M2 EtherCAT

AC SERVO SYSTEM

User Manual

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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:

CE c UL us FUNCTIONAL SAFETY UL LISTED

		Drive	Motor
Europe	EMC Command	EN 61800-3	EN 55011
			EN 55014-1
			EN 55014-2
			EN 6100-3-2
			EN 6100-3-3
	LVD	EN 61800-5-1	EN 60034-1
			EN 60034-5
	STO	UL61800-5-2(SIL2)	
		IEC61508	
		ISO13849-1(PL d)	
UL standard		UL 61800-5-1	UL 1004-1
			UL 1004-6
CSA standard		C22.2 No.274-13	CSA C22.2 No.100

2. Product Description

2.1 Unpacking Check

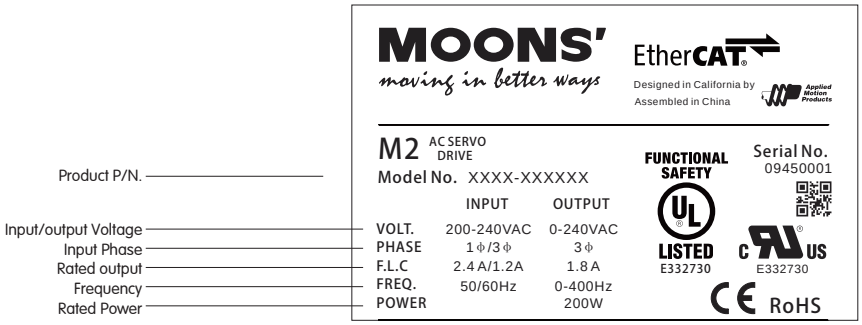
Please refer to this section to confirm the model of servo drive and servo motor .

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. Encoder feedback Connector(Port CN3) (Optional)
7. RJ-45 connectors or CAT5e cables for EtherCAT communication, Port CN6 and CN7)(Optional)
8. 5-PIN connector (For L1,L2,L3,L1C,L2C)
9. 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
EC		EtherCAT	EtherCAT

2.2.3 Drive specification

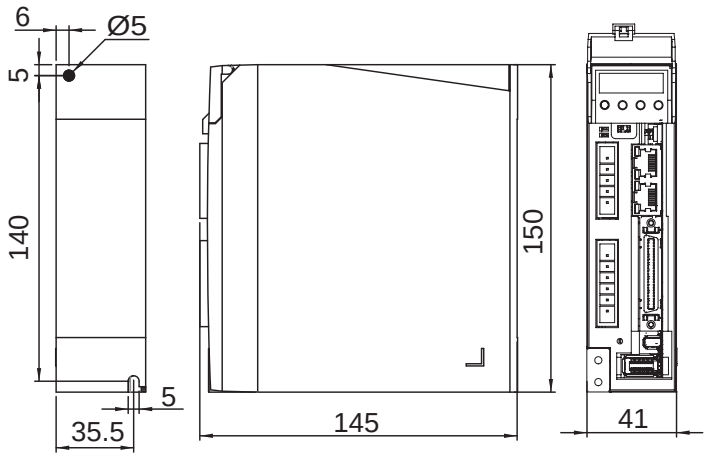
Basic Specification	Input Power	200W	Main Circuit	Single/3-phase, 200 - 240V ±10%, 50/60Hz
			Control Circuit	Single phase, 200 - 240V ±10%, 50/60Hz
		400W	Main Circuit	Single/3-phase, 200 - 240V ±10%, 50/60Hz
			Control Circuit	Single phase, 200 - 240V ±10%, 50/60Hz
		750W	Main Circuit	Single/3-phase, 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) Storage temperature: -20°C to 65°C
		Humidity		Both operating and storage : 10 to 93%RH or less
		Altitude		Lower than 1000m
		Vibration		9.8m/s^2 or less, 10Hz to 60Hz(No continuous use at resonance frequency)
	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
			Output	4 Configurable optically isolated digital outputs, 30VDC, max output current 30mA
		Analog signal	Input	2 inputs (12Bits A/D)
	Communication	RS-232		Connection with PC or 1:1 communication to a host.
		EtherCAT		EtherCAT communication
	Front panel			4 keys (MODE, UP, DOWN, SET) and 5-digit LED
	Regeneration Resistor			Built-in regenerative resistor
	Control mode			CoE(CiA 402), PP, PV, TQ, CSP, CSV HM mode and Q program
	Control input			(1) Servo-ON input (2) Alarm clear input (3) CW/CCW Limit (4) Touch Probe (5) General Input
	Control output			(1) Alarm output (2) Servo-Ready output (3) External brake release (4) Speed arrival output (5) Torque arrival output (6) General Output (7) Position arrival output

2.2.4 Communicaiton Specifications

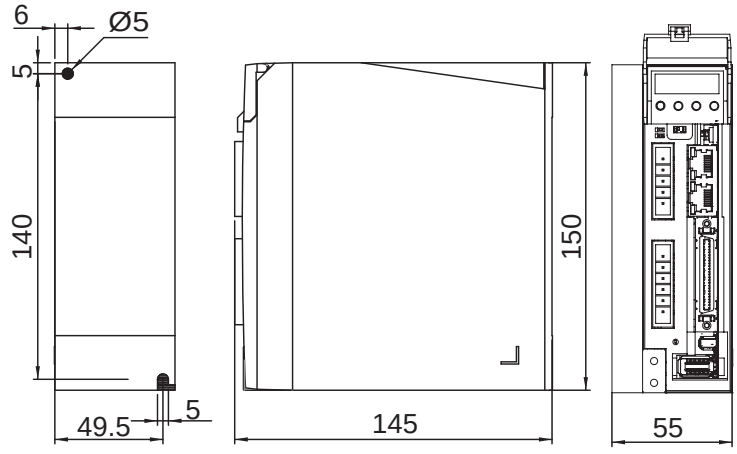
Communication Port	RJ45 x 2 (In：CN6， Out:CN7)
Baud rate	100Mbps
Protocol	CoE： CANopen over EhterCAT
Synchronization modes	Free run SM Event DC SYNC Event
Message types	SDO：SDO is used for acyclic data transmission. PDO： PDO is used for cyclic date transimission EMCY：EMCY is used for error report when a fault has occurred in the drive.
Operation modes	Profile Position Mode（PP） Profile Velocity Mode （PV） Profile Torque Mode （PT） Homing Mode（HM） Cycle Synchronized Postion Mode（CSP） Cycle Synchronized Velocity Mode（CSV）

