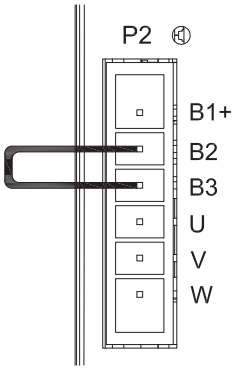
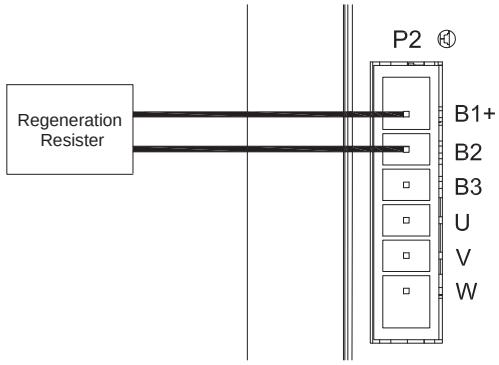



Brake engage/disengage delay time can be set via M servo suite software, or on the drive directly via P function: P-68 (BD) or P-69 (BE).



## 4.5 Regenerative Resister

In M2 series AC servo drives, there is a pre-installed 40W (M2DV-4D5 model: 60W) regeneration resistor. In some applications, the pre-installed regeneration resistor might not be enough to absorb all foldback current. In these cases, a larger wattage regeneration resistor needs to be connected externally, to prevent drive from over voltage warnings.

| Ensure the circuit is closed between B2 and B3, and the circuit is open between B1+ and B3 when using internal resister. | Ensure the circuit is opened between B2 and B3, and connect regenerative resister between B1+ and B2 when using external resister. |
|---|---|
|  |  |

## 4.6 Recommend Cable Specifications

- For drive's main circuit, please use wires withstand at least 600VAC.
- Please select wires with sufficient allowance for parameters such as operating current and ambient temperature.
- Recommended wire selections are as follows:

| Servo Drive And Corespondent Motor Model | | Wire Width $mm^2$ (AWG) | | | |
|---|---|---|---|---|---|
| | | L1/L2/L3 | L1C/L2C | U/V/W | B1+, B3 |
| M2DV-1D82* | SM0401AE4-KCD-*NV | 1.25 (AWG16) | 1.25 (AWG16) | 1.25 (AWG16) | 2.0 (AWG14) |
| | SM0402AE4-KCD-*NV | 1.25 (AWG16) | 1.25 (AWG16) | 1.25 (AWG16) | 2.0 (AWG14) |
| | SM0601AE4-KCD-*NV | 1.25 (AWG16) | 1.25 (AWG16) | 1.25 (AWG16) | 2.0 (AWG14) |
| M2DV-3D02* | SM0602AE4-KCD-*NV | 2.0 (AWG14) | 2.0 (AWG14) | 2.0 (AWG14) | 2.0 (AWG14) |
| M2DV-4D52* | SM0803AE4-KCD-*NV | 3.5 (AWG12) | 3.5 (AWG12) | 3.5 (AWG12) | 3.5 (AWG12) |

## 4.7 Connect to Host Computer, CN1

Port CN1 is used to connect drive with PC. Use M servo suite software to set control mode, change parameter values, and use auto-tuning function and so on.

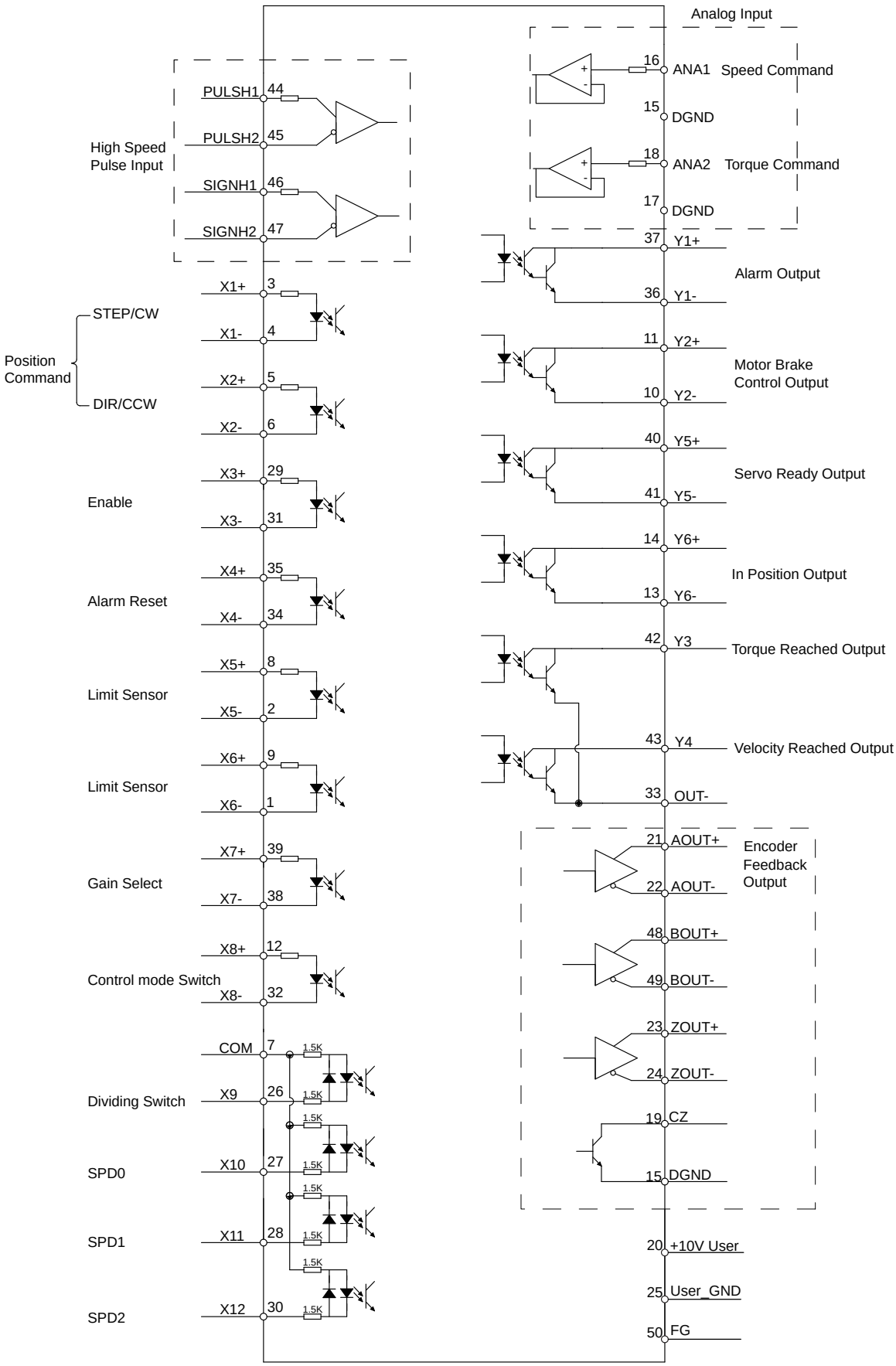
| PIN | Symbol | Function |
|---|---|---|
| 1 | +5V | +5V Power Supply |
| 2 | D- | Data - |
| 3 | D+ | Data + |
| 4 | — | Reserved |
| 5 | GND | Ground |

## 4.8 Input and Output Signal Interface Connector, CN2

### 4.8.1 Input and Output Interface Specifications and Diagram

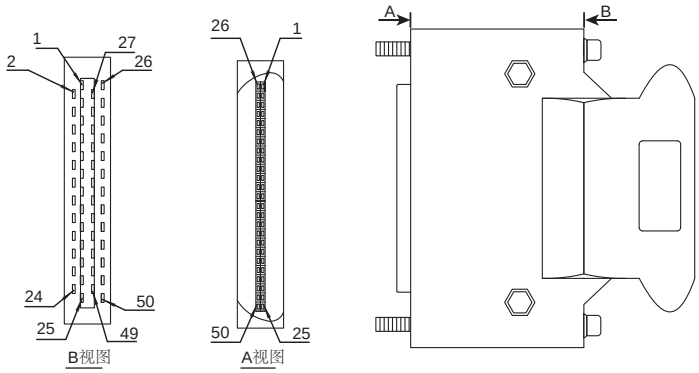
Port CN2 on M2 series AC servo drives is used for input/output signals. Details are shown in table below:

| | | | |
|---|---|---|---|
| I/O Signals | Digital Signal | Inputs | 8 Configurable Optically isolate general Inputs, 5-24VDC, 20mA<br>4 Configurable Optically isolate High Speed inputs |
| | | Outputs | 4 Configurable Optically isolate general Outputs, max 30VDC, 20mA<br>1 Alarm Output, max 30VDC, 20mA.<br>1 motor brake control output, max 30VDC, 100mA . |
| | Analog Signal | Inputs | 2 Analog Inputs, with 12bit resolution |
| | Pulse Signal | Inputs | 2 Optically isolated high speed inputs 500Hz (Open collector)<br>2 high speed differential inputs 2MHz |
| | | Outputs | 4 high speed encoder feedback output (3 Line Driver A/B/Z, and 1 open collector output Z) |


Analog Input
16 ANA1 Speed Command
15 DGND
18 ANA2 Torque Command
17 DGND
High Speed Pulse Input
PULSH1 44
PULSH2 45
SIGNH1 46
SIGNH2 47
Position Command
STEP/CW
DIR/CCW
X1+ 3
X1- 4
X2+ 5
X2- 6
Enable
X3+ 29
X3- 31
Alarm Reset
X4+ 35
X4- 34
Limit Sensor
X5+ 8
X5- 2
Limit Sensor
X6+ 9
X6- 1
Gain Select
X7+ 39
X7- 38
Control mode Switch
X8+ 12
X8- 32
COM 7
Dividing Switch
X9 26
SPD0
X10 27
SPD1
X11 28
SPD2
X12 30
1.5K
37 Y1+
Alarm Output
36 Y1-
11 Y2+
Motor Brake Control Output
10 Y2-
40 Y5+
Servo Ready Output
41 Y5-
14 Y6+
In Position Output
13 Y6-
42 Y3
Torque Reached Output
43 Y4
Velocity Reached Output
33 OUT-
21 AOUT+
Encoder Feedback Output
22 AOUT-
48 BOUT+
49 BOUT-
23 ZOUT+
24 ZOUT-
19 CZ
15 DGND
20 +10V User
25 User_GND
50 FG

## 4.8.2 Signals Description of Connector CN2

### 4.8.2.1 The Layout of CN2 Connector




### 4.8.2.2 Input Signals

M2 series AC servo drive has 12 programmable digital inputs as well as 2 analog inputs.

Each of the input can be specified with different function via parameter settings. The functions are as follows:

- Specified function signals: i.e. STEP/DIR signal, motor enable/disable signals.
- General purpose signal: In velocity mode, torque mode, Q program mode, or SCL mode, it is used as general purpose signal with no specified functions.

| Signal | Symbol | Pin NO. | Details |
|---|---|---|---|
| X1 | X1+ | 3 | This input has three functions:<br>● Accept STEP pulse input such as STEP signals, CW pulse, A pulse in Position mode.<br>● Run/Stop input in torque or velocity mode.<br>● General purpose input. |
| | X1- | 4 | |
| X2 | X2+ | 5 | This input has three functions:<br>● Accept STEP pulse input such as Direction signals, CCW pulse, B pulse in position mode.<br>● Direction input in torque or velocity mode.<br>● General purpose input. |
| | X2- | 6 | |
| X3 | X3+ | 29 | ● Enable/Disable input.<br>● General purpose input. |
| | X3- | 31 | |
| X4 | X4+ | 35 | ● Alarm Reset Input, used to reset drive alarm.<br>● General purpose input. |
| | X4- | 34 | |
| X5 | X5+ | 8 | ● Limit Sensor Input.<br>● General purpose input. |
| | X5- | 2 | |
| X6 | X6+ | 9 | ● Limit Sensor Input.<br>● General purpose input. |
| | X6- | 1 | |
| X7 | X7+ | 39 | ● Gain Select Input in all control mode.<br>● General purpose input. |
| | X7- | 38 | |
| X8 | X8+ | 12 | ● Switch Control mode between main mode and second mode.<br>● General purpose input. |
| | X8- | 32 | |
| X9 | X9 | 26 | ● Dividing Switch, change the pulses per revolution for electronic Gearing.<br>● General purpose input. |
| X10 | X10 | 27 | ● Pulse Inhibited Input. Ignore the pulse input when this input is activated in position mode.<br>● Speed Selecting Input 1 in change Speed mode.<br>● General purpose input. |
| X11 | X11 | 28 | ● Speed Selecting Input 2 in change Speed mode.<br>● General purpose input. |

| | | | |
|---|---|---|---|
| X12 | X12 | 30 | ● Speed Selecting Input 3 in change Speed mode.<br>● General purpose input. |
| COM | COM | 7 | X9-X12 COM point. |
| High-Speed Pulse Inputs | PULSH1 | 44 | High-speed pulse inputs (+5VDC line drive input).The max. input frequency is 2MHz.<br>Three different pulse command can be selected:<br>● Pulse & Direction<br>● CW Pulse and CCW Pulse<br>● A Quadrature B pulse<br>(NOTE: DO NOT use it with X1/X2 both. ) |
| | PULSH2 | 45 | |
| | SIGNH1 | 46 | |
| | SIGNH2 | 47 | |
| Analog Input Signal 1 | ANA1 | 16 | ● In velocity command mode in analog velocity mode. The offset, dead band, function of analog input 1 can be set by M Servo Suit or parameters P-51, P-55 and P-60.<br>● Sets or requests the analog Input gain that relates to motor position when the drive is in analog position command mode.<br>● Sets or requests the gain value used in analog velocity mode.<br>● General Analog Input in Q mode. |
| | DGND | 15 | Digital Ground for Analog input. |
| Analog Input Signal 2 | ANA2 | 18 | ● In torque command mode in analog torque mode. The offset, dead band, function of analog input 2 can be set by M Servo Suit or parameters P-53, P-57 and P-61.<br>● General Analog Input in Q mode |
| | DGND | 17 | Digital Ground for Analog input. |

### 4.8.2.3 Inputs Function List

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Step | ■ | | | | | | | | | | | |
| DIR | | ■ | | | | | | | | | | |
| CW Limit | | | | | ● | | | | | | | |
| CCW Limit | | | | | | ● | | | | | | |
| Start/Stop | ▲▼ | | | | | | | | | | | |
| Direction | | ▲▼ | | | | | | | | | | |
| Servo enable | | | ● | | | | | | | | | |
| Alarm clear | | | | ● | | | | | | | | |
| Speed selection 1,2,3 | | | | | | | | | | ▲ | ▲ | ▲ |
| Global gain selection | | | | | | | ■ | | | | | |
| Control mode selection | | | | | | | | ● | | | | |
| Pulse encoder Resolution selection | | | | | | | | | ■ | | | |
| Pulse Inhabit | | | | | | | | | | ■ | | |
| General Input | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

■– Position Mode ▲– Velocity Mode ▼ – Torque Mode ● – All Modes

### 4.8.2.4 Output Signals

M2 series AC servo drive has 6 programmable digital output signals available; each of the output can be specified with different function via parameter settings.

| Signal | Symbol | Pin NO. | Details |
|---|---|---|---|
| Y1 | Y1+ | 37 | This output has two functions:<br>• Alarm Output.<br>• General purpose output. |
| | Y1- | 36 | |
| Y2 | Y2+ | 11 | This output has two functions:<br>• Motor brake control output.<br>• General purpose output. |
| | Y2- | 10 | |
| Y3 | Y3+ | 42 | • Torque Reached Output.<br>• General purpose output. |
| | Y3- | 33 | |
| Y4 | Y4+ | 43 | • Moving signal output, output signal when dynamic position error less than set value in position mode.<br>• Velocity reach output. Output signal when actual speed is same as the target speed and the speed ripple less than ripple range.<br>• General purpose output. |
| | Y4- | 33 | |
| Y5 | Y5+ | 40 | • Servo ready output. Output servo ready signal when the drive is ready to be controlled and without alarm.<br>• General purpose output. |
| | Y5- | 41 | |
| Y6 | Y6+ | 14 | • In position signal output, output signal when in position, and the position error less than set value in position mode.<br>• Tach out output. Tach output, produces pulses relative to the motor position with configurable resolution.<br>• General purpose output. |
| | Y6- | 13 | |
| Encoder pulse feedback Output | AOUT+ | 21 | The encoder feedback phase A line drive output. |
| | AOUT- | 22 | |
| | BOUT+ | 48 | The encoder feedback phase B line drive output. |
| | BOUT- | 49 | |
| | ZOUT+ | 23 | The encoder feedback phase Z line drive output. |
| | ZOUT- | 24 | |
| | ZOUT | 19 | The encoder feedback phase Z output. (Open collector) |
| +10V Output | +10V User | 20 | +10VDC user, max 100mA |
| | USER_GND | 25 | +10VDC user Ground |

#### 4.8.2.5 Outputs Function List

| Output Pin | | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 |
|---|---|---|---|---|---|---|---|
| Function | Alarm Output | ● | | | | | |
| | InPosition error | | | | | | ● |
| | Dynamical Position error | | | | ■ | | |
| | Tach Out | | | | | | ● |
| | Brake | | ● | | | | |
| | Torque Reach | | | ● | | | |
| | Servo Ready | | | | | ● | |
| | Velocity Reach | | | | ▲▼ | | |
| | General Output | ● | | ● | ● | ● | ● |

■– Position Mode ▲– Velocity Mode ▼ – Torque Mode ● – All Modes

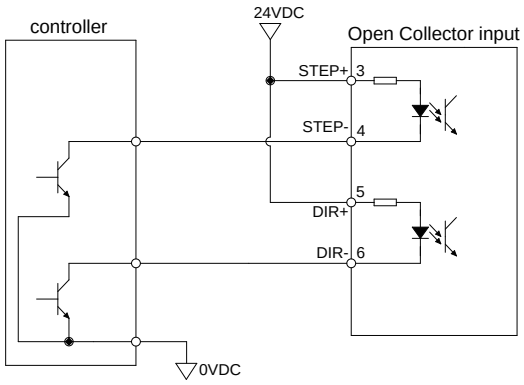
### 4.8.3 Input Signal Interface Connector, CN2

#### 4.8.3.1 Position pulse signal input

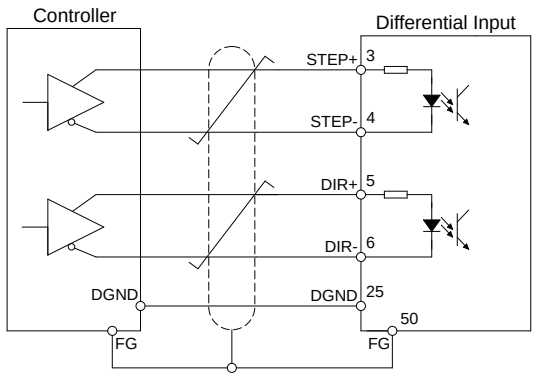
M2 series AC servo has two high speed pulse intputs, STEP/DIR and PULSH/SIGNH. STEP/DIR supports 5-24VDC up to 500Hz open collector input signal or differential input signal through line driver. PULSH/SIGNH supports 5VDC up to 2MHz with differential line driver input.

**NOTE: STEP/DIR and PULSH/SIGNH CANNOT be used at the same time.**

#### A. Open Collector Input Signal Diagram

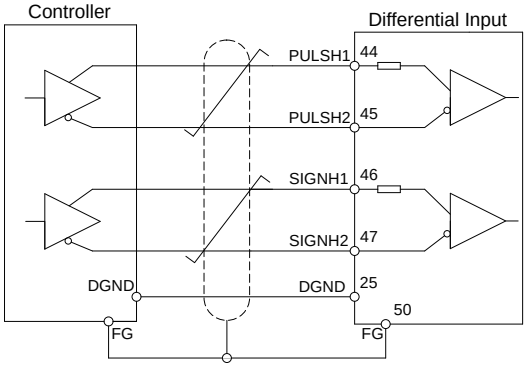



#### B. Differential Input Signal Diagram




#### C.High Speed Differential Signal Input Diagram

**Please ONLY use 5V supply for PULSH/SIGNH input, DO NOT use 24V.**



## D. Pulse Input Description

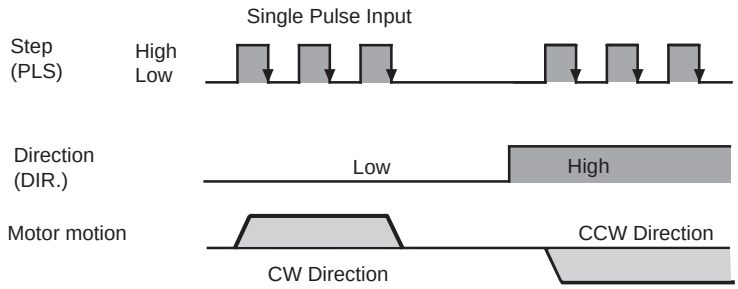
### STEP/DIR Pulse Input

When both STEP and DIR input signal is ON, the motor will rotate in one direction

When STEP input signal is ON, and DIR input signal is OFF, the motor will rotate in the opposite direction.

*Direction signal (DIR) can be configured via M Servo Suite software.

The following graph represents motor rotates in CW direction when DIR input is ON.

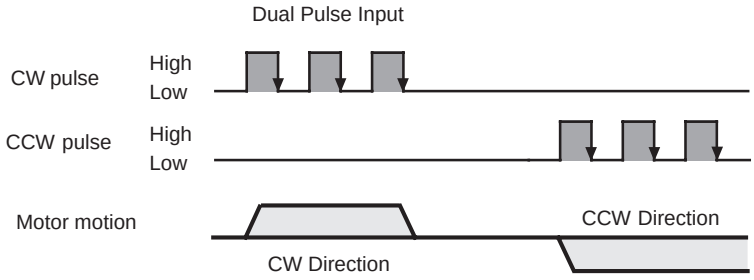



### CW/CCW Pulse

When Pulse input into X1, the motor will rotate in one direction.

When Pulse input into X2, the motor will rotate in the opposite direction.

*Motor direction can be configured via M servo suite.

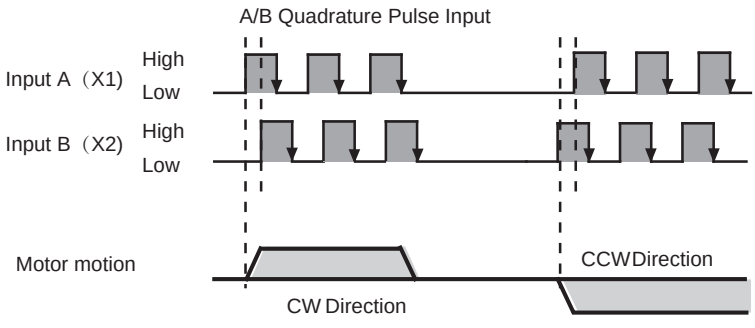



### A/B Quadrature

In A/B Quadrature mode, motor rotary direction is based on the the leading signal between A and B.

*Motor rotate direction can be configured via M servo suite. Direction is defined by the leading input between X1/X2.

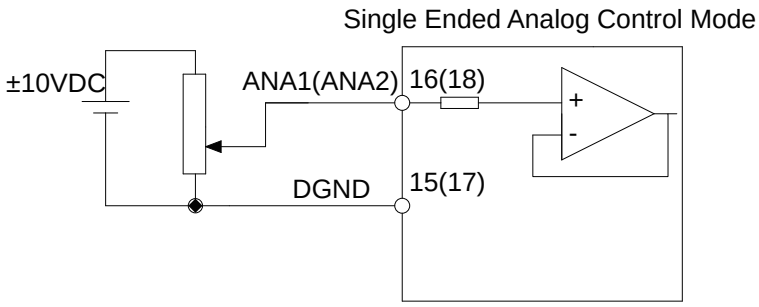
The following graph represents motor rotates in CW direction when X1 is leading X2.



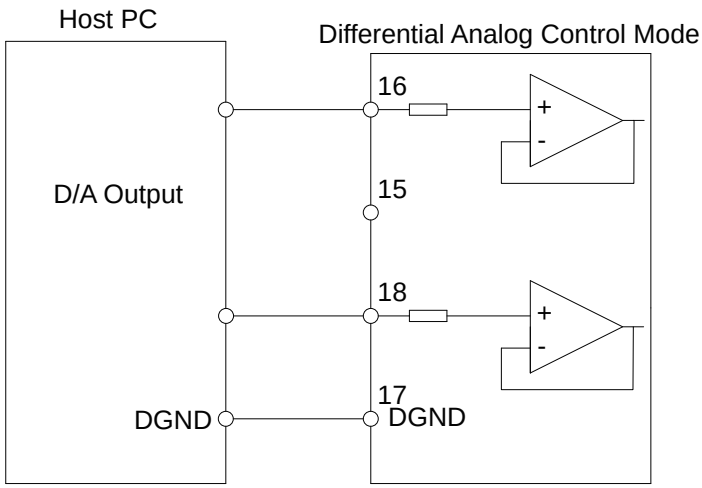
### 4.8.3.2 Analog Signal Input For Velocity And Torque Mode

M2 series AC servo drive has 2 single ended analog inputs and 1 differential analog input. The input voltage range is between -10V~+10V. Velocity and torque range can be configured via M servo suite software.

#### A.Single Ended Analog Input




#### B. Differential Analog Input



#### 4.8.3.3 High Speed Input Port X1,X2,X3,X4

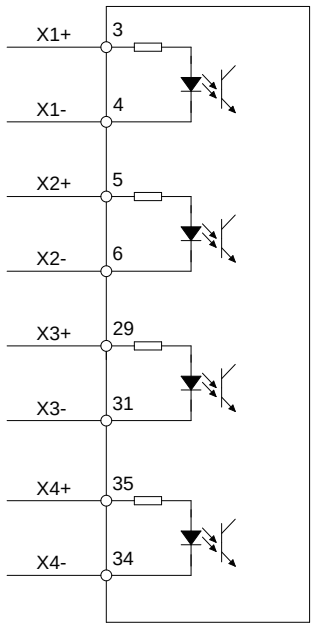
##### A. High Speed Input Port

M2 series AC servo drive has 4 Optically isolated high speed digital inputs X1、X2、X3、X4. These inputs allow input voltage from 5VDC~24VDC with maximum current of 20mA, and up to 500KHz. They can be used for general propose inputs, connecting sensor switch signals, PLC controllers or other types of controller output signals.

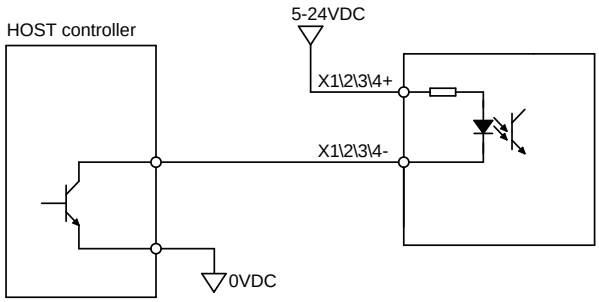
**NOTE: When drive is in position mode, X1, X2 can ONLY be set as STEP/DIR signal.**

**When drive is NOT in position mode, X1, X2 can be set as general purpose signals.**

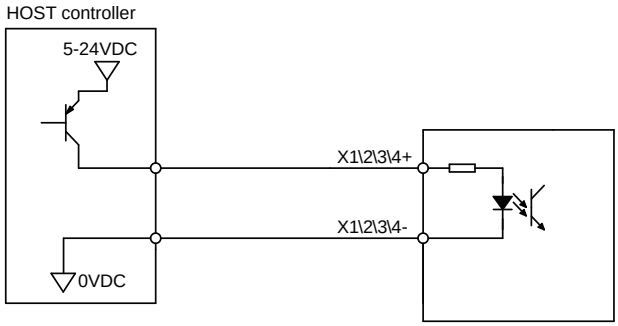
X1、X2、X3、X4 Circuit Are As Follows:



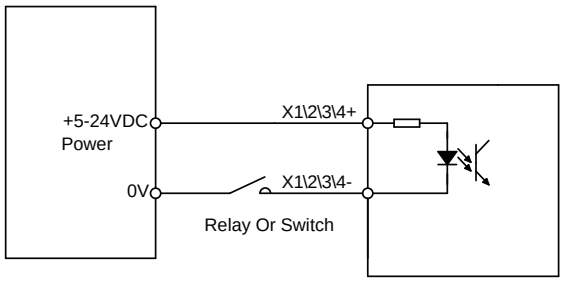
## B. High Speed Input Connection Diagram



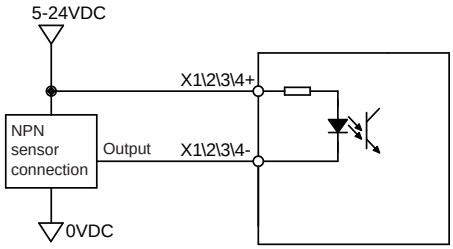

Host Sink Mode



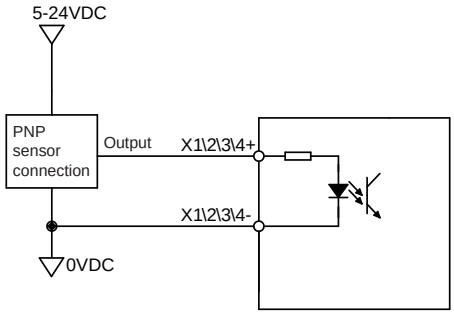

Host Sourcing Mode




Sensor And Switch Connection




NPN Sensor Connection

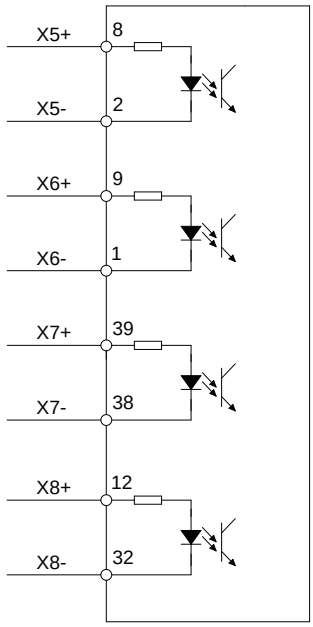



NPN Sensor Connection

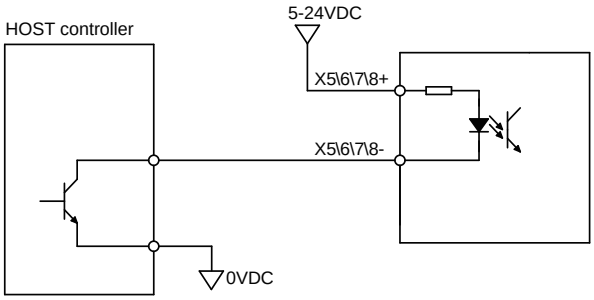
### 4.8.3.4 General Digital Input X5、X6、X7、X8

M2 series AC servo drive has 4 Optically isolated general digital inputs X5、X6、X7、X8. It allows input voltage range 5VDC-24VDC, with maximum input current of 20mA up to 5KHz. Both single ended and differential signal is allowed.

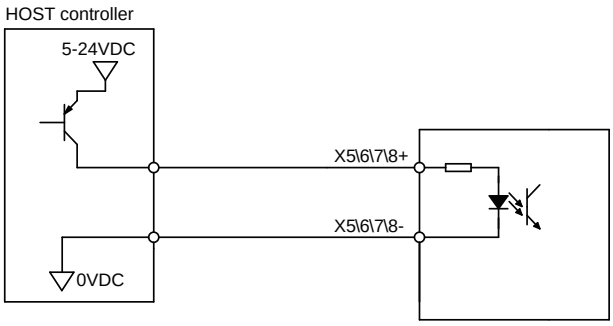
### X5、X6、X7、X8 Circuit Are As Follows:



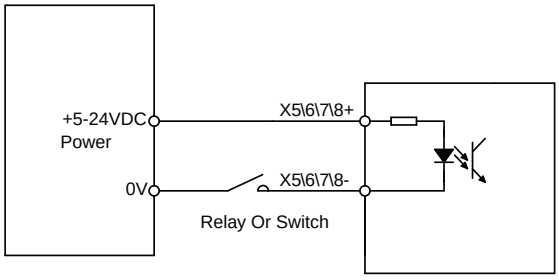
## X5、X6、X7、X8 Input Port Connection Diagram



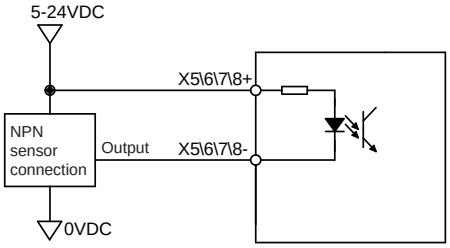

Host Sink Mode



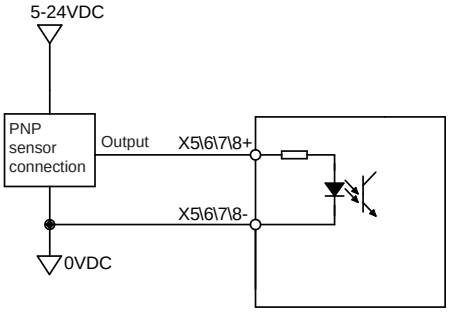

Host Sourcing Mode




Sensor And Switch Connection




NPN Sensor Connection




PNP Sensor Connection

### 4.8.3.5 X9、X10、X11、X12 Input With Common Com Port

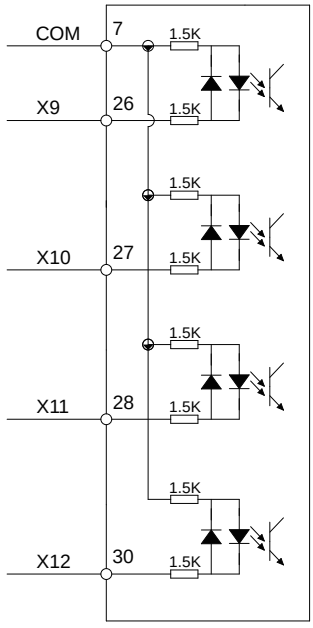
M2 series AC drive also has 4 single ended optically isolated inputs connecting with single common node ‘COM’. They can be used with sourcing or sinking signals, 5-24V. This allows connection to PLCs, sensors, relays and mechanical switches. Because the input circuits are isolated, they require a source of power. If you are connecting to a PLC, you should be able to get power from the PLC power supply. If you are using relays or mechanical switches, you will need a 5-24 V power supply.

#### What is COM?

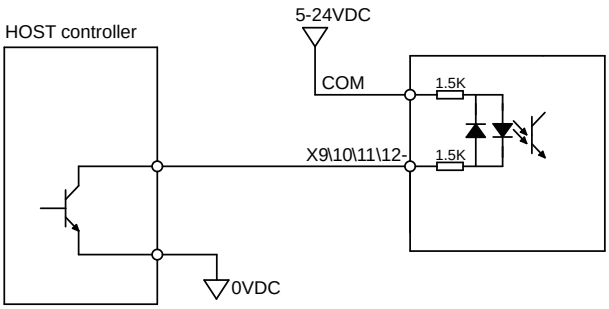
“Common” is an electronics term for an electrical connection to a common voltage. Sometimes “common” means the same thing as “ground”, but not always. If you are using sinking (NPN) signals, then COM must connect to power supply +. If you are using sourcing (PNP) input signals, then you will want to connect COM to ground (power supply -).

**NOTE: If current is flowing into or out of an input, the logic state of that input is low or closed. If no current is flowing, or the input is not connected, the logic state is high or open.**

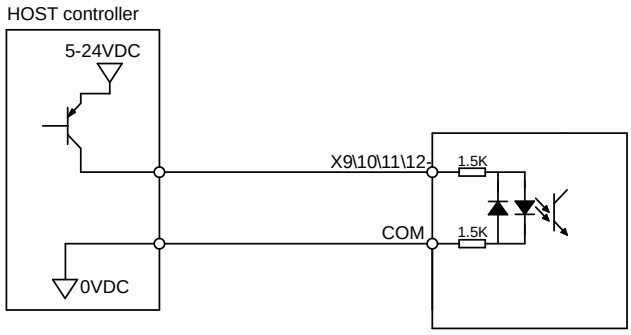
#### X9、X10、X11、X12 Circuit Are As Follows:



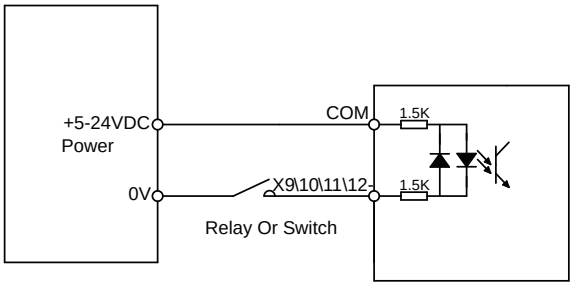
## X9、X10、X11、X12 Input Port Connection Diagram



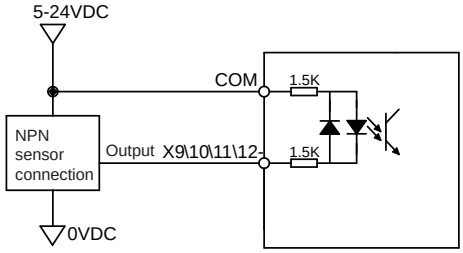

Host Sink Mode



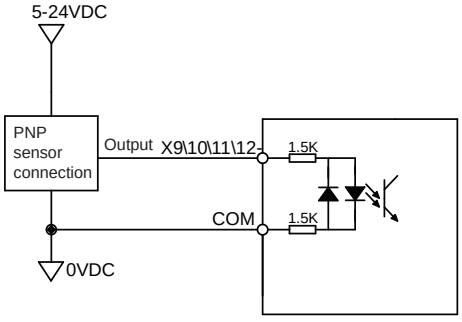

Host Sourcing Mode




Sensor And Switch Connection




NPN Sensor Connection

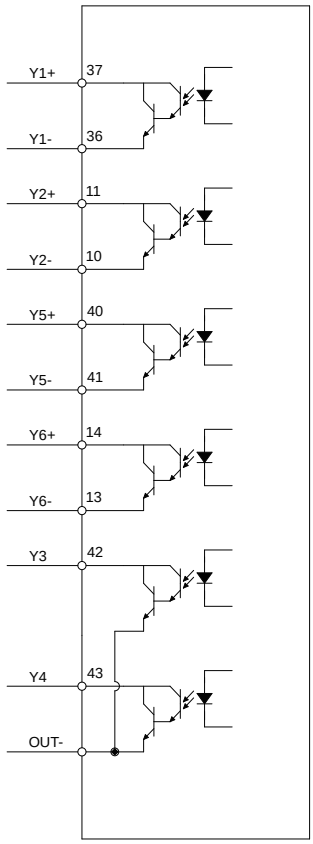



PNP Sensor Connection

### 4.8.4 CN2 Output Signal Specification

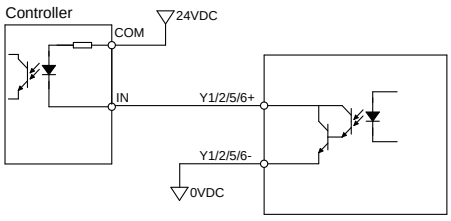
M2 series AC servo drive features 6 optically isolated digital outputs. They can be configured via M Servo Suite. Y1、Y2、Y5、Y6 are differential output signals, they can be used for both sourcing or sinking signals. Y3、Y4 common ground outputs， they can be used for sinking signals.

#### 4.8.4.1 CN2 Output Signal Diagram

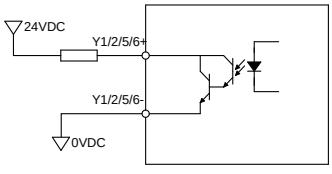



#### 4.8.4.2 Y1、Y2、Y5、Y6 Output Connection Diagram

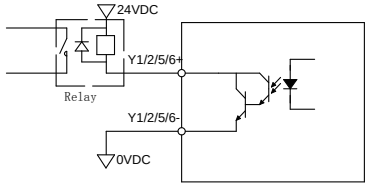
**NOTE: Y1、Y3、Y4、Y5、Y6 maximum outputs are 30VDC 30mA. Y2 maximum output is 30VDC, 100mA.**




Opt Coupler Circuity

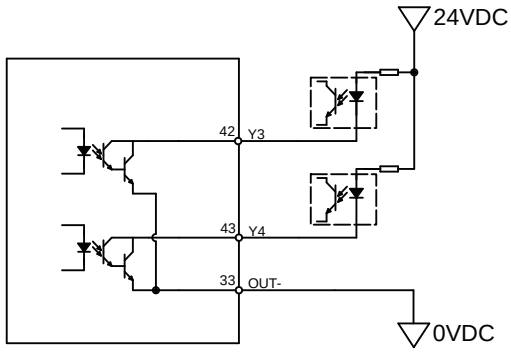



Connect To External Load




Connect To Relay Circuity

#### 4.8.4.3 Y3、Y4 Connection Examples

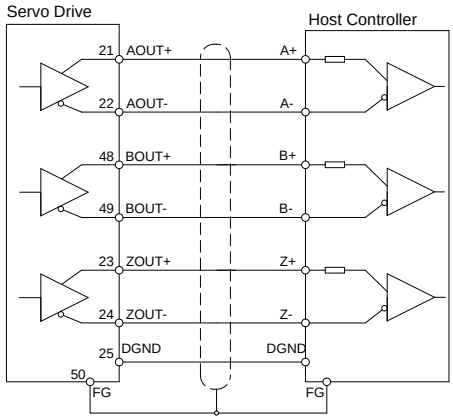



### 4.8.5 Encoder Feedback Output

M2 series AC servo drive can output encoder A/B/Z phase as differential output signals through line driver. The output signal is 5V, A/B signals are 10000 pulse/rev, Z signal is 1 pulse/rev.

The host must use line receiver to receive the signals. Please use twist pair wires for signal transfer.

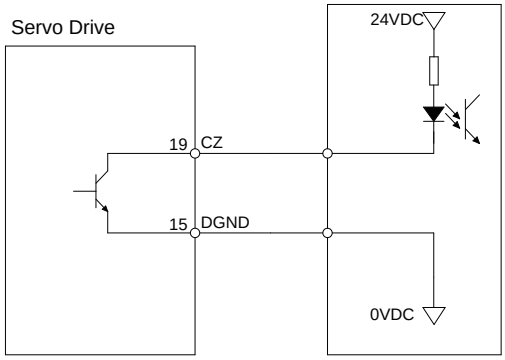
#### 4.8.5.1 A/B/Z Connection Diagram




**NOTE: Please make sure the host controller and the servo drive are connected to a common ground.**

#### 4.8.5.2 Z Phase Open Collector Output

In M2 series AC servo drive, encoder signal Z uses open collector output circuitry. Due to the narrow bandwidth of encoder signal Z, please use high speed optocoulper circuitry for the host receiver.



## 4.9 STO Connector

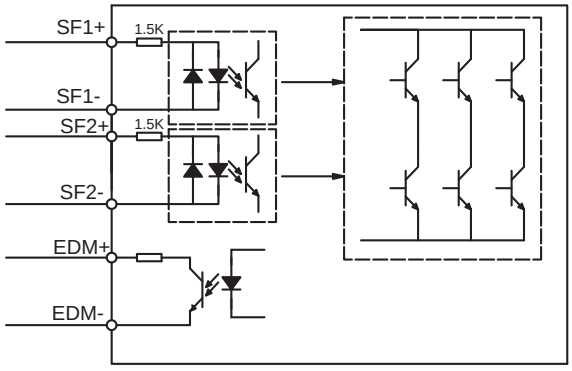
On the M2AC series servo drives, the STO (Safe Torque Off) function is connected via port CN5. The STO function shuts off the motor current turning off the motor output torque by forcibly turning off the signal of the servo driver power transistor. This is done internally through the STO Input/Output signal circuit.

### 4.9.1 Safety Precautions

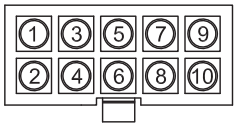
- If the STO function does not trigger, make sure the STO connector is plugged into CN5 on the drive correctly.
- When using the STO function, perform an equipment risk assessment to ensure that the system conforms to the safety requirements.
- Even when the STO function is enabled, the servo motor may move due to external force (e.g. gravitational force on the vertical axis). Make sure a holding brake is used in applications where this is possible.
- When the STO function engages and removes the torque, the motor will be “free running”, requiring more distance until the motion stops. Make sure this will not be a safety issue.
- When the STO function operates, it will turn off the current to the motor, but it does not turn off the power to the servo drive. Make sure to disconnect the power to the drive before performing any maintenance on it.
- After the STO function is triggered, the drive will have a fault alarm status(Alarm code: r20to), and the motor will be disabled.
- After the STO signal return to normal, the drive will automatically clear the STO fault alarm, but the motor will remain disabled . To restore the system to normal operation, re-enable is needed.

### 4.9.2 STO Input/Output Signals

#### 4.9.2.1 STO Internal Circuit Diagram




#### 4.9.2.2 CN5 Connector diagram



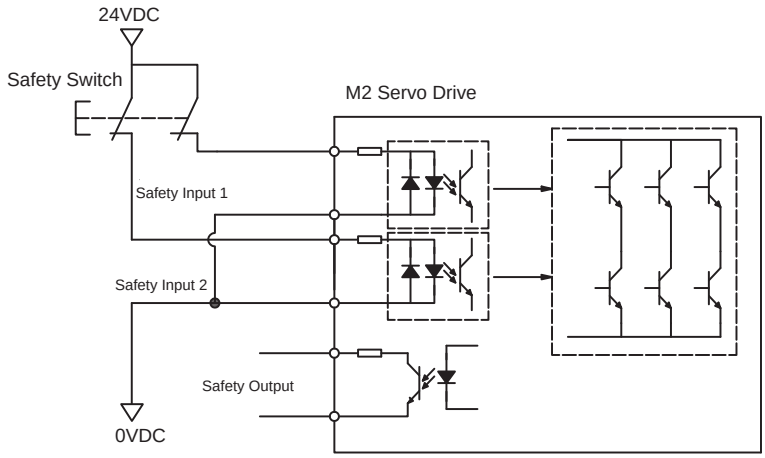

| Item | Part number | Vendor |
|---|---|---|
| Housing | 43025-1000 | Molex |
| Crimp | 43030-0005 | Molex |

### 4.9.2.3 STO Signal Definition

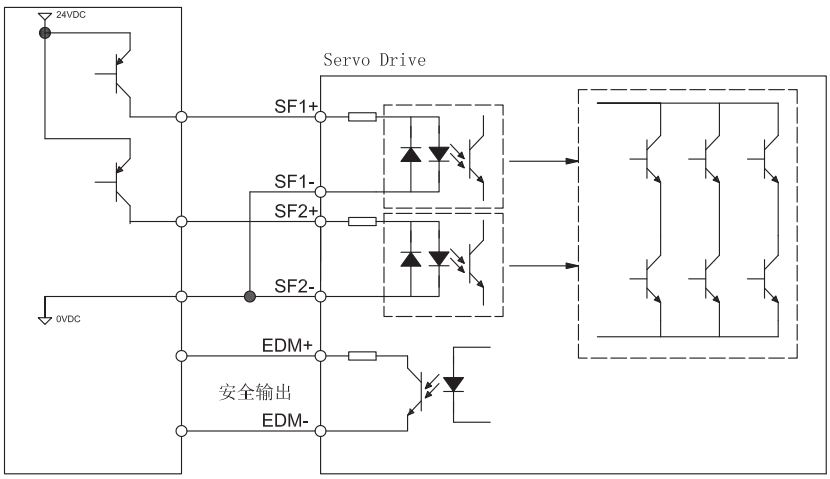
| Signal | Symbol | Pin | Description | Control Mode |
|---|---|---|---|---|
| Safety Input SF1 | SF1+ | 1 | When SF1 has no input signal, e.g. the port is disconnected, SF1 will be considered OFF. The upper half of the internal power transistor will be shut off. | Compatible with all control modes |
| | SF1- | 5 | | |
| Safety Input SF2 | SF2+ | 3 | When SF2 has no signal input, e.g. the port is disconnected, SF2 will be considered OFF. The upper half of the internal power transistor will be shut off. | |
| | SF2- | 2 | | |
| Safety Output | EDM+ | 6 | Output monitor signal used to check the safety function. | |
| | EDM- | 4 | | |
| Ground | DGND | 7, 8 | +5VDC power ground | |
| +5V power | +5V | 9, 10 | +5VDC power supply | |

### 4.9.2.4 STO Connection Diagrams

#### Connection to safety switch

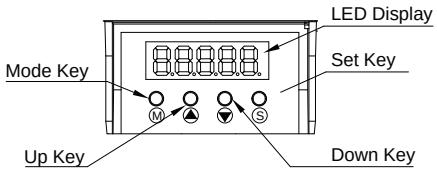



#### Safety light curtain connection



# 5. Display and Operation

## 5.1 Description of Control Panel




| Symbol | Name | Details |
|---|---|---|
| | LED Display | The LCD display (5 digits, 7 segments) show the drive's operating condition and warning codes, parameters and settings values. |
|  | MODE Key | Press and hold on mode button to switch LED display mode<br>a). Monitoring selection mode<br>b). Function selection mode<br>c). Parameter setting mode<br>When editing the parameters, press on MODE button can move the cursor to the left and then change parameters by using arrow keys. |
|  | UP/DOWN Key | UP and DOWN Key. Pressing the UP and DOWN key can scroll through and change monitor codes, parameter groups and various parameter settings. |
|  | SET Key | Press to entering mode<br>Press and hold to save parameters/settings |

## 5.2 Mode Switch Control

1) Press  key and  key can change modes among status monitoring, function control, parameters setting and etc.

2) If no warnings or faults has occur, the drive will not go into warning and fault display mode.

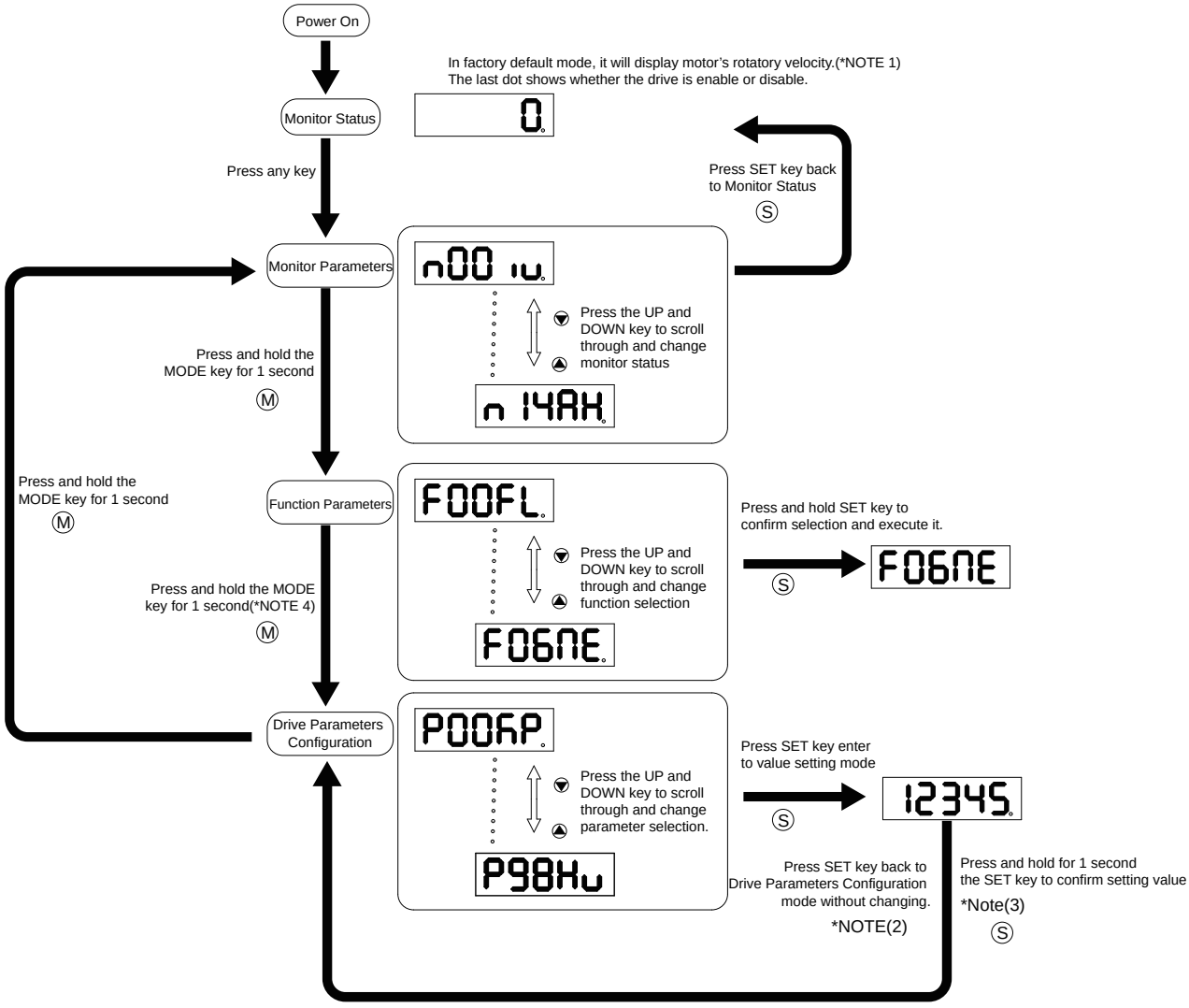
3) If any of the following warnings are detected by the drive, the LED display on the drive will switch into warning or fault display mode immediately. Press any key on the drive will switch back to previous display mode.

4) When no key (s) on the control panel is pressed for 20 seconds, the display will switch back to pervious status monitoring display mode.

5) In monitoring selection mode, function selection mode and parameter setting mode, when editing the parameters, press on  can move the cursor to the left and then change parameters by using   keys.

6) In status monitoring mode, press and hold  key, will lock the control panel. To unlock the panel, please press and hold the  key again.

## Control mode switch flowchart:




**NOTE:**

**1) When power is applied, drive's display will show customer defined monitoring mode. In factory default mode, it will display motor's rotary velocity.**

**2) In parameter setting mode, press Ⓢ key will quit from parameter setting mode, and return back to parameter selection mode, and changes will not be saved.**

**3) In parameter setting mode, press and hold Ⓢ button will confirm and apply current parameter setting. This will effect immediately. However, this change will not save to drive's Flash. If parameter is required for permanent use, please go to function mode" F04EA ", and then press and hold Ⓢ button to save the parameter change.**

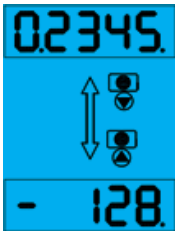
**4) When drive is connected to the host computer with M servo suite on, parameter setting mode CANNOT accessed directly on drive's control panel.**

## 5.3 LED display description

### 5.3.1 Decimal Point And Negative Sign Description

| LED display | Description |
|---|---|
|  negative sign  motor enable sign | Negative sign: when display value ≥-9999, the highest digit will show as '-'. i.e.  , as '-9999'<br>When display value≤-10000, the negative sign will be shown,  , as "-10000" |

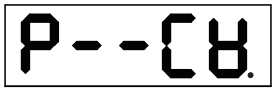
### 5.3.2 Parameter View Setting

| LED display | Description |
|---|---|
|  | There are only 5 digits on the LED display, when more than 5 digits are needed, it will show as following:<br>When the highest digit is flashing, it means the lower 5 digits are show. Press  to show the upper 5 digits.<br>The graph is showing '-12802345' |

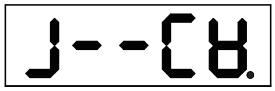
### 5.3.3 Parameter Save Setting

| LED display | Description |
|---|---|
|  | In parameter setting mode, press and hold  key will save the changing parameter. 'Saved' will also be shown display on the LED. |
|  | In parameter setting mode when motor is rotating, press and hold  , LED display will show status as busy. It means that the current parameter cannot be saved, please stop the current motor motion and save the parameter again. |

### 5.3.4 Point To Point Motion Mode

| LED display | Description |
|---|---|
|  | P-CW means motor are rotating in CW direction under point-to-point mode |
|  | P-CCW means motor are rotating in CCW direction under point-to-point mode |

### 5.3.5 Jog Mode

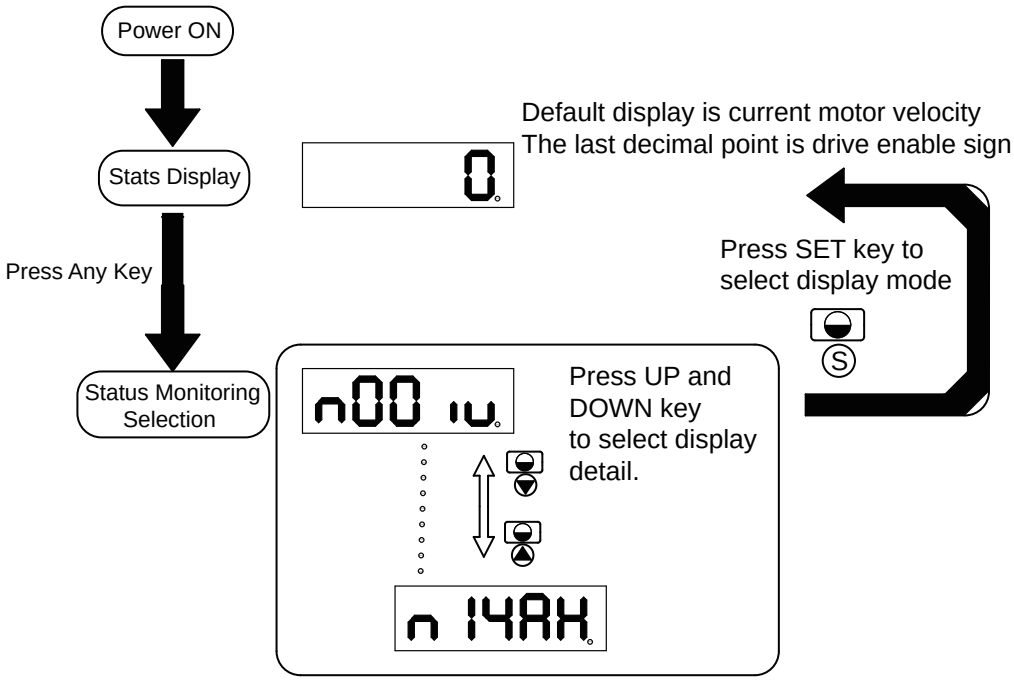
| LED display | Description |
|---|---|
|  | J—CW means motor rotating in CW direction under JOG mode |
|  | J—CCW means motor rotating in CCW direction under JOG mode |

### 5.3.6 Control Panel Lock

| LED display | Description |
|---|---|
|  | This means the key panel is locked. Press and hold S for 1 second under status monitoring mode to lock. |
|  | When control is locked. Press and hold S for 1 second to unlock the key panel. |

## 5.4 Status Monitoring Selection Mode

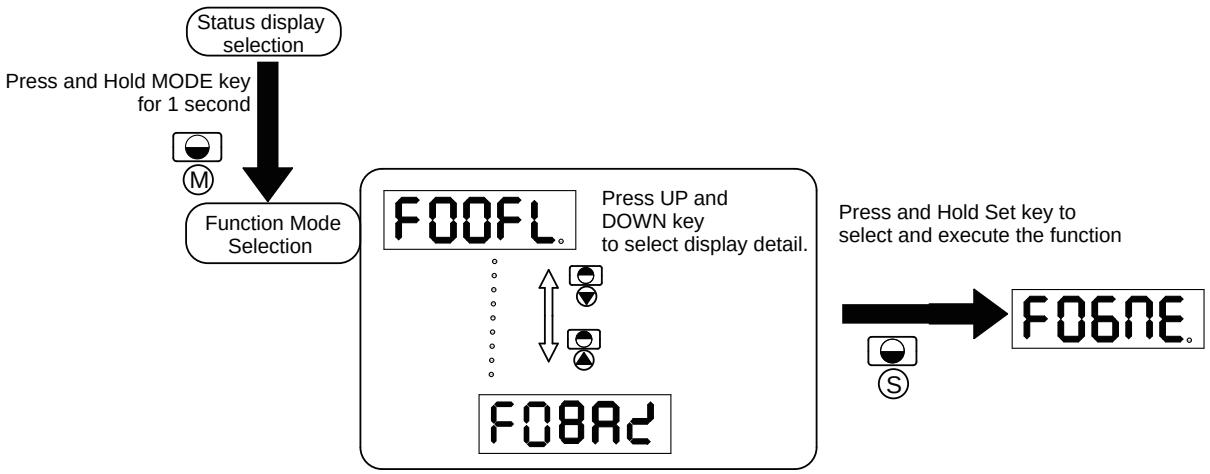
To change the status monitoring type, please press M to enter monitoring selection mode, and then use ▲ ▼ to make selections, and press S to confirm. Steps are shown as follows:



| N mode selection and setting | LED display | Description | Unit |
|---|---|---|---|
| n-00 |  | Motor Rotating Speed | RPM |
| n-01 |  | Position Error | Pulse |
| n-02 |  | Pulse Counter | counts |
| n-03 |  | Encode Counter | counts |
| n-04 |  | Command Position Counter | counts |
| n-05 |  | Drive Temperature | x 0.1℃ |
| n-06 |  | DC Bus Voltage | x0.1V |
| n-07 |  | Fault History 1 | |
| n-08 |  | Fault History 2 | |
| n-09 |  | Fault History 3 | |
| n-10 |  | Fault History 4 | |
| n-11 |  | Fault History 5 | |
| n-12 |  | Fault History 6 | |
| n-13 |  | Fault History 7 | |
| n-14 |  | Fault History 8 | |

## 5.5 Function Mode Control

In function mode (display F+ parameter number), you can select functions for preoperational mode, restart the drive, enable or disable the drive and so on. In status monitoring mode, press and hold M for 1 second will enter function control mode. Press ▲ ▼ to select function, and then press and hold S to confirm or execute the function. (**NOTE: F-00(FL) and F-01(CJ) excepted**)

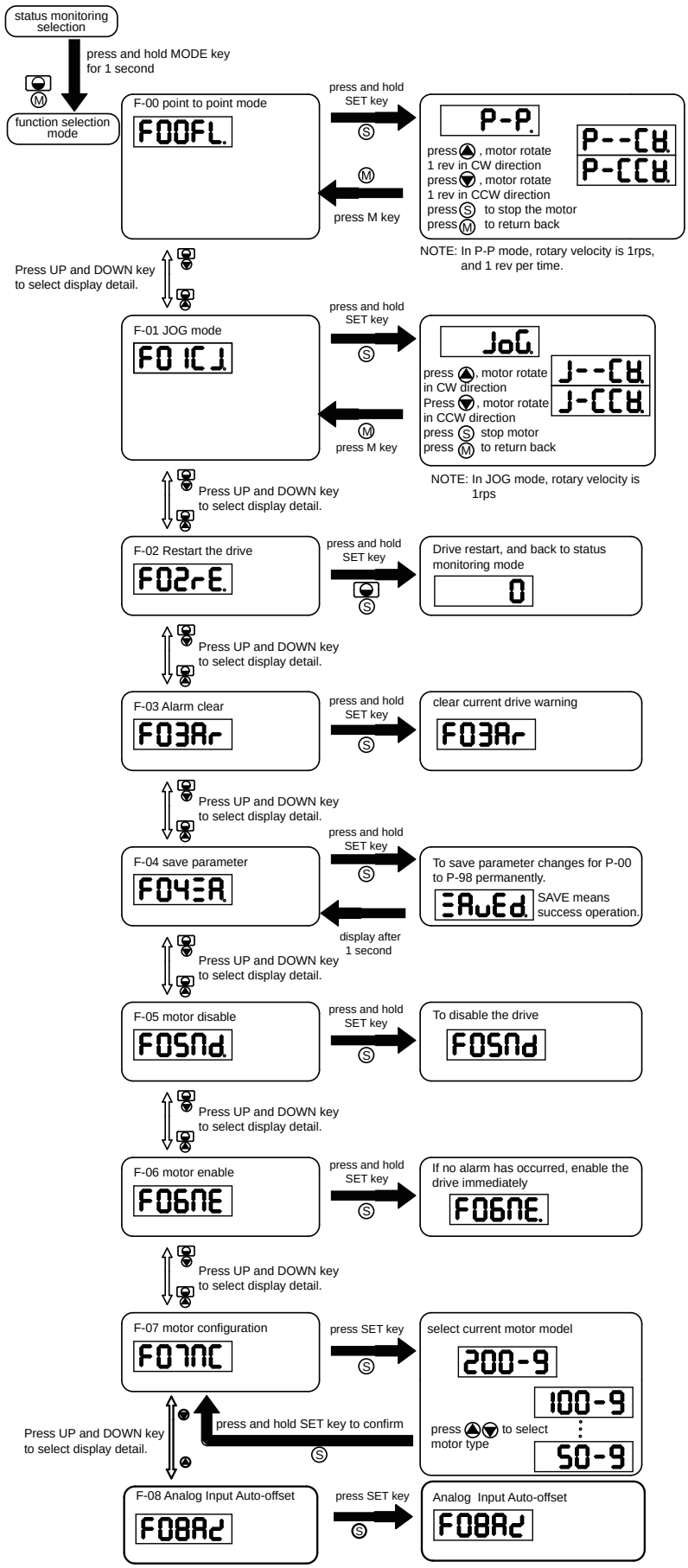



### 5.5.1 Function Mode Description

Function mode details are as follows:

| Function mode number | LED display | Description |
|---|---|---|
| F-00 | F00FL | point to point position mode: 1) rotating speed: 1rps 2)travel distance: 1rev |
| F-01 | F01CJ | JOG mode: JOG speed 1rps |
| F-02 | F02rE | Restart the drive |
| F-03 | F03Ar | (F-03AR) Clear drive's current alarm |
| F-04 | F04SA | (F-04SA) Save parameter changes for P-00 to P-98 |
| F-05 | F05Md | (F-05MD) Drive disable |
| F-06 | F06nE | (F-06ME) Drive enable |
| F-07 | F07MC | (F-07MC) Select motor specification |
| F-08 | F08Az | (F-08AZ)Analog auto tunning |

## 5.5.2 Operation Flow Chart

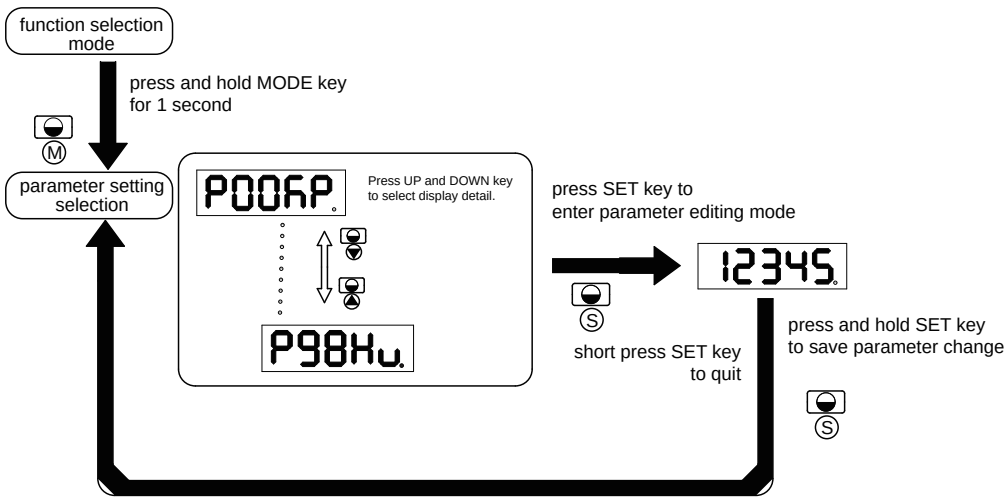


## 5.6 Parameter Setting Mode

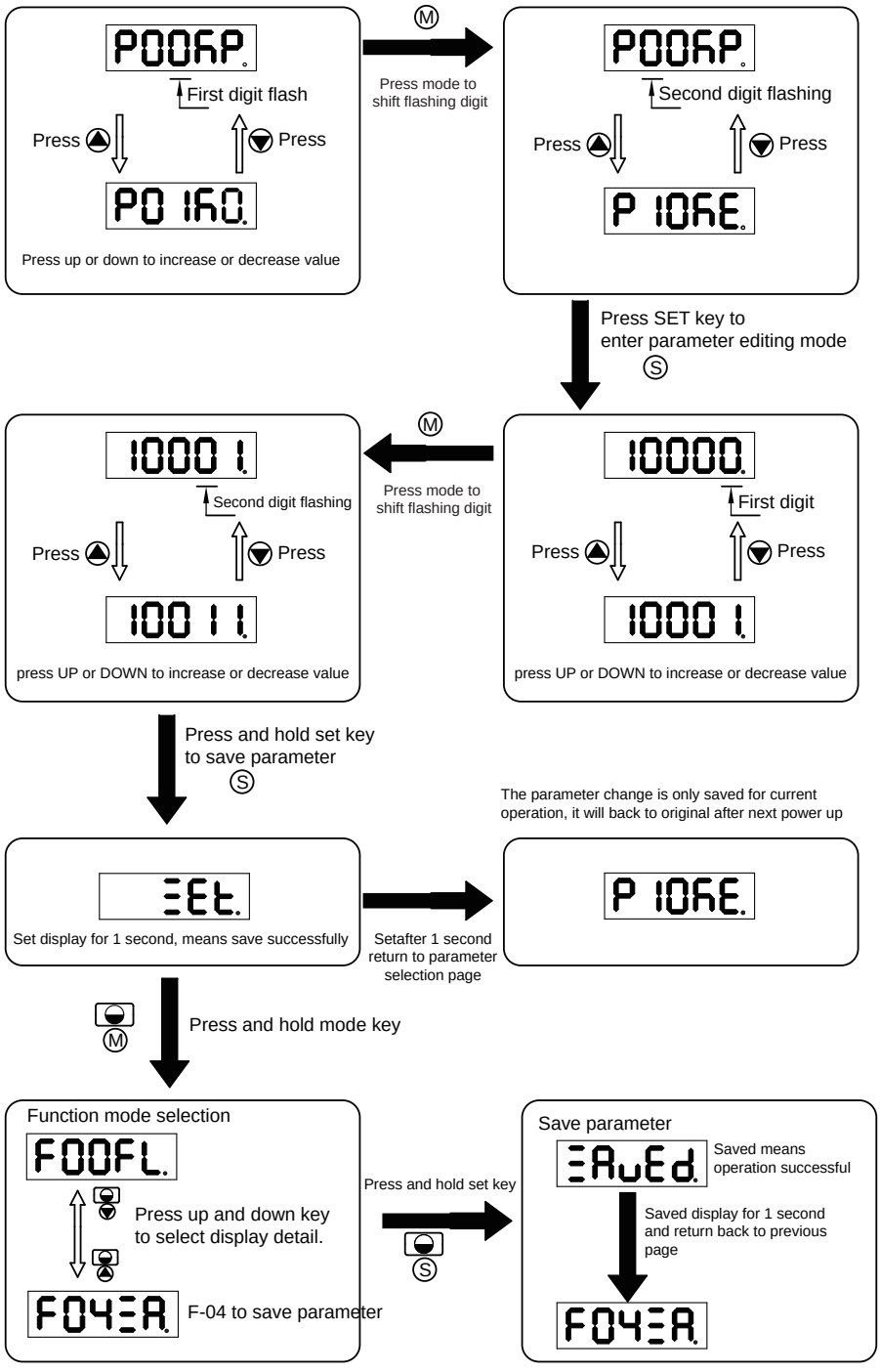
### 5.6.1 Parameter Setting Description

The parameter setting mode (P+parameter number) allows you to select, display and edit the required parameter. In function control mode, press and hold M for 1 second to enter parameter setting mode. Use ▲ ▼ to select required parameter, and press S to view or edit the parameter. Press S again to quit and no change will be saved. Press and hold S for 1 second to save the parameter change. However this change will NOT be saved at next power on.

If you want to save parameter PERMANENTLY, please go into function control mode (F+parameter number), and use F-04SA function.

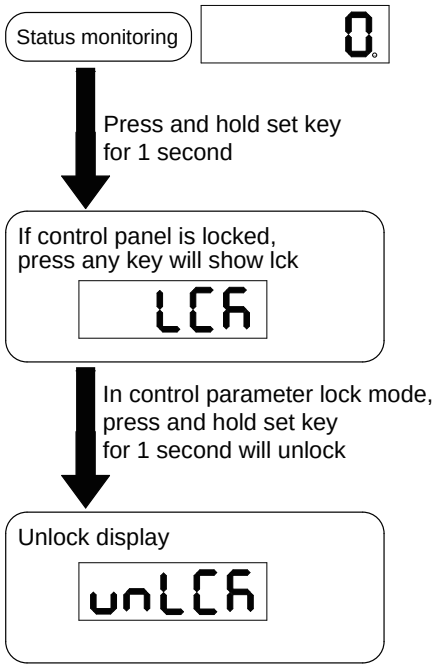


## 5.6.2 Parameter Editing Examples



## 5.7 Control Panel Lock

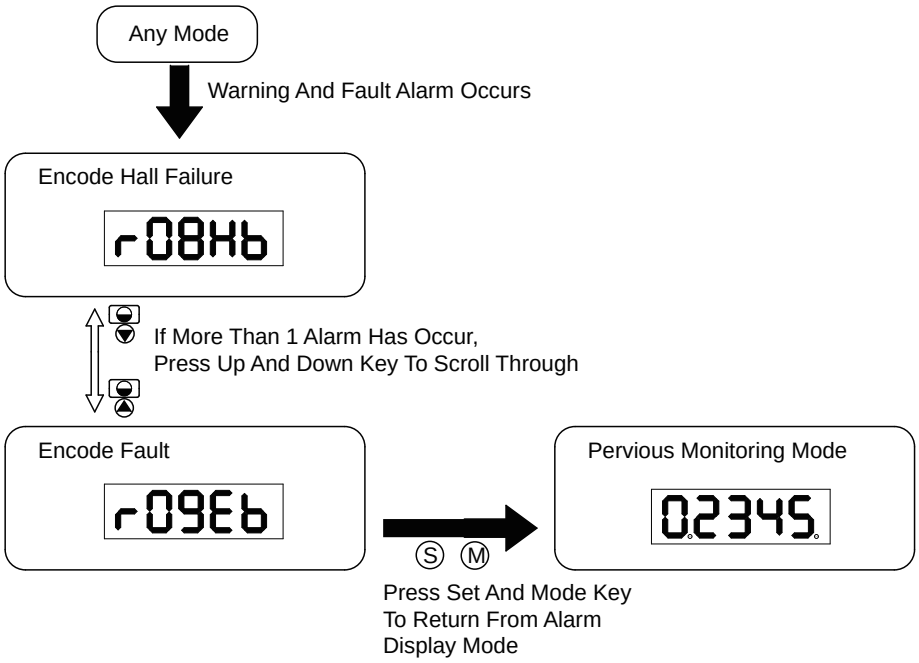
In order to prevent faulty use on key panel, key panel lock is featured on all M2AC servo drives. When lock function is on, no function can be changed directly on drive's control panel.




## 5.8 Warning And Fault Display

When power is applied, if any of the following warnings are detected by the drive, the LED display on the drive will switch into warning or fault display mode immediately.

If more than one warning is detected, you can scroll through by press  button. Press  or  button to clear the warning display and back to pervious display mode.



| LED display | Description | LED display | Description |
|---|---|---|---|
| r01ot | Drive over temperature | r14cL | CW limit is activated |
| r02ur | Internal voltage fault | r15cL | CCW limit is activated |
| r03uH | Over voltage | r16CL | Current limit |
| r04HC | Over current | r17CE | Communication error |
| r05LC | | r18EF | Parameter save failed |
| r06rC | | r19LP | Phase loss of the main circuit |
| r08Hb | Bad hall sensor | r20to | STO is activated |
| r09Eb | Encoder error | r21rF | Regeneration failed |
| r10PL | Position error | r22uV | Low voltage |
| r11Lu | Low voltage | r239E | Q program is empty |
| r12ou | Velocity limited | r24dd | Motion Command Received While Motor in Disable |
| r13Lt | CW limit or CCW limit activated | | |

# 6. Preoperational mode

When preoperational mode is operating, please disconnect servo motor from any mechanical system to prevent any damages and accidents. Please perform this operation under no load condition.

## 6.1 Inspection Before Trail Run

In order to avoid any accidents and damages to servo drive and mechanical systems, we strongly recommend following safety checks before you turn on the drive.

1) Connection inspections

Please ensure secure wirings for power connector P1, motor connector P2, Encoder connector CN3, communication connector CN1. Ensure wirings connection, and wires are correctly insulated (not short circuit) for all connectors.

Ensure ground wire from power connector P1, and motor connector P2 are securely connected (screwing) to the shield ground.

2) Power supply inspection

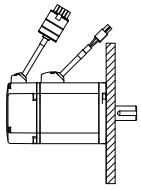
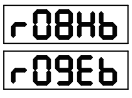
Check and ensure voltage supplies between L1/L2/L3, meets drive's power supply specifications.

Check and ensure voltage between L1C/L2C is within the correct supply voltage range.

3) Ensure secure installation of servo drive and motor.

4) Ensure no load is installed on the servo motor.

## 6.2 Trail Run Procedure

| Step | Details | Description |
|---|---|---|
| 1 | Please securely install the motor.  | 1) The motor can be installed on the machine.<br>2) Ensure no load is installed on the servo motor. |
| 2 | Please ensure the wiring between the drive and motor is correctly. | 1.Terminal U,V,W and FG must connect to Red, Yellow ,Blue and Yellow/Green cable separately (U:Red, V:Yellow, U:Blue, FG:Yellow/Green).If not connect to the specified cable and terminals, then the drive cannot control motor.<br>2.Ensure to connect encoder cable to CN2 connector correctly. |
| 3 | Please make sure the main power circuit wiring connect correctly. | Refer to Section 3.1 Connecting to Peripheral Devices to confirm the main power circuit wiring connect correctly. |
| 4 | Supply the Power | Do not supply 380VAC power supply into the servo system. |
| 5 | The LED Display will show as follows without alarm:  <br>When the alarm occurs, it will display:  | 1. When the power is on ,the normal display should be shown without any alarm codes and the drive is disabled.<br>2. If display shows alarm codes such as r-08 and r-09. It means that the encoder feedback connection is incorrectly. Check if the encoder wiring of servo motor is loose or incorrect.<br>3. Please refer to the other alarm trouble shooting10. |
| 6 | User need to setup a motor brake control circuit when using a electromagnetic brake motor. | Please refer to Section 3.4 Electromagnetic Brake for more details. |
| 7 | Motor Configuration | Configure the correct motor that has been used with the M2 Servo Suit or the operation panel. Please refer to Motor Configuration 6.3 |
| 8 | JOG Trail Run without Load | Ready to run JOG trail if all steps above are done. |

## 6.3 Motor Configuration Manually

Before JOG mode operation, M2 series AC servo drive requires motor configuration setup. For more details about how to configure your motor specification, please refer to chapter 2.3.

### 6.3.1 Use Drive Control Panel To Setup

Motor information and LED display list:

| LED display | Motor Model Number | | LED display | Motor Model Number |
|---|---|---|---|---|
| 50-F | SM0401AE2-KCD-NNV | | 50-9 | SM0401AE4-KCD-NNV |
| 100-F | SM0402AE2-KCD-NNV | | 100-9 | SM0402AE4-KCD-NNV |
| 200-F | SM0601AE2-KCD-NNV | | 200-9 | SM0601AE4-KCD-NNV |
| 400-F | SM0602AE2-KCD-NNV | | 400-9 | SM0602AE4-KCD-NNV |
| 250-F | SM0801AE2-KCD-NNV | | 250-9 | SM0801AE4-KCD-NNV |
| 500-F | SM0802AE2-KCD-NNV | | 500-9 | SM0802AE4-KCD-NNV |
| 750-F | SM0803AE2-KCD-NNV | | 750-9 | SM0803AE4-KCD-NNV |

For more MOONS' motor information, please refer to appendix 1.For example: To setup a drive for model: SM0402AE4-KCD-NNV09 motor. These are the following steps:

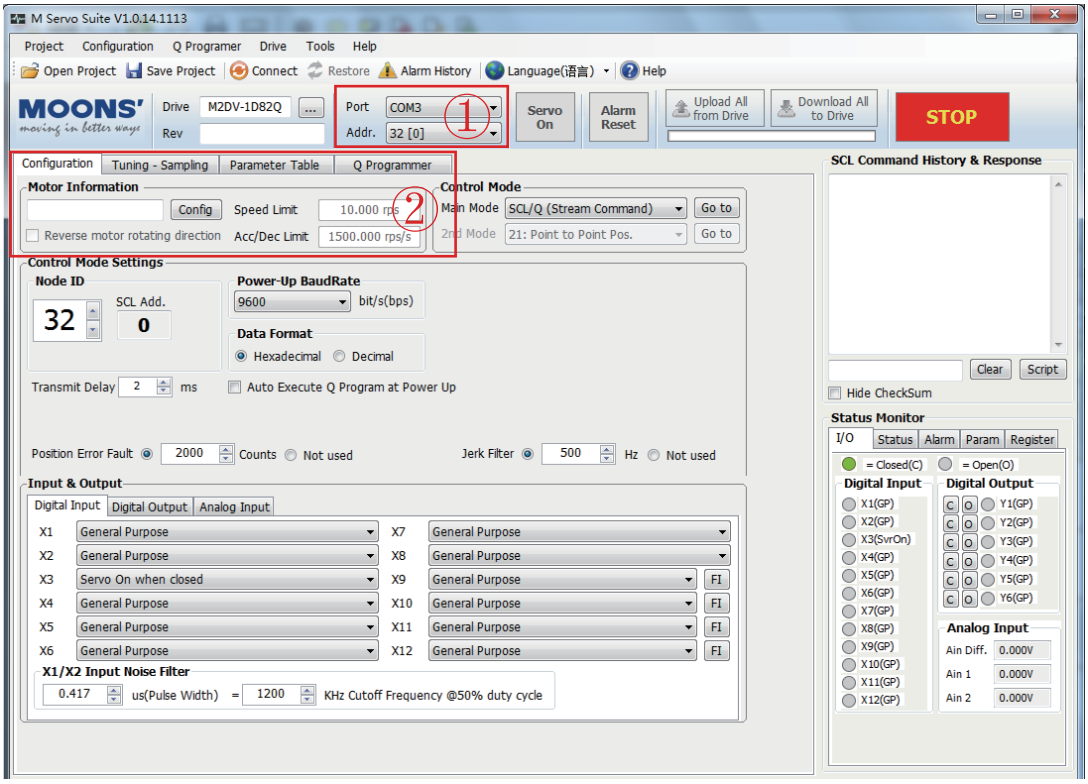
| Step | LED display | Description |
|---|---|---|
| 1 | F00FL. | Press (M) into the Function Parameters mode at the Monitor Status mode |
| 2 | F07MC | Press the (▲) and (▼) key to select F07 (MC) |
| 3 | 200-9 | Press (S) key into value setting mode. |
| 4 | 100-9 | Press (▲)、(▼) key to change value. |
| 5 | SAvEd. | Press and hold (S) key for 1 second to confirm motor configuration. |
| 6 | F07MC | |
| | | Parameter is effective only after the servo drive is restarted. |

### 6.3.2 Use Software To Config Motor

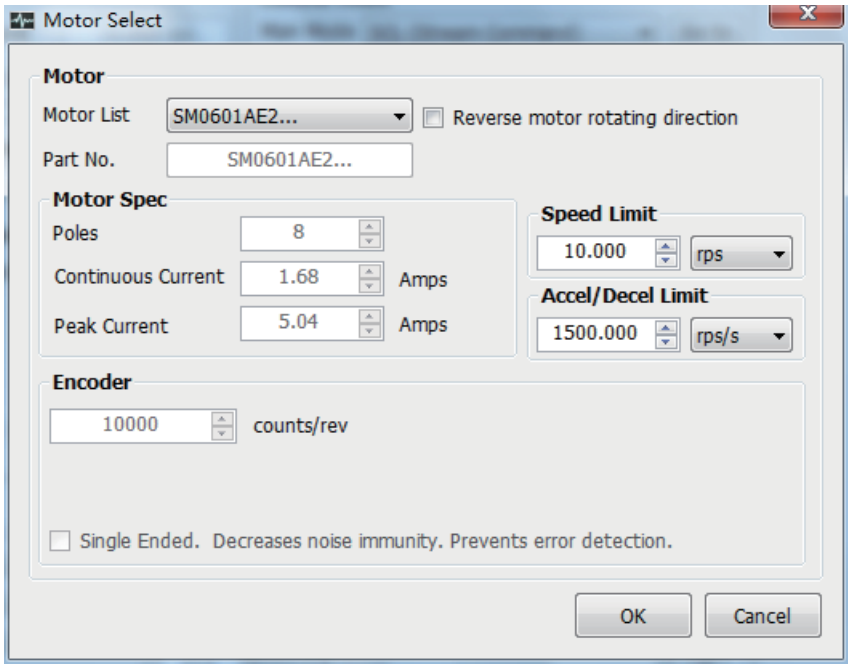
User can also use M Servo Suite to configure motor information

step 1: Run M Servo Suite on PC, and select the correspondent communication port

step 2: after successful connection, use the drive configuration page to setup




Step 3: click on motor config to do motor selection as follows.




Step 4: Click “download to drive” to save the setting to the drive.