2.2.4 Drive Dimensions (Unit: mm)

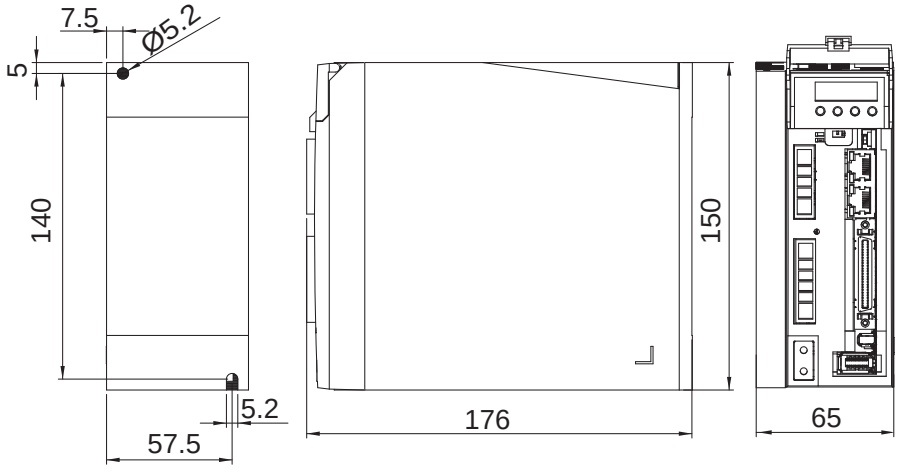
2.2.4.1 50W 100W 200W Type



2.2.4.2 400W Type

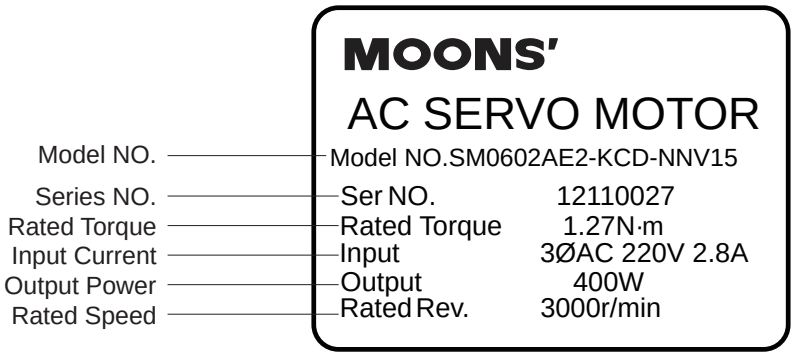


2.2.4.3 750W Type

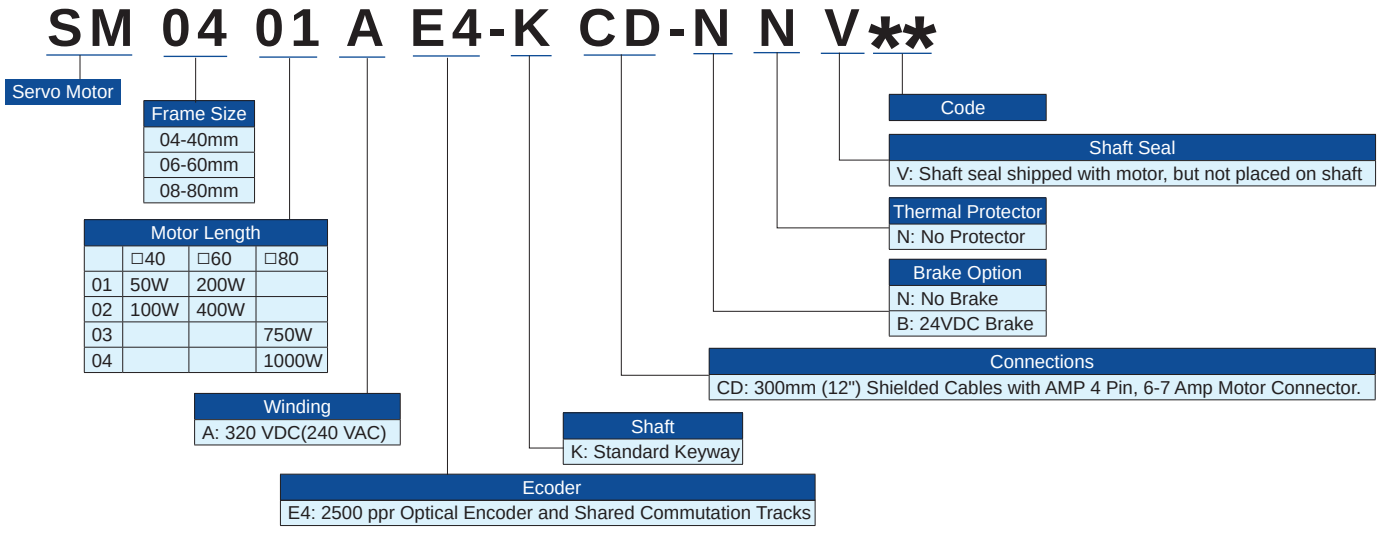


2.3 Servo Motor Model Introduction

2.3.1 Motor Name Plate Description



2.3.2 Motor Model Description



2.3.3 Motor Specification And Dimension - Low Inertia Motor

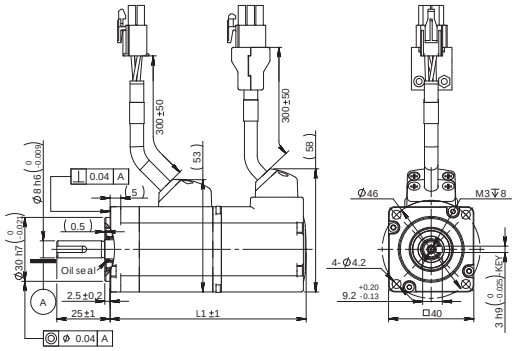
2.3.3.1 □40mm Specification and Dimension

□ Specifications

Type		SM0401AE4-KCD-*NV	SM0402AE4-KCD-*NV
Rated Output Power	watts	60	100
Rated Speed	rpm	3000	3000
Max Speed	rpm	6000	6000
Rated Torque	Nm	0.19	0.32
Peak Torque	Nm	0.48	0.93
Rated Current	A (rms)	0.7	1.2
Peak Current	A (rms)	1.75	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
Rotor Inertia	$Kg{\cdot}m^2$	0.0232×10^{-4}	0.0428×10^{-4}
Rotor Inertia-With Brake Option	$Kg{\cdot}m^2$	0.0298×10^{-4}	0.0494×10^{-4}
Shaft Load - Axial	N (max.)	50	50
Shaft Load - Radial (End of Shaft)	N (max.)	50	60
Weight	kg	0.4	0.55
Weight-With Brake Option	kg	0.65	0.8

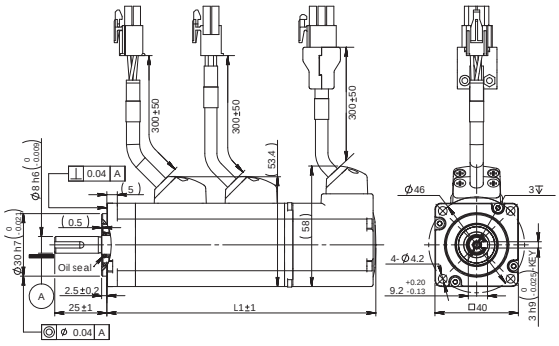
□ Dimensions (Unit:mm)

1) Without Brake



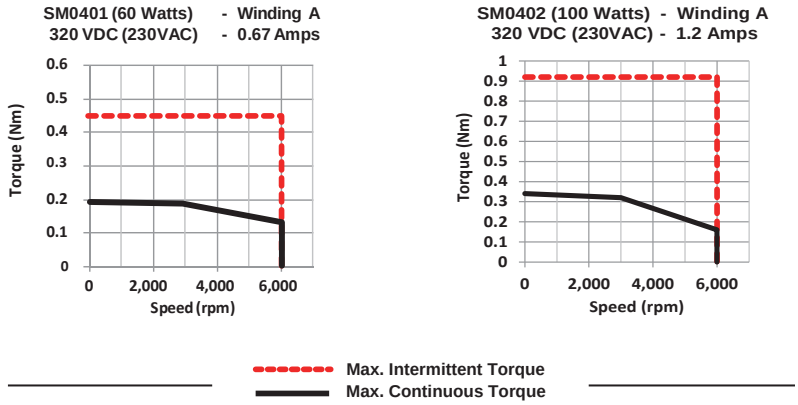
Without Brake	L1
SM0401AE4-KCD-NNV	92
SM0402AE4-KCD-NNV	109

2) With Brake



With Brake	L1
SM0401AE4-KCD-BNV	129
SM0402AE4-KCD-BNV	147

☐ Torque Curves



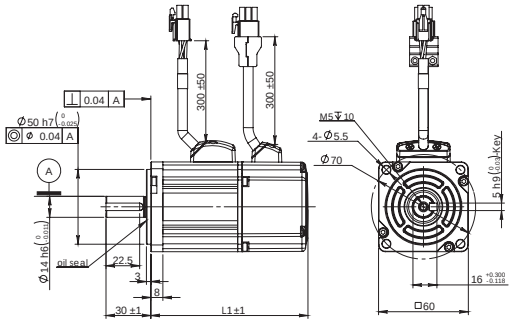
2.3.3.2 □60mm Specification and Dimension

□ Specifications

Type		SM0601AE4-KCD-*NV	SM0602AE4-KCD-*NV
Rated Output Power	watts	200	400
Rated Speed	rpm	3000	3000
Max Speed	rpm	6000	6000
Rated Torque	Nm	0.64	1.27
Peak Torque	Nm	1.9	3.8
Rated Current	A (rms)	1.5	2.75
Peak Current	A (rms)	4.5	8.3
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 (typ.)	25	12.9
Rotor Inertia	$Kg{\cdot}m^2$	0.165×10^{-4}	0.272×10^{-4}
Rotor Inertia-With Brake Option	$Kg{\cdot}m^2$	0.22×10^{-4}	0.326×10^{-4}
Shaft Load - Axial	N (max.)	70	70
Shaft Load - Radial (End of Shaft)	N (max.)	200	240
Weight	kg	1.1	1.4
Weight-With Brake Option	kg	1.6	1.9

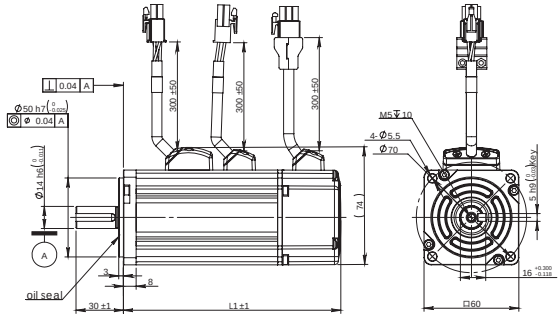
□ Dimensions (Unit:mm)

1) Without Brake



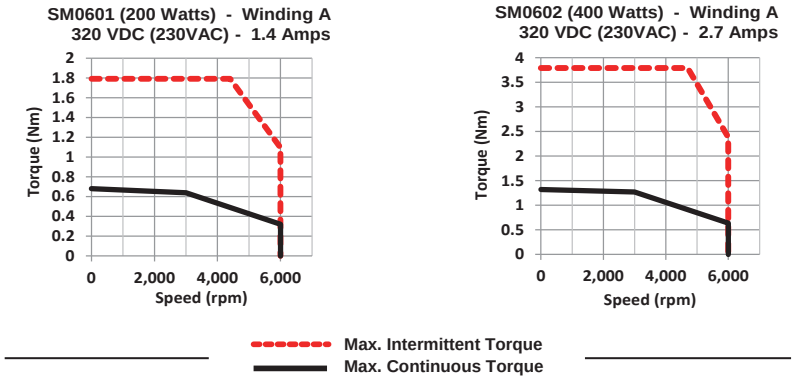
Without Brake	L1
SM0601AE4-KCD-NNV	105
SM0602AE4-KCD-NNV	125

2) With Brake



With Brake	L1
SM0601AE4-KCD-BNV	145
SM0602AE4-KCD-BNV	165

☐ Torque Curves



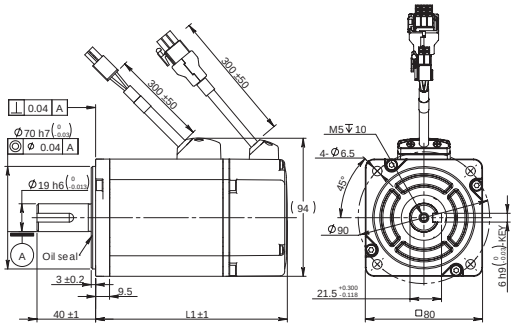
2.3.3.3 □80mm Specification and Dimension

□ Specifications

Type		SM0801AE4-KCD-*NV	SM0802AE4-KCD-*NV	SM0803AE4-KCD-*NV
Rated Output Power	watts	300	550	750
Rated Speed	rpm	3000	3000	3000
Max Speed	rpm	6000	5500	6000
Rated Torque	Nm	0.95	1.8	2.4
Peak Torque	Nm	2.3	4.6	6.9
Rated Current	A (rms)	1.8	3.0	4.5
Peak Current	A (rms)	4.5	8.3	13.5
Voltage Constant±5%	V (rms) / K rpm	34.3	37.3	36.6
Torque Constant±5%	Nm / A (rms)	0.532	0.586	0.543
Winding Resistance(Line-Line)	Ohm ±10%@25°C	5.9	2.7	1.47
Winding Inductance(Line-Line)	mH (typ.)	26	13.9	8.2
Rotor Inertia	$Kg{\cdot}m^2$	0.45×10^{-4}	0.63×10^{-4}	0.89×10^{-4}
Rotor Inertia-With Brake Option	$Kg{\cdot}m^2$	0.53×10^{-4}	0.71×10^{-4}	0.97×10^{-4}
Shaft Load - Axial	N (max.)	90	90	90
Shaft Load - Radial (End of Shaft)	N (max.)	200	240	270
Weight	kg	1.7	2.2	2.6
Weight-With Brake Option	kg	2.5	3.0	3.4

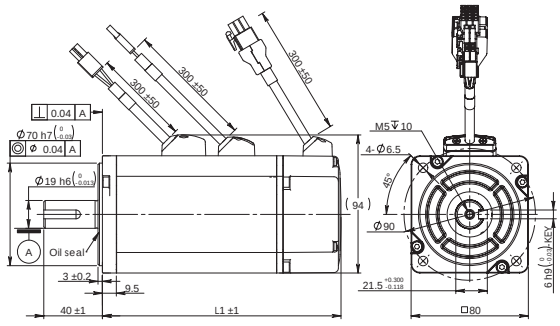
□ Dimensions (Unit:mm)

1) Without Brake



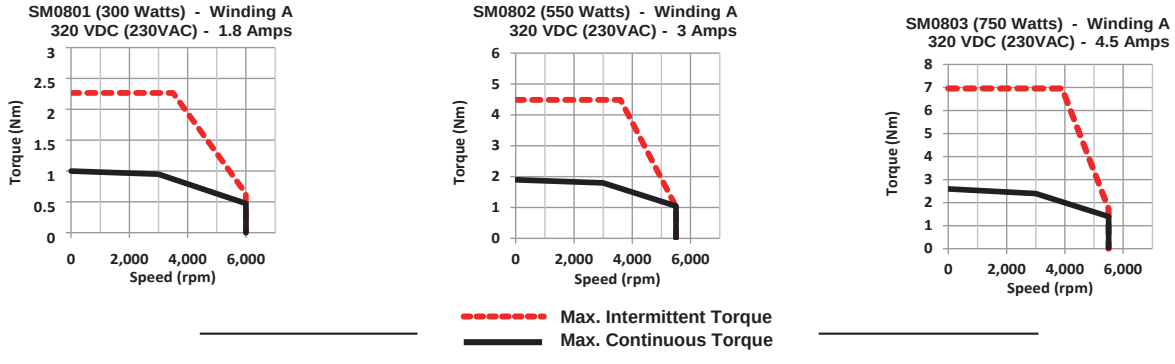
Without Brake	L1
SM0801AE4-KCD-NNV	101
SM0802AE4-KCD-NNV	116
SM0803AE4-KCD-NNV	131

2) With Brake



With Brake	L1
SM0801AE4-KCD-BNV	148
SM0802AE4-KCD-BNV	163
SM0803AE4-KCD-BNV	178

☐ Torque Curves



2.3.4 Motor Specification And Dimension - Medium Inertia Motor

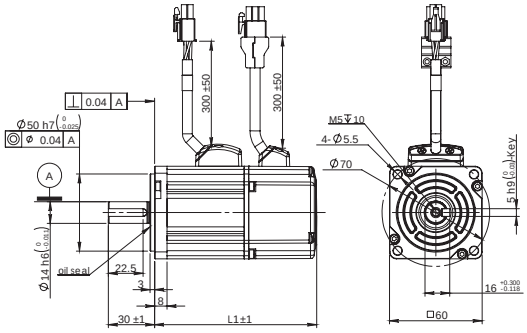
2.3.4.1 □60mm Specification and Dimension

□ Specifications

Type		SM0602AE4-KCD-NNV-M	SM0602AE4-KCD-BNV-M
Rated Output Power	watts	400	400
Rated Speed	rpm	3000	3000
Max Speed	rpm	6000	6000
Rated Torque	Nm	1.27	1.27
Peak Torque	Nm	3.8	3.8
Rated Current	A (rms)	2.75	2.75
Peak Current	A (rms)	8.3	8.3
Voltage Constant±5%	V (rms) / K rpm	29	29
Torque Constant±5%	Nm / A (rms)	0.484	0.484
Winding Resistance(Line-Line)	Ohm ± 10%@25°C	3.7	3.7
Winding Inductance(Line-Line)	mH (typ.)	12.9	12.9
Rotor Inertia	$Kg{\cdot}m^2$	0.682×10^{-4}	0.72×10^{-4}
Shaft Load - Axial	N (max.)	70	70
Shaft Load - Radial (End of Shaft)	N (max.)	240	240
Weight	kg	1.6	2.1

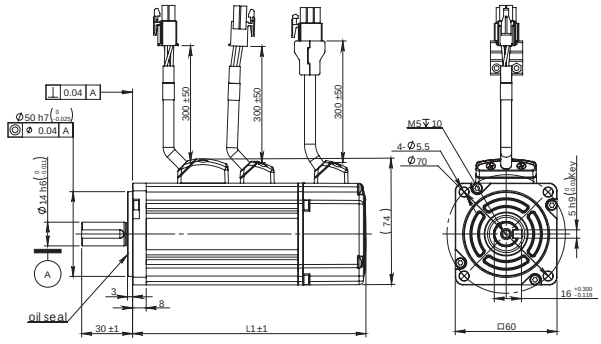
□ Dimensions (Unit:mm)

1) Without Brake



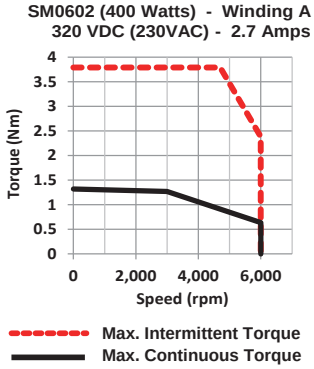
Without Brake	L1
SM0602AE4-KCD-NNV-M	135

2) With Brake



With Brake	L1
SM0602AE4-KCD-BNV-M	175

☐ Torque Curves



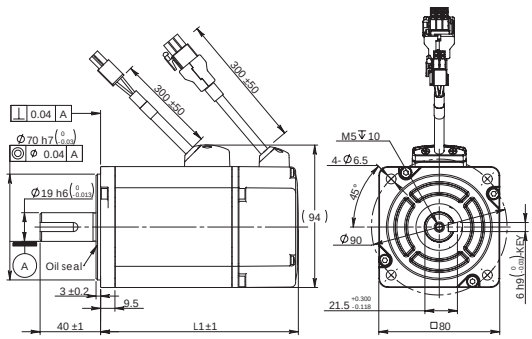
2.3.4.2 □60mm Specification and Dimension

□ Specifications

Type		SM0803AE4-KCD-NNV-M	SM0803AE4-KCD-BNV-M
Rated Output Power	watts	750	750
Rated Speed	rpm	3000	3000
Max Speed	rpm	5500	5500
Rated Torque	Nm	2.4	2.4
Peak Torque	Nm	6.9	6.9
Rated Current	A (rms)	4.5	4.5
Peak Current	A (rms)	13.5	13.5
Voltage Constant±5%	V (rms) / K rpm	36.6	36.6
Torque Constant±5%	Nm / A (rms)	0.543	0.543
Winding Resistance(Line-Line)	Ohm ±10%@25°C	1.47	1.47
Winding Inductance(Line-Line)	mH (typ.)	8.2	8.2
Rotor Inertia	$Kg \cdot m^2$	1.52×10^{-4}	1.56×10^{-4}
Shaft Load - Axial	N (max.)	90	90
Shaft Load - Radial (End of Shaft)	N (max.)	270	270
Weight	kg	2.8	3.6

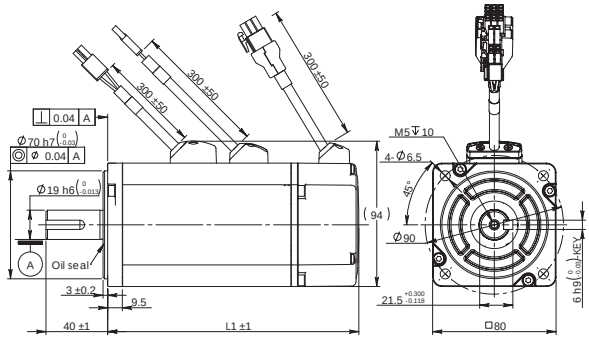
□ Dimensions (Unit:mm)

1) Without Brake



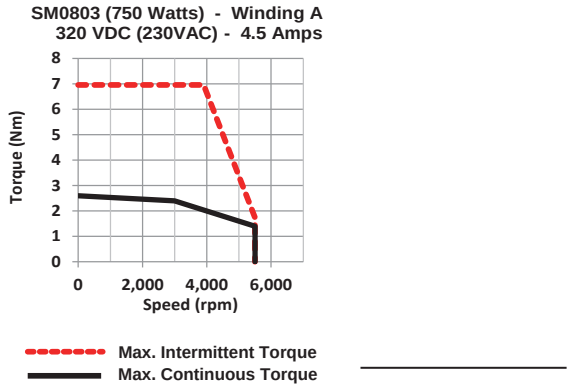
Without Brake	L1
SM0803AE4-KCD-NNV-M	140.8