## 6.4 Operations of JOG Mode

| Step | LED display | Description |
|---|---|---|
| 1 | P00AP | Press M to switch the Monitor Status mode into the Drive Parameters Configuration mode |
| 2 | P62 SI | Scroll ▲、▼ key to select parameter P62 (SI) |
| 3 | 2 | Press S key into value setting mode |
| 4 | 3 | Scroll ▲、▼ key to change values. |
| 5 | SEt | Press and hold S key for 1 second to confirm the setting value. |
| 6 | F00FL | Press M key into the Function Operation mode. |
| 7 | F06nE | Scroll ▲、▼ key to select Function F06 (MC) to enable the motor. |
| 8 | F06nE. | Press and hold SET key for 1 second, the drive will be enabled. The last dot will light to shows the drive is enabled. |
| 9 | F01CJ. | Scroll the ▲、▼ key into function F01 (CJ) to run JOG mode. |
| 10 | JoG. | Press the S key into JOG mode |
| 11 | J--CW. | Press the ▲ key ,the motor will rotate at CW direction with the speed 1rps. |
| 12 | J-CCW. | Press the ▼ key ,the motor will rotate at CCW direction with the speed 1rps. |
| 13 | JoG. | Press the S key to stop the motor |
| 14 | F01CJ. | Press the M key back to the Function Operation mode. |

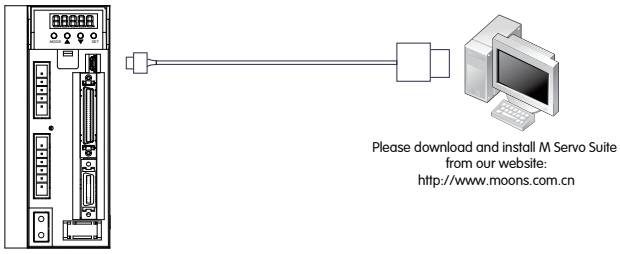
## 6.5 Configuration by Personal Computer

In order to ensure servo drive and motor meet your operation requirements, we strongly recommend customers to use “M servo suite” for following configuration setups:

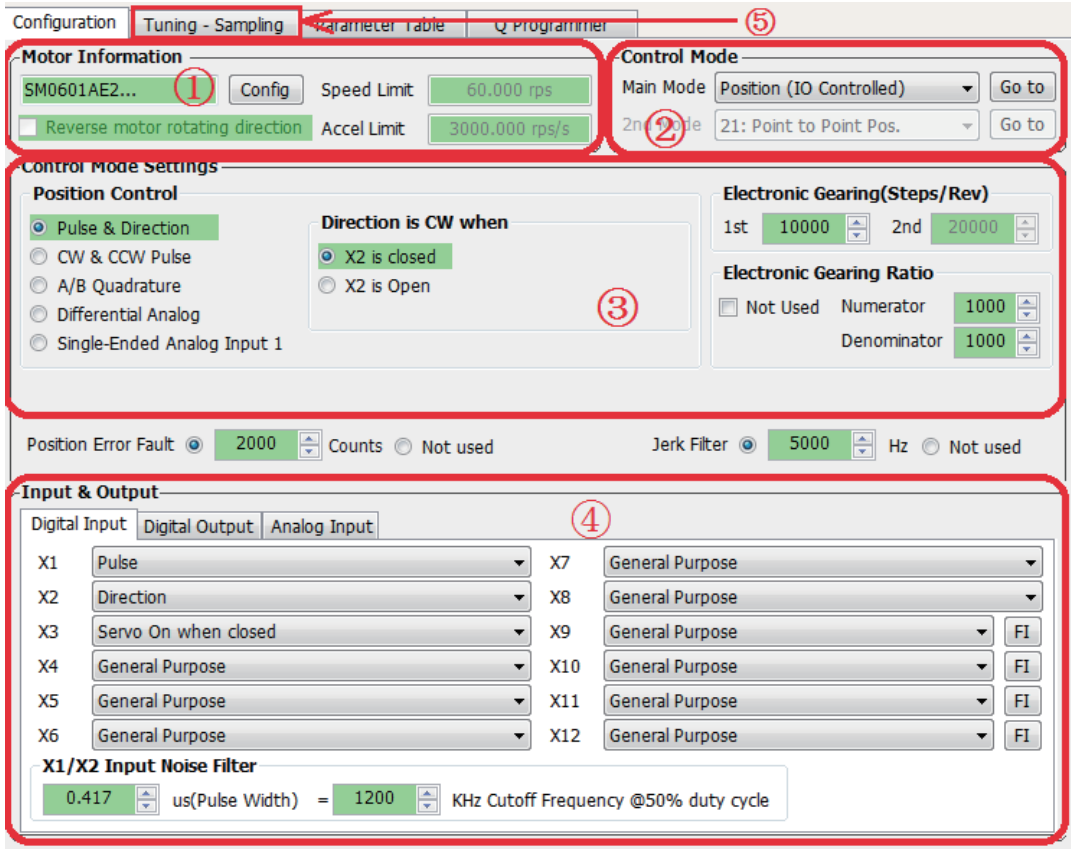
1. Servo Motor model selection and configuration
2. Operational mode selection
3. Define drive’s input/output mode
4. Apply auto tuning function on PID parameters for optimized motor performance.

M Servo Suite’s detail, please refer to the software manual.

### Connect to Personal Computer




### Interface of M2 Servo Suite




| Configuration Steps | Details |
|---|---|
| Step 1 | Motor Configuration |
| Step 2 | Select Control Mode |
| Step 3 | Further configuration |
| Step 4 | I/O configuration |
| Step 5 | Tuning |

# 7. Operation Mode Selection

## 7.1 General Function Setting

### 7.1.1 Drive Servo on settings

To control servo motor enable/disable switch

1) servo on signal

In default setting, servo ON signal configured as follows:

| Signal Name | PIN (CN2) | Condition | Function |
|---|---|---|---|
| X3 | 29 (X3+)<br>31 (X3-) | Closed | Servo motor enable Servo ON |
| | | Open | Servo motor disable Servo OFF |

2) Definition for Servo On signal

Customers can Change parameters P-62 (SI) and P-14 (PM) to setup

A. When P-14 (PM) = 2, parameter settings are as follows:

| P-14 (PM) | P-62 (SI) | Condition | Function |
|---|---|---|---|
| P-14 (PM) = 2 (default) | 1 | Closed | If P-14(PM)=2 and P-62(SI)=2, driver will enable when power-up,and then switch to disable. |
| | | Open | Servo Enable |
| | 2 (default) | Closed | Servo motor enable Servo ON |
| | | Open | Servo motor disable Servo OFF |
| | 3 | | Enable servo motor when power ON |

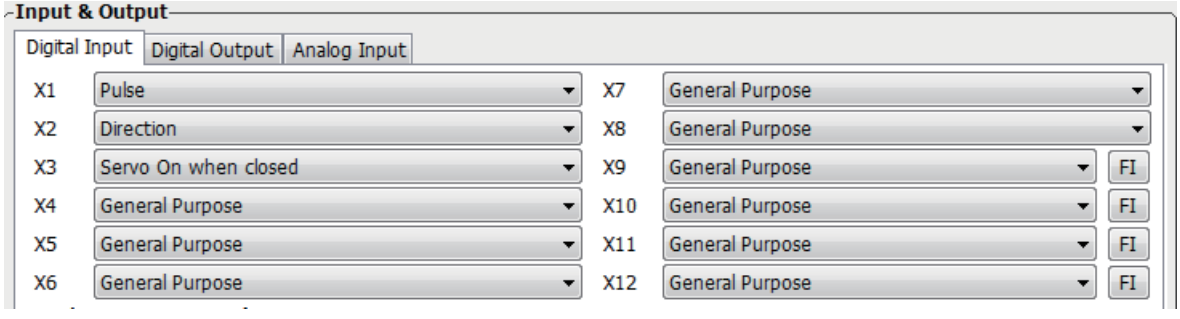
B. When P-14 (PM) = 5, the parameter settings are as follows:

| P-14 (PM) | P-62 (SI) | Condition | Function |
|---|---|---|---|
| P-14 (PM) = 5 | 1 | Closed | Servo motor disable Servo OFF |
| | | Open | Servo motor enable Servo ON |
| | 2 (default) | Closed | Servo motor enable Servo ON |
| | | Open | Servo motor disable Servo OFF |
| | 3 | | Servo motor disable when power ON |

**NOTE: if P-14(PM)=5, regardless P-62(SI)settings. The drive will be in disable mode(Servo OFF) at power up. Please use input X3 to enable based on P-62(SI) setting.**

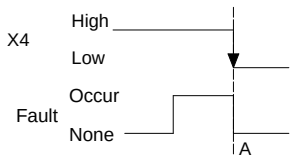
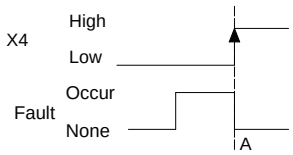
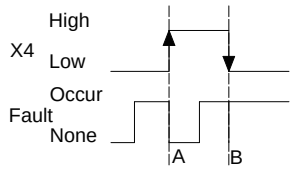
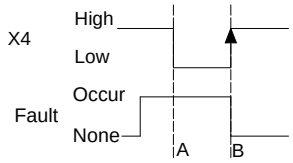
3) Software Configuration

In drive configuration page-----input & output select X3 function to setup.



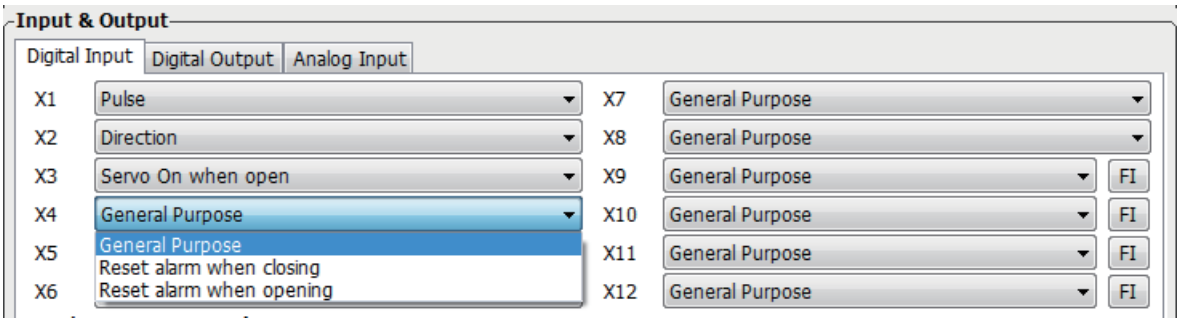
### 7.1.2 Alarm Reset

It is used to clear drive warnings or faults, it can be set via P-63 (AI)

<table>
<tr><th>Signal Name</th><th>PIN (CN2)</th><th>P-63 (AI)</th><th colspan="2">Function</th></tr>
<tr><td rowspan="6">X4</td><td rowspan="6">35 (X4+)<br>34 (X4-)</td><td rowspan="3">1</td><td colspan="2">During normal operation, input X4 must keep Open (HIGH). Change will ONLY be trigged at the change of signal. When X4 changes from Open (HIGH) to Close (LOW), the warning or fault alarms will be cleared.</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>1) X4 at HIGH, alarm NOT cleared<br>2) At point A, X4 change from HIGH to LOW, alarm is cleared</td><td>1) X4 is low, alarm NOT cleared<br>2) At point A, X4 change from LOW to HIGH, alarm NOT cleared<br>3) At point B, X4 change from HIGH to LOW, alarm cleared</td></tr>
<tr><td rowspan="3">2</td><td colspan="2">During normal operation, input X4 must keep CLOSED (LOW). Change will ONLY be trigged by the change of signal. When X4 changes from CLOSE (LOW) to OPEN (HIGH), the warning or fault alarms will be cleared.</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>1) X4 at LOW, alarm NOT cleared<br>2) At point A, X4 change from LOW to HIGH, alarm cleared<br>3) At point B, X4 level from high to low, the alarm does not clear</td><td>1) X4 is HIGH, alarm NOT cleared<br>2) At point A, X4 change from HIGH to LOW, alarm NOT cleared<br>3) At point B, X4 change from LOW to HIGH, alarm cleared</td></tr>
<tr><td>3 (default)</td><td colspan="2">General purpose input</td></tr>
</table>

### Software Configuration

In drive configuration page ----- Input & output select X4 functions to setup.



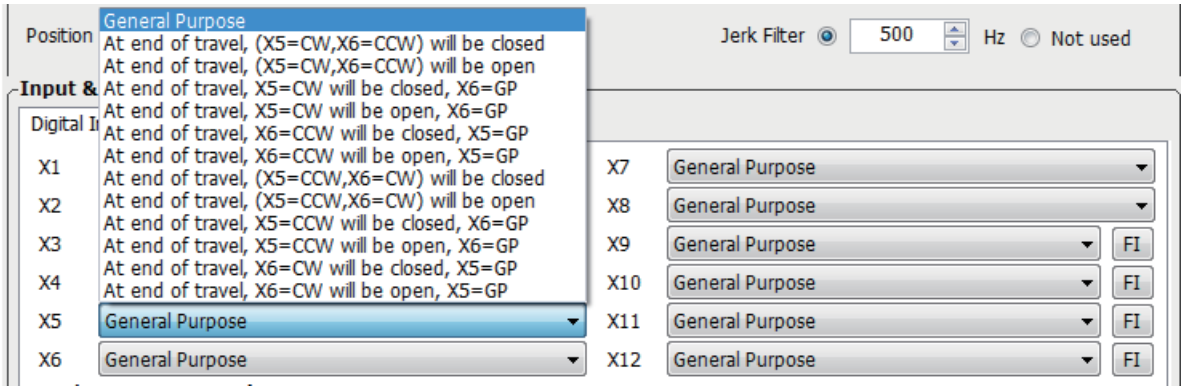
### 7.1.3 CW/CCW limit

In order to prevent accidents that might be caused by mechanical layers moving out of range, it is highly necessary to set CW/CCW position limit by using external I/O switches.

| P-64 (DL) | Description | Condition | Signal Name | Function |
|---|---|---|---|---|
| 1,4 | X5 sets CW limit<br>X6 sets CCW limit<br>Effects when X5/X6 is closed | Closed | X5 | Stop in CW direction, CW limit warning ON |
| | | | X6 | Stop in CCW direction, CCW limit warning ON |
| | | Open | X5 | Rotating in CW direction as normal |
| | | | X6 | Rotating in CCW direction as normal |
| 2,5 | X5 sets CW limit<br>X6 sets CCW limit<br>Effects when X5/X6 is open | Closed | X5 | Rotating in CW direction as normal |
| | | | X6 | Rotating in CCW direction as normal |
| | | Open | X5 | Stop in CW direction, CW limit warning ON |
| | | | X6 | Stop in CCW direction, CCW limit warning ON |
| 3,6,13,16 | X5, X6 as general purpose input (default) | | | |
| 7 | X5 sets CW limit<br>Effects when X5 is closed<br>X6 as general purpose input | Closed | X5 | Stop in CW direction, CW limit warning ON |
| | | Open | X5 | Rotating in CW direction as normal |
| 8 | X5 sets CW limit<br>Effects when X5 is open<br>X6 as general purpose input | Closed | X5 | Rotating in CW direction as normal |
| | | Open | X5 | Stop in CW direction, CW limit warning ON |
| 9 | X6 sets CCW limit<br>Effects when X6 is closed<br>X5 as general purpose input | Closed | X6 | Stop in CCW direction, CCW limit warning ON |
| | | Open | X6 | Rotating in CCW direction as normal |
| 10 | X6 sets CCW limit<br>Effects when X6 is closed<br>X5 as general purpose input | Closed | X6 | Rotating in CCW direction as normal |
| | | Open | X6 | Stop in CCW direction, CCW limit warning ON |
| 11,13 | X6 sets CW limit<br>X5 sets CCW limit<br>Effects when X5 is closed | Closed | X6 | Stop in CCW direction, CCW limit warning ON |
| | | | X5 | Stop in CCW direction, CCW limit warning ON |
| | | Open | X6 | Rotating in CW direction as normal |
| | | | X5 | Rotating in CCW direction as normal |
| 12,16 | X6 sets CW limit<br>X5 sets CCW limit<br>Effects when X5 is open | Closed | X6 | Rotating in CW direction as normal |
| | | | X5 | Rotating in CCW direction as normal |
| | | Open | X6 | Stop in CW direction, CW limit warning ON |
| | | | X5 | Stop in CCW direction, CCW limit warning ON |
| 17 | X6 sets CW limit<br>Effects when X6 is closed<br>X5 as general purpose input | Closed | X6 | Stop in CW direction, CW limit warning ON |
| | | Open | X6 | Rotating in CW direction as normal |
| 18 | X6 sets CW limit<br>Effects when X6 is open<br>X5 as general purpose input | Closed | X6 | Rotating in CW direction as normal |
| | | Open | X6 | Stop in CW direction, CW limit warning ON |
| 19 | X5 sets CW limit<br>Effects when X5 is closed<br>X6 as general purpose input | Closed | X5 | Stop in CCW direction, CCW limit warning ON |
| | | Open | X5 | Rotating in CCW direction as normal |
| 20 | X5 sets CCW limit<br>Effects when X5 is open<br>X6 as general purpose input | Open | X5 | Rotating in CCW direction as normal |
| | | Open | X5 | Stop in CCW direction, CCW limit warning ON |

### Software Configuration

In drive configuration page-----input& output X5/X6 to select correspondent functions




## 7.1.4 Global Gain Switch Function

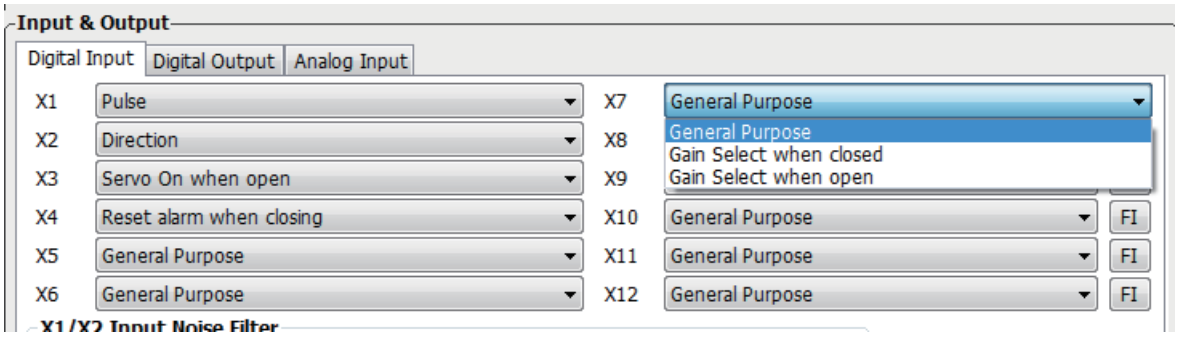
Use input X7 for global gain selection. When gain selection function is used, it helps the servo drive to run the motor with least time delay and as faithful as possible against the host command requirement. Especially in the cases, when load characteristic changes significantly, change off gain value will reduce motor's settling time, motor vibration and so on. It will highly optimize motor's overall performance. The two global gain parameters are: P-00 (KP), and P-01 (KG).

In factory default mode, function selection mode disabled. It can be set via M servo suite software or P-65 (MI) first digit (from right to left) in parameter setting mode directly from the drive.

| Signal Name | PIN | P-65 (MI) | Condition | Function |
|---|---|---|---|---|
| X7 | X7+ (39)<br>X7- (38) | □□□1 | Closed | Use global gain 1-------P-00 (KP) |
| | | | Open | Use global gain 2-------P-01 (KG) |
| | | □□□2 | Closed | Use global gain 2-------P-01 (KG) |
| | | | Open | Use global gain 1-------P-01 (KP) |
| | | □□□3<br>(default) | | Always use global gain 1----P-00(KP) |

### Software Configuration

In drive configuration page-------input/output select X7 function to setup.



### 7.1.5 Control Mode Switch

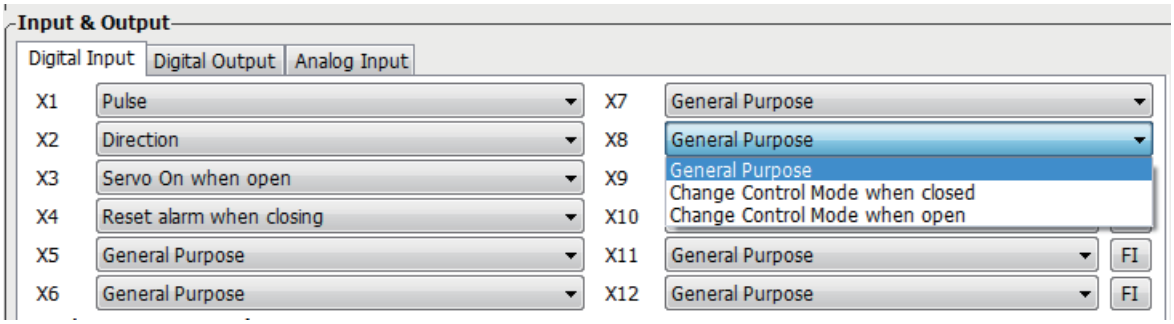
M2 series AC servo drive allows to choose 2 types of control mode by using external input switch X8. The control mode can be configured via two parameters P-12 (CM) and P-13 (CN).

In factory default mode, control mode switch function is disabled. It can be configured via M servo suite or P-65 (MI) third digit (from right to left) in parameter setting mode in the drive.

| Signal Name | PIN | P-65 (MI) | Condition | Function |
|---|---|---|---|---|
| X8 | X8+ (12)<br>X8- (32) | □1□□ | Closed | Use Control mode 1-------P-12 (CM) |
| | | | Open | Use Control mode 2-------P-13 (CN) |
| | | □2□□ | Closed | Use Control mode 2-------P-13 (CN) |
| | | | Open | Use Control mode 1-------P-12 (CM) |
| | | □3□□ (Default) | | Always use control mode 1---P-12(CM) |

### Software Configuration

In drive configuration page-------input/output select X8 function to setup.



### 7.1.6 Drive On Fault Output

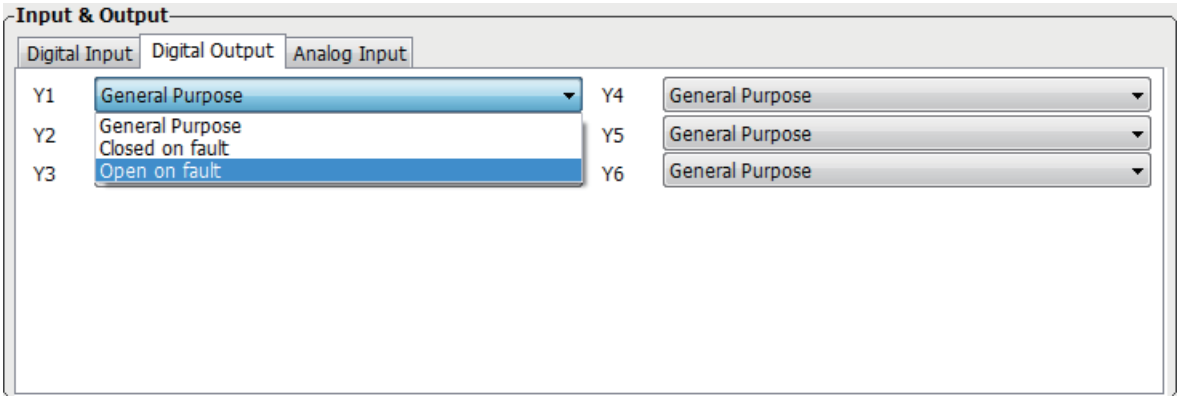
When warnings as below are shown, the drive will send “on fault” output and it will also disable the drive immediately.

Warning list: over position error, encoder error, over temperature, over voltage, low voltage, internal voltage fault, STO warning, FPGA error, over current, over velocity limit, bad hall sensor. On fault output signal can be set by P-65 (AO).

| Signal Name | PIN | P-65 (AO) | Condition | Function |
|---|---|---|---|---|
| Y1 | Y1+ (37)<br>Y1- (36) | □2□□ | Closed | When no warning, output is closed |
| | | | Open | When warning occurs, output is open |
| | | □1□□ | Closed | When warning occurs, output is closed |
| | | | Open | When no warning, output is open |
| | | □3□□ (Default) | | General purpose output, function disabled |

#### Software Configuration

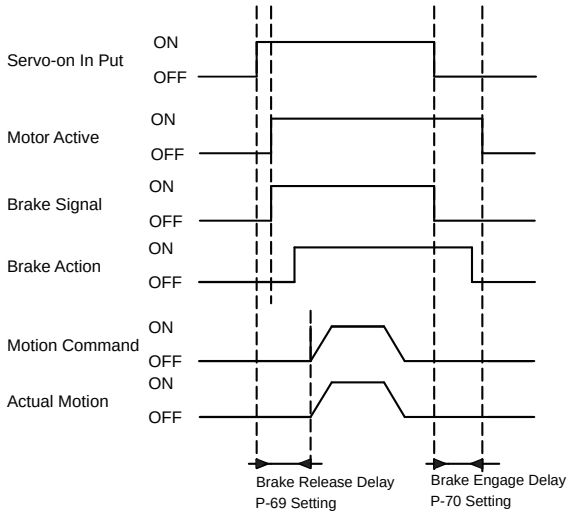
In drive configuration page-------input/output select Y1 function to setup.



### 7.1.7 Motor Brake Control

Servo motor brake is only used for holding the stalling status when motor is disabled or power OFF. It ensures the motor's mechanical layers will NOT move due to gravity or any other external forces.

In order to prevent damage to the brake, there are delay sequences during the brake operation. Please be cautious with brake operation sequence.

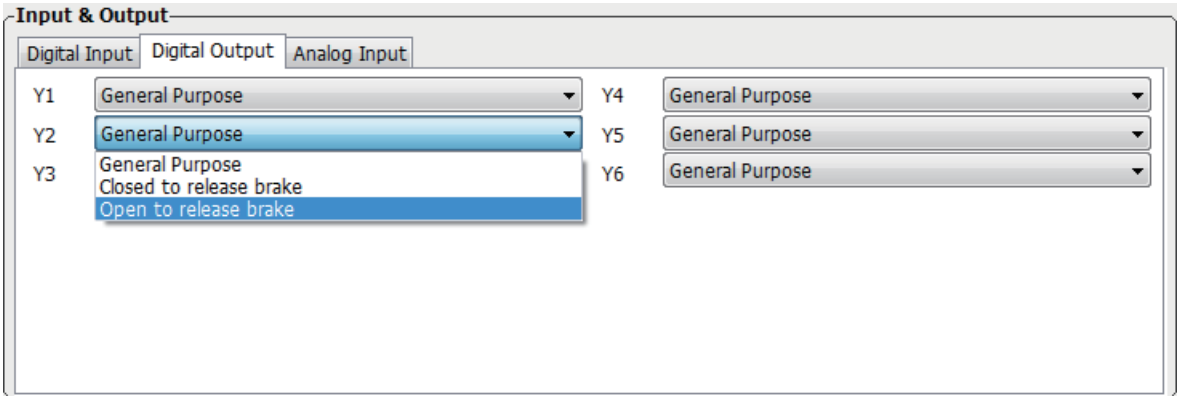



Brake disengage delay and engage delay can be configured via M servo suite software, or change parameters P-69 (BD) and P-70 (BE) directly from the drive.

| Name | PIN | P-67(BO) | Condition | Function |
|---|---|---|---|---|
| Y2 | Y2+ (11)<br>Y2- (10) | 2 | Closed | Hold on brake, brake holds the motor shaft |
| | | | Open | Release brake, brake releases the motor shaft |
| | | 1 | Closed | Release brake, brake releases the motor shaft |
| | | | Open | Hold on brake, brake holds the motor shaft |
| | | 3<br>(default) | | General purpose input, output function disabled |

### Software Configuration

In drive configuration page-------input/output select Y2 function to setup.



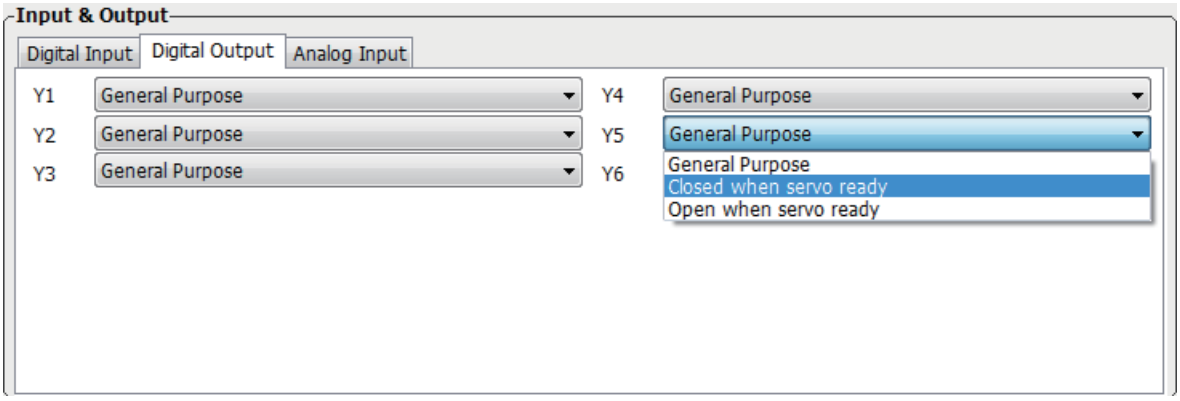
### 7.1.8 Servo Ready Output

When servo drive is power on, if no warning has occurred, output Y5 will outputs “servo ready” signal.

Servo ready function can be configured via M servo suite software, or by change parameters P-68 (MO) the third digit (from right to left) on the drive directly.

| Signal Name | PIN | P-68(MO) | Condition | Function |
|---|---|---|---|---|
| Y5 | Y5+ (40)<br>Y5- (41) | □2□□ | Closed | Closed when servo is not ready |
| | | | Open | Open when servo is ready |
| | | □1□□ | Closed | Closed when servo is ready |
| | | | Open | Open when servo is not ready |
| | | □3□□<br>(default) | | General purpose, function disabled |

#### Software Configuration



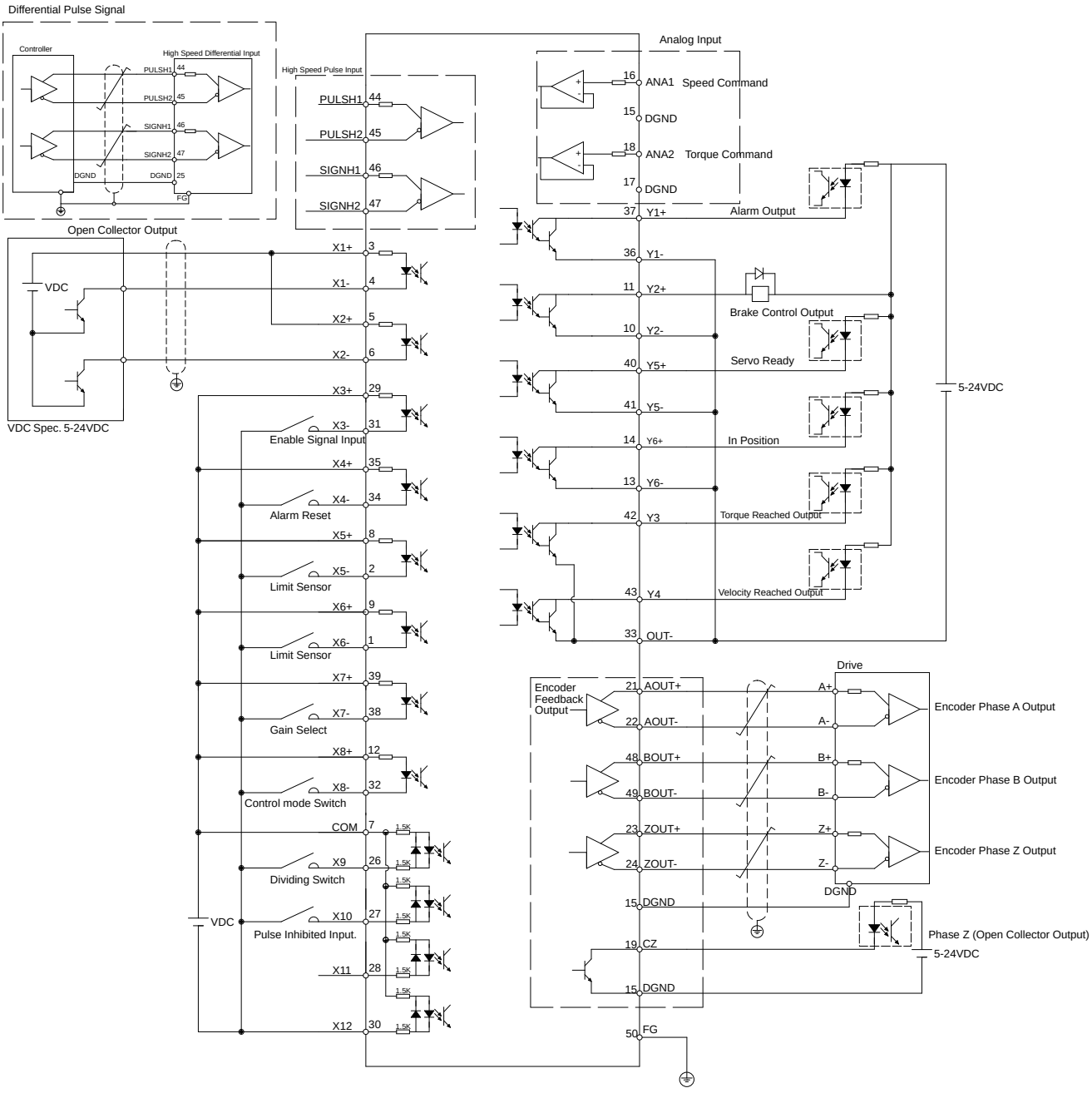

## 7.2 Position Mode

Position mode is widely used in the application where precision positioning is required. In M2 series AC servo drives there are 3 types of position mode: digital pulse position mode, analog position mode and position table mode.

| Mode | Control Signal | P-12 (CM) definitions | Description |
|---|---|---|---|
| Digital pulse position mode | Pulse & Direction<br>CW/CCW Pulse<br>A/B Quadrature | 7 | Up to 500KHz open collector input signal or up to 2MHz differential input signal |
| Analog position mode | +10V~-10V Analog signal | 22 | Use analog voltage signal for position control |
| Position table | Digital input signal | 25 | It has two motion control modes: linear motion with maximum of 64 position set points, and rotary motion with maximum of 32 position division points |

**NOTE: Configuration setting by M servo suite is recommended.**

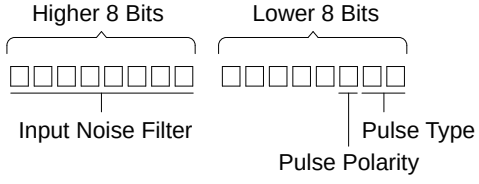
## 7.2.1 Digital Pulse Position Mode Connection Diagram



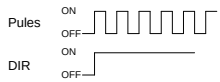
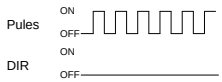
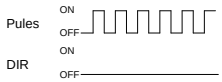
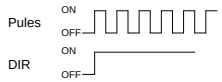
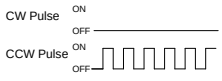
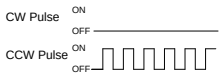
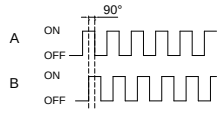
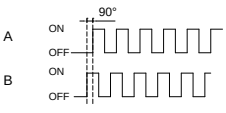
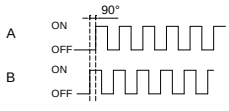
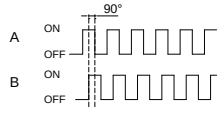

## 7.2.2 Input Pulse Type And Input Noise Filter

There are three types of pulse modes: STEP & Direction; CW/CCW Pulse; A/B Quadrature.

Parameter P-43 (SZ) uses decimal numbers to define pulse input type, polarity and input filter frequency. Transfer into binary number, the HIGHER 8 bits of the number defines input filter frequency, and the LOWER 8 bit defines pulse input type, and polarity.



### 7.2.2.1 Input Pulse Type Setting

| Parameter | Pulse | CW direction setting | CW | CCW | setting value (decimal) |
|---|---|---|---|---|---|
| P-42 (SZ) Lower 8 bits | Step & Direction | X2 on |  |  | 0 |
| | | X2 Off |  |  | 4 |
| | CW/CCW | Pulse On X1 |  |  | 1 |
| | | Pulse On X2 |  |  | 5 |
| | A/B Quadrature | X1 Lead X2 |  |  | 2 |
| | | X2 Lead X1 |  |  | 6 |

### 7.2.2.2 Input Noise Filter Setting

The input noise filter is a low pass filter. When pulse input and output duty cycle is set to 50%, the P-43 (SZ) setting value are as follows

| Parameter | setting value (decimal) | Filter Frequency | setting value (decimal) | Filter Frequency |
|---|---|---|---|---|
| P-42 (SZ) Higher 8 bits | 25344 | 100K | 4864 | 500K |
| | 16640 | 150K | 3072 | 750K |
| | 12544 | 200K | 2304 | 1M |
| | 9984 | 250K | 1792 | 1.2M |
| | 8192 | 300K | 1280 | 1.5M |
| | 6144 | 400K | 1024 | 2M |

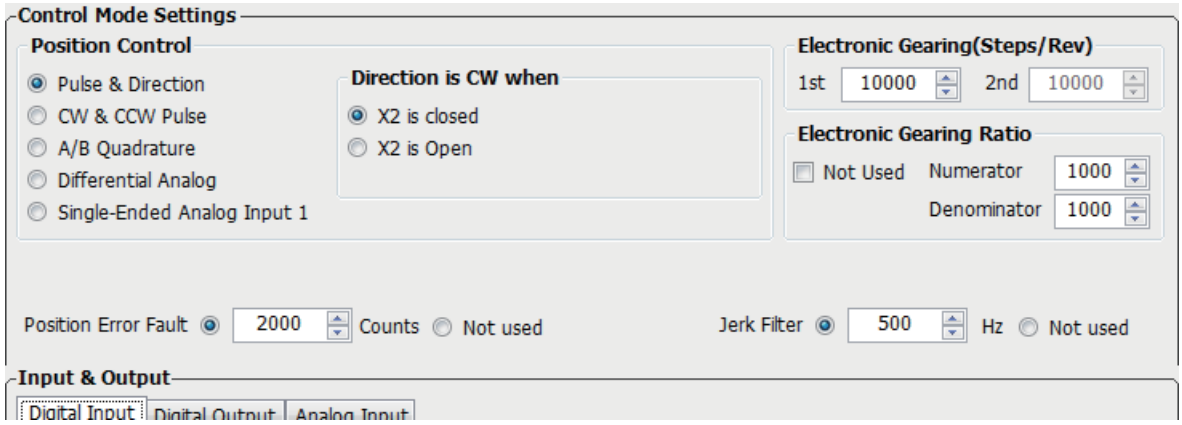
### 7.2.2.3 Parameter P-43 (SZ) Setting

Parameter P-43 (SZ)'s higher 8 digit and lower 8 digit set the definition for input filter frequency and pulse type, the setting value are as shown in table below:

| Filter Frequency | pulse type | CW/CCW condition | P-43 (SZ) setting value | Filter Frequency | pulse type | CW/CCW condition | P-43 (SZ) setting value |
|---|---|---|---|---|---|---|---|
| 100K | Step & Direction | X2 on | 25344 | 500K | Step & Direction | X2 on | 4864 |
| | | X2 Off | 25348 | | | X2 Off | 4868 |
| | CW/CCW | Pulse On X1 | 25345 | | CW/CCW | Pulse On X1 | 4865 |
| | | Pulse On X2 | 25349 | | | Pulse On X2 | 4869 |
| | A/B Quadrature | X1 Lead X2 | 25346 | | A/B Quadrature | X1 Lead X2 | 4866 |
| | | X2 Lead X1 | 25350 | | | X2 Lead X1 | 4870 |
| 150K | Step & Direction | X2 on | 16640 | 750K | Step & Direction | X2 on | 3072 |
| | | X2 Off | 16644 | | | X2 Off | 3076 |
| | CW/CCW | Pulse On X1 | 16641 | | CW/CCW | Pulse On X1 | 3073 |
| | | Pulse On X2 | 16645 | | | Pulse On X2 | 3077 |
| | A/B Quadrature | X1 Lead X2 | 16642 | | A/B Quadrature | X1 Lead X2 | 3074 |
| | | X2 Lead X1 | 16646 | | | X2 Lead X1 | 3078 |
| 200 | Step & Direction | X2 on | 12544 | 1M | Step & Direction | X2 on | 2304 |
| | | X2 Off | 12548 | | | X2 Off | 2308 |
| | CW/CCW | Pulse On X1 | 12545 | | CW/CCW | Pulse On X1 | 2305 |
| | | Pulse On X2 | 12549 | | | Pulse On X2 | 2309 |
| | A/B Quadrature | X1 Lead X2 | 12546 | | A/B Quadrature | X1 Lead X2 | 2306 |
| | | X2 Lead X1 | 12550 | | | X2 Lead X1 | 2310 |
| 250K | Step & Direction | X2 on | 9984 | 1.2M | Step & Direction | X2 on | 1792 |
| | | X2 Off | 9988 | | | X2 Off | 1796 |
| | CW/CCW | Pulse On X1 | 9985 | | CW/CCW | Pulse On X1 | 1793 |
| | | Pulse On X2 | 9989 | | | Pulse On X2 | 1797 |
| | A/B Quadrature | X1 Lead X2 | 9986 | | A/B Quadrature | X1 Lead X2 | 1794 |
| | | X2 Lead X1 | 9990 | | | X2 Lead X1 | 1798 |
| 300K | Step & Direction | X2 on | 8192 | 1.5M | Step & Direction | X2 on | 1280 |
| | | X2 Off | 8196 | | | X2 Off | 1284 |
| | CW/CCW | Pulse On X1 | 8193 | | CW/CCW | Pulse On X1 | 1281 |
| | | Pulse On X2 | 8197 | | | Pulse On X2 | 1285 |
| | A/B Quadrature | X1 Lead X2 | 8194 | | A/B Quadrature | X1 Lead X2 | 1282 |
| | | X2 Lead X1 | 8198 | | | X2 Lead X1 | 1286 |
| 400K | Step & Direction | X2 on | 6144 | 2.0M | Step & Direction | X2 on | 1024 |
| | | X2 Off | 6148 | | | X2 Off | 1028 |
| | CW/CCW | Pulse On X1 | 6145 | | CW/CCW | Pulse On X1 | 1025 |
| | | Pulse On X2 | 6149 | | | Pulse On X2 | 1029 |
| | A/B Quadrature | X1 Lead X2 | 6146 | | A/B Quadrature | X1 Lead X2 | 1026 |
| | | X2 Lead X1 | 6150 | | | | 1030 |

### Software Configuration

In software motor configuration page----control mode settings to select pulse input type and input filter type.




## 7.2.3 Control Pulse Dividing Switch Function

X9 is used as control pulse dividing switch function. When this function is on, it will allow the drive to change the number to encoder counts for per motor revolution. The first pulse dividing ratio is set via parameter P-39 (EG), the second pulse dividing ratio is set via P-40 (PV). Parameter second digit of P-65 (MI) (right to left) is used to set switching conditions.

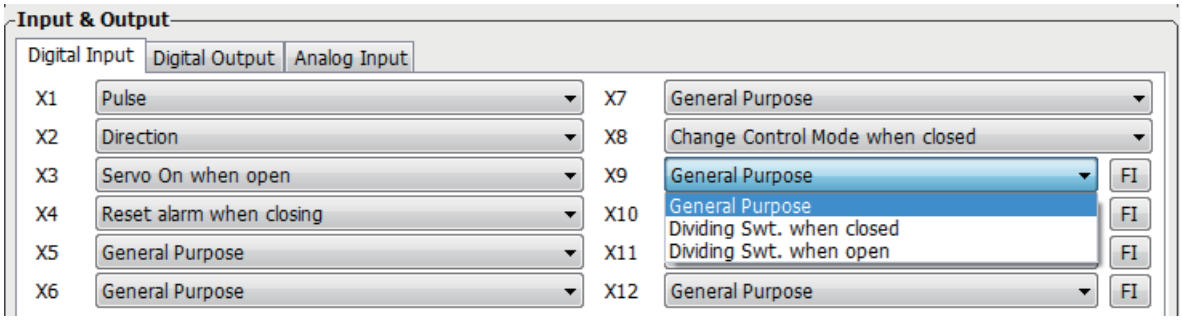
In factory default mode, pulse dividing switch is disabled. It can be set by M servo suite software or parameter P-64 (MI) directly from the drive's panel function.

| Signal Name | PIN | P-65 (MI) | Condition | Function |
|---|---|---|---|---|
| X9 | X9 (26) | □□1□ | Closed | Use 1st pulse dividing ratio ------ P-39 (EG) |
| | | | Open | Use 2nd pulse dividing ratio ------ P-40 (PV) |
| | | □□2□ | Closed | Use 2nd pulse dividing ratio ------ P-40 (PV) |
| | | | Open | Use 1st pulse dividing ratio ------ P-39 (EG) |
| | | □□3□ (default) | | Always use 1st pulse diving ratio ----P-39(EG) |

**NOTE: Please ONLY use pulse dividing ratio function, when no pulse command is sending into the drive. I.e. motor is NOT moving.**

### Software Configuration

In drive configuration page-------input/output select X9 function to setup pulse dividing switch function.