2) With Brake



With Brake	L1
SM0803AE4-KCD-BNV-M	188

☐ Torque Curves



2.4 Servo Drive and Servo Motor Combinations

Servo Drive				
				
EtherCAT		M2DV-1D82EC	M2DV-3D02EC	M2DV-4D52EC
Matching motor				
				
		Frame 40: 60W, 100W	-	-
		Frame 60: 200W	Frame 60: 400W	-
		Frame 80: 300W	Frame 80: 550W	Frame 80: 750W
Low Inertia	Without Brake	SM0401AE4-KCD-NNV SM0402AE4-KCD-NNV SM0601AE4-KCD-NNV SM0801AE4-KCD-NNV	SM0602AE4-KCD-NNV SM0802AE4-KCD-NNV	SM0803AE4-KCD-NNV
	With Brake	SM0401AE4-KCD-BNV SM0402AE4-KCD-BNV SM0601AE4-KCD-BNV SM0801AE4-KCD-BNV	SM0602AE4-KCD-BNV SM0802AE4-KCD-BNV	SM0803AE4-KCD-BNV
Medium Inertia	Without Brake	–	SM0602AE4-KCD-NNV-M	SM0803AE4-KCD-NNV-M
	With Brake		SM0602AE4-KCD-BNV-M	SM0803AE4-KCD-BNV-M
Gearhead Motor				
Without Brake		SM0401AE4-KCD-NNV-PG**A SM0402AE4-KCD-NNV-PG**A SM0601AE4-KCD-NNV-PG**A	SM0602AE4-KCD-NNV-PG**A SM0602AE4-KCD-NNV-M-PG**A	SM0803AE4-KCD-NNV-PG**A SM0803AE4-KCD-NNV-M-PG**A
With Brake		SM0401AE4-KCD-BNV-PG**A SM0402AE4-KCD-BNV-PG**A SM0601AE4-KCD-BNV-PG**A	SM0602AE4-KCD-BNV-PG**A SM0602AE4-KCD-BNV-M-PG**A	SM0803AE4-KCD-BNV-PG**A SM0803AE4-KCD-BNV-M-PG**A

** Standard gear ratios are 5:1; 10:1 and 20:1.

Accessories		
IO Connector		M2-50P
USB mini-B Configuration		2620-150
Standard* Cable	Motor power	1626-X00
	Encoder	2636-X00
	Brake ***	1602-X00
Flexible** Cable	Motor power	1620-X00
	Encoder	2636-X00-C05
	Brake ***	1602-X00-C05

* Standard: Can not be used in a drag chain.

* * Bending test: Min. bend radius: 100mm, Travel distance: 60mm, Lifetime: 5,000,000c.

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

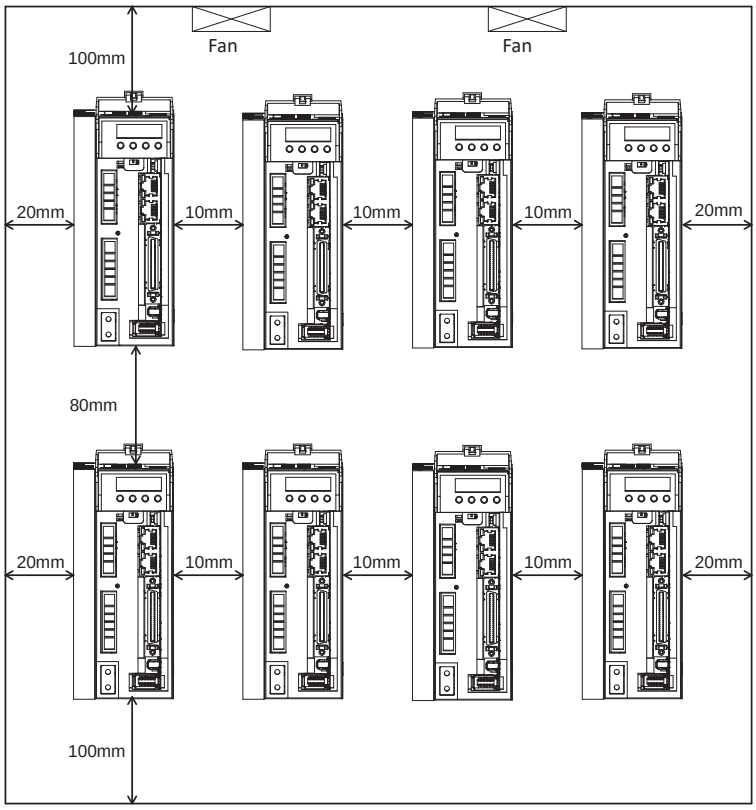
The operation ambient conditions are followed:

- 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.

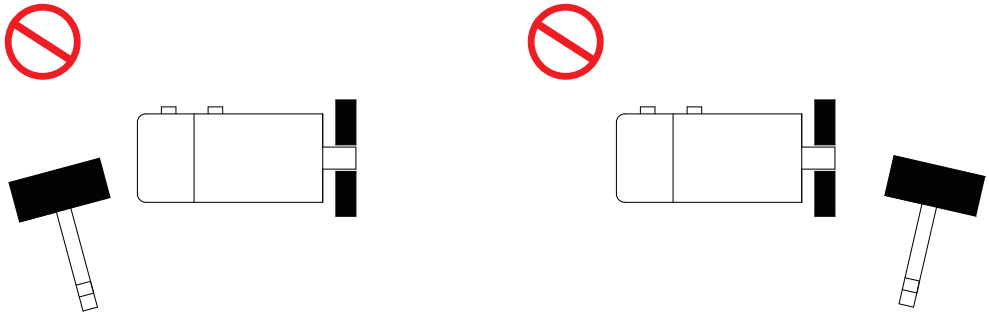
3.3 Installation Space

- 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



3.4 Motor Installation

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

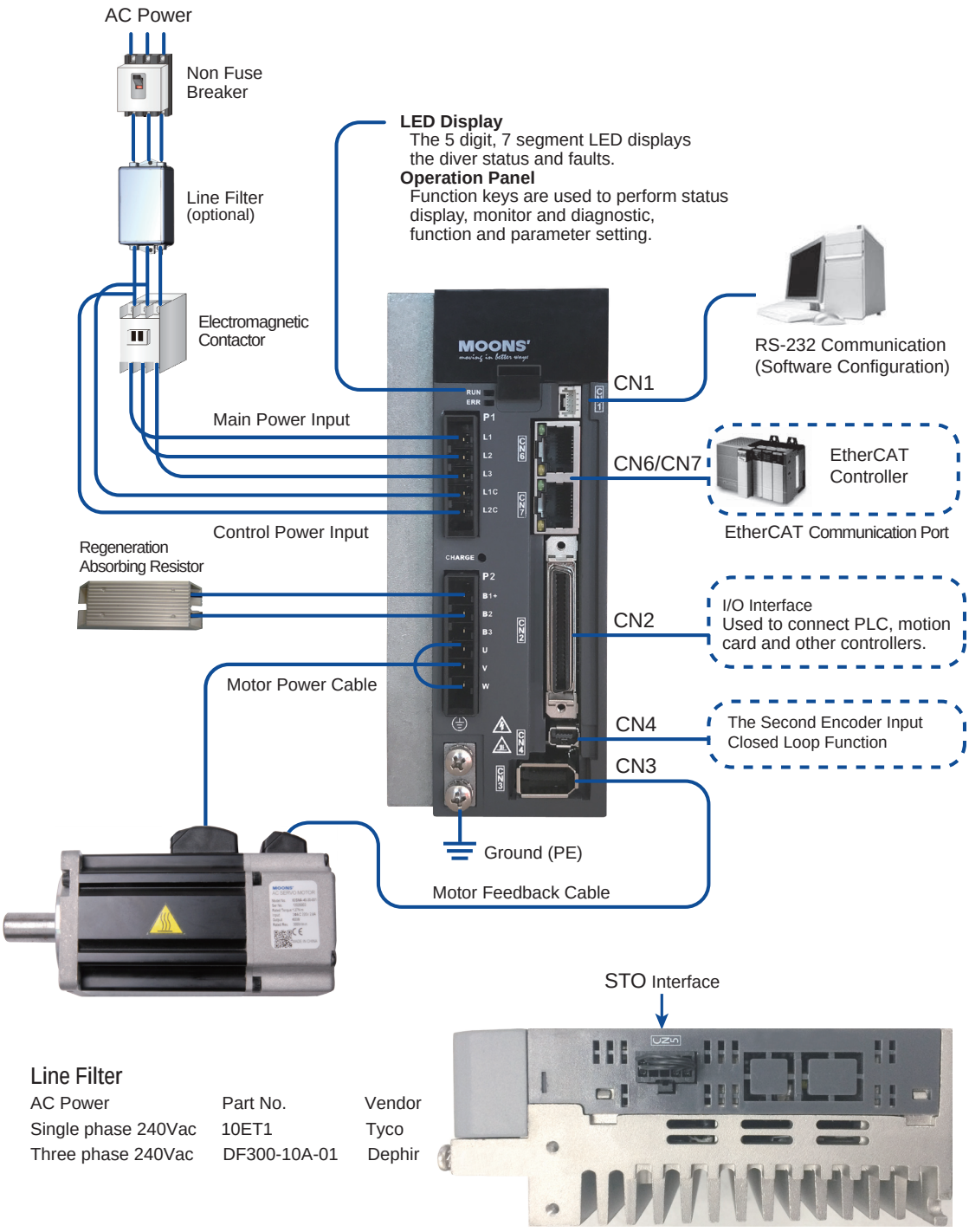


- DO NOT use cables soaked in water or oil.
- Avoid a stress application to the cable outlet and connecting portion by bending.
- Please use flexible cables when using cable carrier, make sure the minimum cable bending diameter is 200mm.
- The shaft through hole and cable end connector is not IP65 design. 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
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>Second Feedback Input</td><td colspan="3">Second Feedback Input for full-closed loop control</td></tr>
<tr><td>CN4</td><td>Encoder Feedback Connector</td><td colspan="3">Used to connect encoder of servo motor.</td></tr>
<tr><td>CN5</td><td>STO connector</td><td colspan="3">STO function</td></tr>
<tr><td>IN</td><td>EtherCAT Input Port</td><td colspan="3">EtherCAT Input Port</td></tr>
<tr><td>OUT</td><td>EtherCAT Output Port</td><td colspan="3">EtherCAT Output Port</td></tr>
</table>

Connections and Wiring Notes

Please ensure grounding wires are securely connected, wires with more than AWG10(5.3mm$^{2)}$) 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.