### 7.2.4 Pulse Inhibition Function

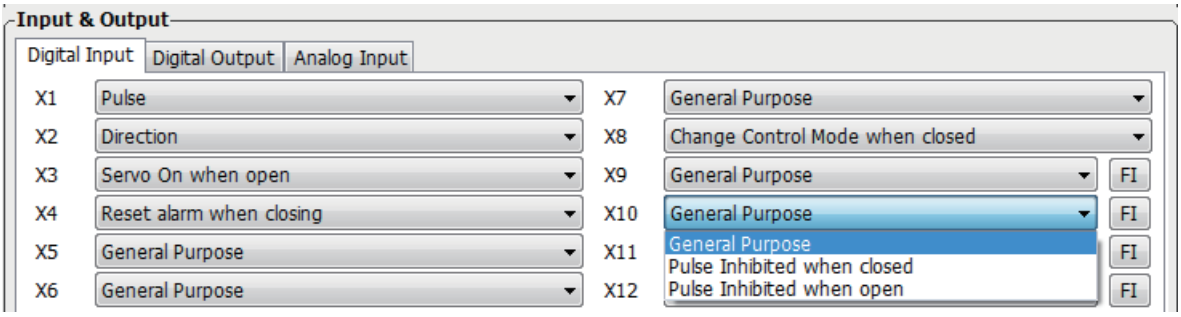
Pulse inhibition function use external input X10 in digital pulse position mode. When external input X10 is triggered, it will enforce the drive to stop receiving pulses input from any source, and stop the servo motor immediately.

In factory default mode, this function is disabled. It can be set via M2 servo suite or P-65 (MI) directly from the drive.

| Signal Name | PIN | P-65 (MI) | Condition | Function |
|---|---|---|---|---|
| X10 | X10 (27) | 2□□□ | Closed | Allow input pulse |
| | | | Open | Disallow input pulse |
| | | 1□□□ | Closed | Disallow input pulse |
| | | | Open | Allow input pulse |
| | | 3□□□ (default) | | General purpose input, function disabled |

#### Software Configuration

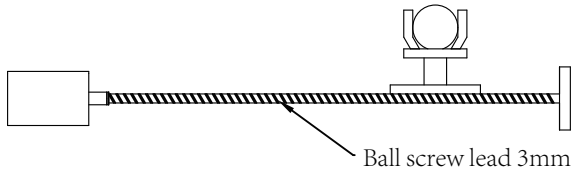
In drive configuration page-------input/output select X10 function to setup pulse inhibition function.




### 7.2.5 Electronic Gearing Ratio

Electronic gearing ratio using the host command pulse count per revolution times the electronic gearing ratio set on drive to set the actual rotatory pulse per revolution. This feature allows more freedom and setting options when certain pulse count or moving counter is required

If motor pulse per revolution is 10000 pulse/rev and the electronic gearing ratio is set to 1. In this case, if host computer send 10000 pulse, the motor will turn 1 revolution. If the electronic gearing ratio is set to 1/2, then motor will only move for 1 pulse position, when host send 2 pulses. i.e. 20000 pulses for 1 motor revolution. In some cases, reasonable electronic gearing ratio can simplify the calculation for the host when send pulse command.




Distance for screw lead, movements requirement 4mm

If no electronic greasing is used, the valuation will be as follows:

Since the screw distance is 3mm, i.e. when motor rotate one rev, the working load will move 3mm. if moving distance 4mm is required, it is 4/3 of rev

Pulse Count Requirement

If motor per rev requires 10000 pulse, then $10000 \times \frac{4}{3} = 13333.33333\cdots$ pulses

It will leads to infinite number with accumulative error in pulse number.

If use electronic gearing ratio

If 1 pulse is set to 1um, and 10000 pulse per rev, the Electronic gearing ratio can be set as follows:

$$\frac{3000}{10000} \times \frac{a}{b} = 1um$$

If Electronic gearing ratio is set to $\frac{a}{b} = \frac{10}{3}$, then 1 pulse send by the host, will leads to 1um movment on the moving object.

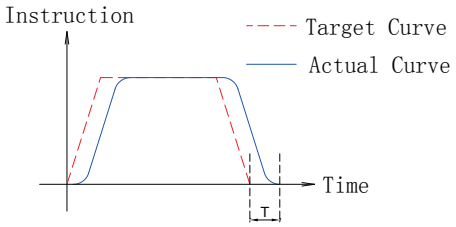
Parameters Setting

| Parameter | Name | Data Range | Default | |
|---|---|---|---|---|
| P-39 (EG) | Required pulse per rev | 200~51200 | 10000 | Set Required pulse per rev |
| P-40 (PV) | Secondary Required pulse per rev | 200~51200 | 10000 | Set secondary Required pulse per rev |
| P-41 (EN) | Electronic gearing Ratio Numerator | 1~1000 | 1000 | Set Electronic gearing Ratio Numerator |
| P-42 (EU) | Electronic gearing Ratio Denominator | 1~1000 | 1000 | Set Electronic gearing Ratio Denominator |

## 7.2.6 Jerk Smoothing Filter

Applying dynamic filter on speed and direction signals can significantly smoothing motor rotary motion, and reduce damages towards mechanical layer.

Jerk smoothing filter effects are as follows：




1) The smaller value of P-07 (KJ), the strong effect it will be.

2) Jerk smoothing filter will cause command delay time T, but it will not effect in position accuracy.

Parameters Setting

| Parameter | Name | Data Range | Default | |
|---|---|---|---|---|
| P-07 (KJ) | Jerk Filter Frequency | 0~5000 | 5000 | Set jerk smoothing filter parameter |

**NOTE: Setting to 0, means no filter effect.**

### 7.2.7 In Position Error Output

In position mode, using the “in position error output” function can help the user the define motors in position status. When the difference between drive’s total receiving pulse and motor’s actual rotating pulse count is within the in position error range, the drive will send out a motor in position signal.

The forth digit of parameter P-68 (MO) defines Y6 output function. parameter P-46 (PD) defines in position error range. P-47 (PE) defines in position error timing duration. If the in position error is within the P-46 (PD) range for more than the time duration of P-47 (PE) setting, the drive will output motor in position signal.

| Signal Name | PIN | P-68 (MO) | Condition | Function |
|---|---|---|---|---|
| Y6 | Y6+ (14)<br>Y6- (13) | 5□□□ | Closed | Closed means motor not in position |
| | | | Open | Open means motor in position |
| | | 4□□□ | Closed | Close means motor in position |
| | | | Open | Open means motor not in position |
| | | 3□□□<br>(default) | | General purpose output, function disabled |

#### Parameters Setting

| Parameter | Name | Data Range | Default | |
|---|---|---|---|---|
| P-46 (PD) | In position error range | 0~32000 | 10 | This parameter sets the in position error range, when in position error count is less than the range, drive will indicates motor in position. |
| P-47 (PE) | In position duration count | 0~32000 | 10 | If the position error is in the in-position range and last longer than the duration time, the motion is supposed to be complete and the motor is in position. If the time value is set to 100 the position error must remain in the range for 100 processor cycles before the motion is supposed to be complete. One processor cycle is 250μsec. |

### 7.2.8 Gain Parameters For Position Control Mode

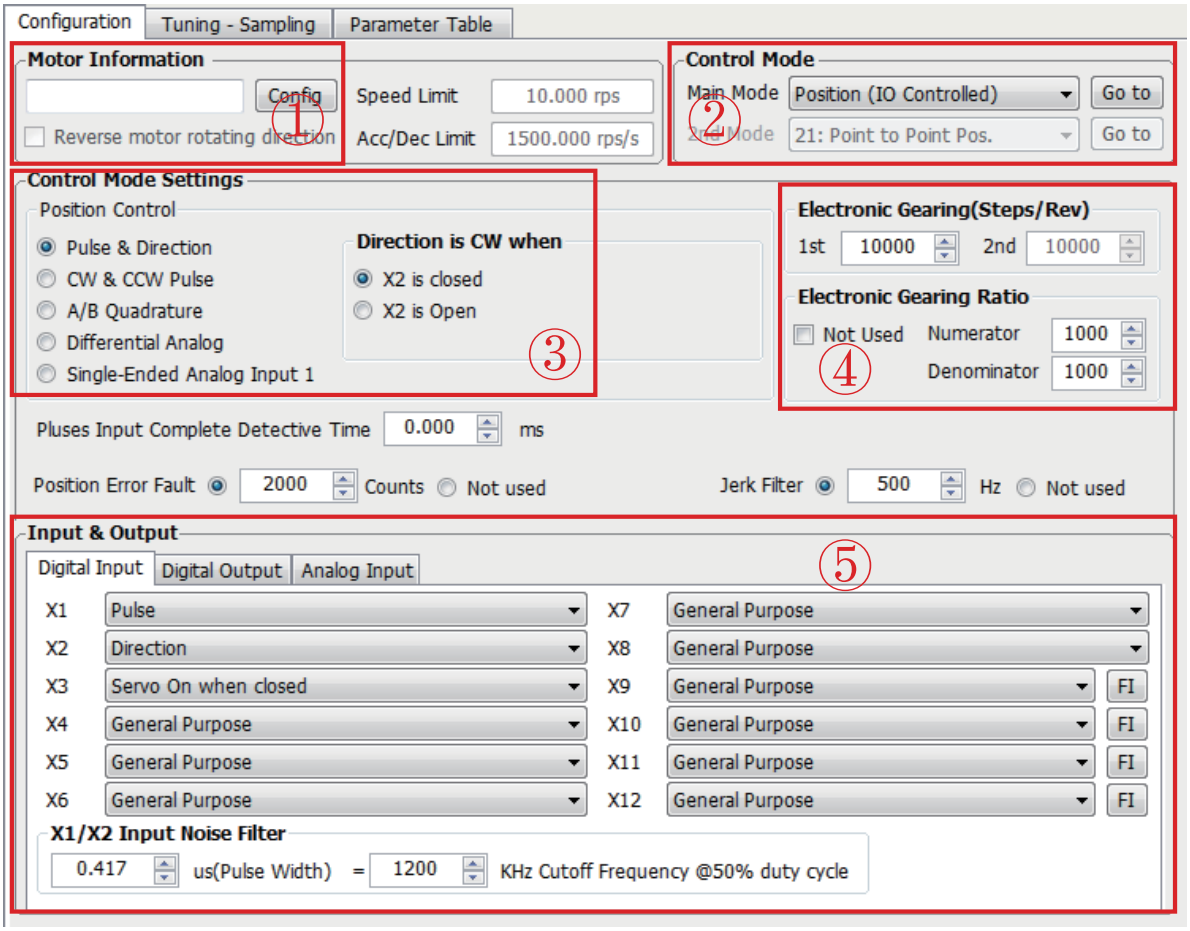
In position mode, reasonable gain parameters will let the servo system running and stop more smoothly, and accurately, and optimize its performance.

In most the cases, M2 servo suite software’s auto tuning function will help you to tune these parameters. However, in some case customer can also use the fine tuning function from the software or parameter setting mode on the drive find out the best performance for you.

| Parameter | Name | Data Range | Default |
|---|---|---|---|
| P-00(KP) | Global gain 1 | 0~32767 | 10000 |
| P-01(KG) | Global gain 2 | 0~32767 | 12000 |
| P-02(KF) | Proportional Gain | 0~32767 | 10000 |
| P-03(KD) | Derivational Gain | 0~32767 | 3000 |
| P-04(KV) | Damping Gain | 0~32767 | 10000 |
| P-05(KI) | Integrator gain | 0~32767 | 500 |
| P-06(KK) | Inertia Feedforward Constant | 0~32767 | 800 |
| P-07(KJ) | Jerk Filter Frequency | 0~32767 | 5000 |
| P-10(KE) | Deriv Filter factor | 0~32767 | 15000 |
| P-11(KC) | PID Filter factor | 0~32767 | 25000 |

### 7.2.9 Software Configuration For Position Mode

The M servo suite can help you easily configured the drive and motor, as well as tuning parameters.




| Step | Operation | Description |
|---|---|---|
| 1st | Configure motor | Choose your motor number. Please refer to 2.3 motor number for details. |
| 2nd | Choose control mode | In control mode, choose “Position” for position mode. |
| 3rd | Control mode configuration | Choose specified input pulse type, Please refer to 4.8.3 CN2 input signal connections and and 7.2 position mode. |
| 4th | Set electronic gearing ratio | Please refer to 7.2.5 for electronic gearing ratio settings. |
| 5th | Set analog signal | Function, or digital input/output functions. In Input/Output functions to setup. Please refer to 4.8.3 CN2 connections, and 7.2 position mode and 7.1 general function settings. |

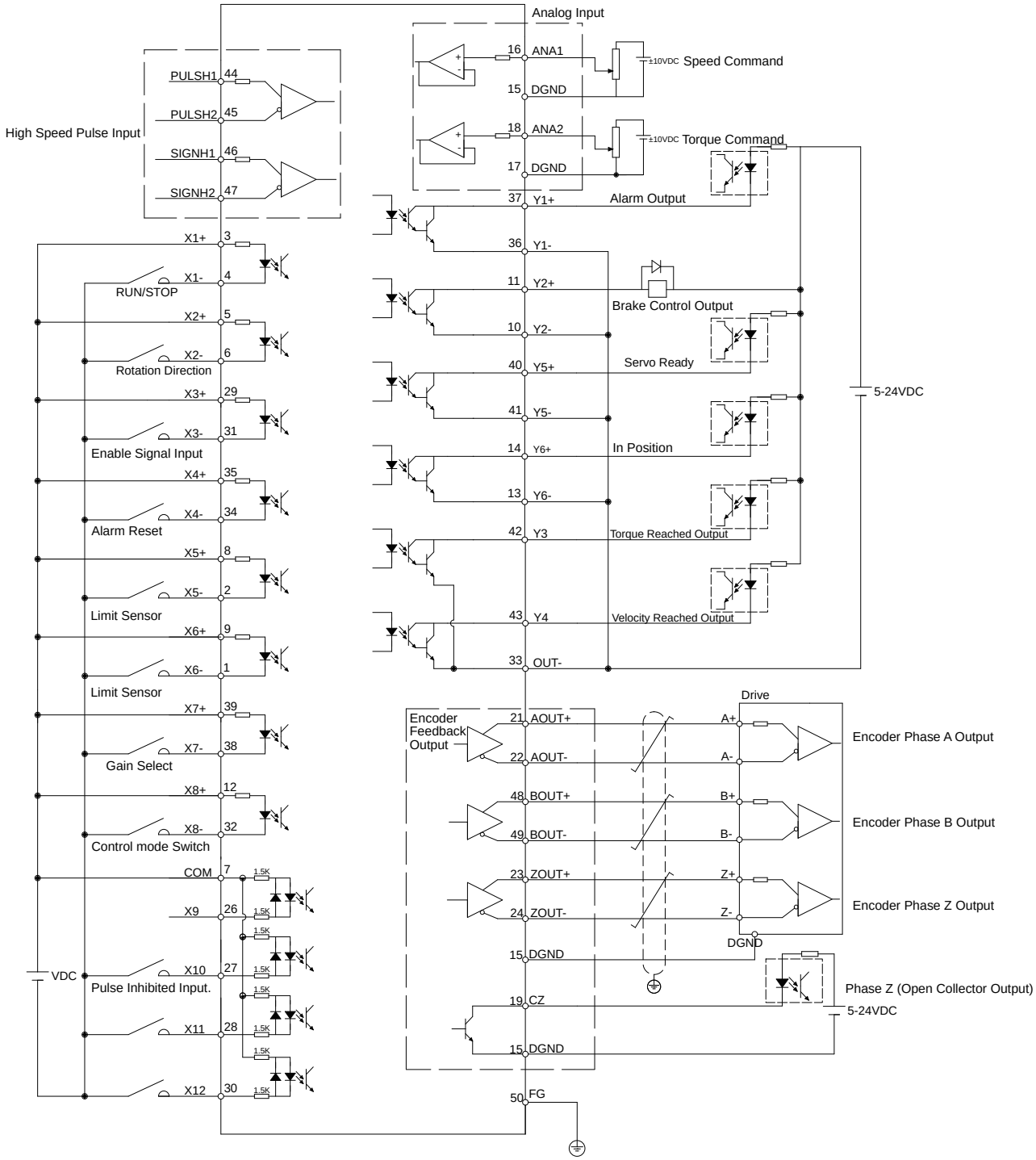
## 7.3 Velocity Mode

The velocity control mode is usually used on the applications of precision velocity control. For M2AC servo drives, they are 4 types of velocity control mode: fix speed mode, analog command mode, SCL control mode and multi velocity control mode. Fix speed mode will set motor running at a constant speed. For analog command mode, velocity is controlled by external voltage input. SCL is a unique software commanding tool design by MOONS' , it use serial communication command to control the motor. For Multi velocity control mode, the drive uses external input to set up different velocity value. There are up to 8 different velocity value can be set.

| Mode | Control Signal | P-12 (CM) Definitions | Description |
|---|---|---|---|
| Analog velocity mode | +10~-10V Analog signal | 11 | Analog velocity mode, NO run/stop signal, X2 is direction switch. |
| Analog velocity mode | +10~-10V Analog signal | 12 | Analog velocity mode, X1 is run/stop signal, X2 is direction switch. |
| Velocity Mode | Digital input signal | 15 | Profile velocity mode, after drive is enabled. The drive will run at velocity set by P-22 (JS). NO run/stop signal, X2 is direction switch |
| Velocity Mode | Digital input signal | 16 | Profile velocity mode, after drive is enabled. The drive will run at velocity set by P-22 (JS). X1 is run/stop switch, X2 is direction switch |
| In position error output | Digital output signal | 17 | Profile velocity mode, NO run/stop signal. X2 is direction switch. X10, X11, X12 is speed selection switch. |
| In position error output | Digital output signal | 18 | Profile velocity mode, X1 is run/stop switch. X2 is direction switch. X10, X11, X12 is speed selection switch. |

**NOTE:We highly recommend using M servo suite software to configure velocity mode.**

## 7.3.1 Velocity Mode Connection Diagram



### 7.3.2 Parameter Settings For Analog Velocity Control Mode

M2 series AC servo drive has 2 12bits analog AD converters. When single ended input signal is used, analog input 1 (ANA1) is used for velocity command, analog input 2 (ANA2) is used for rotating toque command. Differential input via ANA1/ANA2 is also available. In addition, low pass filter, offset and deadband can also be set to the drive.

| Parameter | Name | Data Range | Default | Unit | Description |
|---|---|---|---|---|---|
| P-12 (CM) | Main control mode | 1~8,10~18,21,22 | 7 | | Drive's main control mode selection |
| P-13 (CN) | Secondary control mode | 1~8,10~18,21,22 | 21 | | Drive's secondary control mode selection |
| P-50 (AG) | Analog Velocity Gain | -100~100 | 20 | Rps | Motor rotating velocity when analog voltage is 10VDC |
| P-51 (AN) | Analog Torque Gain | -20~20 | 1 | A | Motor rotating torque when analog voltage is 10VDC |
| P-52 (AV1) | Analog voltage offset 1 | -10~10 | 0 | V | Set analog voltage input 1 offset value |
| P-53 (AV2) | Analog voltage offset 2 | -10~10 | 0 | V | Set analog voltage input 2 offset value |
| P-54 (AV3) | Analog voltage offset (differential) | -10~10 | 0 | V | Set differential analog voltage input offset value |
| P-55 (AS) | Analog input type | 0~1 | 0 | | Analog input type |
| P-56 (AD1) | Analog deadband 1 | 0~255 | 0 | mV | Set analog input 1 deadband offset value |
| P-57 (AD2) | Analog deadband 2 | 0~255 | 0 | mV | Set analog input 2 deadband offset value |
| P-58 (AD3) | Analog deadband (differential) | 0~255 | 0 | mV | Set analog differential input deadband offset value |
| P-59 (AF) | Analog input low pass filter | 1~15990 | 500 | | Analog input noise filter |
| P-60 (AT) | Analog trigger point | -10~10 | 0.000 | V | |
| P-61 (FA1) | Define Analog input 1 function | 1~3 | 3 | | Define Analog input 1 function |
| P-61 (FA2) | Define Analog input 2 function | 1~3 | 3 | | Define Analog input 2 function |

**NOTE: This parameter unit in table above might be different from the LED display unit on the drive. Please refer to parameter 8 for details.**

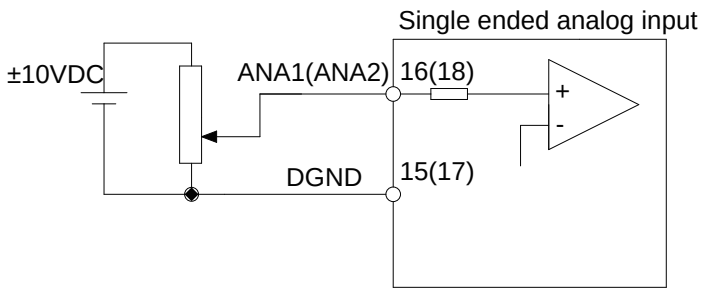
### 7.3.3 Basic Settings For Analog Velocity Control Mode

#### 7.3.3.1 Command Signal For Analog Velocity Mode

In Analog input velocity mode, both single ended and differential signal are acceptable.

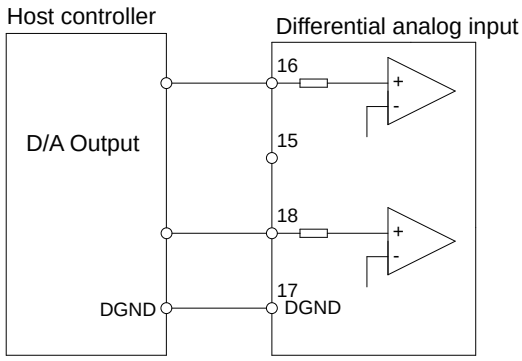
#### A. Single Ended Analog Input

| PIN type | Signal | PIN number | Function |
|---|---|---|---|
| Input | ANA1 | 16 | Analog velocity input signal |
| | DGND | 15 | Analog velocity input signal grounding (digital ground) |



### B. Differential Analog Input

| PIN type | Signal | PIN number | Function |
|---|---|---|---|
| Input | ANA1 | 16 | Analog velocity input for differential input signal |
| | ANA2 | 18 | |
| | DGND | 15 | Analog velocity input signal grounding (digital ground) |




### 7.3.3.2 Analog Velocity Gain

Analog input voltage range is between -10V~+10V. In analog velocity, it requires to set the velocity value to correspondent input voltage value. It can be set via M servo suite software or P-50 (AG) from the drive.

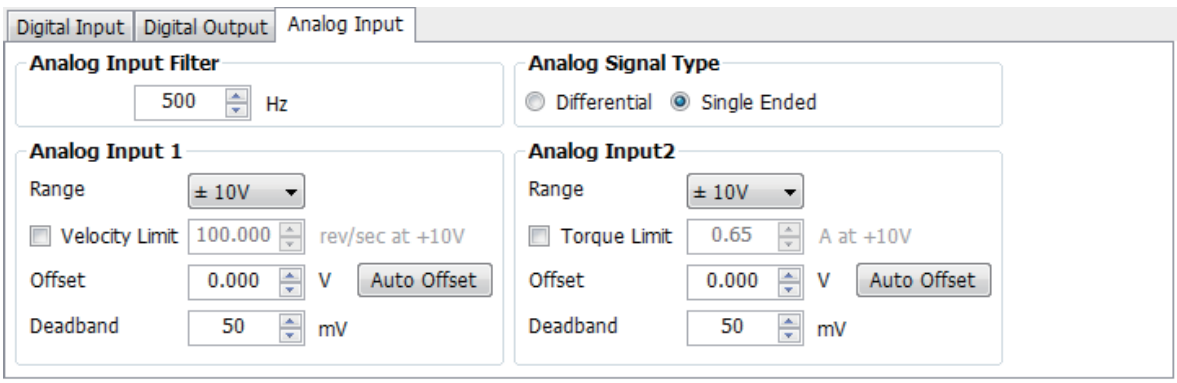
| Parameter | Name | Data Range | Default | Unit | Description |
|---|---|---|---|---|---|
| P-50 (AG) | Analog Velocity Gain | -100~100 | 20 | rps | The corresponding motor rotary velocity for 10vdc analog input voltage. |

**NOTE: if you need to view or set the velocity value on drive's control panel, please refer to following calculation:**

**Drive display value= *V* x 240**

***V*** is target setting velocity rev/second (rps)

### Setting Via Software



### 7.3.3.3 Analog Input Voltage Offset

In some cases, even when host controller set the analog command to 0V, the servo motor might still rotate slowly. This is caused by voltage bias from the analog voltage supply. M servo suite can automatically offset the analog voltage bias, or customers can manually tuning voltage offset value by change parameter P-52 (AV1) and P-53 (AV2).

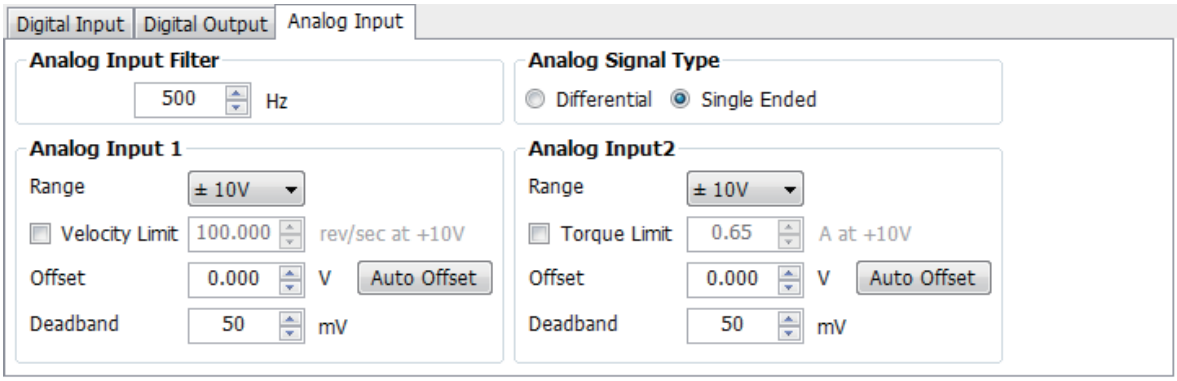
| Parameter | Name | Data Range | Default | Unit | Description |
|---|---|---|---|---|---|
| P-52 (AV1) | Analog input 1 offset | -10~10 | 0 | V | Set Analog input 1 offset |
| P-53(AV2) | Analog input 2 offset | -10~10 | 0 | V | Set Analog input 2 offset |

**NOTE: To display play or change the value on the driver’ s LED display, please refer to following calculations:**

**Drive display value= *A* x 2730**

***A*** is target setting offset, unit Voltage (V)

Setting Via Software



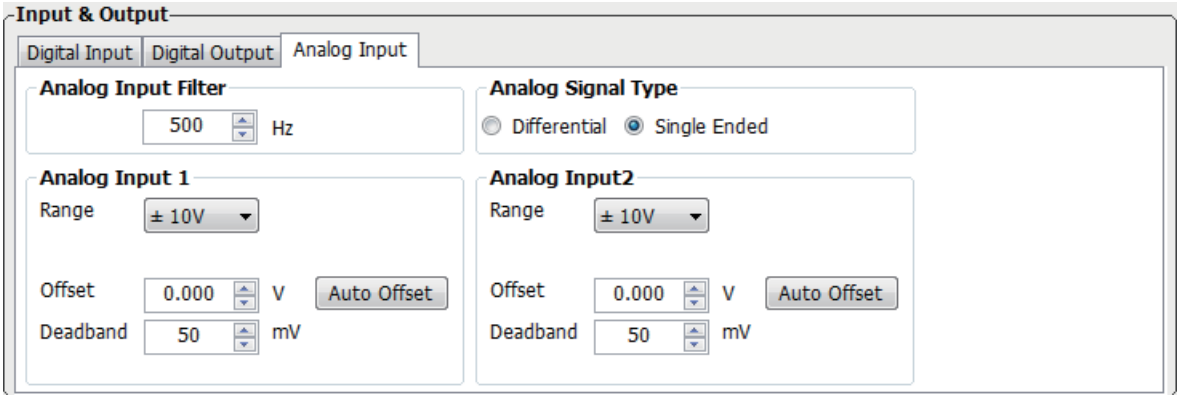
### 7.3.3.4 Analog Input Deadband

In analog control model, even when the input voltage is 0V, it is almost impossible to ensure input voltage is absolute 0V due to external interferences. In some cases, it might cause motor turn slowly in either direction. Therefore, it is highly necessary to setup a reasonable deadband value to prevent this issue.

The analog input deadband can be configured via M servo suite software or parameter P-56 (AD1) directly from the drive's control panel.

| Parameter | Name | Data Range | Default | Unit | Description |
|---|---|---|---|---|---|
| P-56 (AD1) | Deadband for analog input 1 | 0~255 | 0 | mV | Set deadband for analog input 1 |

### Setting Via Software

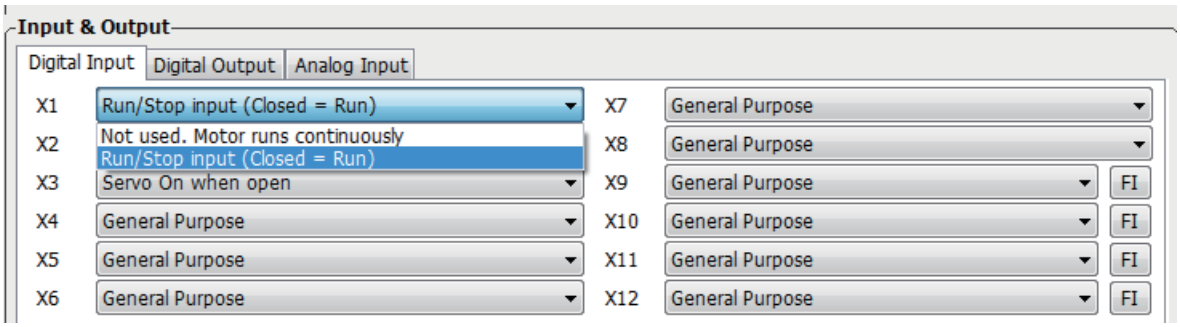


### 7.3.3.5 Run/Stop And Direction Signal

In analog velocity mode, external input X1 can set as run/stop switch, X2 can set as direction switch.

| Signal Name | PIN | Signa | Function | Description |
|---|---|---|---|---|
| X1 | X1+ (3) | Closed | Velocity mode run/stop switch | Motor running, analog voltage value defines rotary velocity. |
| | X1- (4) | Open | | When switch is open, Motor stops rotary regardless of analog input voltage. |
| X2 | X2+ (5) | Closed | Velocity mode run/stop switch | Change motor rotating direction. |
| | X2+ (5) | Open | | Not in use. |

### Setting Via Software



### 7.3.3.6 Torque Limit

In single ended analog mode, analog input 2 (ANA2) can used to set motor's output torque.

#### Parameters Setting

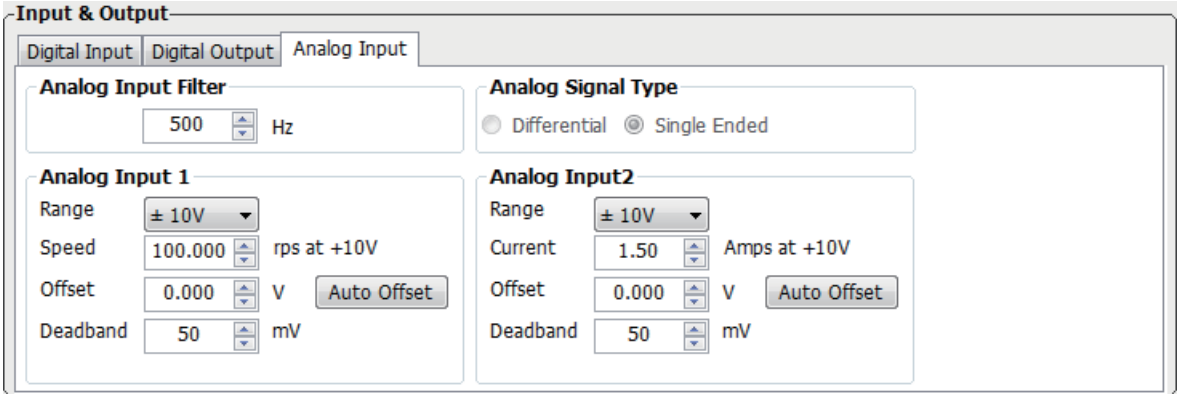
| Parameter | Name | Data Range | Default value | Unit | Description |
|---|---|---|---|---|---|
| P-55 (AS) | Analog type | 0~1 | 0 | | Analog input type<br>0: Single ended input 1: Differential input |
| P-62 (FA2) | Analog 2 function setting | 1~3 | 3 | | Analog input port 2 function setting:<br>2: Torque limit setting 3: Not in use |
| P-51 (AN) | Analog Torque Gain | Based on drive's output ability | 1 | A | Sets correspondent torque output value against 10VDC input voltage. |

**NOTE: if you need to view or set this value on drive's control panel (P-51 (AN)), please refer to following calculation:**

**Drive display value= *A* x 100**

where ***A*** is target torque output value

#### Setting Via Software



### 7.3.3.7 Target Velocity Reach

In velocity mode, when motor's actual velocity and command velocity is the same, "velocity reach" signal can be sent by output Y4 .

The second digit (from right to left) of parameter P-68 (MO) defines the output signal Y4.

| Signal Name | PIN | P-68 (MO) | Condition | Function |
|---|---|---|---|---|
| Y4 | Y4 (43)<br>OUT- (33) | □□B□ | Closed | Closed means target speed not reached |
| | | | Open | Open means reach output speed |
| | | □□A□ | Closed | Close means reach output speed |
| | | | Open | Open means target speed not reached |
| | | □□3□ (default) | | General purpose signal, function disabled. |

### Parameters Setting

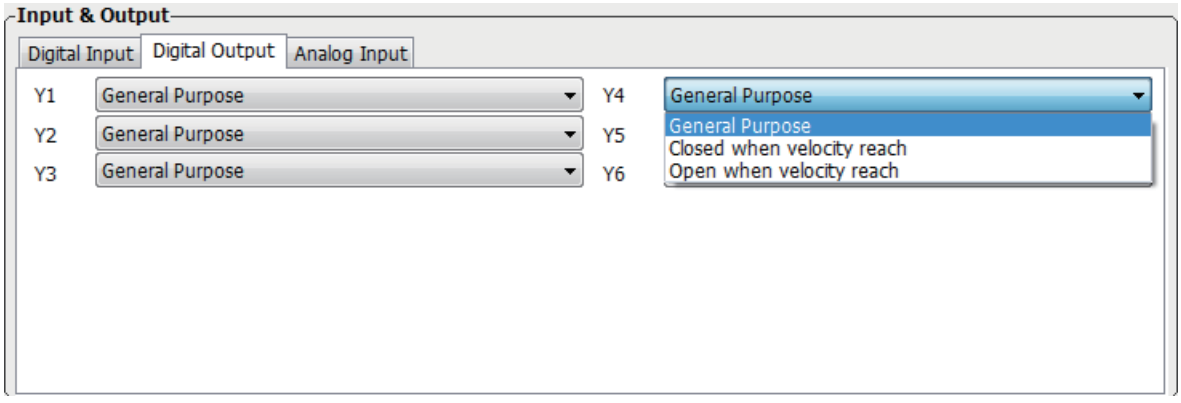
| Parameter | Name | Data Range | Default value | Unit | Description |
|---|---|---|---|---|---|
| P-85 (VR) | Ripple range setting for velocity reach | 0~136 | 0.000 | Rps | The velocity ripple value around the targeted velocity. If the difference between the actual velocity and targeted velocity is within the ripple value. The driver will then define actual torque meets its target torque value. |

**NOTE: if you need to view or set this value on drive's control panel (P-83 (VR), please refer to following calculation:**

**Velocity ripple range = LED display value x 240**

Unit for Velocity ripple range is revolution per second (rps)

### Setting Via Software



### 7.3.4 Analog Input Filter

When analog input is used, there might be external interferences that affect the accuracy of the analog input voltage. In some cases will cause the motor to turn unexpectedly, or unstable torque output. Therefore, analog input filter is recommended. It is designed as a digital low pass filter; reasonable filter frequency can significantly improve the motor performance.

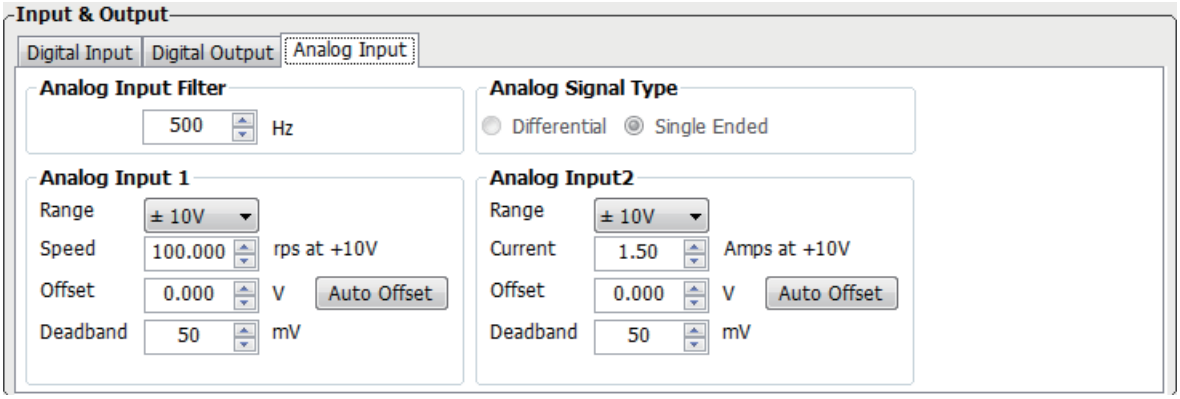
To setup the analog input filter directly from the drive, please refer to the following calculation

$$\text{Display analog input value} = \frac{72090}{\frac{1400}{x} + 2.2}$$

Where X is input filter frequency, unit Hz

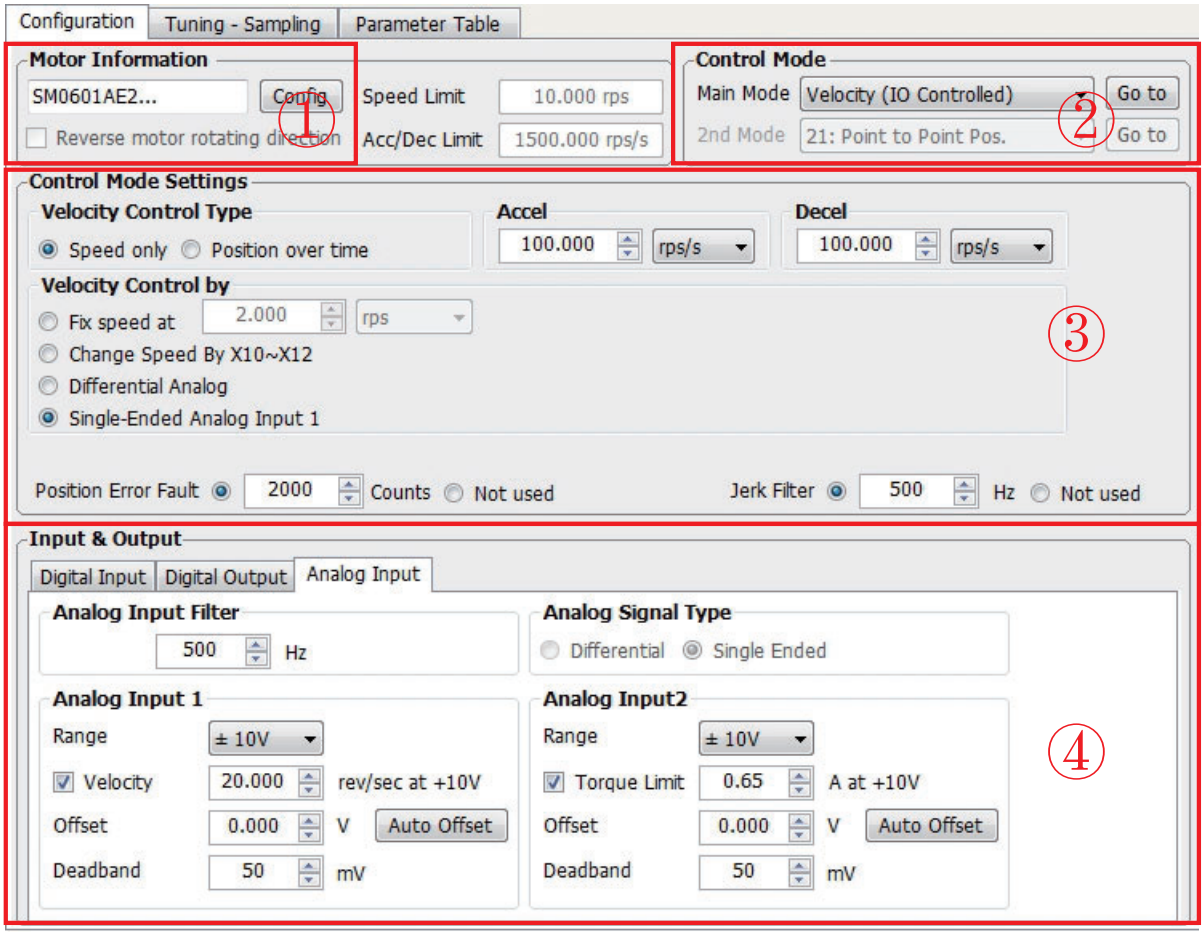
#### Setting Via Software

In drive configuration page-------input/output analog input 1/2 settings to setup



### 7.3.5 Software Configuration For Analog Velocity Mode

The M servo suite can help you easily configure the drive and motor, as well as tuning the parameters.