4.1.3 Recommended Cable Types

● Please use 600V grade polyvinyl chloride insulated wires for main circuit

●Use wires with specifications equal to or less than the wire sizes and allowable currents for avoiding overheat reason

● Use the following type of cable for main circuit

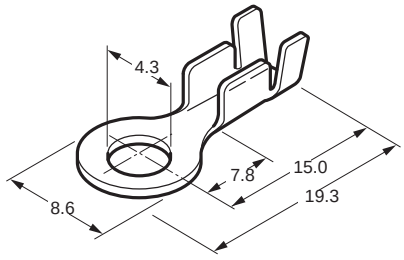
Drive and Applicable Motor		Diameter(AWG)				
		L1/L2/L3	L1C/L2C	U/V/W	B1+,B3	Grounding
M2DV-1D82*	SM0401AE4-KCD-*NV	2.0mm² (AWG14)	2.0mm² (AWG14)	2.0mm² (AWG14)	2.0mm² (AWG14)	5.3mm² (AWG10)
	SM0402AE4-KCD-*NV					
	SM0601AE4-KCD-*NV					
M2DV-3D02*	SM0602AE4-KCD-*NV					
M2DV-4D52*	SM0803AE4-KCD-*NV					

Grounding

- Use 5.3mm²/AWG10 copper conductor cable
- Use following grouding connector and maintain the peeled-off length of 8-9mm.

P/N	Manufacture
SRA-51T-4	JST

- Dimensions



- Fasten torque

Drive	Grounding Screw	
	Size	Fasten torque
M2DV-1D82* M2DV-3D02* M2DV-4D52*	M4	1.4 N.m(*)

Note:

■ Applying fastening torque larger than the maximum value may result in damage to the product.

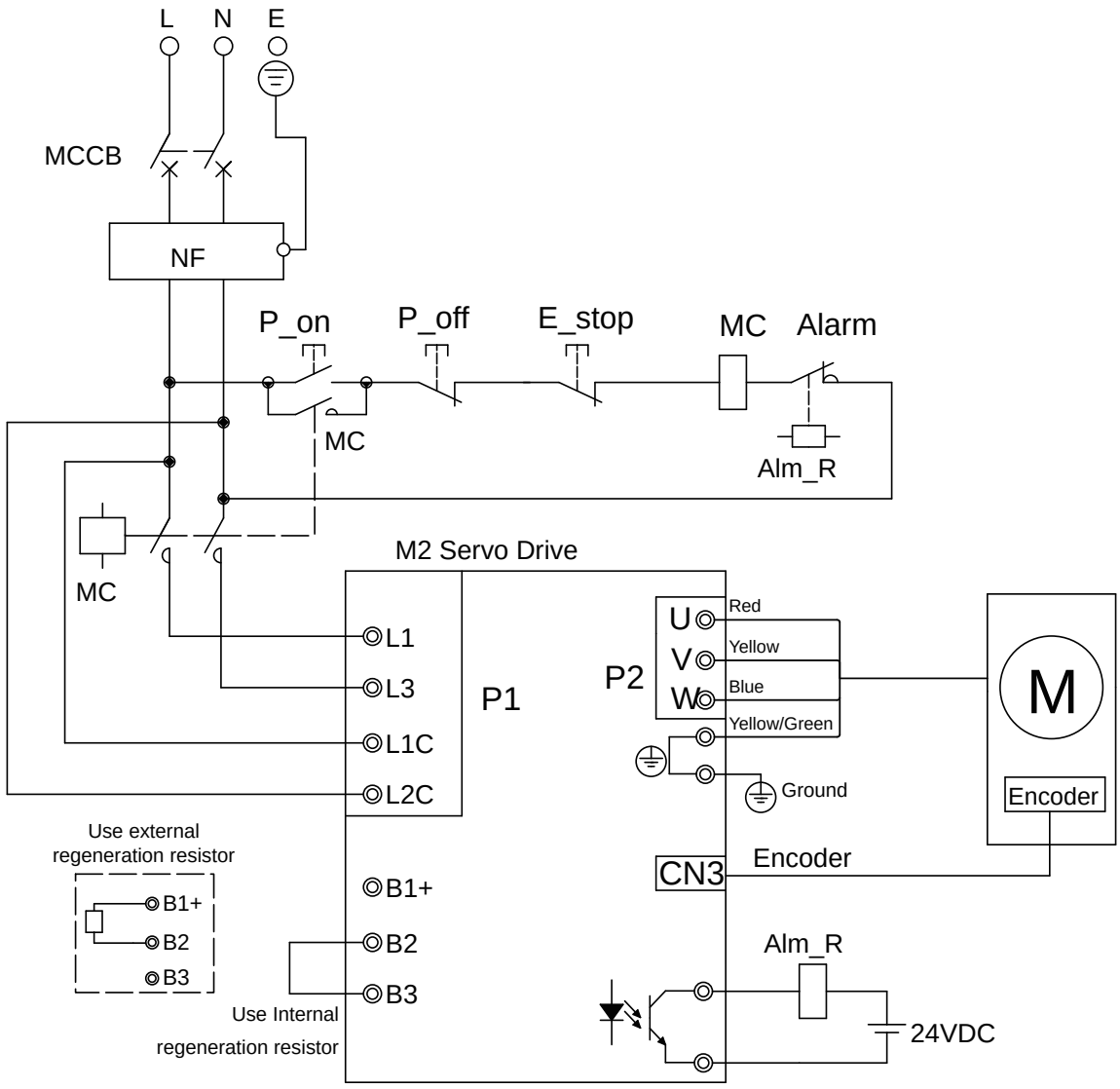
■ Do not apply power without tightening all grounding screws properly, electric spark may generate.

■ Check the grounding screw regularly to avoid looseness

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.

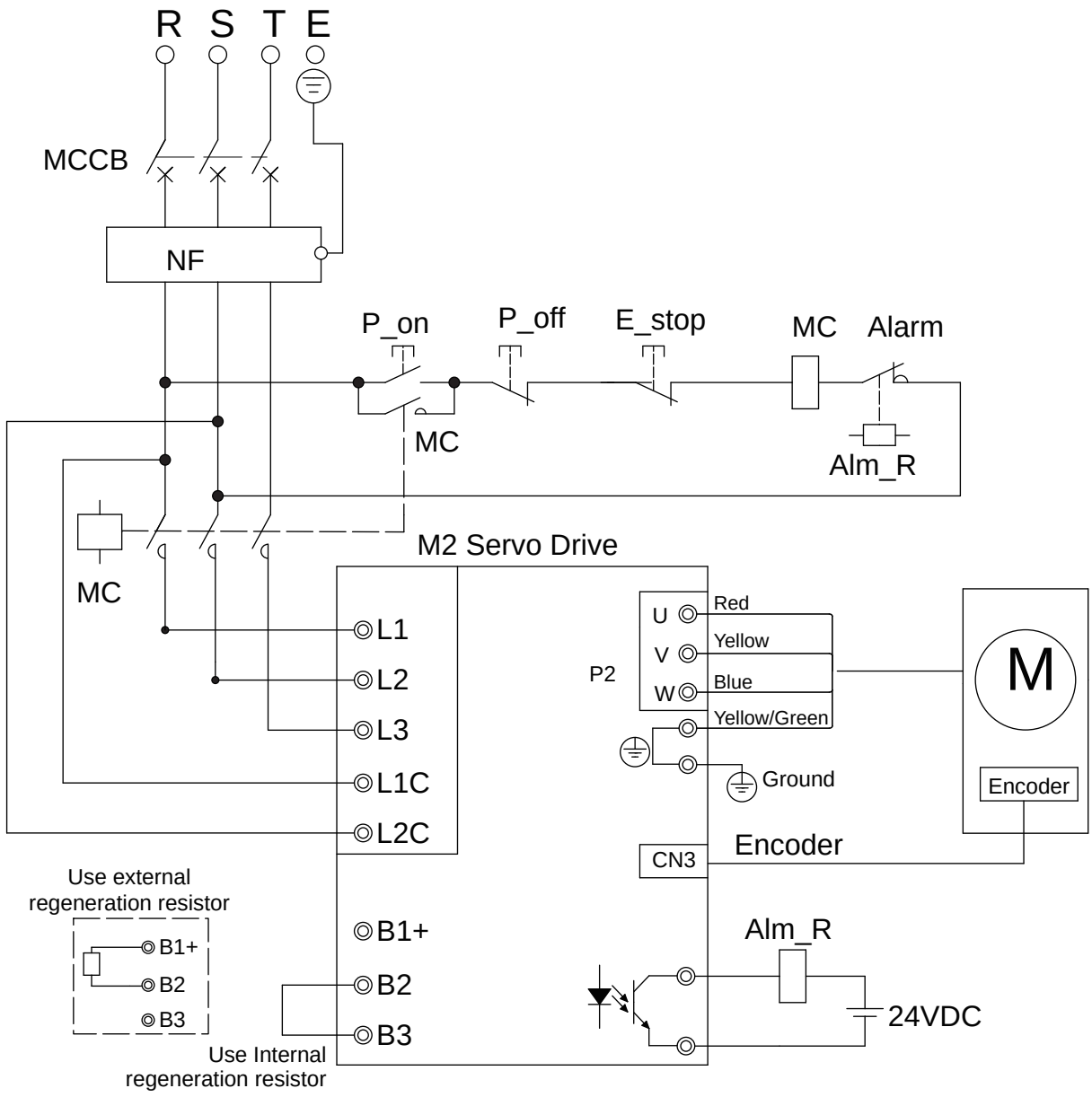
4.1.4.1 Single-Phase Power Supply Connection (AC220V)



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)

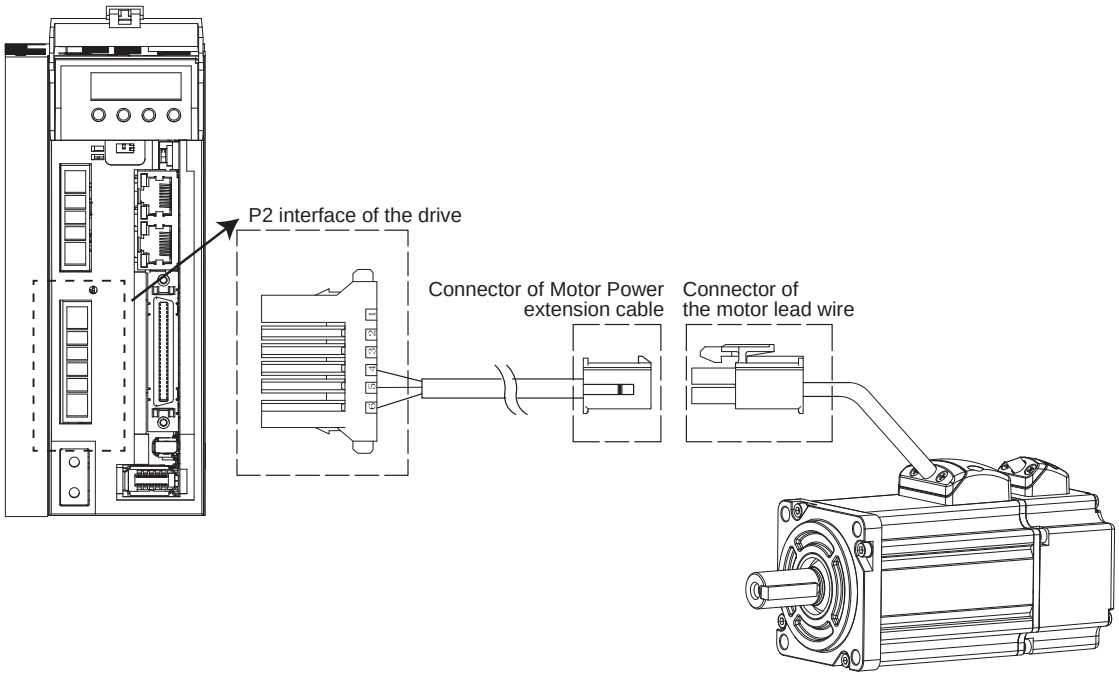


Note:

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

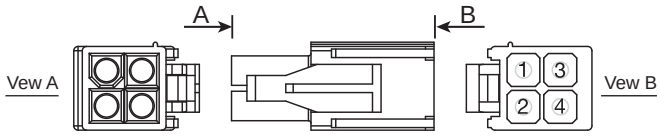
4.2.1 Motor Power Cable Configuration



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

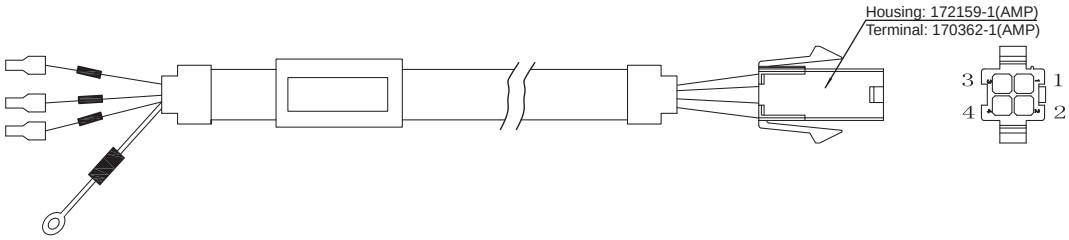


PIN	1	2	3	4
Signal	U	V	W	PE
Colour	Red	Yellow	Blue	Yellow/Green

◆ Model of Motor Connector

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

4.2.3 Wiring Diagram Of Motor Extend Cable

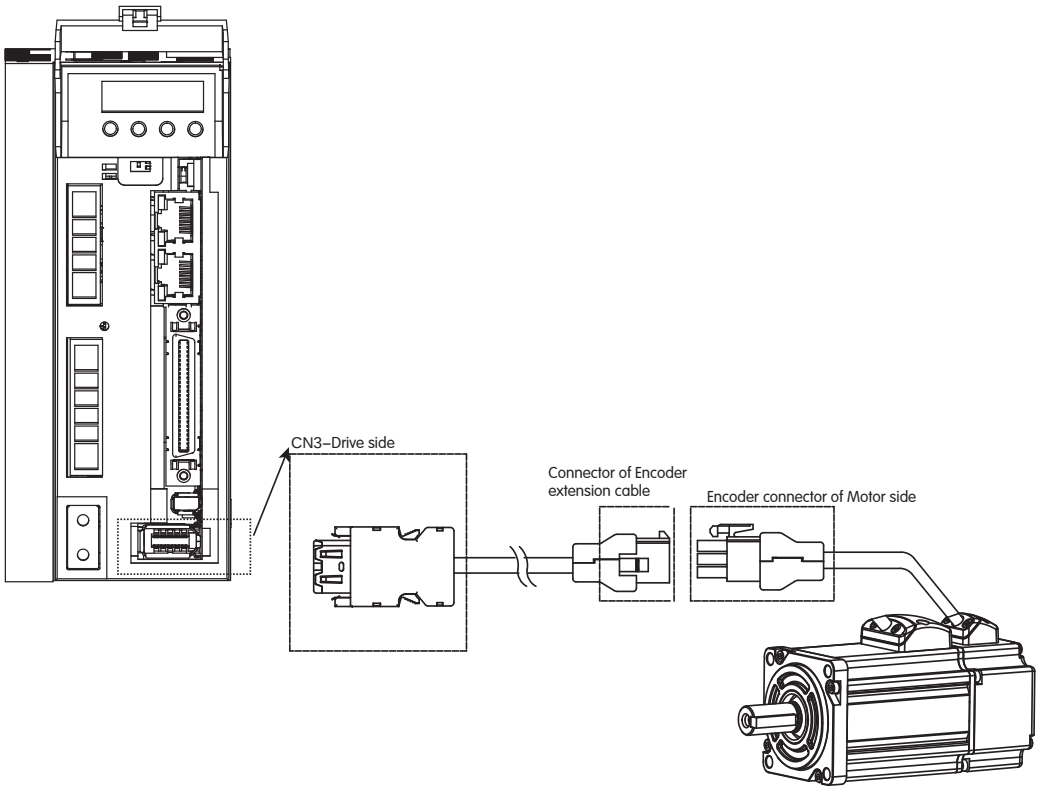


Drive Side(P2)	Signal	Colour	Motor Side(Housing)
(JST) S06B-F32SK-GGXR			AMP 172159-1
4	U	Red	1
5	V	Yellow	2
6	W	Blue	3
Grounding Screw	PE	Yellow/Green	4

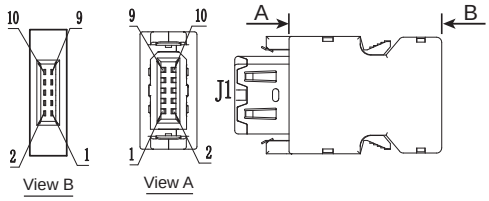
NOTE: Ensure U/V/W is following the order of RED/YELLOW/BULE. Wrong connections will cause motor stop rotation, or wrong rotary directions.