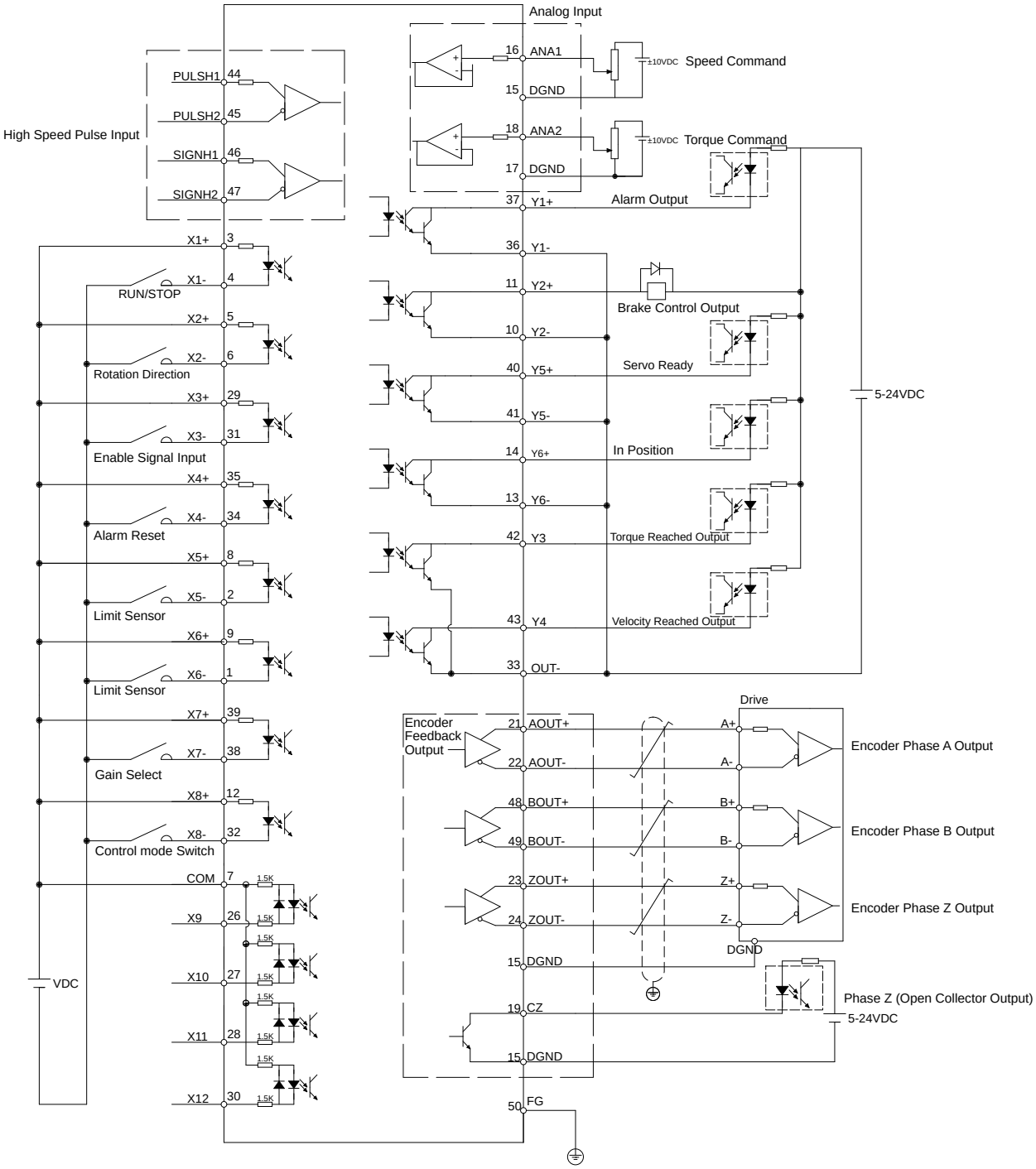

| Step | Operation | Description |
|---|---|---|
| 1st | Configure motor | choose your motor number. Please refer to 2.3 motor number for details |
| 2nd | Choose control mode | In control mode, choose “velocity” for Velocity mode |
| 3rd | Control mode configuration | choose specified velocity analog type, Please refer to 7.3 analog velocity mode and 7.6 command velocity. |
| 4th | Set analog signal | function, or digital input/output functions in Input/Output functions to setup. Please refer to 4.8.3 CN2 connections, and 7.3 velocity mode and 7.1 general function settings. |

## 7.4 Torque Mode

The torque mode is usually used on the applications of precision torque control. For M2 series AC servo drives, they are 2 types of torque control mode: analog input torque mode and SCL command mode. For analog command mode, torque is controlled by external voltage input. SCL is a unique software commanding tool design by MOONS', it use serial communication command to control the motor.

| Mode | Control Signal | P-12 (CM) Definition | Description |
|---|---|---|---|
| Analog input torque mode | +10~-10V Analog signal | 2 | Analog torque mode: No run/stop signal,<br>No direction signal |
| Analog input torque mode | +10~-10V Analog signal | 5 | Analog torque mode: X1 for run/stop signal,<br>No direction signal |
| Analog input torque mode | +10~-10V Analog signal | 3 | Analog torque mode: no run/stop signal;<br>X2 is closed, motor will change its current rotary direction. |
| Analog input torque mode | +10~-10V Analog signal | 4 | Analog torque mode: no run/stop signal;<br>X2 is open, motor will change its current rotary direction. |
| Analog input torque mode | +10~-10V Analog signal | 6 | Analog torque mode: X1 for run/stop signal;<br>X2 is open, motor will change its current rotary direction. |
| Analog input torque mode | +10~-10V Analog signal | 8 | Analog torque mode: X1 for run/stop signal;<br>X2 is close, motor will change its current rotary direction. |
| SCL torque control mode | SCL command | 1 | |

## 7.4.1 Analog Torque Mode Connection Diagram



### 7.4.2 Parameters For Analog Torque Mode

M2 series AC servo drive has two 12bits analog AD converters. When single end input signal is used, analog input 1 (ANA1) is used for velocity command, analog input 2 (ANA2) is used for rotating toque command. Differential input via ANA1/ANA2 is also available. In addition, low pass filter, offset and deadband can also be set to the drive.

| Parameter | Name | Data Range | Default value | Unit | Description |
|---|---|---|---|---|---|
| P-12 (CM) | Main control mode | 1~8,10~18,21,22 | 7 | | Drive's main control mode selection |
| P-13 (CN) | Secondary control mode | 1~8,10~18,21,22 | 21 | | Drive's secondary control mode selection |
| P-50 (AG) | Analog velocity setting | -100~100 | 20 | Rps | Motor rotating velocity when analog voltage is 10VDC |
| P-51 (AN) | Analog torque setting | -20~20 | 1 | A | Motor rotating torque when analog voltage is 10VDC |
| P-52 (AV1) | Analog voltage offset 1 | -10~10 | 0 | V | Set analog voltage input 1 offset value |
| P-53 (AV2) | Analog voltage offset 2 | -10~10 | 0 | V | Set analog voltage input 2 offset value |
| P-54 (AV3) | Analog voltage offset (differential) | -10~10 | 0 | V | Set analog differential voltage input offset value |
| P-55 (AS) | Analog input type | 0~1 | 0 | | Set Analog input type |
| P-56 (AD1) | Analog deadband 1 | 0~255 | 0 | mV | Set analog deadband offset 1 value |
| P-57 (AD2) | Analog deadband 2 | 0~255 | 0 | mV | Set analog deadband offset 2 value |
| P-58 (AD3) | Analog deadband (differential) | 0~255 | 0 | mV | Set analog differential deadband offset value |
| P-59 (AF) | Analog input low pass filter | 1~15990 | 500 | | Analog input noise filter |
| P-60 (AT) | Analog trigger point | -10~10 | 0 | V | |
| P-61 (FA1) | Define Analog value 1 | 1~3 | 3 | | Set Analog input 1 function |
| P-61 (FA2) | Define Analog value 2 | 1~3 | 3 | | Set Analog input 2 function |

**NOTE:This parameter unit in table above might be different from the LED display unit on the drive. Please refer to parameter 9 for details**

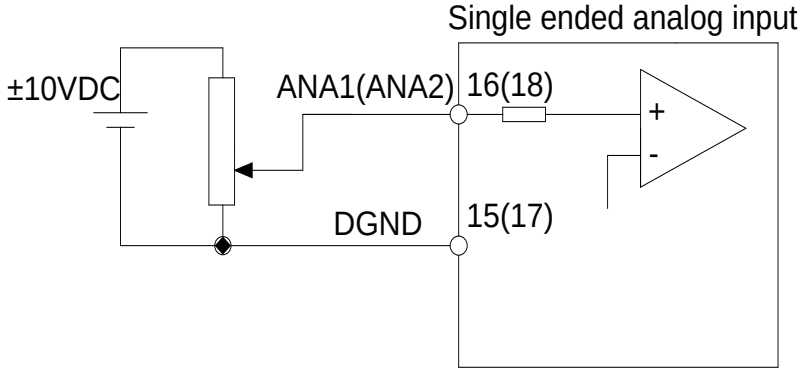
### 7.4.3 Basic Settings For Analog Torque Mode

#### 7.4.3.1 Command Signal For Analog Torque Mode

In Analog input torque mode, both single ended and differential signal are acceptable.

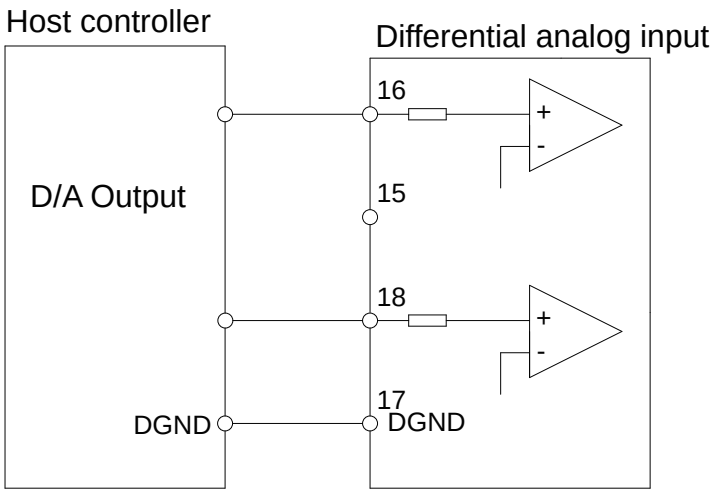
A. Single Eneded Analog Input

| Pin Type | Signal Name | Connector pin allocation | Function |
|---|---|---|---|
| Input | ANA2 | 18 | Analog torque input signal |
| | DGND | 17 | Analog torque input signal grounding |



### B. Differential Analog Input

| Pin Type | Signal Name | Connector pin allocation | Function |
|---|---|---|---|
| Input | ANA1 | 16 | Analog torque input for differential input signal |
| | ANA2 | 18 | |
| | DGND | 15 | Analog torque input signal grounding |




### 7.4.3.2 Analog Torque Gain

Analog input voltage range is between -10V~+10V. In analog torque mode, it requires to set the torque value to its correspondent voltage input value. It can be configured via M servo suite software or parameter P-51 (AN) directly from the drive.

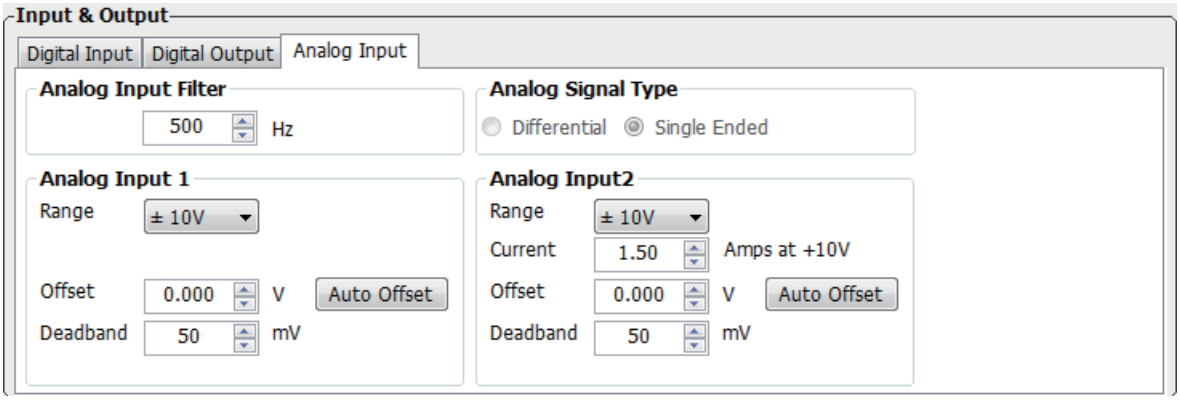
| Parameter | Name | Data Range | Default value | Unit | Description |
|---|---|---|---|---|---|
| P-51 (AN) | Analog Torque Gain | -20~20 | depend on current motor | A | Set the analog torque value corresponding to 10VDC. |

**NOTE: if you need to view or set this value on drive's control panel, please refer to following calculation:**

**Drive display value= *a* x 100**

Where is target torque value unit ***a*** amps

Setting Via Software



### 7.4.3.3 Analog Input Offset

In some cases, even when host controller set the analog command to 0V, the servo motor might still rotate slowly. This is caused by voltage bias from the analog device. M servo suite can automatically offset the analog voltage bias, or customers can manually tuning the offset by change parameter P-53 (AV2).

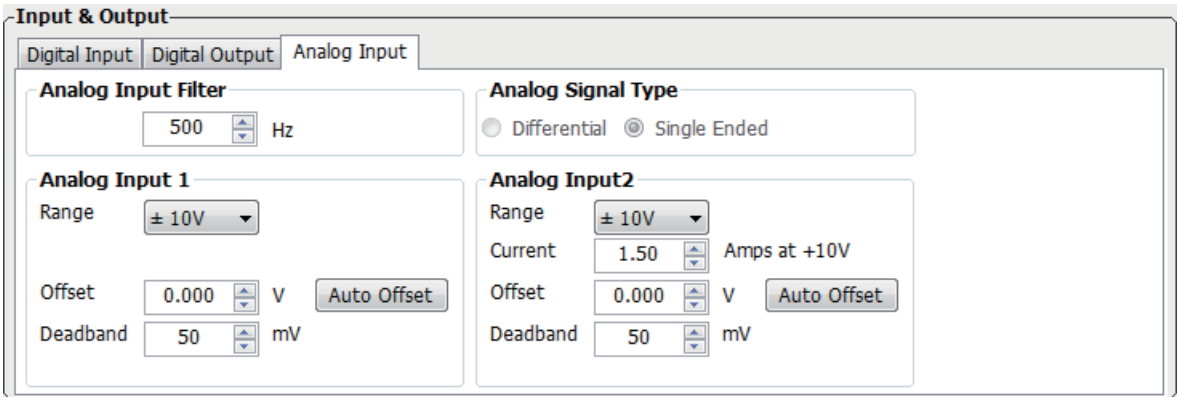
| Parameter | Name | Data Range | Default value | Unit | Description |
|---|---|---|---|---|---|
| P-53 (AV2) | Analog input 2 offset | -10~10 | 0 | V | Set Analog input 2 offset |

**NOTE: if you need to view or set the offset voltage value on drive's control panel, please refer to following calculation:**

**Drive display value= *A* x 2730**

Where ***A*** is target setting offset, unit Voltage (V)

#### Setting Via Software



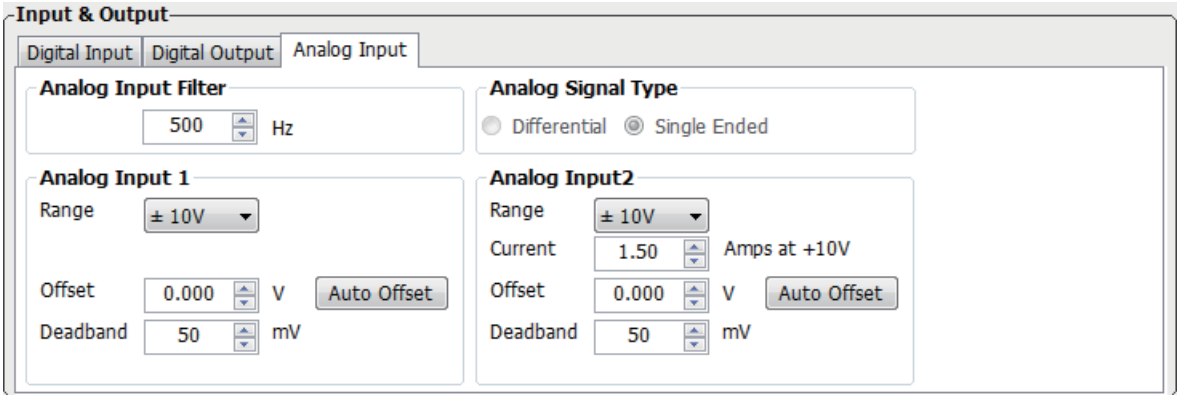

### 7.4.3.4 Analog Deadband

In analog control mode, even when the input voltage is 0V, it is impossible to ensure input voltage is absolute 0V due to external interferences. In some cases, it might case motor turn slowly in either direction. Therefore, it is highly necessary to setup a reasonable deadband value to prevent this issue.

It can be set by M servo suite software and P-57 (AD2) directly from the drive.

| Parameter | Name | Data Range | Default value | Unit | Description |
|---|---|---|---|---|---|
| P-57 (AD2) | Deadband for analog input 2 | 0~255 | 0 | mV | Set deadband for analog input 2 |

#### Setting Via Software

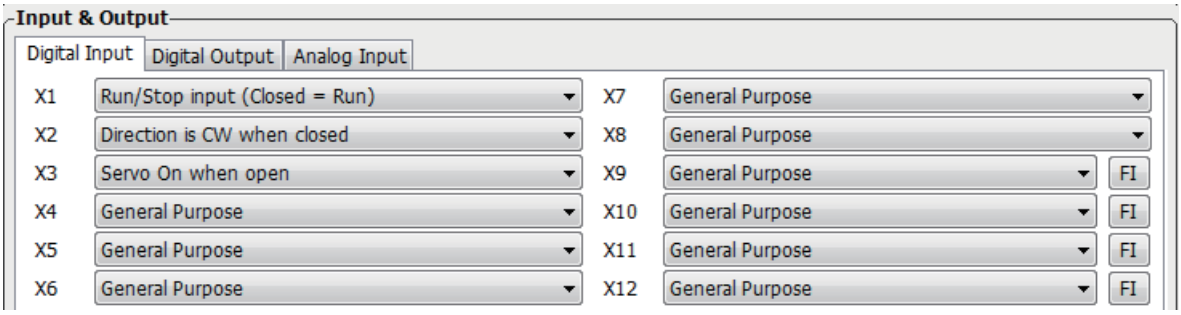


### 7.4.3.5 Run/Stop and Direction signal

In analog torque mode, external input X1 can set as run/stop switch, X2 can set as direction switch.

| Signal Name | PIN | Condition | Function | Description |
|---|---|---|---|---|
| X1 | X1+ (3) | Closed | Torque mode run/ stop switch | When motor running, analog voltage defines motor output torque |
| | X1+ (4) | Open | | In this mode, even with analog input, motor will not turn |
| X2 | X2+ (5) | Closed | Torque mode direction switch | Change current motor rotary direction |
| | X2+ (5) | Open | | Function not used |

#### Setting Via Software




### 7.4.3.6 Velocity Limit

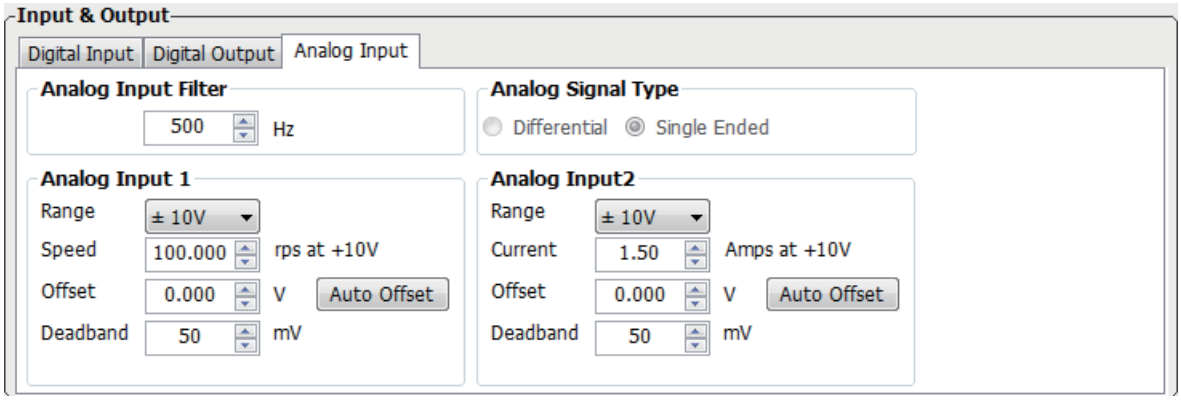
In analog torque mode, if no limit is set on motor's rotatory velocity. If load inertial is small, motor's rotary velocity will be very fast, it might cause damages or accidents to the machinery. Therefore, it is very important to set velocity limit.

The velocity limit for torque mode can be set via analog input 1 (ANA1).

#### Parameters Setting

| Parameter | Name | Data Range | Default value | Unit | Description |
|---|---|---|---|---|---|
| P-55 (AS) | Analog type | 0~1 | 0 | | analog input type:<br>0: single ended input 1:differential input |
| P-61 (FA1) | Analog 2 function setting | 1~3 | 3 | | analog input 1 function type:<br>1: velocity limit 3: not in use |
| P-50 (AG) | Analog Velocity Gain | -100~100 | 10 | Rps | Sets correspondent velocity value against 10VDC input voltage. |

#### Setting Via Software



### 7.4.3.7 Torque Reach

In torque mode, when motor actual torque and command torque is the same, “torque reached” output signal can be sent via Y3 output.

The first digit (from right to left) of parameter P-68 (MO) from the drive defines the output signal Y4.

| Signal Name | PIN | P-67 (MO) | Condition | Function |
|---|---|---|---|---|
| Y3 | Y3 (42)<br>OUT- (33) | □□□9 | Closed | Closed means target torque not reached |
| | | | Open | Open means reach output torque |
| | | □□□8 | Closed | Close means reach output torque |
| | | | Open | Open means target torque not reached |
| | | □□3□ (default) | | General purpose signal, function disabled. |

### Parameters Setting

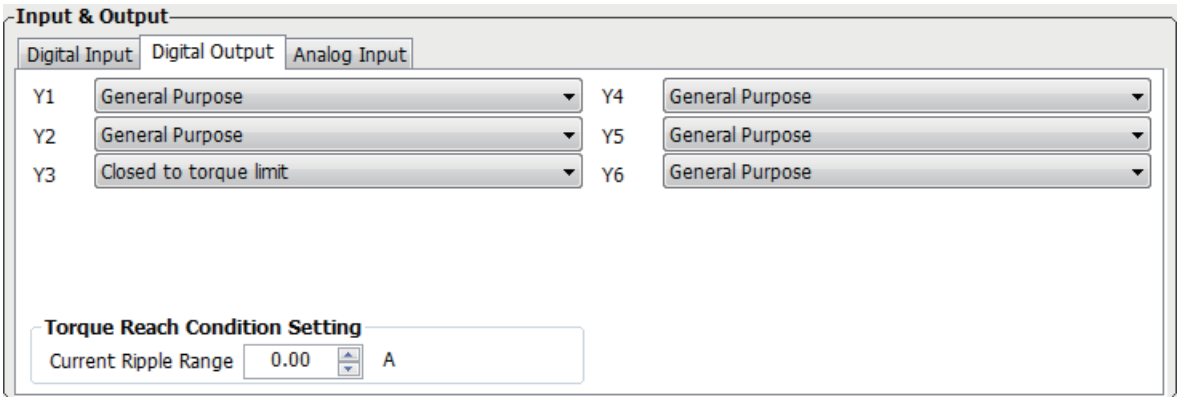
| Parameter | Name | Data Range | Default value | Unit | Description |
|---|---|---|---|---|---|
| P-87 (TV) | Torque within ripple range, when torque reach function in use. | 0.00~3.00 | 0.00 | A | When actual torque output and command torque is same, and within the velocity ripple range. There will be torque reach output signal. |

**NOTE: if you need to view or set this value on drive’s control panel P-86 (TV), please refer to following calculation:**

**LED display value = Torque ripple range X 100**

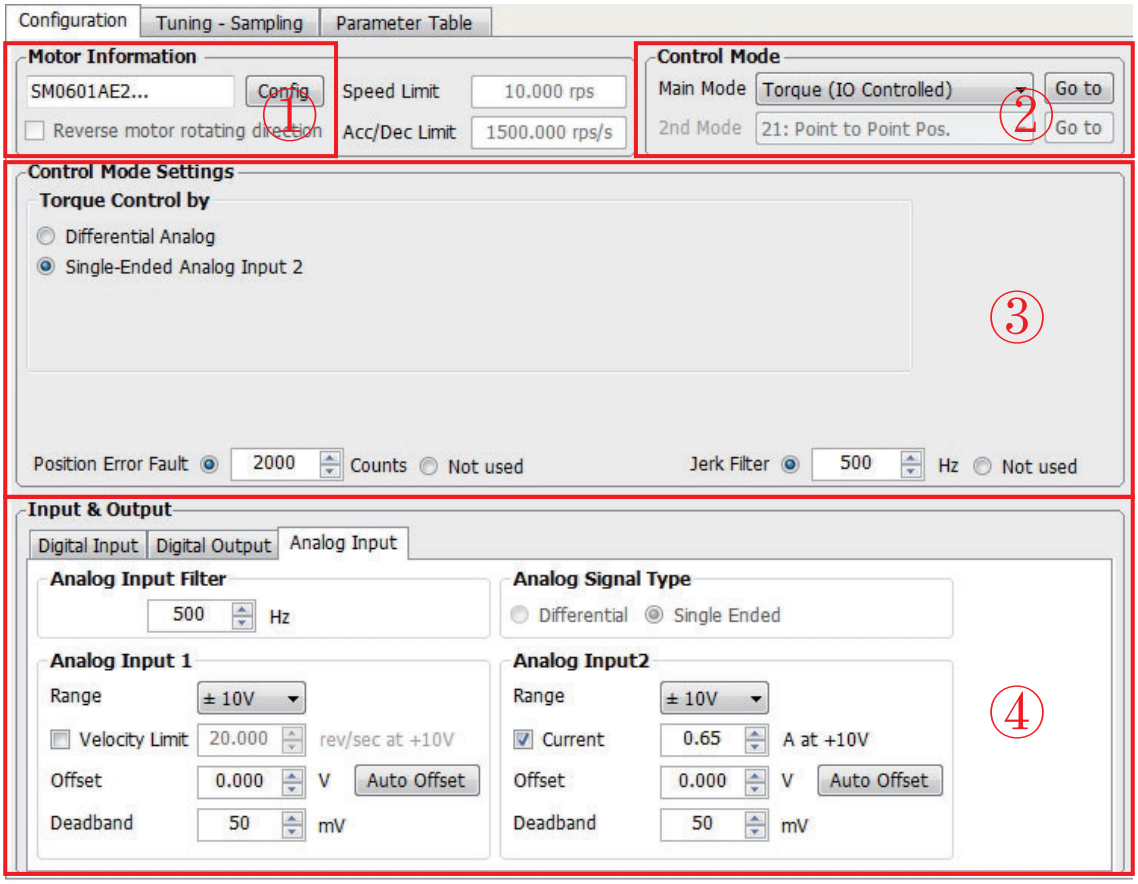
Unit for torque ripple range is A (amps)

### Setting Via Software



### 7.4.4 Software Configuration For Analog Torque Mode

The M servo suite can help you easily configured the drive and motor, as well as tuning parameters.




| Step | Operation | Description |
|---|---|---|
| 1st | Configure motor | Choose your motor number. Please refer to 2.3 Motor number for details. |
| 2nd | Choose control mode | In control mode, choose “torque” for torque mode. |
| 3rd | Control mode configuration | Choose specified torque analog type, please refer to 7.4 Analog torque mode. |
| 4th | Set analog signal function, or digital input/output functions | In Input/Output functions to setup. Please refer to 4.8.3 CN2 connections, and 7.4 torque mode and 7.1 general function settings. |

## 7.5 Position Table Mode Instruction

Position table mode allows **Point-to-Point linear motion** and **Rotary motion** without any external pulse input. Instead, position table mode uses Input port X7~X12 to configuredifferent positions command. Input X4 is the trigger for motion.

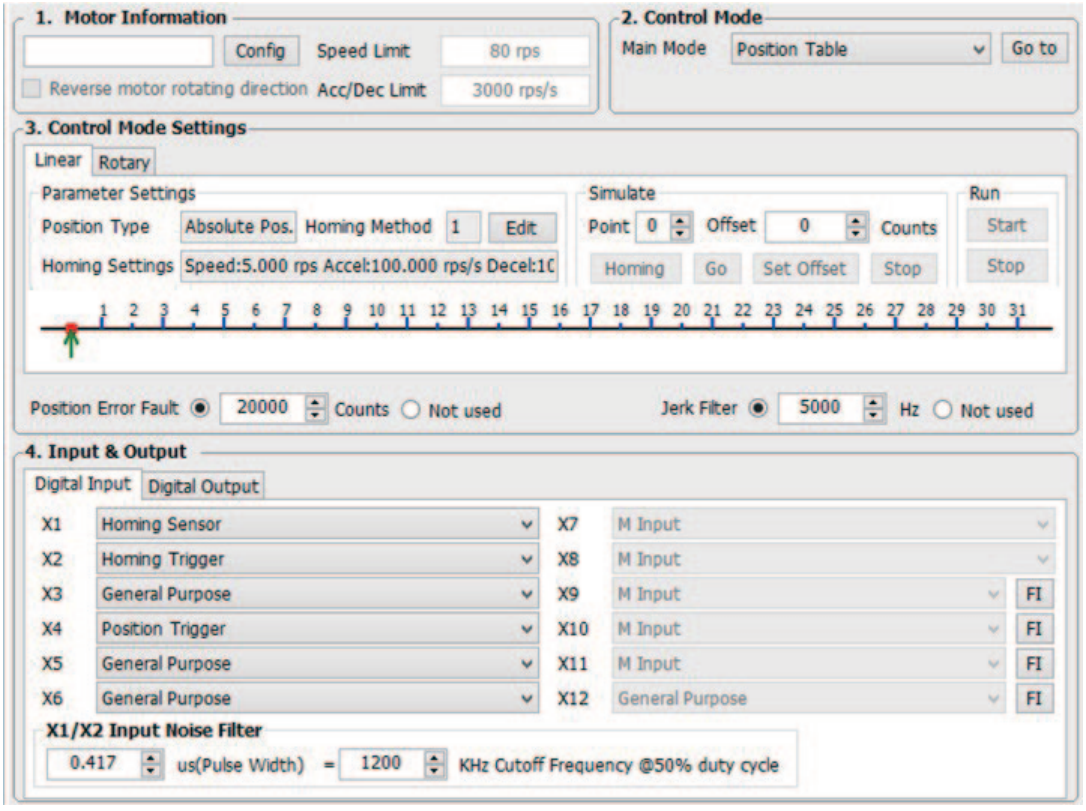



Figure 7.5.1 Position table mode

**NOTE: Only -S type M2 series servo drive supports position table mode**

### 7.5.1 Linear motion

Linear motion for position table mode can set up to 63 positions (not include homing position). Detailed software setting as follows:

#### 7.5.1.1 Linear Motion Software Configuration

1) Open M Servo Suite, connect the driver with software(refer to software manual for details)

2) Select “position table” control mode from”step1: configuration”------“2. Control mode”

As shown in Figure 7.5.2 Select Position Table

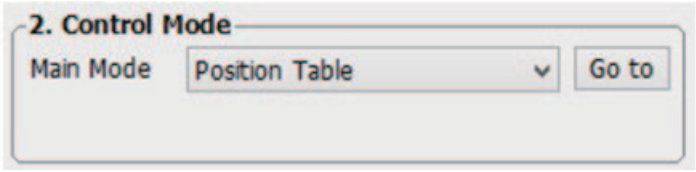



Figure 7.5.2 Select Position Table

3) Select linear motion from “3. Control mode setting” as show in Figure 7.5.3Linear motion setting.

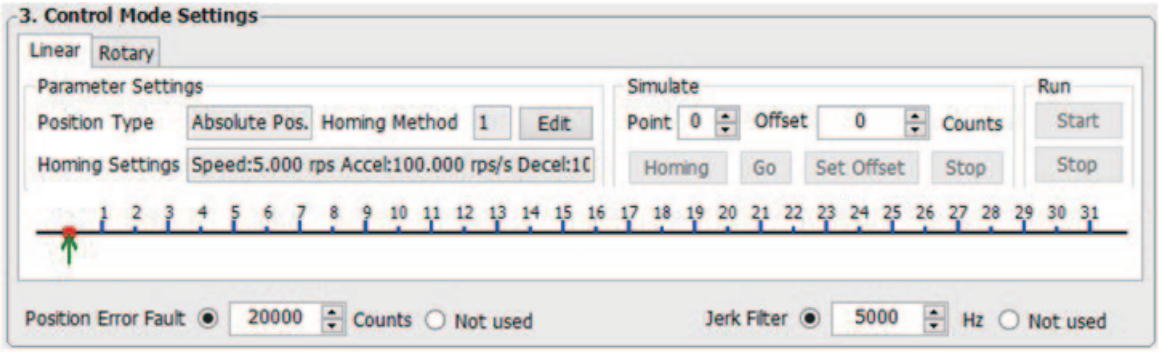



Figure 7.5.3Linear motion setting

4) Click edit for detailed motion configurations, as shown inFigure 7.5.4Linear motion configuration.

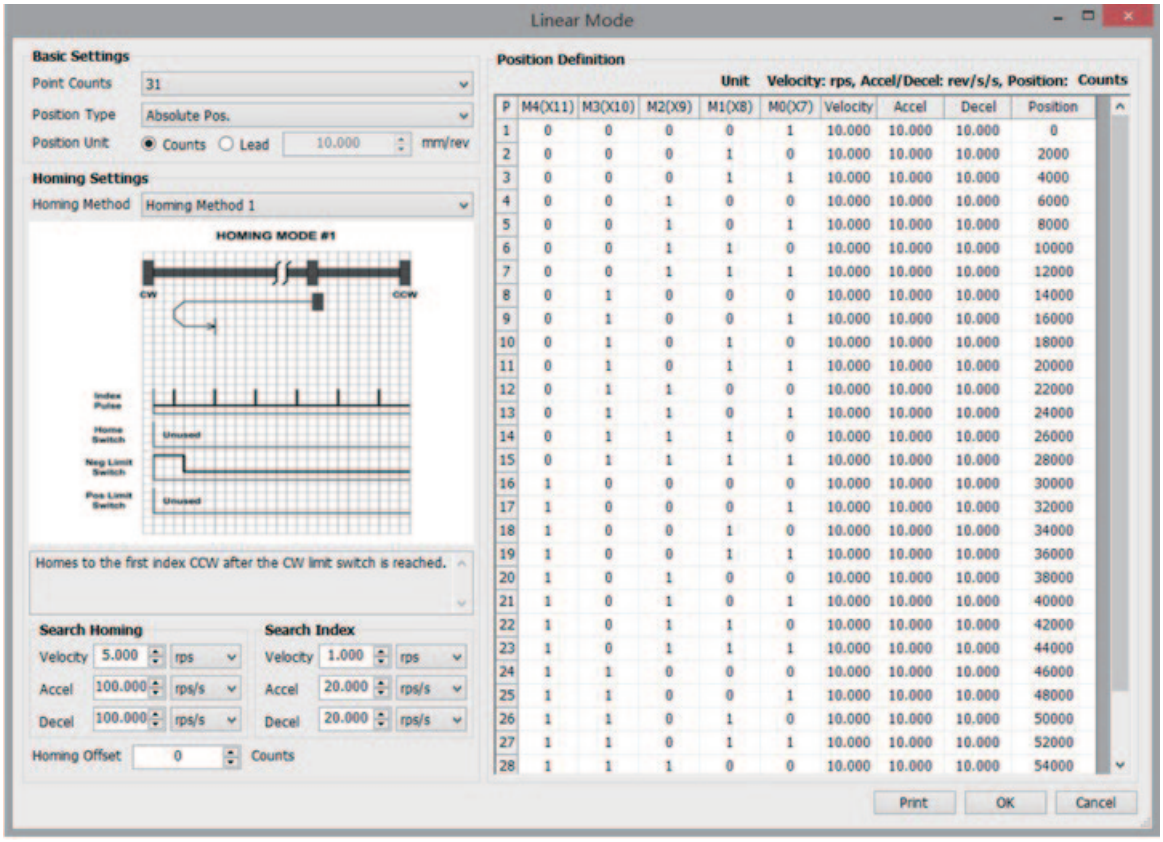



Figure 7.5.4Linear motion configuration

### 7.5.1.2 Basic Configuration

**Point Counts:** Select the number of position points. For M series servo drives, there are four selections: 7. 15. 31. 63number of position points.

**Position type:** There are two types for point-to-point motion: Relative position; and absolutepositon.

Example shown in Figure 7.5.5Relative position VS Absolute positon:

Set P1position for 5revs, P2 position for 10revs, the difference between Relative position and absolute position are as shown in below:

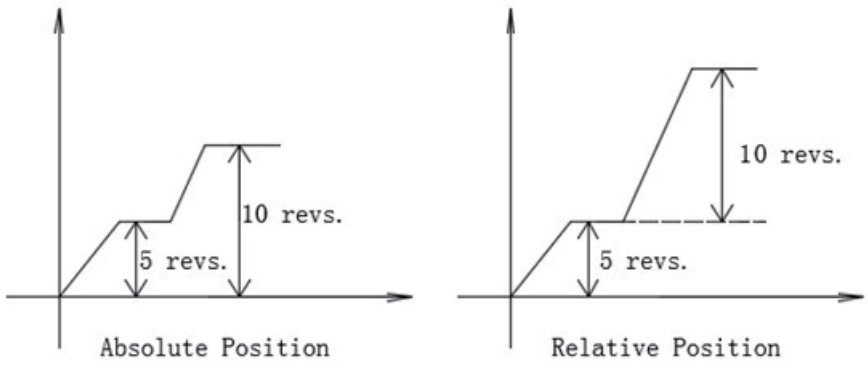



Figure 7.5.5Relative position VS Absolute positon

Position Unit Set position point Units.

**Counts:** It represents the number pulse from encoder output. For position table mode, one motor revolution is 10000 pulse counts.

**Lead:** It represents the distance for one motor revolution. Unit mm/rev.

### 7.5.1.3 Homing settings:

**Homing Method:** There are 12 types to homing available.

**Search homing:** This feature sets the velocity, acceleration and deceleration for search homing switch.

**Search Index:** This feature sets the velocity, acceleration and deceleration for search motor encoder index signal after the homing switch is reached.

**Homing Offset:** After homing process is finished, this sets the offset value from the homing position.

### 7.5.1.4 Print

Click on “Print” to print out the configurations table, as shown in Figure 7.5.6 Print Position Table configuration below:

Position Table Configuration. ©Shanghai AMP & MOONS' Automation Co., Ltd.
Linear Mode
Point Counts: 31
Position Type: Absolute Pos.
Homing Method: Homing Method 1
Search Homing
Velocity: 5 rev/s Accel: 100 rev/s/s Decel: 100 rev/s/s
Search Index
Velocity: 5 rev/s Accel: 100 rev/s/s Decel: 100 rev/s/s
Homing Offset: 0

Position Definition

| | | | | | Unit | Velocity: rps, Accel/Decel: rev/s/s, Position: | | | |
|---|---|---|---|---|---|---|---|---|---|
| P | M4(X11) | M3(X10) | M2(X9) | M1(X8) | M0(X7) | Velocity | Accel | Decel | Position |
| 1 | 0 | 0 | 0 | 0 | 1 | 10.000 | 10.000 | 10.000 | 0 |
| 2 | 0 | 0 | 0 | 1 | 0 | 10.000 | 10.000 | 10.000 | 2000 |
| 3 | 0 | 0 | 0 | 1 | 1 | 10.000 | 10.000 | 10.000 | 4000 |
| 4 | 0 | 0 | 1 | 0 | 0 | 10.000 | 10.000 | 10.000 | 6000 |
| 5 | 0 | 0 | 1 | 0 | 1 | 10.000 | 10.000 | 10.000 | 8000 |
| 6 | 0 | 0 | 1 | 1 | 0 | 10.000 | 10.000 | 10.000 | 10000 |
| 7 | 0 | 0 | 1 | 1 | 1 | 10.000 | 10.000 | 10.000 | 12000 |
| 8 | 0 | 1 | 0 | 0 | 0 | 10.000 | 10.000 | 10.000 | 14000 |
| 9 | 0 | 1 | 0 | 0 | 1 | 10.000 | 10.000 | 10.000 | 16000 |
| 10 | 0 | 1 | 0 | 1 | 0 | 10.000 | 10.000 | 10.000 | 18000 |
| 11 | 0 | 1 | 0 | 1 | 1 | 10.000 | 10.000 | 10.000 | 20000 |
| 12 | 0 | 1 | 1 | 0 | 0 | 10.000 | 10.000 | 10.000 | 22000 |
| 13 | 0 | 1 | 1 | 0 | 1 | 10.000 | 10.000 | 10.000 | 24000 |
| 14 | 0 | 1 | 1 | 1 | 0 | 10.000 | 10.000 | 10.000 | 26000 |

Figure 7.5.6 Print Position Table configuration

### 7.5.1.5 Position Definition

Positon Definition shows the detailed configurations for each position point, including velocity, acceleration and deceleration, position. In this table, it also shows the input condition (X7~X12) totrigger each position.

**Position Definition**

**Unit Velocity: rps, Accel/Decel: rev/s/s, Position: mm**

| P | M5(X12) | M4(X11) | M3(X10) | M2(X9) | M1(X8) | M0(X7) | Velocity | Accel | Decel | Position |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 10.000 | 10.000 | 10.000 | 0.000 |
| 2 | 0 | 0 | 0 | 0 | 1 | 0 | 10.000 | 10.000 | 10.000 | 2.000 |
| 3 | 0 | 0 | 0 | 0 | 1 | 1 | 10.000 | 10.000 | 10.000 | 4.000 |
| 4 | 0 | 0 | 0 | 1 | 0 | 0 | 10.000 | 10.000 | 10.000 | 6.000 |
| 5 | 0 | 0 | 0 | 1 | 0 | 1 | 10.000 | 10.000 | 10.000 | 8.000 |
| 6 | 0 | 0 | 0 | 1 | 1 | 0 | 10.000 | 10.000 | 10.000 | 10.000 |
| 7 | 0 | 0 | 0 | 1 | 1 | 1 | 10.000 | 10.000 | 10.000 | 12.000 |
| 8 | 0 | 0 | 1 | 0 | 0 | 0 | 10.000 | 100.000 | 100.000 | 14000.000 |
| 9 | 0 | 0 | 1 | 0 | 0 | 1 | 10.000 | 100.000 | 100.000 | 16000.000 |
| 10 | 0 | 0 | 1 | 0 | 1 | 0 | 10.000 | 100.000 | 100.000 | 18000.000 |
| 11 | 0 | 0 | 1 | 0 | 1 | 1 | 10.000 | 100.000 | 100.000 | 20000.000 |
| 12 | 0 | 0 | 1 | 1 | 0 | 0 | 10.000 | 100.000 | 100.000 | 22000.000 |
| 13 | 0 | 0 | 1 | 1 | 0 | 1 | 10.000 | 100.000 | 100.000 | 24000.000 |
| 14 | 0 | 0 | 1 | 1 | 1 | 0 | 10.000 | 100.000 | 100.000 | 26000.000 |
| 15 | 0 | 0 | 1 | 1 | 1 | 1 | 10.000 | 100.000 | 100.000 | 28000.000 |
| 16 | 0 | 1 | 0 | 0 | 0 | 0 | 10.000 | 100.000 | 100.000 | 30000.000 |
| 17 | 0 | 1 | 0 | 0 | 0 | 1 | 10.000 | 100.000 | 100.000 | 32000.000 |
| 18 | 0 | 1 | 0 | 0 | 1 | 0 | 10.000 | 100.000 | 100.000 | 34000.000 |
| 19 | 0 | 1 | 0 | 0 | 1 | 1 | 10.000 | 100.000 | 100.000 | 36000.000 |
| 20 | 0 | 1 | 0 | 1 | 0 | 0 | 10.000 | 100.000 | 100.000 | 38000.000 |
| 21 | 0 | 1 | 0 | 1 | 0 | 1 | 10.000 | 100.000 | 100.000 | 40000.000 |
| 22 | 0 | 1 | 0 | 1 | 1 | 0 | 10.000 | 100.000 | 100.000 | 42000.000 |
| 23 | 0 | 1 | 0 | 1 | 1 | 1 | 10.000 | 100.000 | 100.000 | 44000.000 |
| 24 | 0 | 1 | 1 | 0 | 0 | 0 | 10.000 | 100.000 | 100.000 | 46000.000 |
| 25 | 0 | 1 | 1 | 0 | 0 | 1 | 10.000 | 100.000 | 100.000 | 48000.000 |
| 26 | 0 | 1 | 1 | 0 | 1 | 0 | 10.000 | 100.000 | 100.000 | 50000.000 |

Figure 7.5.7Position definition table

**M0(X7) ~ M5(X12)status:** ’0’means input is closed; ’1’means input is Open.

After the homing process, motor will move to corresponding position which selected by input M0(X7) ~ M5(X12), and triggered by X4 (position trigger)when it changesfrom ‘open’ to ‘close’.

5) Click ‘OK’ to finish linear mode settings

6) Click ‘Download to Drive’ the set the drive

7) Close the software turn off the power, and restart both drive and software for running position table mode.

### 7.5.1.6 Simulate

After the configurationprocess, simulate function can verify the settings simulate the motions.

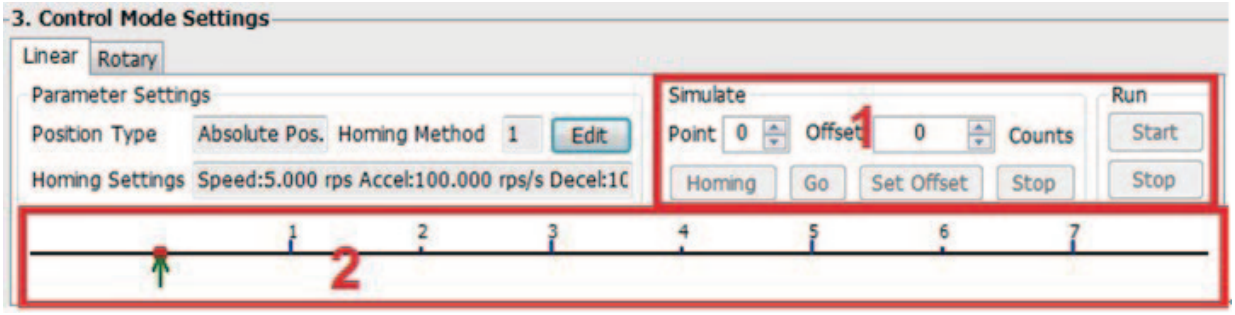



Figure 7.5.8Linear motion Simulate

**Homing:** Click ‘homing’ to start homing process.

**Go:** Set the position point by changing the value in point box, and click ‘go’ button to start the motion. In Figure 7.5.8Linear motion Simulate, green arrow in box ② shows the load position in real time.

**Set Offset:** Confirm offset position, change this value will change the position in position table

**Stop:** Stop current motion immediately

### 7.5.1.7 Linear motion input definition

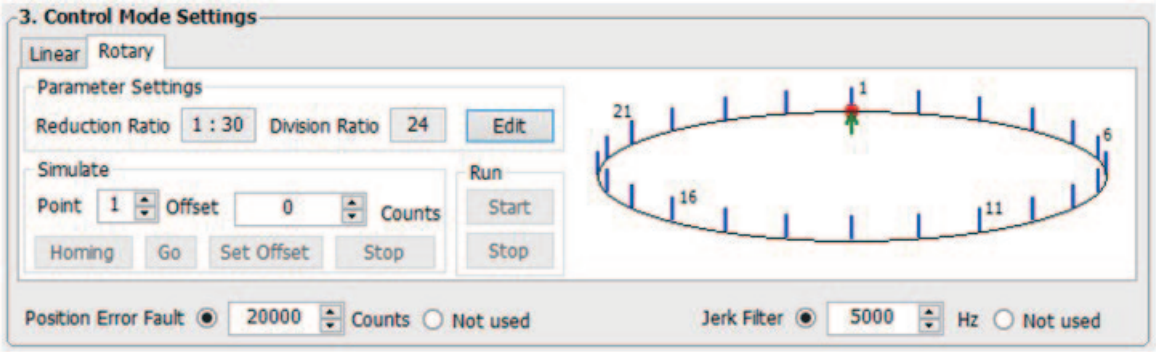
| Input | Function | Description |
|---|---|---|
| X1 | Homing Sensor | Homing sensor switch |
| X2 | Homing Trigger | Triggering homing process |
| X3 | General Purpose | Generalpurpose |
| | Servo On When Closed | Enable the motor drive when input closed |
| | Servo On When Open | Enable the motor drive when input open |
| X4 | PositionTrigger | It is a trigger signal. When Input X4 changes from open to close, motor will move to the position selected by switch M0(X7) ~ M5(X12) |
| X5 | General Purpose | Generalpurpose |
| | CW Limit Sensor | Set CW position limit, please refer to M2 user manual chapter 7.1.3, CW/CCW limit for more details |
| X6 | General Purpose | Generalpurpose |
| | CCW Limit Sensor | Set CCW position limit, please refer to M2 user manual chapter 7.1.3, CW/CCW limit for more details |
| X7~X12 | MInput | Position point input |

### 7.5.2 Rotary motion

Rotary motion is highly suitable for dividing plate applications, system gearing reduction ratio can also be set based on the application. Settings such as number of division per revolution, motion profiles and homing profiles can also be set.

After the configuration. Input X4 is the motion trigger, the load will rotate according to set direction. Each trigger signal will turn the load by one single rotary point based on the settings.

#### 7.5.2.1 Rotary motion software configuration




**Edit:** Click on ‘Edit” to enter detailed configuration page, as shown in Figure 7.5.9Detail configuration for rotary motion below

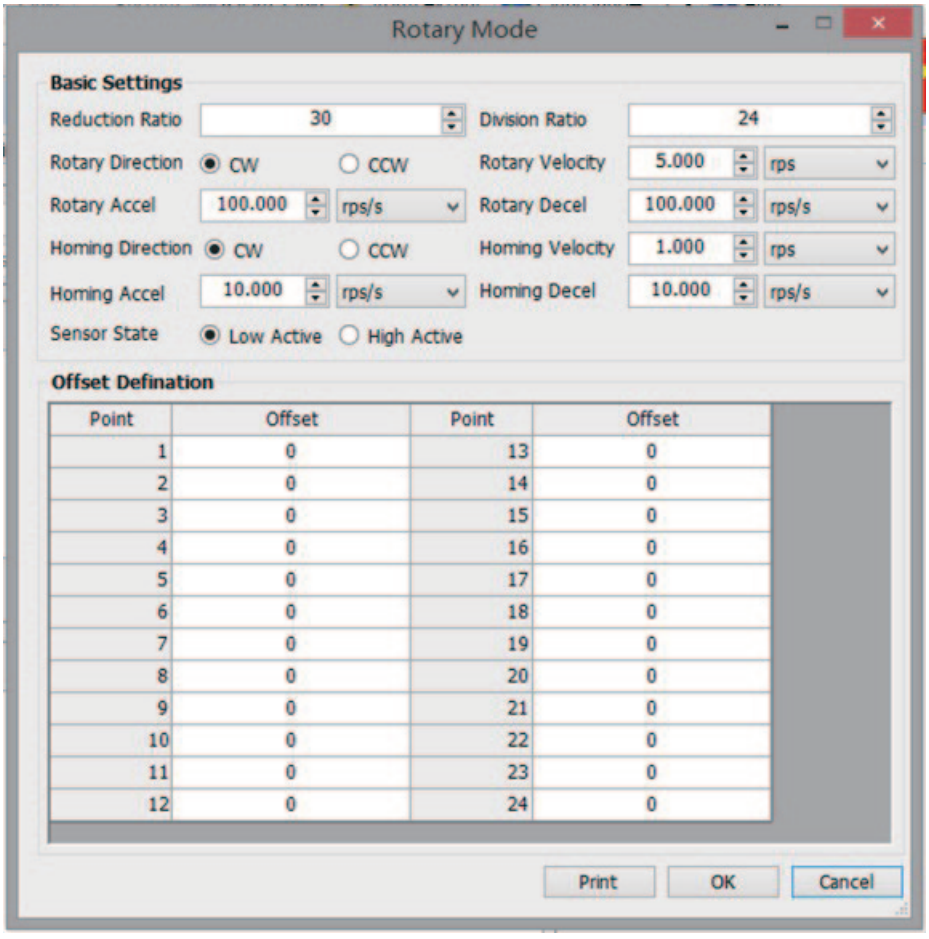



Figure 7.5.9Detail configuration for rotary motion

**Reduction ratio:** Set mechanical gear box ratio

**Division Ratio:** Divide one revolution into numbers of point with equal distance

**Rotary direction:** Select the direction for rotary motion

**Rotary velocity, rotary acceleration, rotary deceleration:** Set motor rotary velocity, rotary acceleration, and rotary deceleration values

**NOTE: the rotary are set based on Motor velocity/acceleration/deceleration. For actual system speed, please refer to ratio calculation shown below:**

**System speed = Motor Speed × Reduction ratio**

**Homing direction:** Set homing direction

**Homing velocity, Homing acceleration, Homing deceleration:** To set motor homing velocity, homing acceleration, and homing deceleration values

**NOTE: the rotary are set based on Motor velocity/acceleration/deceleration. For actual system speed, please refer to ratio calculation shown below:**

**System speed = Motor Speed × Reduction ratio**

**Sensor State:** Set homing sensor type: low active, high active

**Offset definition:** Set position offset for each position point, for minor tunings.

### 7.5.2.2 Rotary motion input definition

| Input | Function | Description |
|---|---|---|
| X1 | Homing Sensor | Homing sensor switch |
| X2 | Homing Trigger | Triggering homing process |
| X3 | General Purpose | Generalpurpose |
| | Servo On When Closed | Enable the motor drive when input closed |
| | Servo On When Open | Enable the motor drive when input open |
| X4 | Position Trigger | It is a trigger signal. When Input X4 change from open to close, the load will move one single rotary point according to the position configuration |

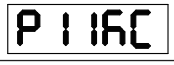
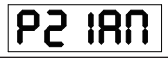
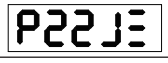
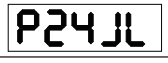
# 8. Parameters and Functions

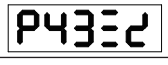
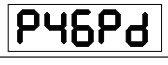
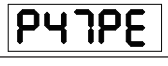
## 8.1 Parameter Category

M2 series AC servo drive has 4 modes.

| type | Function | Example | Details |
|---|---|---|---|
| n---status monitoring setting | Select LED monitoring status type |  | 5.4 status monitoring selection mode |
| F---Function mode setting | Select drive function to execute |  | 5.5 function mode control |
| P---Parameter setting mode | Selection and editing the parameter on the drive |  | 5.6 parameter setting mode |
| r---warning&fault display | Display the warning or fault message When they occurr |  | 5.8 warning and fault display |

## 8.2 Parameter List

| parameter number | Type | SCL command | LED display | Function | Default value | Unit |
|---|---|---|---|---|---|---|
| P00 | PID | KP |  | Global gain 1 | 10000 | |
| P01 | PID | KG |  | Global gain 2 | 12000 | |
| P02 | PID | KF |  | Proportion gain | 6000 | |
| P03 | PID | KD |  | Deriv gain | 2500 | |
| P04 | PID | KV |  | Damping gain | 8000 | |
| P05 | PID | KI |  | Integrator gain | 500 | |
| P06 | PID | KK |  | Inertia Feedforward Constant | 800 | |
| P07 | PID | KJ |  | Jerk Filter Frequency | 5000 | |
| P08 | PID | VP |  | Velocity Loop Proportional Gain | 15000 | |
| P09 | PID | VI |  | Velocity Loop Integral Gain | 600 | |
| P10 | PID | KE |  | Deriv Filter factor | 15000 | |
| P11 | PID | KC |  | PID Filter factor | 25000 | |
| P12 | Control mode | CM |  | Main control mode | 7 | |
| P13 | Control mode | CN |  | Secondary control mode | 21 | |
| P14 | Control mode | PM |  | Power-up mode | 2 | |
| P15 | Control mode | JM |  | Jog mode | 1 | |
| P16 | Current config | GC |  | Current Command of Torque Mode | 0 | 0.01A |
| P17 | Current config | CC |  | Rated Maximum current | 0.5 * | A |
| P18 | Current config | CP |  | Peak current | 1.5 * | A |
| P20 | Profile | VM |  | Maximum velocity | 60.000 | rps |
| P21 | Profile | AM |  | Maximum acceleration/deceleration | 3000 | rps/s |
| P22 | Profile | JS |  | Jog speed | 10.000 | rps |
| P23 | Profile | JA |  | Jog acceleration | 100.00 | rps/s |
| P24 | Profile | JL |  | Jog deceleration | 100 | rps/s |
| P25 | Profile | VE |  | Point to point Velocity | 5 | rps |

| | | | | | | |
|---|---|---|---|---|---|---|
| P26 | Profile | AC |  | Point to point acceleration | 100.00 | rps/s |
| P27 | Profile | DE |  | Point to point deceleration | 100.00 | rps/s |
| P28 | Profile | VC |  | Point to point secondary velocity | 2.000 | rps |
| P29 | Profile | JC1 |  | Jog mode speed 1 | 2.000 | rps |
| P30 | Profile | JC2 |  | Jog mode speed 2 | 10.000 | rps |
| P31 | Profile | JC3 |  | Jog mode speed 3 | 20.000 | rps |
| P32 | Profile | JC4 |  | Jog mode speed 4 | 25.000 | rps |
| P33 | Profile | JC5 |  | Jog mode speed 5 | 30.000 | rps |
| P34 | Profile | JC6 |  | Jog mode speed 6 | 35 | rps |
| P35 | Profile | JC7 |  | Jog mode speed 7 | 40.000 | rps |
| P36 | Profile | JC8 |  | Jog mode speed 8 | 50.000 | rps |
| P37 | Config | ER |  | Encoder resolution | 10000 | counts/rev |
| P39 | Config | EG |  | Electronic gearing | 10000 | counts/rev |
| P40 | Config | PV |  | Secondary Electronic gearing | 10000 | counts/rev |
| P41 | Config | EN |  | Numerator of electronic gearing ratio | 1000 | |
| P42 | Config | EU |  | Denominator of electronic gearing ratio | 1000 | |
| P43 | Config | SZ |  | Input Pulse Setting | 1792 | |
| P44 | Config | PF |  | Position Fault limit | 2000 | counts |
| P45 | Config | PL |  | Dynamical Position error Range | 10 | counts |
| P46 | Config | PD |  | In Position Error Range | 10 | counts |
| P47 | Config | PE |  | In position duration count | 10 | counts |
| P48 | Config | TT |  | Pulses Input Completion count | 2 | ms |
| P49 | Analog | AP |  | Analog Position Gain | 8000 | counts |
| P50 | Analog | AG |  | Analog Velocit Gain | 20.000 | rps |
| P51 | Analog | AN |  | Analog Torque Gain | 1.00 | A |
| P52 | Analog | AV1 |  | Analog input1 offset | 0.000 | V |

*** : This parameter depends on motor models.**

| | | | | | | |
|---|---|---|---|---|---|---|
| P53 | Analog | AV2 | P53Au | Analog input2 offset | 0.000 | V |
| P54 | Analog | AV3 | P54Au | Differential analog input offset | 0.000 | V |
| P55 | Analog | AS | P55AS | Analog type | 0 | |
| P56 | Analog | AD1 | P56Ad | Analog input1 deadband | 0 | mv |
| P57 | Analog | AD2 | P57Ad | Analog input2 deadband | 0 | mv |
| P58 | Analog | AD3 | P58Ad | Differential analog deadband | 0 | mv |
| P59 | Analog | AF | P59AF | Analog input low pass filter value | 500 | Hz |
| P60 | Analog | AT | P60At | Analog threshold | 0.000 | V |
| P61 | Analog | FA | P6 1FA | Analog 1/2 function | 33 | |
| P62 | I/O | SI | P62S1 | Servo enable input setting | 2 | |
| P63 | I/O | AI | P63A1 | Alarm Reset input setting | 3 | |
| P64 | I/O | DL | P64dL | End-of –travel limit Setting | 3 | |
| P65 | I/O | MI | P65M1 | X7，X8，X9，X10 input function setting | 3333 | |
| P66 | I/O | AO | P66Ao | Alarm output function setting | 1 | |
| P67 | I/O | BO | P67bo | Motor brake control setting | 1 | |
| P68 | I/O | MO | P68Mo | Y3，Y4，Y5，Y6 output function setting | 3341 | |
| P69 | I/O | BD | P69bd | Brake disengage Delay | 200 | ms |
| P70 | I/O | BE | P70bE | Brake engage delay | 200 | ms |
| P71 | I/O | FI1 | P71F1 | Input X9 noise filter | 0 | |
| P72 | I/O | FI2 | P72F1 | Input X10 noise filter | 0 | |
| P73 | I/O | FI3 | P73F1 | Input X11 noise filter | 0 | |
| P74 | I/O | FI4 | P74F1 | Input X12 noise filter | 0 | |
| P76 | communication | PR | P76Pr | Communication protocol | 15 | |
| P77 | communication | TD | P77td | Transmit delay | 2 | |
| P78 | communication | BR | P78br | Baud rate | 1 | |
| P79 | communication | DA | P79dA | RS-485 Address | 32 | |
| P80 | communication | CO | P80Co | CANopen Node ID | 1 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| P81 | communication | CB | P8 1C6 | CANopen Baudrate | 0 | |
| P82 | Regeneration | ZR | P82dr | Regen resistor value | 40 | Ω |
| P83 | Regeneration | ZC | P83dC | Regen resistor continuous wattage | 200 | w |
| P84 | Regeneration | ZT | P84dt | Regen resistor peak time | 125.00 | ms |
| P85 | Other | VR | P85ur | Ripple range setting for velocity reach | 0.000 | rps |
| P86 | Other | TO | P86to | Tach out counts | 0 | |
| P87 | Other | TV | P87tu | Ripple range setting for torque reach | 0.00 | A |
| P88 | Other | PK | P88PK | Parameter lock on the drive's control panel | 0 | |
| P89 | Other | DD | P89dd | LED Default status monitor type | 0 | |
| P90 | Other | MA | P90MA | LED Warning Display Mask Code | 65535 | |
| P91 | Other | HA1 | P9 1HA | Accel of seeking end-of-travel limit during homing | 100 | rps/s |
| P92 | Other | HA2 | P92HA | Accel of seeking homing switch during homing | 100 | rps/s |
| P93 | Other | HA3 | P93HA | Accel of feeding to homing switch during homing | 10 | rps/s |
| P94 | Other | HO1 | P94Ho | Decel of seeking end-of-travel limit during homing | 100 | rps/s |
| P95 | Other | HO2 | P95Ho | Decel of seeking homing switch during homing | 100 | rps/s |
| P96 | Other | HO3 | P96Ho | Decel of feeding to homing switch during homing | 10 | rps/s |
| P97 | Other | HV1 | P97Hu | Velocity of seeking end-of-travel limit during homing | 10 | rps |
| P98 | Other | HV2 | P98Hu | Velocity of seeking homing switch during homing | 5 | rps |
| P99 | Other | HV3 | P99Hu | Velocity of feeding to homing switch during homing | 0.5 | rps |
| P100 | Other | KL | P.00KL | Follow factor | 0 | |

## 8.3 Parameter Description

| P-00 (KP) | Global gain 1 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 10000 | ------ | DEC |

Sets or requests the servo control proportional gain term. Gain value is relative: “0” meaning no gain, “32767” meaning full gain. This parameter is the primary gain term for minimizing the position error. Larger KP value means higher stiffness, and fast response. However, if gain value is too high, it will leads to vibration.

Use input X7 for global gain selection. When gain selection function is used, it helps the servo drive to run the motor with least time delay and as faithful as possible against the host command requirement. Especially in the cases, when load characteristic changes significantly, change off gain value will reduce motor’s settleing time, motor vibration and so on. It will highly optimize motor’s overall performance. The two global gain parameters are: P-00 (KP), and P-01 (KG).

| P-01 (KG) | Global gain 2 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 12000 | ------ | DEC |

Sets or requests the secondary servo control proportional gain term. Gain value is relative: “0” meaning no gain, “32767” meaning full gain. This parameter is the primary gain term for minimizing the position error. Larger KP value means higher stiffness, and fast response. However, if gain value is too high, it will leads to vibration.

| P-02 (KF) | Proportion gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 10000 | ------ | DEC |

The servo control proportional gain term. Gain value is relative: “0” meaning no gain, “32767” meaning full gain. This parameter is the primary gain term for minimizing the position error. Increase of KF will increase stiffness and reduce in position time duration. However, it might cause vibration if gain is too large.

| P-03 (KD) | Deriv gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 3000 | ------ | DEC |

The servo control differential gain. Gain value is relative: “0” meaning no gain, “32767” meaning full gain. It works to damp low speed oscillations.

| P-04 (KV) | Damping gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 10000 | ------ | DEC |

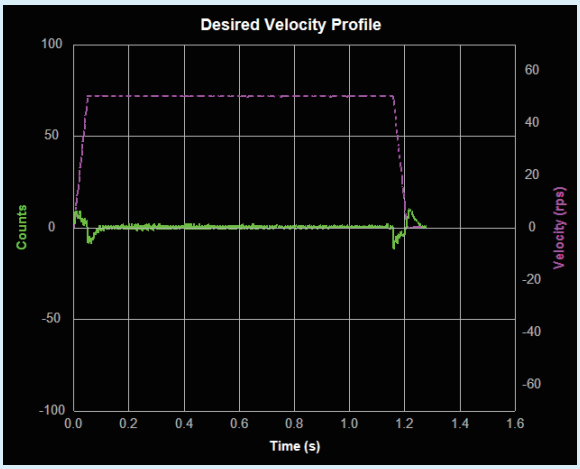
The servo control Proportional gain term of the velocity error. Gain value is relative: 0 = no gain, 32767 = full gain. KV minimizes the velocity error, and vibration in position control mode.

| P-05 (KI) | Integrator gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 500 | ------ | DEC |

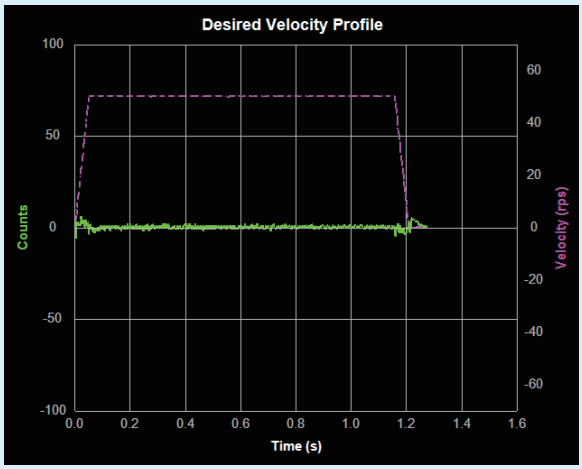
The servo control integrator gain term. Gain value is relative: “0” meaning no gain, “32767”meaning full gain. It minimizes (or may even eliminate) position errors especially when holding position.

| P-06 (KK) | Inertia Feedforward Constant | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 800 | ------ | DEC |

The servo control inertia feed forward gain. Gain value is relative: “0” meaning no gain, “32767”meaning full gain. KK improves acceleration control by compensating for the load inertia.




Without KK parameter, Inertia Feedforward Constant.
Red Line (Dash) : Actual velocity
Green Line (Filled) : Position error

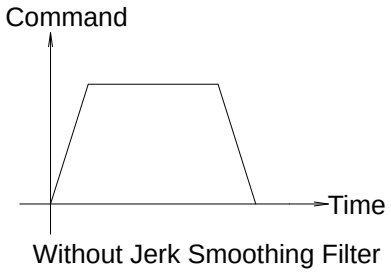



With KK parameter, Inertia Feedforward Constant.
Red Line (Dash) : Actual velocity
Green Line (Filled) : Position error

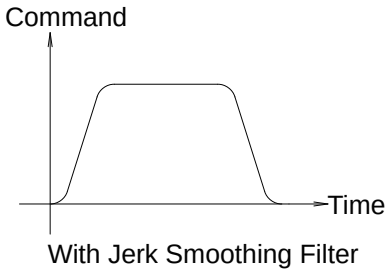
| P-07 (KJ) | Jerk Filter Frequency | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~5000 | 5000 | ------ | DEC |

This parameter sets the Jerk Filter frequency in Hz . The lower the frequency value the more pronounced the S-curve profile will be. Setting the value to 0 will disable the filter.

S-curve acceleration/deceleration ramps are beneficial in positioning systems where instantaneous changes in speed may cause the load to jerk excessively. One example is when the load is connected to the motion actuator via a long moment arm. If the arm is not sufficiently rigid, changes in speed at the actuator can result in undesirable oscillations and increased settling time at the load. Smoothed transitions in speed changes, can alleviate this unwanted motion and reduce settling time.




Without Jerk Smoothing Filter




With Jerk Smoothing Filter

| P-08 (VP) | Velocity Loop Proportional Gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 15000 | ------ | DEC |

The velocity-mode servo control Proportional gain term. Gain value is relative: 0 = no gain, 32767 = full gain. VP minimizes velocity error when in velocity mode 2.

| P-09 (VI) | Velocity Loop Integral Gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 1000 | ------ | DEC |

The velocity-mode (“JM2”) servo control integrator gain term. Gain value is relative: 0 = no gain, 32767 = full gain. VI minimizes steady state velocity errors.

| P-10 (KE) | Deriv Filter factor | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 15000 | ------ | DEC |

The differential control parameters filter frequency. The filter is a simple one-pole, low-pass filter intended for attenuating high frequency oscillations. The value is a constant that must be calculated from the desired roll off frequency.

| P-11 (KC) | PID Filter factor | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 25000 | ------ | DEC |

The servo control overall filter frequency. The filter is a simple one-pole, low-pass filter intended for attenuating high frequency oscillations. The value is a constant that must be calculated from the desired roll off frequency.

| P-12 (CM) | Main control mode | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~8，10~18，21，22，25 | 7 | ------ | DEC |

Parameter P-12 (CM) is used to set drive's control mode.

Parameter mode list are as follows:

| Mode | Control Signal | P-12 (CM) | Description |
|---|---|---|---|
| SCL command mode | SCL command | 1 | Use SCL command to control motor's output torque |
| Analog input torque mode | +10~-10V Analog signal | 2 | Use external analog voltage input signal to control motor's output torque.<br>Analog torque mode: No run/stop signal,<br>No direction signal. |
| Analog input torque mode | +10~-10V Analog signal | 3 | Analog torque mode: no run/stop signal;<br>X2 is closed, motor will change its current rotary direction. |
| Analog input torque mode | +10~-10V Analog signal | 4 | Analog torque mode: no run/stop signal;<br>X2 is open, motor will change its current rotary direction. |
| Analog input torque mode | +10~-10V Analog signal | 5 | Analog torque mode: X1 for run/stop signal,<br>No direction signal. |
| Analog input torque mode | +10~-10V Analog signal | 6 | Analog torque mode: X1 for run/stop signal;<br>X2 is open, motor will change its current rotary direction. |
| Analog input torque mode | +10~-10V Analog signal | 8 | Analog torque mode: X1 for run/stop signal;<br>X2 is close, motor will change its current rotary direction. |
| Digital pulse position mode | STEP & Direction; CW/CCW Pulse; A/B Quadrature. | 7 | Up to 500KHz open collector input signal or up to 2MHz differential input signal. |
| Command velocity mode | SCL command | 10 | Use SCL command to control motor rotation velocity. |
| Analog velocity mode | +10~-10V Analog signal | 11 | Using external analog voltage input to motor velocity.<br>Analog velocity mode, NO run/stop signal, X2 is direction switch. |
| Analog velocity mode | +10~-10V Analog signal | 12 | Analog velocity mode, X1 is run/stop signal, X2 is direction switch |
| Velocity mode | Digitial input signal | 15 | Profile velocity mode, after drive is enabled. The drive will run at velocity set by P-21 (JS). NO run/stop signal, X2 is direction switch. |
| Velocity mode | Digitial input signal | 16 | Profile velocity mode, after drive is enabled. The drive will run at velocity set by P-21 (JS). NO run/stop signal, X2 is direction switch. |
| Multi velocity mode | Digitial input signal | 17 | Profile velocity mode, NO run/stop signal. X2 is direction switch. X10, X11, X12 is speed selection switch. |
| Multi velocity mode | Digitial input signal | 18 | Profile velocity mode, X1 is run/stop switch. X2 is direction switch. X10, X11, X12 is speed selection switch. |
| Point to point Velocity | SCL command | 21 | Use SCL command to control point to point position mode. |
| Analog position mode | +10~-10V Analog signal | 22 | Use analog input voltage signal for position control . |
| Position table | Internal position mode | 25 | It have two motion control mode: linear motion with maximum of 64 position set points, and rotary motion with maximum of 32 position division points. |

| P-13 (CN) | Secondary control mode | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~8，10~18，21，22，25 | 21 | ------ | DEC |

Servo drive's secondary control mode. Please refer to P-12 (CM) main control mode, and 7.1.5 control mode selection.

| P-14 (PM) | Power-up mode | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 2，5，7， | 2 | ------ | DEC |

The power-up mode of the drive. PM determines how the drive is configured for serial communications at power-up. For example, for SCL applications set PM=2 or PM=5. The power-up mode is also set when configuring the drive with Quick Tuner or Configurator. PM2 (Q / SCL) is the same as PM7 (Q Program Mode), except the program is not automatically executed at power up.

| P-15 (JM) | Jog mode | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1，2 | 2 | ------ | DEC |

There are two Jog modes available:

JM 1: Jog Mode 1 uses a "position-type" of servo control that moves the target position which causes the servo to move at the set velocity. Jog Mode 1 will cause the servo motor to always move the same distance over time. A drawback is that the servo can fault if the position error during the move exceeds the value set by the PF (Position Fault) command.

JM 2: uses a "velocity-type" of servo control that applies torque to the motor to maintain velocity. This method functions better with high inertia loads because it ignores the value set by the PF (Position Fault) command. It also allows the drive to function in a "torque-limited velocity" mode or a "velocity-limited torque" mode. Jog Mode 2 also uses a different set of control parameters, VI and VP, for "tuning" the velocity mode.

| P-16 (GC) | Current Command of Torque Mode | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | Based on drive's output ability | 0 | 0.01A | DEC |

The immediate current for the servo motor and drive when the servo drive is set for Command Torque Mode.

**NOTE: if you need to view or set this value on drive's control panel P-16 (GC), please refer to following calculation:**

**LED display value = *B* x 100**

Where ***B*** is target setting current, Unit for is A (amps)

| P-17 (CC) | Rated Maximum current | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | Dependson motor model | 0.5 | A | DEC |

The continuous (RMS) current setting of the servo drive.

**NOTE: In normal operation, please DONOT change this parameter.**

**NOTE: if you need to view or set this value on drive's control panel P-16 (CC), please refer to following calculation:**

**LED display value = *B* x 100**

Where ***B*** is target setting current, Unit for is A (amps)

| P-18 (CP) | Peak current | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | Dependson motor model | 1.5 | A | DEC |

CM sets the peak (RMS) current setting of the servo drive. Peak current sets the maximum current that should be used with a given motor. When the motor position requires more than the continuous value, the peak current time calculation is done using I^2/T which integrates current values for more accurate modeling of drive and motor heating. The servo drive will allow peak current for nor more than one second. After one second of operation at peak current the current is reduced to the continuous current setting (see CC command).

**NOTE: In normal operation, please DONOT change this parameter.**

**NOTE: if you need to view or set this value on drive's control panel P-18(CP), please refer to following calculation:**

**LED display value = *B* x 100**

Where ***B*** is target setting current, Unit for is A (amps)

| P-20 (VM) | Maximum velocity | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 60 | rps | DEC |

The maximum motor velocity in rev/sec. Used in all control modes to limit the maximum speed of the drive.

**NOTE: if you need to view or set this value on drive's control panel P-20 (VM), please refer to following calculation:**

**LED display value = *V* x 240**

Where ***V*** is target velocity setting, Unit is rps (rev/sec).

| P-21 (AM) | maximum acceleration/ deceleration | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 3000 | rps/s | DEC |

The maximum acceleration/deceleration allowed. When the targeted acceleration/deceleration excels the maximum value, the actual acceleration/deceleration will limit to the maximum value.

Also sets the deceleration rate used when an end-of-travel limit is activated during a move or when an ST (Stop) or SK (Stop & Kill) command is sent.

**NOTE: if you need to view or set this value on drive's control panel P-21 (AM), please refer to following calculation:**

**LED display value = *B* x 6**

Where ***B*** is target maximum acceleration/deceleration setting, Unit is rps/s .

| P-22 (JS) | Jog velocity | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 10 | rps | DEC |

The speed for Jog moves in rev/sec.

**NOTE:If you need to view or set this value on drive's control panel P-22 (JS), please refer to following calculation:**

**LED display value = *V* x 240**

Where = ***V*** is target velocity setting, Unit is rps (rev/sec) .

| P-23 (JA) | Jog acceleration | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 100 | rps/s | DEC |

The accel/decel rate for Jog moves and velocity control mode in rev/sec/sec. Setting JA overwrites the

both the last JA and JL values. This means that to have different jog accel and jog decel values, you should first send JA to set the jog accel and then send JL to set the jog decel.

**NOTE: if you need to view or set this value on drive's control panel P-23 (JA), please refer to following calculation:**

**LED display value = *B* x 6**

Where ***B*** is jog acceleration/deceleration setting, Unit is rps/s .

| P-24 (JL) | Jog deceleration | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 100 | rps/s | DEC |

The accel/decel rate for Jog moves and velocity control mode in rev/sec/sec. Setting JA overwrites the both the last JA and JL values. This means that to have different jog accel and jog decel values, you should first send JA to set the jog accel and then send JL to set the jog decel.

**NOTE: if you need to view or set this value on drive's control panel P-23 (JA), please refer to following calculation:**

**LED display value = *B* x 6**

Where ***B*** is jog acceleration/deceleration setting, Unit is rps/s .

| P-25 (VE) | Point to point Velocity | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 10 | rps | DEC |

The shaft speed for point-to-point move commands like FL, FP, FS, FD, SH, etc.

**NOTE: if you need to view or set this value on drive's control panel P-25 (VE), please refer to following calculation:**

**LED display value = *V* x 240**

Where = ***V*** is target velocity setting, Unit is rps (rev/sec) .

| P-26 (AC) | Point to point acceleration | Data Range | Default value | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 100 | rps/s | DEC |

The acceleration rate used in point-to-point move commands in rev/sec/sec.

**NOTE: if you need to view or set this value on drive's control panel P-26 (AC), please refer to following calculation:**

**LED display value = *B* x 6**

Where ***B*** is point to point move acceleration setting, Unit is rps/s .

| P-27 (DE) | Point to point deceleration | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 100 | rps/s | DEC |

The deceleration rate used in point-to-point move commands in rev/sec/sec.

**NOTE: if you need to view or set this value on drive's control panel P-27 (DE), please refer to following calculation:**

**LED display value = *B* x 6**

Where ***B*** is point to point move deceleration setting, Unit is rps/s .

| P-28 (VC) | speed change | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 2 | rps | DEC |

The secondary speed for FC and FD moves.

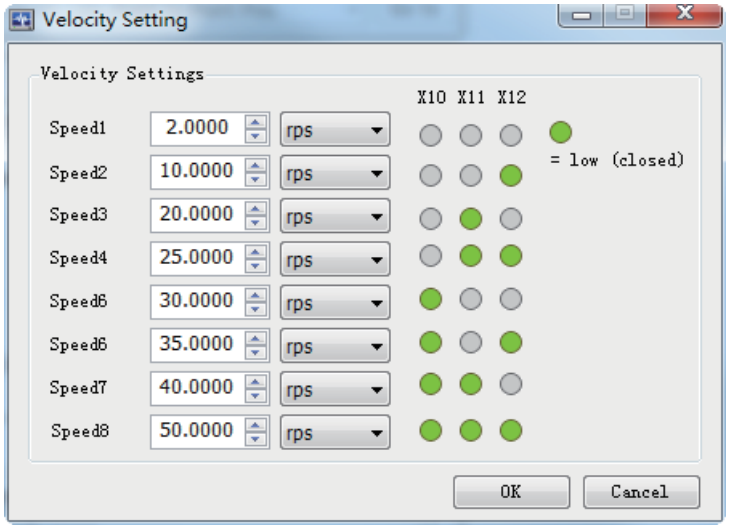
**NOTE: if you need to view or set this value on drive's control panel P-28 (VC), please refer to following calculation:**

**LED display value = *V* x 240**

Where = ***V*** is target velocity setting, Unit is rps (rev/sec) .

| P-29 (JC) | Jog mode speed 1 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 2 | rps | DEC |

The first speed used in velocity mode. This only applies to control modes 15, 16, 17, and 18.




| P-30 (JC) | Jog mode speed 2 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 10 | rps | DEC |

The second speed used in velocity mode. This only applies to control modes 13, 14, 17, and 18.

| P-31 (JC) | Jog mode speed 3 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 20 | rps | DEC |

The third speed used in velocity mode. This only applies to control modes 13, 14, 17, and 18.

| P-32 (JC) | Jog mode speed 4 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 25 | rps | DEC |

The fourth speed used in velocity mode. This only applies to control modes 13, 14, 17, and 18.

| P-33 (JC) | Jog mode speed 5 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 30 | rps | DEC |

The fifth speed used in velocity mode. This only applies to control modes 13, 14, 17, and 18.

| P-34 (JC) | Jog mode speed 6 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 35 | rps | DEC |

The sixth speed used in velocity mode. This only applies to control modes 13, 14, 17, and 18.

| P-35 (JC) | Jog mode speed 7 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 40 | rps | DEC |

The seventh speed used in velocity mode. This only applies to control modes 13, 14, 17, and 18.

| P-36 (JC) | Jog mode speed 8 | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.025~100 | 50 | rps | DEC |

The eighth speed used in velocity mode. This only applies to control modes 13, 14, 17, and 18.

| P-37 (ER) | Encoder resolution | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 200~12800 | 10000 | counts | DEC |

Sets the encoder resolution in quadrature counts. For example, if the motor connected to the drive has an 8000count (2000 line) per revolution encoder, set the encoder resolution to 8000.

**NOTE: for MOONS' motor please DONOT change this parameter**

| P-39 (EG) | Electronic gearing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 200~32000 | 10000 | counts | DEC |

EG defines the pulses per revolution for electronic gearing. For example, with an EG value of 10000 the servo drive will require 10000 pulses from the master pulse source to move the servo motor 1 revolution.

| P-40 (PV) | Secondary Electronic gearing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 200~32000 | 10000 | counts | DEC |

PV defines the pulses per revolution for secondary electronic gearing. Please refer to 7.2.3 control pulse dividing switch function

| P-41 (EN) | Numerator of electronic gearing ratioNumerator of electronic gearing ratio | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~1000 | 1000 | | DEC |

Defines the numerator of electronic gearing ratio.

Please refer to 7.2.5 Electronic gearing ratio

| P-42 (EU) | Denominator of electronic gearing ratio | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~1000 | 1000 | | DEC |

Defines the denominator of electronic gearing ratio. Please refer to 7.2.5 Electronic gearing ratio

| P-43 (SZ) | Input Pulse Setting | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~65535 | 1792 | | DEC |

Pulse counter configuration and digital filter parameters in digital position control mode.

Bit0~bit1: pulse type。

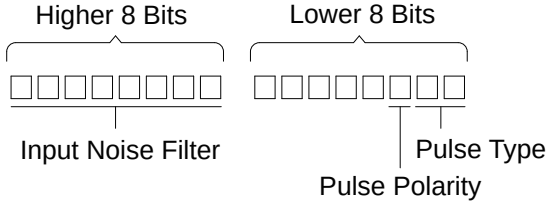
0 = STEP/DIR

1 = CW/CCW

2 = A/B quadrature

bit2: count direction

Bit8~bit15：digital filter parameter




Please refer to 7.2.2 input pulse type and input noise filter

| P-44 (PF) | Position Fault limit | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32000 | 2000 | | DEC |

The Position Fault limit in encoder counts. This value defines the limit threshold, in encoder counts, reached between actual position and commanded position before the system produces a position fault error. On drive's LED display, it will 

| P-45 (PL) | Dynamical Position error Range | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32000 | 10 | | DEC |

Define the usage of input X10 as inhibiting the pulse input.

PI1: Inhibit the pulse input when input X10 is closed.

PI2: Inhibit the pulse input when input X10 is open.

PI3: Input X10 is used as general purpose input.

| P-46 (PD) | In Position Error Range | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32000 | 10 | | DEC |

This parameter is used to set in-position error range. For example, motor is in-position or in completion of rotating. The actual finish position is in the target In-position error range for the time that is longer than PE specified timing. Then the driver will define the motion complete or motor is in-position. Refer to P-47 (PE).

Please refer to 7.2.7 in position error output

| P-47 (PE) | In position duration count | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32000 | 10 | 250us | DEC |

PE sets the timing counts for In range determination. For example, if In position error P-46 (PD) is defined. PE will sets the time duration for the test, if no in-position is shown within the time duration, driver will define motor as in-position.

Time is counted as processor cycles, one cycle refers to 250μsec.

Please refer to 7.2.7 in position error output

| P-48 (TT) | Pulses Input Completion count | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~20000 | 16 | 125us | DEC |

This parameter is used to define a time duration. It is used to determine whether the driver has finished receiving all pluses or not. If the driver has not receive any pluses for the period that is longer than TT defined time, then the driver will define no pluses is sent to drive.

One count equivalent to 125μs

| P-49 (AP) | Analog Position Gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32000 | 8000 | counts | DEC |

AP sets the analog Input gain that relates to motor position when the drive is in analog position command mode. Gain value sets the commanded position when the analog input is at the configured full scale value.

| P-50 (AG) | Analog Velocity Gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | -100.000~100.000 | 20.000 | rps | DEC |

Analog gain value used in analog velocity modes. The gain value is used to establish the relationship between the analog input and the motor speed. The units are 0.25 rpm. For example, if the analog input is scaled to 0 - 5 volt input and the gain is set to 2400, when 5 volts is read at the analog input the motor will spin at 10 rps.

TIP: To set the analog velocity gain to the desired value, multiply the desired motor speed in rps by 240, or the desired motor speed in rpm by 4.

**NOTE: if you need to view or set this value on drive's control panel P-50 (AG), please refer to following calculation:**

**LED display value = *V* x 240**

Where ***V*** is target velocity setting, Unit is rps (rev/sec).

| P-51 (AN) | Analog Torque Gain | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | Drive's maximum current output ability | 1.00 | A | DEC |

This parametersets the analog Input gain that relates to motor position when the drive is in analog position control mode. Analog torque gain value sets the commanded torque when the analog input is at the configured full scale value (±10V ).

| P-52 (AV) | Analog input1 offset | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | -10.000~+10.000 | 0.000 | A | DEC |

The offset value of analog input 1 in volts. In some cases, even when host controls set the analog command to 0V, the servo motor might still rotate slowly. This is caused by voltage bias from the analog voltage supply. This can be adjusted by this offset value.

**NOTE: if you need to view or set this value on drive' s control panel, please refer to following calculation:**

**LED display value = *A* x 2730**

Where ***A*** is voltage offset, Unit is V.

| P-53 (AV) | Analog input2 offset | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | -10.000~+10.000 | 0.000 | A | DEC |

The offset value of analog input 2 in volts. Please refer to 7.4.3.3 analog input offset.

| P-54 (AV) | Differential analog input offset | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | -10.000~+10.000 | 0.000 | A | DEC |

The offset value of differential analog input in volts. Please refer to 7.4.3.3 analog input offset.

| P-55 (AS) | Analog type | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~1 | 1 | ----- | DEC |

This is the analog input scaling setting. This is a code that determines what type of analog input scaling is desired.