4.3 Encoder Connector CN3

4.3.1 Motor Encoder Feedback Cable Configuration



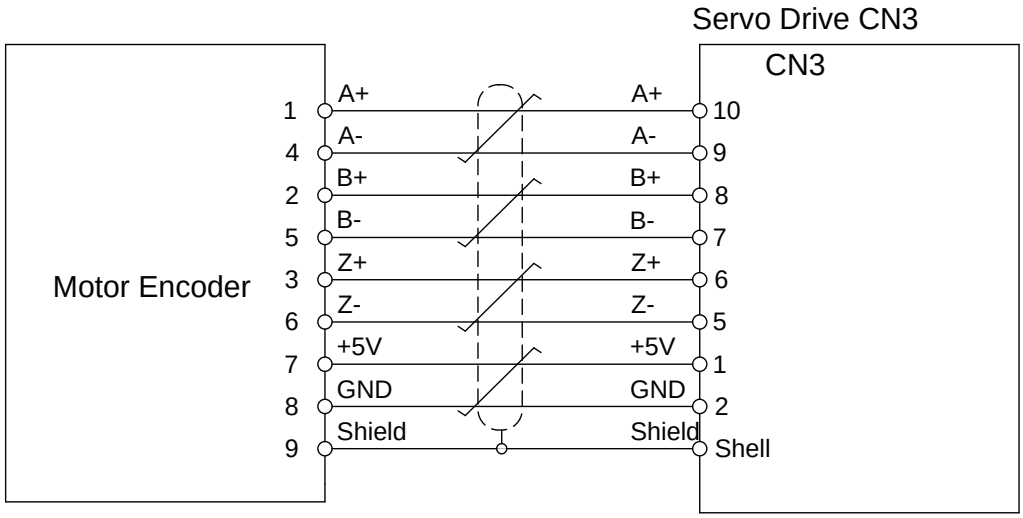
4.3.2 The Layout of CN3 Connector



Pin NO.	Symbol	Description
1	Encoder +5V	Encoder power supply +5V
2	GND	GND
5	Z-	Encoder Z-
6	Z+	Encoder Z+
7	B-	Encoder B-
8	B+	Encoder B+
9	A-	Encoder A-
10	A+	Encoder A+
Shell	Shield	Shield

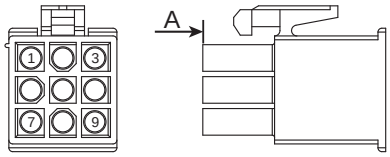
4.3.3 Connect to Motor Encoder

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



4.3.4 Specifications of Encoder Connector

A. PIN Assignment



View A

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

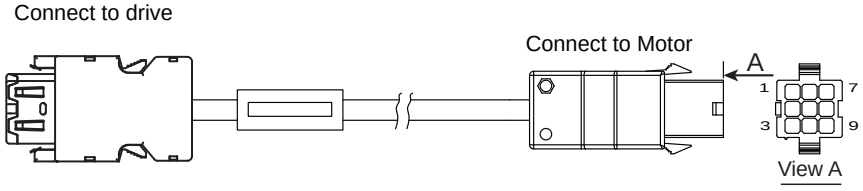
NOTE: The HALL signal U/V/W ONLY appears for 15 ms after encoder powered on, it will then covert to A/B/Z signals.

Specification of 9PIN AMP Connector

Type	Motor Side	Extension cable
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
			AMP 172161-1
10	A+/U+	Blue	1
8	B+/V+	Green	2
6	Z+/W+	Yellow	3
9	A-/U-	Blue/Black	4
7	B-/V-	Green/Black	5
5	Z-/W-	Yellow/Black	6
1	+5V	Red	7
2	GND	Black	8
Shell	Shield	Shield	9

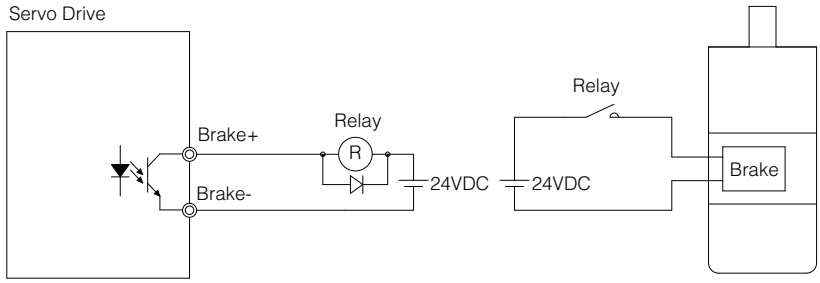
4.4 Electromagnetic Brake

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.

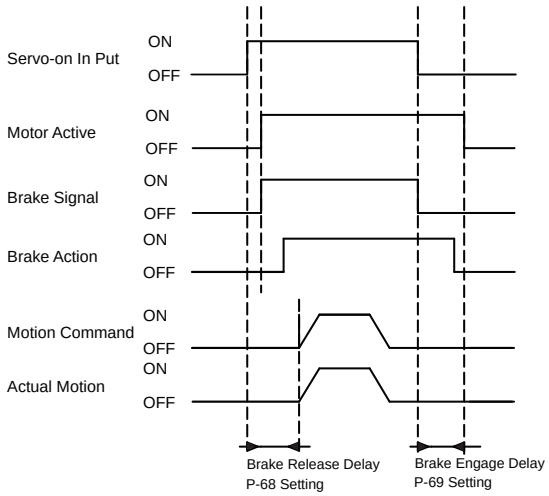
During the brake/release action, there might be “Ka-Da” sounds occurring, this does not affect the use of brake.

Specification of brakes are as follows:

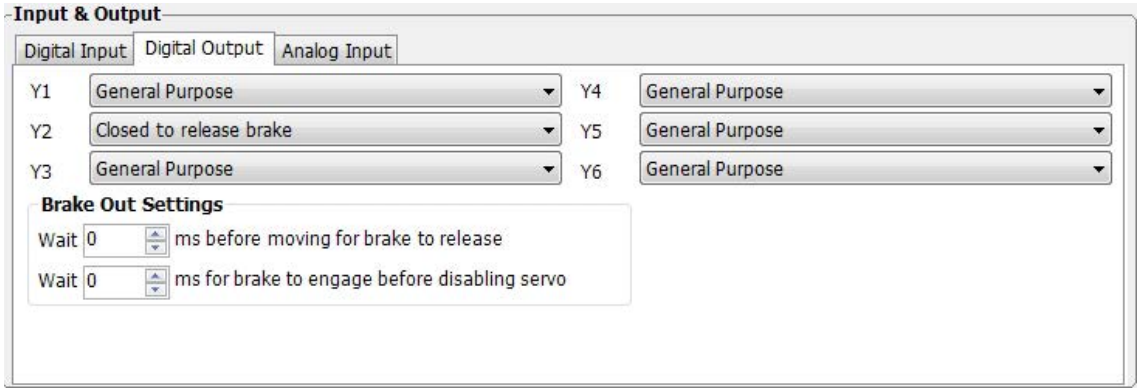
	Motor Power				
Type	50W	100W	200W	400W	750W
Holding Torque (N•m)	0.35		2		4.5
Working Current (A)	0.25		0.38		0.61
Rated Voltage (V)	24V±10%				
Release Time	<25ms				
Engage Time	<25ms				
Release Voltage (V)	Release Voltage 18.5VDC				

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.

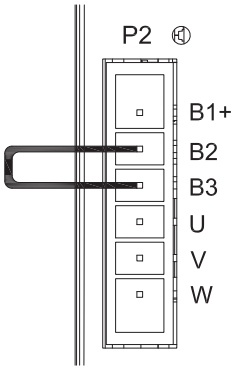
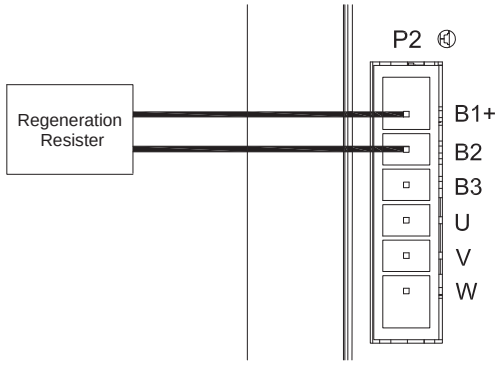


Brake engage/disengage delay time can be set via M servo suite software, or on the drive directly via P function: P-69 (BD) or P-70 (BE).



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 EMC Control

	The servo pack uses high-speed switching electronic components. Peripheral devices may receive switching noise.
	The servo pack uses microprocessor that may receive switching noise from peripheral devices.

Follow the EMC specifications and measures described in this manual when installing and wiring.The servo pack conforms to relevant standard under：

- EN 61800-3

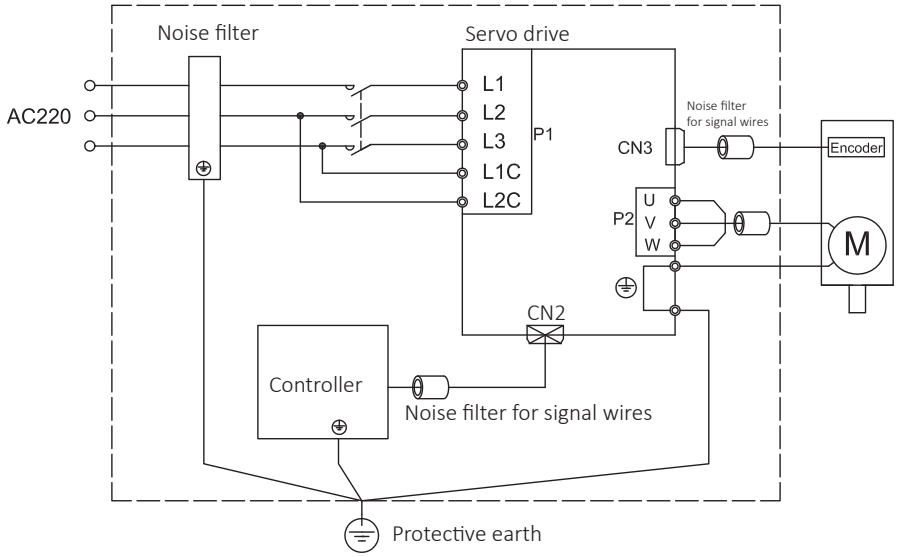
To prevent the noise the servo pack and peripheral devices from causing a malfunction, Take the following precautions against noise as required.

- Position the input reference device and noise filter as close to the drive as possible.
- Always ensure correctly grounding.
- Do not bundle or run the main circuit cables together with the I/O signal cables or encoder cables in the same duct.Keep the main circuit cables separated from these signal cables with a gap of at least 30cm.
- Use twisted pair and shield cables for singal inputs and outputs.