0: single ended input

1: differential input

| P-56 (AD) | Analog input1 deadband | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~255 | 0 | mV | DEC |

The analog deadband value of the analog input 1 in millivolts. The deadband value is the zone around the “zeroed”value of the analog input. This deadband defines the area of the analog input range that the drive should interpret as “zero”. The deadband is an absolute value that in usage is applied to either side of the zero point.

| P-57 (AD) | Analog input2 deadband | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~255 | 0 | mV | DEC |

The analog deadband value of the analog input 2 in millivolts. The deadband value is the zone around the “zeroed”value of the analog input. This deadband defines the area of the analog input range that the drive should interpret as “zero”. The deadband is an absolute value that in usage is applied to either side of the zero point.

| P-58 (AD) | Differential analog deadband | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~255 | 0 | mV | DEC |

The analog deadband value of the differential analog input in millivolts. The deadband value is the zone around the “zeroed”value of the analog input. This deadband defines the area of the analog input range that the drive should interpret as “zero”. The deadband is an absolute value that in usage is applied to either side of the zero point.

| P-59 (AF) | Analog input filter value | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~15990 | 500 | ---- | DEC |

Applies a digital filter to the analog input (s). This is a simple single pole filter that rolls off the all analog input. When analog input is used, there might be external interferences that affect the accuracy of the analog input voltage. In some cases, it will cause the motor to turn unexpectedly, or unstable torque output. Therefore, analog input filter is recommended. It is designed as a digital low pass filter; reasonable filter frequency can significantly improve the motor performance. Please refer to 7.3.4 analog input filter

| P-60 (AT) | Analog threshold | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | -10.000~10.000 | 0.000 | V | DEC |

This sets the analog Input Threshold that is used by the “Feed to Sensor” command. The threshold value sets the Analog voltage that determines a sensor state or a trigger value.

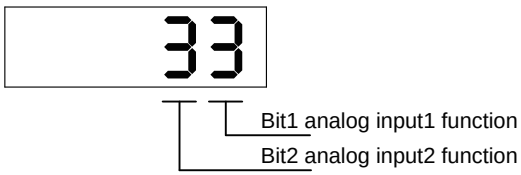
**NOTE: if you need to view or set this value on drive’s control panel P-60 (AT), please refer to following calculation:**

$$\text{LED display value} = A \times 1000$$

Where $A$ is target voltage value, Unit is V (volts).

| P-61 (FA) | Analog 1/2 function | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 00-33 | 33 | --- | HEX |

Defines the function of the single analog input X1 and X2. It is defined by two digits, first from the right is X1, the other is X2




X1:

1: Analog input X1 is used as velocity or position reference input.

2: Not used.

3: Analog input X1 is used as general purpose analog input.

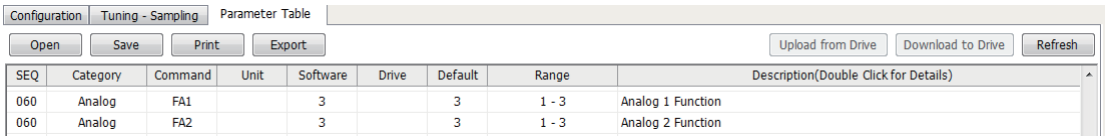
X2:

1: Not used.

2: Analog input X2 is used as torque reference input.

3: Analog input X2 is used as general purpose analog input.

In M Servo Suite parameter table, it is divided into 2 command, FA1 for first bit, and FA2 for second bit (from right to left)




| P-62 (SI) | Servo enable input setting | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1，2，3 | 2 | --- | DEC |

The usage of the Enable input. Input X3 is the default Enable input on all drives. There are 3 possible usage states for the Enable function:

SI1: Drive is enabled when X3 is open.

SI2: Drive is enabled when X3 is closed.

SI3: Input X3 is used as general purpose inputs.

Please refer to 7.1.1 servo on settings.

| P-63 (AI) | Alarm Reset input setting | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1，2，3 | 3 | --- | DEC |

Defines the function of the X3 input. This input can be used to clear a drive fault and reset the Alarm Code (see AL command).

Please refer to 7.1.2 alarm reset

| P-64 (DL) | End-of –travel limit Setting | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1，2，3 | 3 | --- | DEC |

CW and CCW end-of-travel limits are available on all drives and can be used to define the boundaries ofacceptable motion in a motor/drive system.

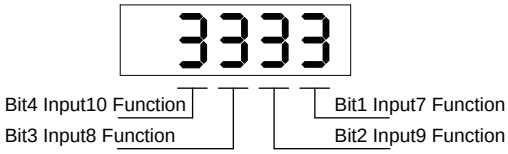
For example, define inputs X5 and X6 as dedicated end-of-travel limits. If one of these inputs is activated while defined as an end-of-travel limit, motor rotation will stop in that direction, and an alarm code will show at the drive's status LEDs.

If not needed, X5 and X6 can be redefined as general purpose inputs.

Please refer to 7.1.3 CW/CCW limit

| P-65 (MI) | X7，X8，X9，X10 input function setting | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1111~3333 | 3333 | --- | DEC |

Defines the functions for X7，X8，X9，X10 based on the number of digits from right to left .




Bit1 defines X7 for control global gain selection function

1: When input X7 is open select parameter KG, close for parameter KP.

2: When input X7 is open select parameter KP, close for parameter KG.

3: X7 uses as general purpose, parameter KP is used.

Bit2 defines X9 for electronic gearing selection

1: When input X9 is open select parameter EG for electronic gearing, close for parameter PV for electronic gearing.

2: When input X9 is open select parameter PV for electronic gearing, close for parameter EG for electronic gearing.

3: X9 as general purpose, use parameter EG for electronic gearing.

Bit3 defines X8 control selection function

1: When input X8 is open select CN control mode, close for CM control mode.

2: When input X8 is open select CM control mode, close for CN control mode.

3: X8 as general purpose.

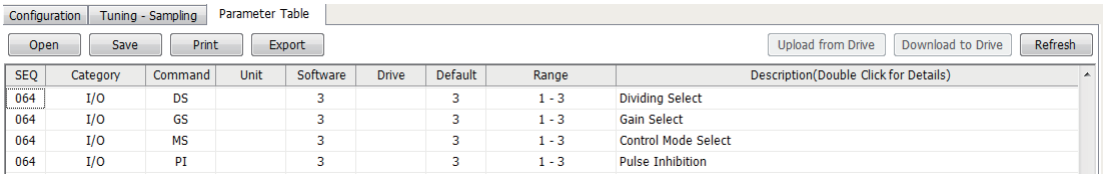
Bit4 defines X10 for pulse inhibition function

1: When X10 is closed pulse inhibition function is on

2: When X10 is open pulse inhibition function is on

3: Input X10 set as general purpose

In M servo suite parameter table section, it is divided into 4 parameters, GS represents bit 1, DS represents bit 2, MS represents bit 3. PI represents bit 4




Please also refer to 7.1.4 gain selection function, 7.1.5 control mode selection, 7.2.3 input electronic gearing selection, and 7.2.4 pulse inhibition function

| P-66 (AO) | Alarm output function setting | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~3 | 3 | --- | DEC |

Defines usage of digital output Y1. Normally this output is used to indicate an Alarm caused by a Drive Fault. This output can being reconfigured as a general purpose output for use with other types of output commands. There are three states that can be defined: AO1: Output Y1 is closed (active, low) when a Drive Fault is present. AO2: Output Y1 is open (inactive, high) when an Drive Fault is present. AO3: Output Y1 is not used as an Alarm Output and can be used as a general purpose output.

| P-67 (BO) | Motor brake control setting | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~3 | 3 | --- | DEC |

BO defines usage of digital output Y2 as the Brake Output, which can be used to automatically activate and deactivate a holding brake. Output Y2 can also be configured as a general purpose output for use with other types of output commands. There are three states that can be defined:

BO1: Output Y2 is closed (energized) when drive is enabled, and open when the drive is disabled.

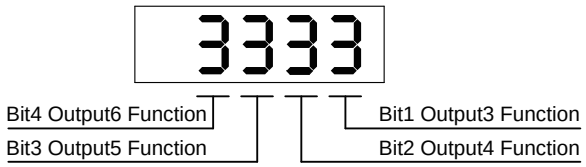
BO2: Output Y2 is open (de-energized) when drive is enabled, and closed when the drive is disabled.

BO3: Output Y2 is not used as a Brake Output and can be used as a general purpose output.

Please also refer to 7.1.7 motor brake control

| P-68 (MO) | Y3，Y4，Y5，Y6 output function setting | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | | 3333 | --- | HEX |

P-68 (MO) defines Y3，Y4，Y5，Y6 output functions. It is based on digits from right to left.




Defines the drive's Motion Output digital output function on output Y3. There are three Motion Output states that can be defined:

8: When the output torque reached the targeted torque, output Y3 is closed

9: When the output torque reached the targeted torque, output Y3 is open

3: Output Y3 is used as general output.

Defines the drive's Motion Output digital output function on output Y4. There are five Motion Output states that can be defined:

6: When the dynamical position error is within the range specified by PL command, output Y3 is closed.

7: When the dynamical position error is within the range specified by PL command, output Y3 is open.

A:When the actual velocity reached the targeted velocity, output Y3 is closed.

B:When the actual velocity reached the targeted velocity, output Y3 is open.

3: Output Y3 is used as general output.

Defines the drive's Motion Output digital output function on output Y5. There are 3 Motion Output states that can be defined:

1: When the drive is enabled, output Y5 is closed.

2: When the drive is enabled, output Y5 is open.

3: Output Y5 is used as general output.

Defines the drive's Motion Output digital output function on output Y6. There are 4 Motion Output states that can be defined:

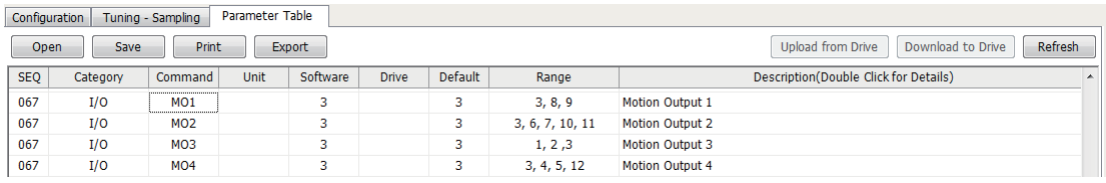
4: When the motion is completed and the motor is in position, output Y3 is closed.

5: When the motion is completed and the motor is in position,, output Y3 is open.

C:When the motor is running,

3: Output Y6 is used as general output.

In M servo suite parameter function, it is divided into 4 functions. MO1 for bit 1, MO2 for Bit 2, MO3 for bit 3, MO4 for bit 4




| | | | | | |
|---|---|---|---|---|---|
| P-69 (BD) | Brake disengage Delay | Data Range | Default | Unit | Data type |
| | | 0~32000 | 200 | ms | DEC |
| P-70 (BE) | Brake engage delay | Data Range | Default | Unit | Data type |
| | | 0~32000 | 200 | ms | DEC |

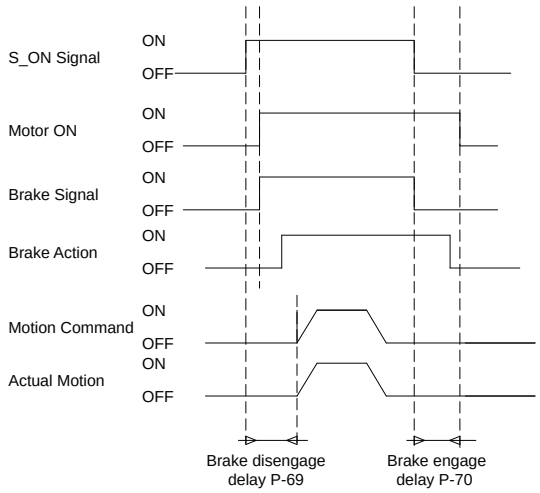
BD only takes effect if the BO command is set to 1 or 2. After a drive is enabled this is the time value that may delay a move waiting for the brake to disengage. When beginning a move the delay value must expire before a move can take place. The delay timer begins counting down immediately after the drive is enabled and the brake output is set. The BD command sets a time in milliseconds that a move may be delayed.

This Only takes effect if the BO command is set to 1 or 2. After a drive is commanded to be disabled,

this is the time value that delays the actual disabling of the driver output. When using the dedicated brake output

(see BO command) the output is activated immediately with the disable command, then the drive waits the delay

time before turning off the motor current.




| P-71 (FI) | Input X9 noise filter | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 0 | --- | DEC |

Applies a digital filter to the input X9. The digital input must be at the same level for the time period specified by the FI command before the input state is updated. For example, if the time value is set to 100 the input must remain high for 100 processor cycles before high is updated as the input state. One processor cycle is 250µsec. A value of “0” disables the filter.

| P-72 (FI) | Input X10 noise filter | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 0 | --- | DEC |

Applies a digital filter to the input X10. The digital input must be at the same level for the time period specified by the FI command before the input state is updated. For example, if the time value is set to 100 the input must remain high for 100 processor cycles before high is updated as the input state. One processor cycle is 250µsec. A value of “0” disables the filter.

| P-73 (FI) | Input X11 noise filter | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 0 | --- | DEC |

Applies a digital filter to the input X11. The digital input must be at the same level for the time period specified by the FI command before the input state is updated. For example, if the time value is set to 100 the input must remain high for 100 processor cycles before high is updated as the input state. One processor cycle is 250µsec. A value of “0” disables the filter.

| P-74 (FI) | Input X12 noise filter | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~32767 | 0 | --- | DEC |

Applies a digital filter to the input X12. The digital input must be at the same level for the time period specified by the FI command before the input state is updated. For example, if the time value is set to 100 the input must remain high for 100 processor cycles before high is updated as the input state. One processor cycle is 250µsec. A value of “0” disables the filter.

| P-76 (PR) | Communication protocol | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1-127 | 15 | --- | DEC |

The serial communication protocol settings. There are a number of settings that can be turned on or off in the PR command. Each setting is assigned a bit in a 8-bit binary word. The parameter of the PR command is the decimal equivalent of this word. If you send the PR command without a parameter the drive will respond with the decimal equivalent of the word as well. The different protocol settings and their bit assignments are shown below.

Bit 0 = Default (“Standard SCL”)

bit 1 = Always use Address Character

bit 2 = Ack/Nack

bit 3 = Checksum (RESERVED)

bit 4 = RS-485 Adaptor

bit 5 = 3-digit numeric register addressing

bit 6 = Checksum Type

bit 7 = Little endian or big endian used in MODBUS type drive

bit 8 = Four wires/two wires

| P-77 (TD) | Transmit delay | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~100 | 2 | --- | DEC |

The time delay used by the drive when responding to a command that requests a response. Typically this is needed when using the 2-wire RS-485 interface (Half-duplex). Because the same wires are used for both receive and transmit a time delay is usually needed to allow transition time.

| P-78 (BR) | Baud rate | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~5 | 1 | --- | DEC |

This parameter sets the bit rate (baud) for serial communications. At power up a drive will send its power-up packet detected after 1 second and the drive is configured for SCL or Q operation (see PM command) the drive will setthe baud rate according to the value stored in the Baud Rate NV parameter. A Host system can set the baud rateat anytime using this command.

1 = 9600bps

2 = 19200bps

3 = 38400bps

4 = 57600bps

5 = 115200bps

| P-79 (DA) | RS-485 Address | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~32 | 32 | --- | DEC |

The individual drive address character for multi-drop RS-485/MODBUS communications. This command is not required for single-axis (point-to-point) or RS-232 communications.

| P-80 (CO) | CANopen Node ID | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 1~127 | 1 | --- | DEC |

The CANopen NODE-ID forCANOpen type drives.

| P-81 (CB) | CANopen Baudrate | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0-7 | 0 | --- | DEC |

CANopen drive supports 8 types for baud rate.

| Setting value | Baud rate | Setting value | Baud rate |
|---|---|---|---|
| 0 | 1M | 4 | 125K |
| 1 | 800K | 5 | 50K |
| 2 | 500K | 6 | 25K |
| 3 | 250K | 7 | 12.5K |

| P-82 (ZR) | Regen resistor value | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0-1000 | 40 | Ω | DEC |

The regeneration resistor value. M2 drives dynamically calculate the continuous wattage induced into an external regeneration resistor and must know the value of the regen resistor to do this effectively.

| P-83 (ZC) | Regen resistor continuous wattage | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0-32000 | 200 | W | DEC |

Calculate the continuous wattage induced into an external regeneration resistor and must know the continuous wattage rating of the regen resistor to do this effectively.

| P-84 (ZT) | Regen resistor peak time | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0-8000 | 250 | ms | DEC |

The regeneration resistor time constant. Decides the peak time that the resistor can tolerate full regeneration voltage. The time is scaled as period count. One period is 250us.

| P-85 (VR) | Ripple range setting for velocity reach | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0-136 | 0.000 | rps | DEC |

The velocity ripple value around the targeted velocity. If the difference between the actual velocity and targeted velocity is within the ripple value. The driver will then define actual torque meets its target torque value.

Please refer to 7.3.3.7 target velocity reach

| P-86 (TO) | Tach out counts | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | | 0 | --- | DEC |

The count value of tach out per revolution.

0 = 1 * pole pairs

1 = 2 * pole pairs

2 = 4 * pole pairs

3 = 8 * pole pairs

4 = 16 * pole pairs

5 = 32 * pole pairs

6 = 64 * pole pairs

7 = 128 * pole pairs

| P-87 (TV) | Ripple range setting for torque reach | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.00-1.50 | 0.00 | A | DEC |

The torque ripple value around the targeted torque. If the difference between the actual torque and targeted torque is within the ripple value. The driver will then define actual torque meets its target torque value.

Please refer to 7.4.3.7 torque reach for more details.

| P-88 (PK) | Parameter lock on the drive's control panel | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0，1 | 0 | | DEC |

This parameter determines whether the parameters of the driver can be modified directly from the push bottoms on the driver.

0 = Yes

1 = No

| P-89 (DD) | LED Default status monitor type | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~14 | 0 | | DEC |

Sets or requests the default monitor status on the driver's LEDs display.

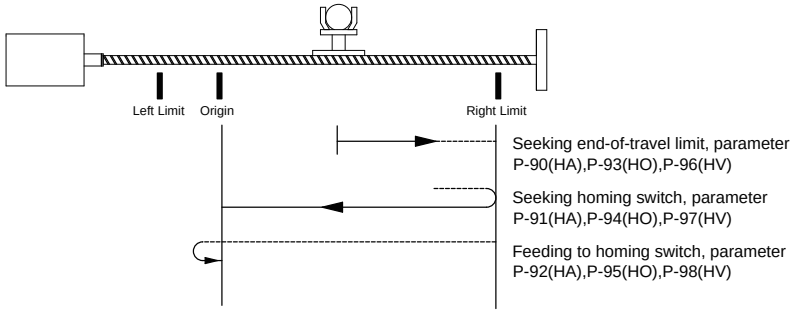
| P-90 (MA) | LED Warning Display Mask Code | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0~65535 | 65535 | | DEC |

This parameter setting can mask some unwanted warnings from driver's LED display. In order to avoid the constant flashing from the driver's display. However, it only limits to certain warning: CCW/CW Limits; under voltage; move while disabled; current foldback; blank Q segments, flash memory; Comm error.

| P-91 (HA) | Accel of seeking end-of-travel limit during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 100 | rps/s | DEC |

In homing mode, this parameter sets the acceleration rate for seeking the end of travel limit.

Please refer to the graph below.




| P-92 (HA) | Accel of seeking homing switch during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 10 | rps/s | DEC |

In homing mode, after end of travel is reached, this sets the acceleration rate for seeking the homing switch.

Please refer to parameter P-91 (HA)

| P-93 (HA) | Accel of feeding to homing switch during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 10 | rps/s | DEC |

In homing mode, after the homing switch is reached it sets the acceleration rate for feed back to the homing switch.

Please refer to parameter P-91 (HA)

| P-94 (HO) | Decel of seeking end-of-travel limit during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 100 | rps/s | DEC |

In homing mode, this parameter sets the deceleration rate for seeking the end of travel limit.

Please refer to parameter P-91 (HA)

| P-95 (HO) | Decel of seeking homing switch during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 10 | rps/s | DEC |

In homing mode, after end of travel is reached, this sets the deceleration rate for seeking the homing switch.

Please refer to parameter P-91 (HA)

| P-96 (HO) | Decel of feeding to homing switch during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 10 | rps/s | DEC |

In homing mode, after the homing switch is reached it sets the deceleration rate for feed back to the homing switch.

Please refer to parameter P-91 (HA)

| P-97 (HV) | Velocity of seeking end-of-travel limit during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 100 | rps/s | DEC |

In homing mode, this parameter sets the velocity rate for seeking the end of travel limit.

Please refer to parameter P-91 (HA)

| P-98 (HV) | Velocity of seeking homing switch during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 10 | rps/s | DEC |

In homing mode, after end of travel is reached, this sets the velocity rate for seeking the homing switch.

Please refer to parameter P-91 (HA)

| P-99 (HV) | Velocity of feeding to homing switch during homing | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | 0.167~5000 | 10 | rps/s | DEC |

In homing mode, after the homing switch is reached it sets the velocity rate for feed back to the homing switch.

Please refer to parameter P-91 (HA)

| P-100 (KL) | Follow factor | Data Range | Default | Unit | Data type |
|---|---|---|---|---|---|
| | | -32000~+32000 | 0 | | DEC |

Servo follow factor: Higher value will reduce system noise, eliminate the overshoot, but it will reduce the system dynamic following performance. Lower value will raise system stiffness, but will cause system noise probably.

# 9. Communication

M2 series AC servo drive supports multiple communication interface.

| Model type | Communication |
|---|---|
| -Q | RS-232 |
| -R | RS-485 |
| -C | CANopen |
| -IP | Ethernet |
| -E | |

## 9.1 RS-232 communication

For Q type drives, port CN6 is used for RJ-11 communication port, it is used for RS-232 communication. Customers can use serial communication command SCL to control the drive.

### 9.1.1 What is SCL

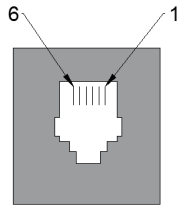
SCL or serial command language, was developed by MOONS to give users a simple way to control a motor drive via a serial port. This eliminates the need for separate motion controllers or to supply control signals, like Pulse & Direction, to your step and servo motor drives. It also provides an easy way to interface to a variety of other industrial devices like PLCs, industrial computers, and HMIs, which most often have standard or optional serial ports for communicating to other devices.

NOTE:For more details about SCL command, please download Host Command Reference manual from MOONS website.

### 9.1.2 RS-232 Connections

For servo drive port CN6, RJ-11 pin definitions are as follows:

| PIN | Definition |
|---|---|
| 1，3，6 | Not used |
| 2 | RX |
| 4 | TX |
| 5 | GND |

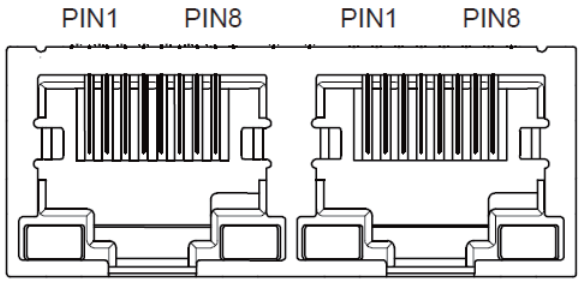



## 9.2 RS-485 Communication

R type drive uses port CN6 and CN7 for standard RJ45 (8p8C) design. This can be used to build RS-485 daisy chain networks. In addition to the SCL command controlling methods, customers can also use ModBUS/RTU to control the drive.

### 9.2.1 RS-485 PIN definition

For RS-485 communication, customer can use the dual RJ45 on the side of the drive to build the daisy chain network system.




Pin definitions as follows:

| PIN | Definition |
|---|---|
| 4, 5, 7, 8 | GND |
| 1 | RX+ |
| 2 | RX- |
| 3 | TX+ |
| 6 | TX- |

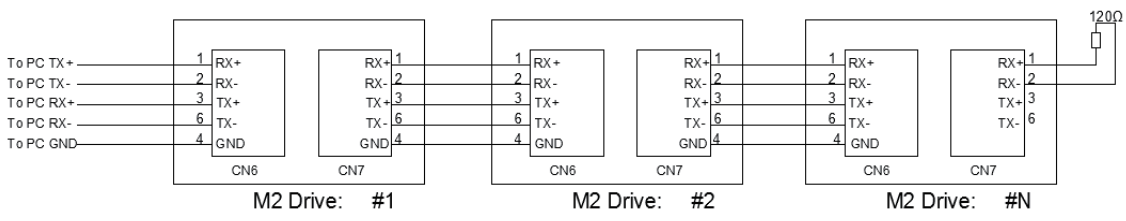
### 9.2.2 RS-485 Connection Method

RS-422/485 communication allows connection of more than one drive to a single host PC, PLC, HMI or other computer. It also allows the communication cable to be long. The use of Category 5 cable is recommended as it is widely used for computer net- works, inexpensive, easily obtained and certified for quality and data integrity.

The M2 drives can be used with either Two-Wire or Four-Wire RS-422/485 implementation. The connection can be point-to-point (i.e. one drive and one host) or a multi-drop network (one host and up to 32 drives).

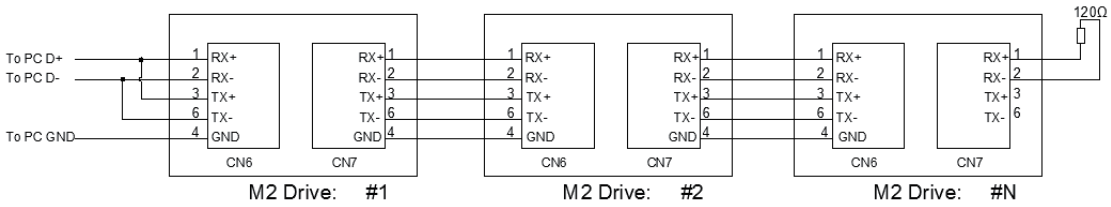
#### Four-Wire Configuration

Four-Wire Systems utilize separate transmit and receive wires. One pair of wires must connect the host's transmit signals to each drive's RX+ and RX- terminals. The other pair connects the drive's TX+ and TX- terminals to the host's receive signals. A logic ground terminal is provided on each drive and can be used to keep all drives at the same ground potential. This terminal connects internally to the DC power supply return (V-), so if all the drives on the RS-422/485 network are powered from the same supply it is not necessary to connect the logic grounds. One drive's GND terminal should still be connected to the host computer ground.



### Two-Wire Configuration

In a 2-wire system, the host must disable its transmitter before it can receive data. This must be done quickly before a drive begins to answer a query. The M2 drive includes a transmit delay parameter that can be adjusted to compensate for a host that is slow to disable its transmitter. This adjustment can be made over the network using the TD command, or it can be set using the M servo suite software. It is not necessary to set the transmit delay in a four wire system.




**NOTE: For RJ45 crystal connector, we recommend standard CAT5 cables.**

## 9.3 ModBUS/RTU Communication

There are two types of communication methods for ModBUS, ASCII(American Standard Code for information interchange) mode and RTU(Remote Terminal Unit)mode, this is defined based on different bus modulation and demodulation methods. For M2 series AC servo drives, only ModBUS RTU is supported.

### 9.3.1 Data Encode

Big-endian: The most significant byte (MSB) value is stored at the memory location with the lowest address; the next byte value in significance is stored at the following memory location and so on. This is akin to Left-to-Right reading in hexadecimal order.

For example: To store a 32bit data 0x12345678 into register address 40031 and 40032. 0x1234 will be defined as MSB, and 0x5678 as LSB. With big-endian system

Register 40031 = 0x1234

Register 40032 = 0x5678

When transfer 0x12345678, the first word will be 0x1234, and the second word will be 0x5678

Little-endian: The most significant byte (MSB) value is stored at the memory location with the highest address; the next byte value in significance is stored at the following memory location and so on. This is akin to Left-to-Right reading in hexadecimal order.

For example: To store a 32bit data 0x12345678 into register address 40031 and 40032. 0x5678 will be defined as MSB, and 0x1234 as LSB. With little-endian system

Register 40031 = 0x5678

Register 40032 = 0x1234

When transfer 0x12345678, the first words will be 0x5678, and the second words will be 0x1234

M2 drive parameter P-75 (PR) defines data transfer type

P-75 (PR) = 5 represents Big-Endian

P-75 (PR) = 133 represents Little-Endian

### 9.3.2 Communication Address

In the network system, each drive requires a unique drive address. Only the drive with the matching address will responded to the host command. In ModBUS network, address “0” is the broadcast address. It cannot be used for individual drive’s address. ModBUS RTU/ASCII can set drive address from 1 to 31.

### 9.3.3 Communication Baud Rate And Framing

M2 series AC servo drive has a fixed communication data framing: 8,N,1. Date bits:8, parity checking: none, stop bit: 1.

Parameter P-77 (BR) defines the communication baud rate.

In serial communication, the change of baudrate will NOT effect immediately, it will ONLY effects at next power up of the drive.

1 = 9600bps

2 = 19200bps

3 = 38400bps

4 = 57600bps

5 = 115200bps

### 9.3.4 Power Up Mode

Parameter P-14 (PM) sets the power up mode for the drive. For current M2 servo drives, these are the power up mode:

8 = Modbus/RTU mode when powered up.

9 = Q mode with Modbus/RTU communication, when powered up.

### 9.3.5 Modbus/RTU Data Framing

ModBUS RTU is a master and slave communication system. The CRC checking code includes from drive’s address bits to data bits. This standard data framing are as follows:


based on data transfer status, there can be two types of response code:

Normal ModBUS response:

response function code = request function code

ModBUS error response:

response function code = request function code + 0x80

providing an error code to indicate the error reasoning.

### 9.3.6 M2 Series AC Servo Drive Register Address And Function List:

| M2 Series | | | | |
|---|---|---|---|---|
| **Register** | **Access** | **Data Type** | **Description** | **SCL Register** |
| 40001 | Read Only | SHORT | Alarm Code (AL) | f |
| 40002 | Read Only | SHORT | Status Code (SC) | s |
| 40003 | Read Only | SHORT | Drive Digital output | |
| 40004 | Read Only | SHORT | Drive Digital output | i |
| 40005..6 | Read Only | LONG | Encoder Position (IE, EP) | e |
| 40007..8 | Read Only | LONG | Immediate Absolute Position(IP) | I |
| 40009..10 | Write | LONG | Absolute Position Command(SP) | P (Capital) |
| 40011 | Read Only | SHORT | Immediate Actual Velocity (IV0) | v |
| 40012 | Read Only | SHORT | Immediate Target Velocity (IV1) | w |
| 40013 | Read Only | SHORT | Immediate Drive Temperature (IT) | t |
| 40014 | Read Only | SHORT | Immediate Bus Voltage (IU) | u |
| 40015..16 | Read Only | LONG | Immediate Position Error (IX) | x |
| 40017 | Read Only | SHORT | Immediate Analog Input Value (IA) | a |
| 40018 | Read Only | SHORT | Q Program Line Number | b |
| 40019 | Read Only | SHORT | Immediate Current Command (IC) | c |
| 40020..21 | Read Only | LONG | Relative Distance (ID) | d |
| 40022..23 | Read Only | LONG | Sensor Position | g |
| 40024 | Read Only | SHORT | Condition Code | h |
| 40025 | Read Only | SHORT | Analog Input 1 (IA1) | j |
| 40026 | Read Only | SHORT | Analog Input 2 (IA2) | k |
| 40027 | Read Only | SHORT | Command Mode (CM) | m |
| 40028 | R/W | SHORT | Point-to-Point Acceleration (AC) | A |
| 40029 | R/W | SHORT | Point-to-Point Deceleration (DE) | B |
| 40030 | R/W | SHORT | Velocity (VE) | V |
| 40031..32 | R/W | LONG | Point-to-Point Distance (DI) | D |
| 40033..34 | R/W | LONG | Change Distance (DC) | C |
| 40035 | R/W | SHORT | Change Velocity (VC) | U |
| 40036 | Read Only | SHORT | Velocity Move State | n |

| | | | | |
|---|---|---|---|---|
| 40037 | Read Only | SHORT | Point-to-Point Move State | o |
| 40038 | Read Only | SHORT | Q Program Segment Number | p |
| 40039 | Read Only | SHORT | Reserved | |
| 40040 | Read Only | SHORT | Phase Error | z |
| 40041..42 | R/W | LONG | Position Offset | E |
| 40043 | R/W | SHORT | Miscella neous Flags | F |
| 40044 | R/W | SHORT | Current Command (GC) | G |
| 40045..46 | R/W | LONG | Input Counter | I |
| 40047 | R/W | SHORT | Jog Accel (JA) | |
| 40048 | R/W | SHORT | Jog Decel (JL) | |
| 40049 | R/W | SHORT | Jog Velocity (JS) | J |
| 40050 | R/W | SHORT | Max Velocity | |
| 40051 | R/W | SHORT | Continuous Current(CC) | N |
| 40052 | R/W | SHORT | Peak Current (CP) | O (Capital) |
| 40053 | Read Only | SHORT | Reserved | |
| 40054..55 | R/W | LONG | Pulse Counter | S |
| 40056 | R/W | SHORT | Analog Position Gain (AP) | X |
| 40057 | R/W | SHORT | Analog Threshold (AT) | Y |
| 40058 | R/W | SHORT | Analog Offset (AV) | Z |
| 40059..60 | R/W | LONG | Accumulator | 0 |
| 40061..62 | R/W | LONG | User Defined Register | 1 |
| 40063..64 | R/W | LONG | User Defined Register | 2 |
| 40065..66 | R/W | LONG | User Defined Register | 3 |
| 40067..68 | R/W | LONG | User Defined Register | 4 |
| 40069..70 | R/W | LONG | User Defined Register | 5 |
| 40071..72 | R/W | LONG | User Defined Register | 6 |
| 40073..74 | R/W | LONG | User Defined Register | 7 |
| 40075..76 | R/W | LONG | User Defined Register | 8 |
| 40077..78 | R/W | LONG | User Defined Register | 9 |
| 40079..80 | R/W | LONG | User Defined Register | : |

| | | | | |
|---|---|---|---|---|
| 40081..82 | R/W | LONG | User Defined Register | ; |
| 40083..84 | R/W | LONG | User Defined Register | < |
| 40085..86 | R/W | LONG | User Defined Register | = |
| 40087..88 | R/W | LONG | User Defined Register | > |
| 40089..90 | R/W | LONG | User Defined Register | ? |
| 40091..92 | R/W | LONG | User Defined Register | @ |
| 40093..94 | R/W | LONG | User Defined Register | [ |
| 40095..96 | R/W | LONG | User Defined Register | \ |
| 40097..98 | R/W | LONG | User Defined Register | ] |
| 40099..100 | R/W | LONG | User Defined Register | ^ |
| 40101..102 | R/W | LONG | User Defined Register | _ |
| 40103..104 | R/W | LONG | User Defined Register | ` |
| 40105 | R/W | SHORT | Brake Release Delay(BD) | |
| 40106 | R/W | SHORT | Brake Engage Delay(BE) | |
| 40107 | Read Only | SHORT | Reserved | |
| 40108 | Read Only | SHORT | Reserved | |
| 40109 | Read Only | SHORT | Firmware version | |
| 40110 | R/W | SHORT | Analog Filter Gain(AF) | |
| 40111 | Read Only | SHORT | Reserved | |
| 40112 | Read Only | SHORT | Alarm Code High bit | |
| 40113 | R/W | SHORT | Jog Change(JC) | |
| 40114 | R/W | SHORT | Jog Change(JC) | |
| 40115 | R/W | SHORT | Jog Change(JC) | |
| 40116 | R/W | SHORT | Jog Change(JC) | |
| 40117 | R/W | SHORT | Jog Change(JC) | |
| 40118 | R/W | SHORT | Jog Change(JC) | |
| 40119 | R/W | SHORT | Jog Change(JC) | |
| 40120 | R/W | SHORT | Jog Change(JC) | |
| 40121 | R/W | SHORT | X9 Input Filter | |
| 40122 | R/W | SHORT | X10 Input Filter | |

| | | | | |
|---|---|---|---|---|
| 40123 | R/W | SHORT | X11 Input Filter | |
| 40124 | R/W | SHORT | X12 Input Filter | |
| 40125 | R/W | SHORT | Command Opcode | |
| 40126 | R/W | SHORT | Parameter 1 | |
| 40127 | R/W | SHORT | Parameter 2 | |
| 40128 | R/W | SHORT | Parameter 3 | |
| 40129 | R/W | SHORT | Parameter 4 | |
| 40130 | R/W | SHORT | Parameter 5 | |
| 40131 | R/W | SHORT | Global Gain(KP) | |
| 40132 | R/W | SHORT | Global Gain1(KG) | |
| 40133 | R/W | SHORT | Proportional Gain(KF) | |
| 40134 | R/W | SHORT | Damping Gain(KD) | |
| 40135 | R/W | SHORT | Velocity Gain(KV) | |
| 40136 | R/W | SHORT | Integral Gain(KI) | |
| 40137 | R/W | SHORT | Inertia Feed forward Gain(KK) | |
| 40138 | R/W | SHORT | Jerk Filter(KJ) | |
| 40139 | R/W | SHORT | Velocity Mode Proportional Gain(VP) | |
| 40140 | R/W | SHORT | Velocity Mode Integral Gain(VI) | |
| 40141 | R/W | SHORT | Damping Filter Gain(KE) | |
| 40142 | R/W | SHORT | Current Filter Gain(KC) | |
| 40143 | R/W | SHORT | Control Mode(CM) | |
| 40144 | R/W | SHORT | Control Mode 1(CN) | |
| 40145 | R/W | SHORT | Operation Mode(PM) | |
| 40146 | R/W | SHORT | Jog Mode(JM) | |
| 40147 | R/W | SHORT | Hard-Stop Current Limit(HC) | |
| 40148 | R/W | SHORT | Max Acceleration(AM) | |
| 40149 | Read Only | SHORT | Encoder Resolution(ER) | |
| 40150 | Read Only | SHORT | Reserved | |
| 40151 | Read Only | SHORT | Steps-Rev(EG) | |
| 40152 | R/W | SHORT | Electronic Ration Numerator(EN) | |

| | | | | |
|---|---|---|---|---|
| 40153 | R/W | SHORT | Electronic Ration Denominator(ED) | |
| 40154 | Read Only | SHORT | Step Mode (SZ) | |
| 40155 | R/W | SHORT | Position Fault(PF) | |
| 40156 | R/W | SHORT | Dynamic Position Error Count(PL) | |
| 40157 | R/W | SHORT | In-Position Counts(PD) | |
| 40158 | R/W | SHORT | In-Position Timing(PE) | |
| 40159 | R/W | SHORT | Pulse Complete Timing(TT) | |
| 40160 | R/W | SHORT | Analog Velocity Gain(AG) | |
| 40161 | R/W | SHORT | Analog Torque Gain(AN) | |
| 40162 | R/W | SHORT | Analog Offset 1(AV1) | |
| 40163 | R/W | SHORT | Analog Offset 2(AV2) | |
| 40164 | R/W | SHORT | Analog Type(AS) | |
| 40165 | R/W | SHORT | Analog Deadband 1(AD1) | |
| 40166 | R/W | SHORT | Analog Deadband 2(AD2) | |
| 40167 | R/W | SHORT | Analog Deadband (AD) | |
| 40168 | R/W | SHORT | Analog Function(FA) | |
| 40169 | R/W | SHORT | Servo Enable(SI) | |
| 40170 | R/W | SHORT | Alarm Reset(AI) | |
| 40171 | R/W | SHORT | Define Limits Input(DL) | |
| 40172 | R/W | SHORT | Motion Input | |
| 40173 | R/W | SHORT | Alarm Output(AO) | |
| 40174 | R/W | SHORT | Brake Output(BO) | |
| 40175 | R/W | SHORT | Motion Output(MO) | |
| 40176 | R/W | SHORT | Reserved | |
| 40177 | R/W | SHORT | Communication Protocol(PR) | |
| 40178 | R/W | SHORT | Transmit Delay(TD) | |
| 40179 | R/W | SHORT | Baud Rate(BR) | |
| 40180 | R/W | SHORT | Communication Address(DA) | |
| 40181 | R/W | SHORT | Velocity value(VR) | |
| 40182 | R/W | SHORT | Tach-out Count(TO) | |

| | | | | |
|---|---|---|---|---|
| 40183 | R/W | SHORT | Torque Value(TV) | |
| 40184 | R/W | SHORT | Parameters Lock(PK) | |
| 40185 | R/W | SHORT | Default Display(DD) | |
| 40186 | R/W | SHORT | Mask Alarm(MA) | |
| 40187 | R/W | SHORT | Homing Acceleration 1 | |
| 40188 | R/W | SHORT | Homing Acceleration 2 | |
| 40189 | R/W | SHORT | Homing Acceleration 3 | |
| 40190 | R/W | SHORT | Homing Deceleration 1 | |
| 40191 | R/W | SHORT | Homing Deceleration 2 | |
| 40192 | R/W | SHORT | Homing Deceleration 3 | |
| 40193 | R/W | SHORT | Homing Velocity 1 | |
| 40194 | R/W | SHORT | Homing Velocity 2 | |
| 40195 | R/W | SHORT | Homing Velocity 3 | |
| 40196 | R/W | SHORT | Clamp Resistance(ZR) | |
| 40197 | R/W | SHORT | Clamp Count (ZC) | |
| 40198 | R/W | SHORT | Clamp time(ZT) | |
| 40199 | Read Only | SHORT | Reserved | |
| 40200 | Read Only | SHORT | Reserved | |

### 9.3.7 Command Opcode description

Register 40125 is defined as command Opcode, when following command is entered into register, the drive will execute the corresponding operation.

1) SCL Command Encoding Table

| SCL Command Encoding Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Function | SCL | Opcode | Parameter 1 | Parameter 2 | Parameter 3 | Parameter 4 | Parameter 5 |
| Alarm Reset | AX | 0xBA | × | × | × | × | × |
| Start Jogging | CJ | 0x96 | × | × | × | × | × |
| Stop Jogging | SJ | 0xD8 | × | × | × | × | × |
| Encoder Function | EF | 0xD6 | 0,1,2 or 6 | × | × | × | × |
| Encoder Position | EP | 0x98 | Position | × | × | × | × |
| Feed to Double Sensor | FD | 0x69 | I/O Point 1 | Condition 1 | I/O Point 2 | Condition 2 | × |
| Follow Encoder | FE | 0xCC | I/O Point | Condition | × | × | × |
| Feed to Length | FL | 0x66 | × | × | × | × | × |
| Feed to Sensor with Mask Distance | FM | 0x6A | I/O Point | Condition | × | × | × |
| Feed and Set Output | FO | 0x68 | I/O Point | Condition | × | × | × |
| Feed to Position | FP | 0x67 | × | × | × | × | × |
| Feed to Sensor | FS | 0x6B | I/O Point | Condition | × | × | × |
| Feed to Sensor with Safety Distance | FY | 0x6C | I/O Point | Condition | × | × | × |
| Jog Disable | JD | 0xA3 | × | × | × | × | × |
| Jog Enable | JE | 0xA2 | × | × | × | × | × |
| Motor Disable | MD | 0x9E | × | × | × | × | × |
| Motor Enable | ME | 0x9F | × | × | × | × | × |
| Seek Home | SH | 0x6E | I/O Point | Condition | × | × | × |
| Set Position | SP | 0xA5 | Position | × | × | × | × |
| Filter Input | FI | 0xC0 | I/O Point | Filter Time | × | × | × |
| Filter Select Inputs | FX | 0xD3 | × | × | × | × | × |
| Step Filter Freq | SF | 0x06 | Freq | × | × | × | × |
| Analog Deadband | AD | 0xD2 | 0.001 V | × | × | × | × |
| Alarm Reset Input | AI | 0x46 | Function ('1'..'3') | I/O Point | × | × | × |
| Alarm Output | AO | 0x47 | Function ('1'..'3') | I/O Point | × | × | × |
| Analog Scaling | AS | 0xD1 | × | × | × | × | × |
| Define Limits | DL | 0x42 | 1..3 | × | × | × | × |
| Set Output | SO | 0x8B | I/O Point | Condition | × | × | × |
| Wait for Input | WI | 0x70 | × | × | × | × | × |
| Queue Load & Execute | QX | 0x78 | 1..12 | × | × | × | × |
| Wait Time | WT | 0x6F | 0.01 sec | × | × | × | × |
| Stop Move, Kill Buffer | SK | 0xE1 | × | × | × | × | × |
| Stop Move, Kill Buffer | SKD | 0xE2 | × | × | × | × | × |

For more detailed command functions description, please refer to **Host Command Reference manual.**

2) Digital I/O Function Selection And I/O Status

| Character | hex code | |
|---|---|---|
| '0' | 0x30 | Index of encode |
| '1' | 0x31 | input 1 or output 1 |
| '2' | 0x32 | input 2 or output 2 |
| '3' | 0x33 | input 3 or output 3 |
| '4' | 0x34 | input 4 or output 4 |
| '5' | 0x35 | input 5 or output 5 |
| '6' | 0x36 | input 6 or output 6 |
| '7' | 0x37 | input 7 |
| '8' | 0x38 | input 8 |
| '9' | 0x39 | input 9 |
| ':' | 0x3A | input 10 |
| ';' | 0x3B | input 11 |
| '<' | 0x3C | input 12 |
| 'L' | 0x4C | low state (closed) |
| 'H' | 0x48 | high state (open) |
| 'R' | 0x52 | rising edge |
| 'F' | 0x46 | falling edge |

### 9.3.8 Function Code

MOONS drives currently support following Modbus function code:

1) 0x03: Read holding registers
2) 0x04: Read input registers
3) 0x06: Write single registers
4) 0x10: Write multiple registers

#### 9.3.8.1 Function Code 0X03, Reading Multiple Holding Registers

If we want to read encoder's actual position command to drive Node ID 1, the data address for encoder's actual position is register 40005. If the register value is in decimal numbers it will be 250000, and the transfer method is P-75 (PR) = 5, for big-endian transfer.

Communication details are as follows:

| Command Message (Master) | | | | Response Message (slave) | | |
|---|---|---|---|---|---|---|
| Function | Data | Number Of Bytes | | Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 | | Slave Address | 01H | 1 |
| Function Code | 03H | 1 | | Function Code | 03H | 1 |
| Starting Data Address | 00H (High)<br>04H (Low) | 2 | | Number of Data (In Byte) | 04 | 1 |
| Number of Data (In word) | 00 (High)<br>02 (Low) | 2 | | Content of Starting Data Address 40005 | 00H (High)<br>26H (Low) | 2 |
| CRC Check Low | 85 | 1 | | Content of second Data Address 40006 | 25H (High)<br>A0 (Low) | 2 |
| CRC Check High | CA | 1 | | CRC Check Low | 01H | 1 |
| | | | | CRC Check High | 10H | 1 |

Host Sending: 01 03 00 04 00 02 85 CA

Drive Reply: 01 03 04 00 26 25 A0 01 10

If error is occurred, drive reply format: 01 83 XX CRC_L CRC_H

Where XX = 01 : Function code 03 unsupported

XX = 02 : Incorrect reading on driving address or numbers

XX = 03 : Reading register address out of range

XX = 04 : Reading failure

### 9.3.8.2 Function Code 0x06, Writing Single Register

If we want to set motor rotary velocity 12.5 rps to drive node ID 11, the corresponding address is register 40030. The write in data value for the register will be 12.5 x 240 = 3000. In hexadecimal number, it is 12CH.

Communication Details are as follows:

| Command Message (Master) | | | | Response Message (slave) | | |
|---|---|---|---|---|---|---|
| function | data | number of bytes | | function | data | number of bytes |
| Slave Address | 0BH | 1 | | Slave Address | 0BH | 1 |
| Function Code | 06H | 1 | | Function Code | 06H | 1 |
| Starting Data Address | 00H (High)<br>1DH (Low) | 2 | | Starting Data Address | 00H (High)<br>1DH (Low) | 2 |
| Content of Data | 01 (High)<br>2C (Low) | 2 | | Content of Data | 01 (High)<br>2C (Low) | 2 |
| CRC Check Low | 19 | 1 | | CRC Check Low | 19 | 1 |
| CRC Check High | 2B | 1 | | CRC Check High | 2B | 1 |

Host Sending: 0B 06 00 1D 01 2C 19 2B

Drive Reply: 0B 06 00 1D 01 2C 19 2B

If error is occurred, drive reply format: 01 86 XX CRC_L CRC_H

Where XX = 01 : Function code 06 unsupported

XX = 02 : Incorrect writing on driving address or number

XX = 03 : Writing register address out of range

XX = 04 : Writing failure

### 9.3.8.3 Function Code 0X10, Writing Multiple Registers

If we writing target distance 30000 into drive NODE-ID 10, the correspondent register address will be 40031. Transfer into hexadecimal, it is 7530h.

Communication Details are as follows:

| Command Message (Master) | | | | Response Message (slave) | | |
|---|---|---|---|---|---|---|
| Function | Data | Number Of Bytes | | Function | Data | Number Of Bytes |
| Slave Address | 0AH | 1 | | Slave Address | 0AH | 1 |
| Function Code | 10H | 1 | | Function Code | 10H | 1 |
| Starting Data Address | 00H (High)<br>1EH (Low) | 2 | | Starting Data Address | 00H (High)<br>1EH (Low) | 2 |
| Number of Data<br>(In word) | 00H (High)<br>02H (Low) | 2 | | Number of Data<br>(In word) | 00H (High)<br>02H (Low) | 2 |
| Number of Data<br>(In byte) | 04H | 1 | | CRC Check Low | 20 | 1 |
| Content of first Data address | 00 (High)<br>00 (Low) | 2 | | CRC Check High | B5 | 1 |
| Content of second Data address | 75H (High)<br>30H (Low) | 2 | | | | |
| CRC Check Low | 70 | 1 | | | | |
| CRC Check High | 8F | 1 | | | | |

Host Sending： 0A 10 00 1E 00 02 04 00 75 30 70 8F

Drive Reply： 0A 10 00 1E 00 02 20 B5

If error is occurred, drive reply format: 01 90 XX CRC_L CRC_H

Where XX = 01： Function code 10 unsupported

XX = 02： Incorrect reading on driving address or number

XX = 03： Reading register address out of range

XX = 04： Reading failure

## 9.3.9 Modbus/RTU Applications

### 9.3.9.1 Position Control

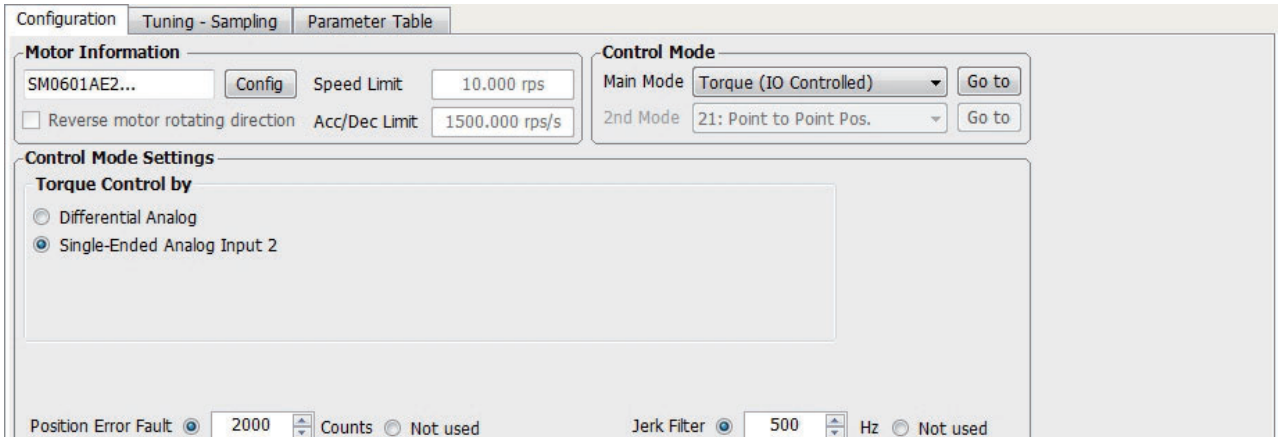
### 1.Target Profile Planning

| SCL command | Target Value | Unit | Dec | Dec (Hex) | Description |
|---|---|---|---|---|---|
| AC | 100 | rps/s | 40028 | 600 (258h) | The unit for register 40028 is $\frac{1}{6}rps^2$ , when target acceleration is 100rps/s, the value will be 600 |
| DE | 200 | rps/s | 40029 | 1200 (258h) | The unit for register 40029 is $\frac{1}{6}rps^2$ . When target deceleration is 200rps/s, the value will be 1200 |
| VE | 10 | rps | 40030 | 2400 (960) | The unit for register 40030 is $\frac{1}{240}rps$. When target velocity is 200rps/s, the value will be 1200 |
| DI | 20000 | counts | 40031~40032 | 20000 (4E20h) | The target distance will be 20000 counts |

### 2. Drive Setting

| Parameter | Function |
|---|---|
| P-75 (PR) = 5 | Big-endian data transfer |
| P-76 (TD) = 10 | feedback delay 10ms |
| P-77 (BR) = 3 | communication baud rate 38400bps |
| P-78 (DA) = 1 | Communication address 1 |
| P-14 (PM) = 8 | Power up mode as Modbus/RTU |

Use M servo suite software for configurations:



## 3. Sending Command

### First Step :

Set acceleration register 40028 = 285h, deceleration register 40029 = 4B0h, velocity register 40030 = 960h, and target position 40031~40032 = 4E20h.

Host Sending: 01 10 00 1B 00 05 0A 02 58 04 B0 09 60 00 00 4E 20 24 3B

Rive Respond: 01 10 00 1B 00 05 70 0D

| Command Message (Master) | | |
|---|---|---|
| Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 |
| Function Code | 10H | 1 |
| Starting Data Address | 00H (High)<br>1BH (Low) | 2 |
| Number of Data<br>(In word) | 00H (High)<br>05H (Low) | 2 |
| Number of Data<br>(In word) | 0AH | 1 |
| Content of first Data address 40028 | 02 (High)<br>58 (Low) | 2 |
| Content of second Data address 40029 | 04H (High)<br>B0H (Low) | 2 |
| Content of third Data address 40030 | 09H (High)<br>60H (Low) | 2 |
| Content of fourth Data address 40031 | 00H (High)<br>00H (Low) | 2 |
| Content of fifth Data address 40032 | 4EH (High)<br>20H (Low) | 2 |
| CRC Check Low | 24 | 1 |
| CRC Check High | 3B | 1 |

| Command Message (Slave) | | |
|---|---|---|
| Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 |
| Function Code | 10H | 1 |
| Starting Data Address | 00H (High)<br>1BH (Low) | 2 |
| Number of Data<br>(In word) | 00H (High)<br>05H (Low) | 2 |
| CRC Check Low | 70 | 1 |
| CRC Check High | 0D | 1 |

### Second Step: Point To Point Motion Command

Chapter 9.3.7 command Opode describes register 40125's control code. From the SCL code list shows that for point to point position motion, it requires to write data 0x66 to register 40125.

| SCL Command Encoding Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Function | SCL | Opcode | Parameter 1 | Parameter 2 | Parameter 3 | Parameter 4 | Parameter 5 |
| Feed to Length | FL | 0x66 | × | × | × | × | × |

Host Sending： 01 06 00 7C 00 66 C8 38

Drive Reply： 01 06 00 7C 00 66 C8 38

Listed As Below:

| Command Message (Master) | | |
|---|---|---|
| Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 |
| Function Code | 06H | 1 |
| Starting Data Address | 00H (High)<br>7CH (Low) | 2 |
| Content of Data | 00 (High)<br>66 (Low) | 2 |
| CRC Check Low | C8 | 1 |
| CRC Check High | 38 | 1 |

| Command Message (Slave) | | |
|---|---|---|
| Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 |
| Function Code | 06H | 1 |
| Starting Data Address | 00H (High)<br>7CH (Low) | 2 |
| Content of Data | 00 (High)<br>66 (Low) | 2 |
| CRC Check Low | C8 | 1 |
| CRC Check High | 38 | 1 |

### 9.3.9.2 JOG mode

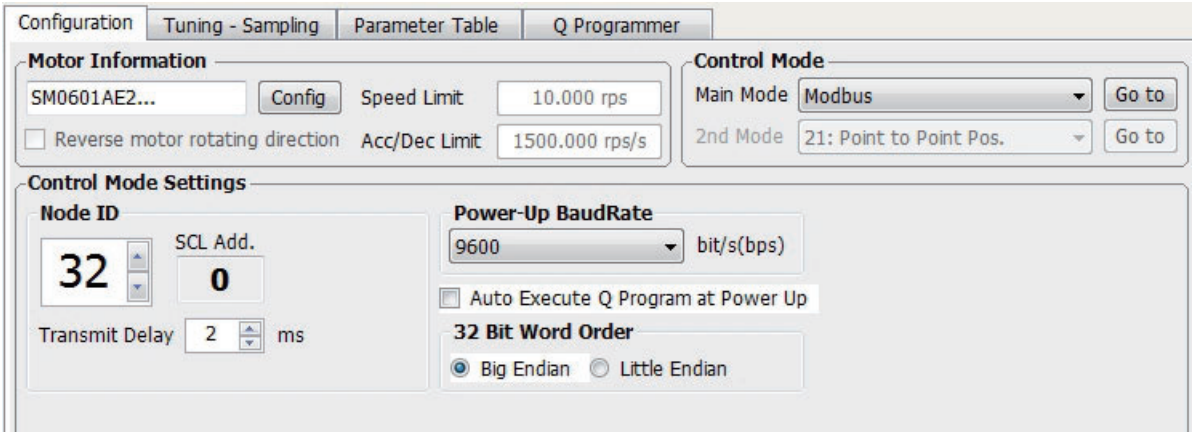
#### 1. JOG mode required parameters:

| SCL command | Target Value | Unit | Dec | Dec (Hex) | Description |
|---|---|---|---|---|---|
| AC | 100 | rps/s | 40047 | 600 (258h) | The unit for register 40028 is $\frac{1}{6}rps^2$ , when target acceleration is 100rps/s, the value will be 600 |
| JL | 200 | rps/s | 40048 | 1200 (258h) | The unit for register 40029 is $\frac{1}{6}rps^2$ . When target deceleration is 200rps/s, the value will be 1200 |
| JS | 10 | rps | 40049 | 2400 (960) | The unit for register 40030 is $\frac{1}{240}rps$. When target velocity is 200rps/s, the value will be 1200 |

#### 2. Drive Setting

| Parameter | Function |
|---|---|
| P-75 (PR) = 5 | Big-endian data transfer |
| P-76 (TD) = 10 | Feedback delay 10ms |
| P-77 (BR) = 3 | Communication baud rate 38400bps |
| P-78 (DA) = 1 | Communication address 1 |
| P-14 (PM) = 8 | Power up mode as modbus/rtu |

Use M servo suite software for configurations:



## 3. Sending Command

### First Step:

Set velocity mode acceleration register as 40047 = 258h, deceleration register as 40048 = 4B0h, and velocity register 40049 = 960h.

Host Sending: 01 10 00 2E 00 03 06 02 58 04 B0 09 60 A0 9F

Drive Reply: 01 10 00 2E 00 03 E0 01

| Command Message (Master) | | |
|---|---|---|
| Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 |
| Function Code | 10H | 1 |
| Starting Data Address | 00H (High)<br>2EH (Low) | 2 |
| Number of Data<br>(In word) | 00H (High)<br>03H (Low) | 2 |
| Number of Data<br>(In word) | 06H | 1 |
| Content of first Data address 40047 | 02 (High)<br>58 (Low) | 2 |
| Content of second Data address 40048 | 04H (High)<br>B0H (Low) | 2 |
| Content of third Data address 40049 | 09H (High)<br>60H (Low) | 2 |
| CRC Check Low | A0 | 1 |
| CRC Check High | 9F | 1 |

| Command Message (Slave) | | |
|---|---|---|
| Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 |
| Function Code | 10H | 1 |
| Starting Data Address | 00H (High)<br>2EH (Low) | 2 |
| Number of Data<br>(In word) | 00H (High)<br>03H (Low) | 2 |
| CRC Check Low | 70 | 1 |
| CRC Check High | 0D | 1 |

### Second Step : Command For Executing Point To Point Motion

Chapter 9.3.7 command Opode describes register 40125's control code. From the SCL code list shows that for JOG mode, it requires to write data 0x66 to register 40125 to start, and sending 0xD8 to register 40125 to stop.

| SCL Command Encoding Table | | | | | | | |
|---|---|---|---|---|---|---|---|
| Function | SCL | Opcode | Parameter 1 | Parameter 2 | Parameter 3 | Parameter 4 | Parameter 5 |
| Start Jogging | CJ | 0x96 | × | × | × | × | × |
| Stop Jogging | SJ | 0xD8 | × | × | × | × | × |

Start

Host Sending: 01 06 00 7C 00 96 C8 7C

Drive Reply: 01 06 00 7C 00 96 C8 7C

Stop

Host Sending: 01 06 00 7C 00 D8 48 48

Drive Reply: 01 06 00 7C 00 D8 48 48

Starting message :

| Command Message (Master) | | | | Command Message (Slave) | | |
|---|---|---|---|---|---|---|
| Function | Data | Number Of Bytes | | Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 | | Slave Address | 01H | 1 |
| Function Code | 06H | 1 | | Function Code | 06H | 1 |
| Starting Data Address | 00H (High)<br>7CH (Low) | 2 | | Starting Data Address | 00H (High)<br>7CH (Low) | 2 |
| Content of Data | 00 (High)<br>96 (Low) | 2 | | Content of Data | 00 (High)<br>96 (Low) | 2 |
| CRC Check Low | C8 | 1 | | CRC Check Low | C8 | 1 |
| CRC Check High | 7C | 1 | | CRC Check High | 7C | 1 |

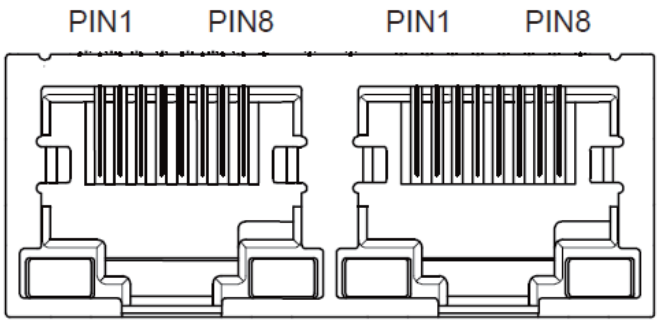
Stopping Message:

| Command Message (Master) | | | | Command Message (Slave) | | |
|---|---|---|---|---|---|---|
| Function | Data | Number Of Bytes | | Function | Data | Number Of Bytes |
| Slave Address | 01H | 1 | | Slave Address | 01H | 1 |
| Function Code | 06H | 1 | | Function Code | 06H | 1 |
| Starting Data Address | 00H (High)<br>7CH (Low) | 2 | | Starting Data Address | 00H (High)<br>7CH (Low) | 2 |
| Content of Data | 00 (High)<br>D8 (Low) | 2 | | Content of Data | 00 (High)<br>D8 (Low) | 2 |
| CRC Check Low | 48 | 1 | | CRC Check Low | 48 | 1 |
| CRC Check High | 48 | 1 | | CRC Check High | 48 | 1 |

## 9.4 CANopen Communication

For C type drive, port CN6 and CN7 uses standard RJ45 (8p8c) design, customers can use CAT wires to build daisy chain network.

### 9.4.1 RJ45(8p8c)Pin Definitions




Pin definitions as follows：

| PIN | Definition |
|---|---|
| 1 | CAN_H |
| 2 | CAN_L |
| 3，7 | GND |
| 6 | CHGND |
| 4，5，8 | |

### 9.4.2 CANopen NODE-ID

In the CANopen network, each of the drive needs to have a unique NODE-ID. For M2 series AC servo drive, it allows you to set NODE-ID from 1-112, “0” cannot be used for ID setting.

Parameter P-79 (CO) can set NODE-ID for dives.

### 9.4.3 CANopen Communication Baud Rate

Parameter P-80 (CB) can set CANopen communication baud rate. For CANopen drive, it supports 8 types of communication baud rate.

| Setting value | communication baud rate | Setting value | communication baud rate |
|---|---|---|---|
| 0 | 1M | 4 | 125K |
| 1 | 800K | 5 | 50K |
| 2 | 500K | 6 | 25K |
| 3 | 250K | 7 | 12.5K |

For more details, please refer to CANopen user manual.

# 10.Trouble Shooting

## 10.1 Drive Alarm List

| LED display | Description | Alarm type | Drive status after alarm occurs |
|---|---|---|---|
| r01ot | Drive over temperature | Fault | Servo off |
| r02ur | Internal voltage fault | Fault | Servo off |
| r03uH | Over voltage | Fault | Servo off |
| r04HC | Over current | Fault | Servo off |
| r05LC | | Fault | Servo off |
| r06rC | | Fault | Servo off |
| r08Hb | Bad hall sensor | Fault | Servo off |
| r09Eb | Encoder error | Fault | Servo off |
| r 10PL | Position error | Fault | Servo off |
| r 11Lu | Low voltage | Fault | Servo off |
| r 12ou | Velocity limited | Warning | No change to drive's status |
| r 13Lt | CW limit or CCW limit activated | Warning | No change to drive's status |
| r 14cL | CW limit is activated | Warning | No change to drive's status |
| r 15cL | CCW limit is activated | Warning | No change to drive's status |
| r 16CL | Current limit | Warning | No change to drive's status |
| r 17CE | Communication error | Warning | No change to drive's status |
| r 18EF | Parameter save failed | Warning | No change to drive's status |
| r 19LP | Phase loss of the main circuit | Warning | No change to drive's status |
| r20to | STO is activated | Warning | Servo off |
| r21rF | Regeneration failed | Warning | No change to drive's status |
| r22uH | Low voltage | Warning | No change to drive's status |
| r239E | Q program is empty | Warning | No change to drive's status |
| r24dd | Move when the drive is disabled. | Warning | No change to drive's status |

## 10.2 Drive alarm reason and solutions

| LED display | Description | Alarm type | Processing method |
|---|---|---|---|
| r01ot | Drive over temperature | Temperature of the heat sink or power device has been risen over the specified temperature.<br>1. Ambient temperature has risen over the specified temperature.<br>2. Over-load | 1. Improve the ambient temperature and cooling condition.<br>2. Increase the capacity of the driver and motor. Set up longer acceleration/deceleration time. Lower the load |
| r02ur | Internal voltage fault | Drive internal voltage failure. | 1. Please check supply power voltage<br>2. Please replace the drive with a new one, and contact MOONS |
| r03uH | Over voltage | Drive DC bus voltage is too high<br>220V series : 420V<br>1. Power supply voltage has exceeded the permissible input voltage.<br>2. Disconnection of the regeneration discharge resistor<br>3. External regeneration discharge resistor is not appropriate and could not absorb the regeneration energy.<br>4. Failure | Measure the voltage between lines of connector (L1, L2 and L3).<br>1. Enter correct voltage.<br>2. Measure the resistance of the internal regeneration resistor.<br>3. please measure the external resistor, Replace the external resistor if the value is ∞.<br>4. Please contact MOONS or replace the driver with a new one. |
| r04HC<br>r05LC<br>r06rC | Over current | 1. Failure of servo driver (failure of the circuit, IGBT or other components)<br>2. Short of the motor wire (U, V and W)<br>3. Burnout of the motor<br>4. Poor contact of the motor wire.<br>5. Input pulse frequency is too high.<br>6. Motor is over load, command output torque is larger than maximum torque, for a long operating time.<br>7. Poor gain adjustment cause motor vibration, and abnormal nosie.<br>8. Machine has collided or the load has gotten heavy. Machine has been distorted.<br>9. Welding of contact of dynamic braking relay due to frequent servo ON/OFF operations. | 1. Turn to Servo-ON, while disconnecting the motor. If error occurs immediately, replace with a new driver.<br>2. Check that the motor wire (U, V and W) is not shorted, and check the branched out wire out of the connector. Make a correct wiring connection.<br>3. Measure the insulation resistance between motor wires, U, V and W and earth wire. In case of poor insulation, replace the motor.<br>4. Check the balance of resister between each motor line, and if unbalance is found, replace the motor.<br>5. Check the loose connectors. If they are, or pulled out, fix them securely.<br>6. Adjust gain value settings.<br>7. Measuring brake voltage<br>8. Check drive and motor encoder and power wires.<br>9. please contact MOONS. |
| r08Hb | Bad hall sensor | Hall sensor fault | 1. please check encoder connection<br>2. please check your drive motor configurations. |
| r09Eb | Encoder error | Encoder signal fault | please check encoder connection. |
| r 10PL | Position error | Position error value exceeds the position error range set by parameter P-43 (PF). | 1. Please check parameter P-43 (PF).<br>2. Please check drive gain value settings.<br>3. Please check the load factor of the regeneration resistor, increase the capacity of the driver and the motor, and loosen the deceleration time |
| r 11Lu | Encoder error | 1. Power supply voltage is low. Instantaneous power failure has occurred<br>2. Lack of power capacity...Power supply voltage has fallen down due to inrush current at the main power-on.<br>3. Failure of servo driver (failure of the circuit) | Measure the voltage between lines of connector and terminal block L1,L2,L3.<br>1. Increase the power capacity. Change the power supply.<br>2. please check connections between L1,L2,L3. Please refer to 4.1.5 drive power connection<br>3. please cpntact MOONS |

| | | | |
|---|---|---|---|
| r 12ou | Position error | Motor rotary velocity exceeds parameter P-19 (VM) setting value. | Please check motor velocity command if it is within the P-19 (VM) range.<br>1. Avoid high velocity command<br>2. Check the command pulse input frequency and division/multiplication ratio.<br>3. Make a gain adjustment when an overshoot has occurred due to a poor gain adjustment.<br>4. Make a wiring connection of the encoder as per the wiring diagram. |
| r 13Lt | CW limit or CCW limit activated | CW and CCW limit is ON | 1. External limit switch is triggered.<br>2. Check x5 and x6 limit settings, please refer to chapter7.1.3 Cw/ccw limit. |
| r 14cL | CW limit is activated | CCW limit triggered | 1. External limit switch is triggered.<br>2. Check x5 and x6 limit settings. |
| r 15cL | CCW limit is activated | CW limit triggered | |
| r 16CL | Current limit | Driver's output current exceeds setting value P-18 (CP)<br>1. Load was heavy and actual torque has exceeded the rated torque and kept running for a long time.<br>2. Oscillation and hunching action due to poor gain adjustment. Motor vibration, abnormal noise.<br>3. Machine has collided or the load has gotten heavy. Machine has been distorted. | 1. Make a gain re-adjustment.<br>2. Increase the capacity of the driver and motor. Set up longer acceleration/deceleration time. Lower the load.<br>3. Check motor wirings for U/V/W as red/yellow/bule. |
| r 17CE | Communication error | Drive and host communication error. | Please check wiring connection, and drive's communication address and baud rate setting. |
| r 18EF | Parameter save failed | Saving parameter failure. | 1. Please try to save again.<br>2. if problems is not solved, please contact MOONS |
| r 19LP | Phase loss of the main circuit | - - - | - - - |
| r20to | STO is activated | Safety torque off function is activated. Either or both safety input 1 or 2 is ON. | Please confirm safety input 1 and 2 wiring configuration.<br>Please check Safety sensor setting. |
| r2 1rF | Regeneration failed | Regenerative energy has exceeded the capacity of regenerative resistor.<br>1. Due to the regenerative energy during deceleration caused by a large load inertia, converter voltage has risen, and the voltage is risen further due to<br>the lack of capacity of absorbing this energy of the regeneration discharge resistor.<br>2. Regenerative energy has not been absorbed in the specified time due to a high motor rotational speed. | 1. Internal resistor value is smaller than required, cannot absorb the regeneration energy.<br>2. Please check external regeneration resistor connections.<br>3. Reduce rotary velocity and decrease acceleration and deceleration value. |
| r22uU | Low voltage | Drive voltage lower than 170VDC<br>1) Power supply voltage is low. Instantaneous power failure has occurred<br>2) Lack of power capacity...Power supply voltage has fallen down due to inrush current at the main power-on.<br>3) Failure of servo driver (failure of the circuit) | 1) Increase the power capacity. Change the power supply.<br>2) Please check l1, l2, l3 power connections, please refer to 4.1.5 P1 drive power connection.<br>3) please contact moons. |
| r239E | Q program is empty | Drive in Q mode, but Q program is empty. | 1. Please check Q program.<br>2. Please check operation mode correction.<br>3. Please check Q program coding, make sure no faults to stop the program running. |
| r24dd | Move when the drive is disabled. | Motion command is received while motor is disabled. | Please enable the motor, and send the command again. |

## Revision History

| Document History | Date | Remarks |
|---|---|---|
| v1.0 | 2014.10.31 | |

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For technical support, contact: ama-support@moons.com.cn

# 11. STO function

## 11.1 Operation and maintenance procedures

### 11.1.1 The replacement of components

The replacement of components with a limited life is different , Disassembling for inspection and repair should be carried out only by authorized dealers or service company. The Components as following:

| Components | Standard replacement cycles /year |
|---|---|
| motor | Life time varies depending on working conditions. |
| Drive | Life time varies depending on working conditions. |
| Connector kit | Life time varies depending on working conditions. |
| STO terminal | Life time varies depending on working conditions. |

### 11.1.2 Prevent hazardous event

Even while the STO function is working, the following potential safety hazards exist.

Check safety in risk assessment. The actions and constraints necessary to prevent an unsafe and /or reduce the consequences of a hazardous event, including:

1.) The motor may move when external force (e.g. gravity force on vertical axis) is exerted on it. Provide an external brake, etc.,

2.) The STO turns off the current to the motor but does not turn off power to the servo driver and does not isolate it. When starting maintenance service on the servo driver,turn off the driver by using a different disconnecting device.

3.) When using STO function, connect equipment conforming to the safety standards.

4.) Do not touch the motor axis when working .

### 11.1.3 Maintenance procedures of STO faults or failures

According to user manual instructions, you can do some maintenance, if the customer find STO safety malfunctions or failure, please contact your local MOONS’ customer representative.

### 11.1.4 Commissioning and testing

The STO Terminal block is MOONS’ standard plug, generally do not pull out from the drive.

For connection to the host controller control the STO function, please use the appropriate connector or consulting MOONS’ customer representative.

## 11.2. The implementation of Safety Functional

### 11.2.1 Safety Functional Specification

During the normally operation, if inspection the violation of limits, the STO off, the drive give alarm signal.

#### 11.2.1.1 Safety input Signal

STO Safety input Signal as following:

| Signal | Symbol | Pin No. | contents | Control mode |
|---|---|---|---|---|
| Safety input 1 | SF1+ | 1 | When SF1 input turns off, the STO function activate | Compatible all control mode |
| | SF- | 2 | | |
| Safety input 2 | SF1+ | 3 | When SF2 input turns off, the STO function activate | |
| | SF- | 5 | | |

**Note: When safety input SF1 or SF2 is OFF, STO function activate.**

#### 11.2.1.2 External device monitor (EDM)output signal

The monitor output signal is used by the external device to monitor the state of the safety input signal. Connect the monitor output to the external device monitor terminal of the safety devices such as safety controller and safety sensor.

| Signal | Symbol | Pin No. | contents | Control mode |
|---|---|---|---|---|
| EDM Output | EDM+ | 6 | When STO function work，The monitor output signal EDM may used | Compatible all control mode |
| | EDM- | 4 | | |

#### 11.2.1.2 +5VDC Source

STO Terminal block is kit, if the STO unused, keep the STO terminal block connect the STO port, The SF1, SF2 connect the internal +5VDC and DGND:

| Signal | Symbol | Pin No. | contents | Control mode |
|---|---|---|---|---|
| Digit | DGND | 7,8 | DGND | Compatible all control mode |
| +5V | +5VDC | 9,10 | +5VDC output | |

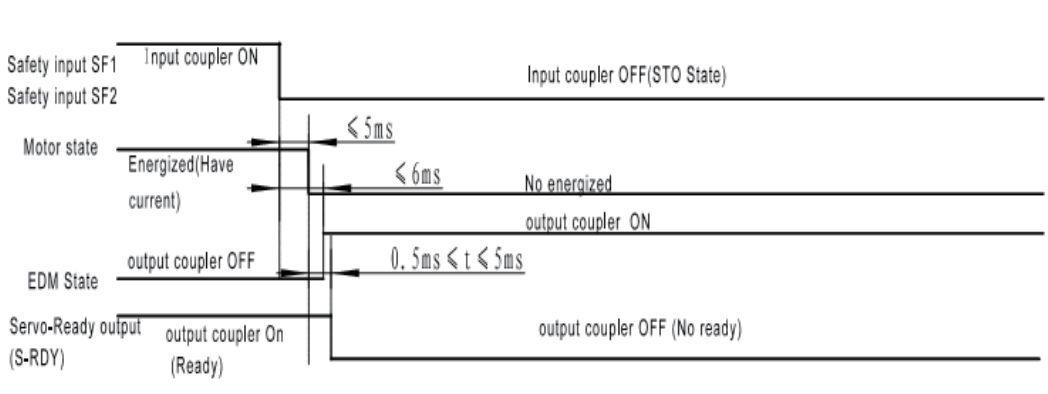
### 11.2.2 The fault reaction function

The safe torque off (STO) function is a safety function that shuts the motor current and turns off motor output torque by forcibly turning off the driving signal of the servo driver internal power transistor

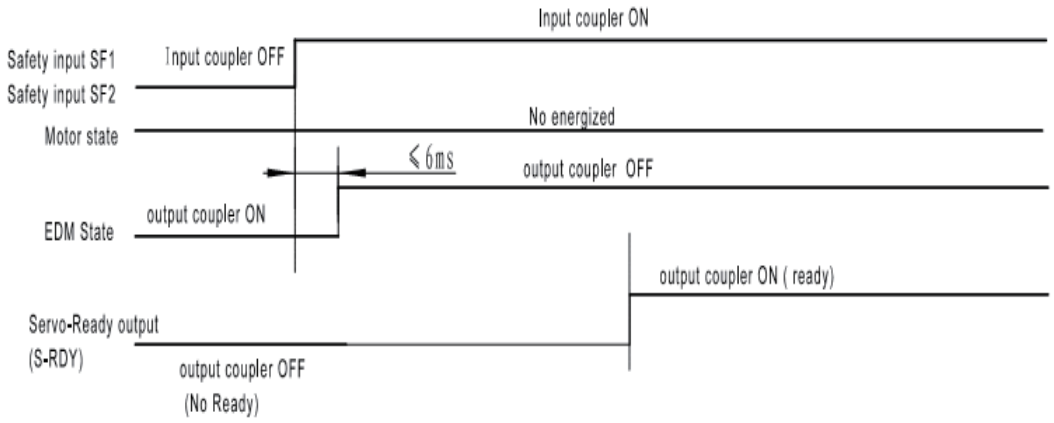
### 11.2.3 Response time

The response time of each safety related function and of the associated fault reaction function, should accord with the timing chart as following:

#### 11.2.3.1 Operating timing chart for safety status



#### 11.2.3.2 Return timing from safety state:




### 11.2.4 Safety function activated or prohibit

In high demand or continuous operation mode the STO function is activated or disabled state

### 11.2.5 STO function as the highest priority.

Drive with overload, overheating, over-current, over-voltage, IPM abnormal protection function, but STO function as the highest priority.

## 11.3 The safety integrity information

The safety integrity information for each safety function, including, the SIL capability and the PFH value.

The SIL/SIL capability 2 and PFH=1.41e-09/H

## 11.4 The environmental and operating conditions for safety function

### 11.4.1 The environmental and operating conditions

Safety function is intended to beused as following:

| Item | Conditions |
|---|---|
| Ambient temperature | 0-50℃(free from freezing) |
| Ambient humidity | 20%～85%(free from condensation) |
| Storage humidity | 93%(free from condensation) |
| Storage temperature | -20℃～65℃ |
| Altitude | Lower than 1000m |
| Vibration | 1g, 10-150HZ(Do not continuously use the driver for along time at the resonance point.) |
| EMC | Refer to standard EN61800-3 C2 category |

**Note: Extreme temperatures are permissible only for short period such as during transportation.**

## 11.5. Safety function constraints

### 11.5.1 Failure rate

The failure rates is calculation and estimated under the ambient 50℃.

### 11.5.2 Mission time and proof test

proof test intervals: 20 years, as appropriate

miss time: 20H each day, as appropriate

### 11.5.3 Testing, calibration or maintenance requirements

The testing, calibration or maintenance requirements need profession person.

### 11.5.4 Avoiding the systematic failure

1.) Be sure the STO work in reasonable environment

2.) Be sure the machine brake no loosen

3.) Be sure the motor work normally

4.) Make sure safety input cables status

### 11.5.5 SIL capability

The SIL capability of STO is 2

### 11.5.6 Identify the hardware and software configuration

Identify the hardware: When STO function work, drive hardware circuit is triggered, forced to shut off the power transistor drive internal work to prevent motor rotating, and the drive is disable state. STO is a kind of hardware level safety protection devices, to protect the safety of person and equipment in an emergency

Identify the software: When STO Function active，the PWM drive signal is shut down by the hardware to shut off the motor current, at the same time, the drive LED displays alarm code 

.

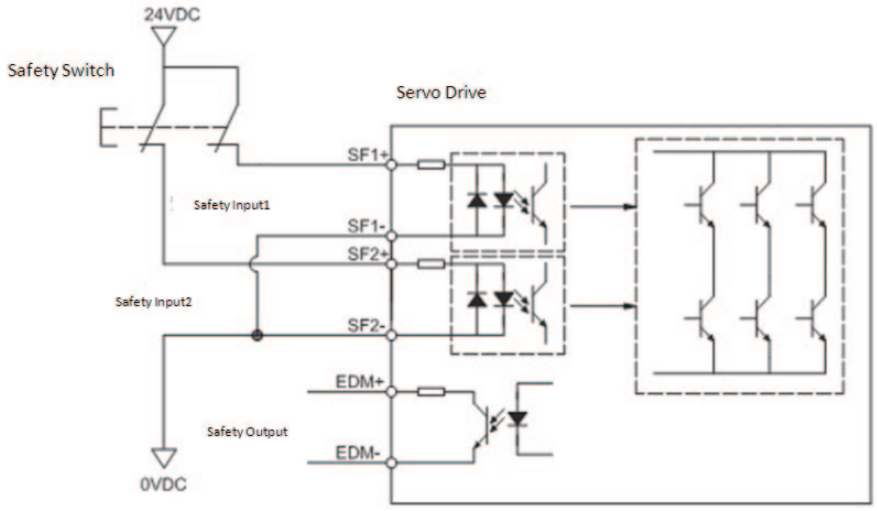
When failure occurrence, you may check the two safety input wiring and terminal block if Loosen or damaged, or contact MOONS'.

## 11.6 The installation and commissioning guidance

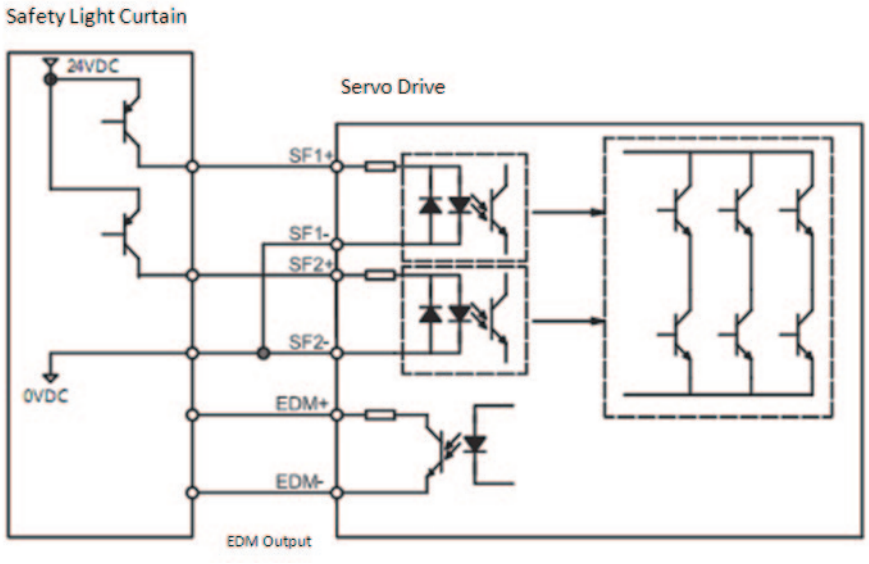
### 11.6.1 Installation

We have been making the best effort to ensure the highest quality .however application of exceptionally large external noise disturbance and EMC disturbance may result in unexpected action. It is highly recommended that you make a fail-safe design and secure the safety in the operative range. For the drive installation .You may refer to the 3.4 chapter. STO safety function connect as following.

#### 11.6.1.1 Example of connection to safety switch




#### 11.6.1.2 Example of connection to safety Light Curtain




**Note: EDM output, user can connect the power to 24VDC(max), 100mA(max),limit resistance is necessary.**

### 11.6.2 commissioning

1. Be sure the grounding terminal or grounding wire provided is fine. To avoid electric shock and malfunction.
2. Please use the STO safety-related function in Vibration-free place or the limited environment.

## 11.7. The requirements for configuration test of safety functions,

### 11.7.1 General and normal running condition, annual average is 30℃, Perform the daily and periodical inspection as per the items below.

| Type | Cycles | Items to be inspected |
|---|---|---|
| Daily inspection | daily | 1. Make sure the ambient temperature and humidity<br>2. Main circuit voltage<br>3. Damage of the cables<br>4. Pinching of foreign object at the load<br>5. Loose connection or misalignment between the motor and machine or equipment. |
| Annual inspection | 1 year | 1. Loose tightening<br>2. Trace of overheat<br>3. Damage to STO terminal block<br>4. SF1 safety input circuit function if work normal<br>5. SF2 safety input circuit function if work normal |

### 11.7.2 Safety relevant parameters and their values

| Parameter | Actual value |
|---|---|
| PFH | 1.41e-09/H |
| MTTFd | High |
| CCF ( for EN ISO 13849) | 95 |
| CCF ( for IEC 61508) | 49 |
| Category | 3 |
| DC | Low |
| SFF | 67.645% |
| HFT | 1 |
| Beta Factor | 2% |
| PL | d |
| The SIL/SIL capability | 2 |

### 11.7.3 The test procedures of safety functions

Logical relation between safety input signal and EDM output signal

| Signal | Symbol | Photocoupler logic | | | |
|---|---|---|---|---|---|
| Safety input | SF1 | ON | ON | OFF | OFF |
| | SF2 | ON | OFF | ON | OFF |
| EDM output | EDM | OFF | OFF | OFF | ON |

1. Safety input SF1, SF2 are OFF, and the photocoupler in EDM output circuit is ON.
2. Monitoring the logics (all 4 states) of photocoupler shown in the table above, theexternal device can determine the status (normal or abnormal) of safety input circuit and EDM output circuit., make sure the safety function normal.

### 11.7.4 The description of the safety related components

1.) The safety related components that will be used in the application, including software versions which including STO function abnormal alarm.

2.) To avoid EMC disturbance，the drive need to connect external EMI filter, the model please contact the manufacturer to consult.

3.) STO Terminal block is important in application.

# Appendix

Appendix 1：LED Character Reference

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  |  |  |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  |  |  |  |  |  |  |  |  |
| A | B | C | D | E | F | G | H | I | J |
|  |  |  |  |  |  |  |  |  |  |
| K | L | M | N | O | P | Q | R | S | T |
|  |  |  |  |  |  | | | | |
| U | V | W | X | Y | Z | | | | |

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