4.6.1 Noise filter

Installing a noise filter in the appropriate place will minimize the noise as much as possible.

The following diagram shows an solution of wiring for noise control.



Mandatory requirments to conform to EMC:

1) Remove the paint layer on the contact surface when the drive is mounted on a metal plate.
2) Position the input noise filter as close to the drive as possible
3) Always ensure correctly grounding
4) Use shield cables for main circuit. Shield of cable should be directly grounded to PE connector.

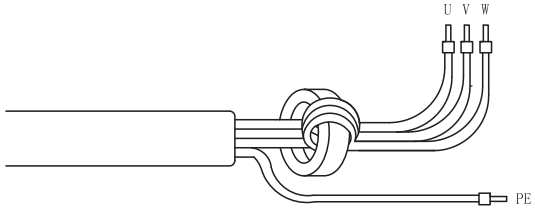
4.6.2 Recommended EMI noise filter

P/N	Specifications	Manufacture
M2-EMI10A	250VAC，10A	LCR
10ET1	250VAC，10A	TYCO
DF300-10A-01	250VAC，10A	Dephir

4.6.3Clamp noise filter for cable

Install noise filters for signal lines to all cables(Power cable, motor cable, encoder cable and I/O signal cable)

Signal cable	Wind cables the 2-3 turns to form the signal noise filter.
Motor cable	Remove the cable's jacket to the length so that wires can be wound on the clamp noise filter for 2-3 turns. For effective noise reduction, U/V/W should be wound togther, except the PE cable.
Encoder cable	Wind cables the 2-3 turns to form the signal noise filter.



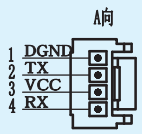
4.6.4 Recommended clamp noise filter

MOONS' P/N	P/N	Manufacture
M2-OP3035	ZCAT3035-1330	TDK

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 No.	Symbol	Function
1	GND	GND
2	TX	RS-232 transmit-
3	+5V	+5V
4	RX	RS-232 Receiver

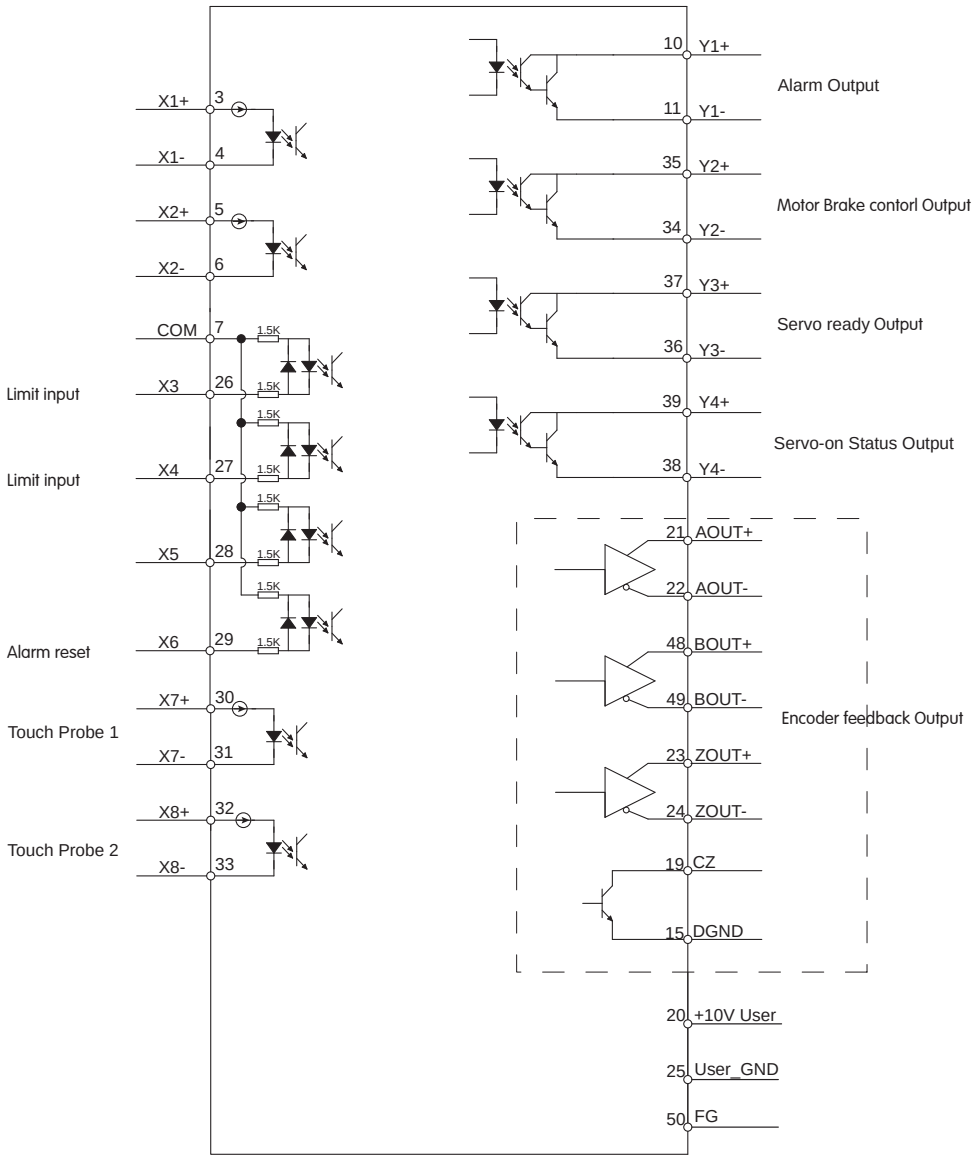


4.8 Input and Output Signal Interface Connector, CN2

4.8.1 Input and Output Interface Specifications and Diagram

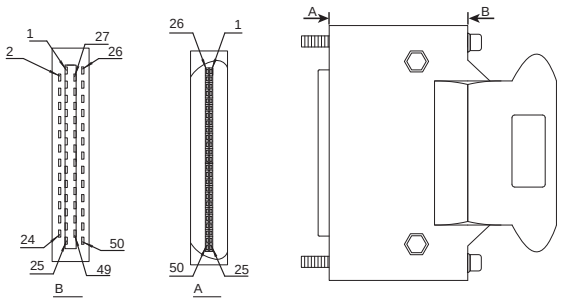
Port CN2 on M2 series AC servo drives is used for input/output signals. Details are shown in table below:

I/O Signals	Digital Signal	Inputs	8 Configurable Optically isolate general Inputs, 5-24VDC, 20mA
		Outputs	4 Configurable Optically isolate general Outputs, max 30VDC, 20mA .



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 8 programmable digital inputs.

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

- Specified function signals: Alarm reset, Limit sensor input, touch probe.
- General purpose signal: Be used as general purpose signal with no specified functions.

Signal	Symbol	Pin NO.	Details
X1	X1+	3	● General purpose input.
	X1-	4	
X2	X2+	5	● General purpose input.
	X2-	6	
X3	X3	26	● Limit sensor input ● General purpose input.
X4	X4	27	● Limit sensor input ● General purpose input.
X5	X5	28	● General purpose input.
X6	X6	29	● General purpose input.
X7	X7+	30	● Touch probe 1. ● General purpose input.
	X7-	31	
X8	X8+	32	● ouch probe 2 ● General purpose input.
	X8-	33	
COM	COM	7	X3-X6 COM port

4.8.2.4 Output Signals

M2 series AC servo drive has 4 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+	10	This output has two functions: • Alarm Output. • General purpose output.
	Y1-	11	
Y2	Y2+	35	This output has two functions: • Motor brake control output. • General purpose output.
	Y2-	34	
Y3	Y3+	37	• Torque Reached Output. • Servo ready output • Moving signal output, output signal when dynamic position error less than set value in position mode. • General purpose output.
	Y3-	36	
Y4	Y4+	39	• Servo on status • Velocity reach output. Output signal when actual speed is same as the target speed and the speed ripple less than ripple range. • In position signal output, output signal when in position, and the position error less than set value in position mode. • General purpose output.
	Y4-	38	
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

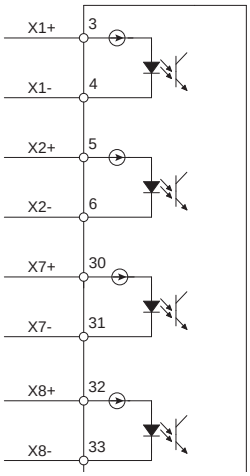
4.8.3 Input Signal Interface Connector, CN2

4.8.3.1 High Speed Input Port X1,X2,X7,X8

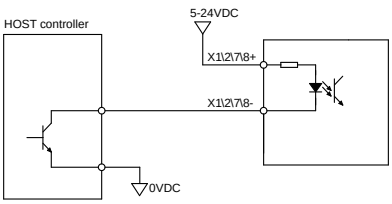
A. High Speed Input Port

M2 series AC servo drive has 4 Optically isolated high speed digital inputs X1、X2、X7、X8. These inputs allow input voltage from 5VDC~24VDC with maximum current of 20mA, and up to 4MHz. They can be used for general propose inputs, connecting sensor switch signals, touch probe input(X7 and X8 only), PLC controllers or other types of controller output signals.

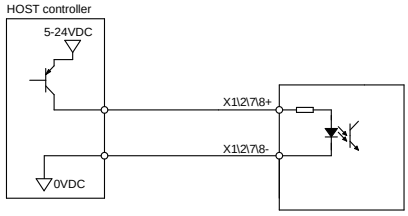
X1、X2、X7、X8 Circuit Are As Follows:



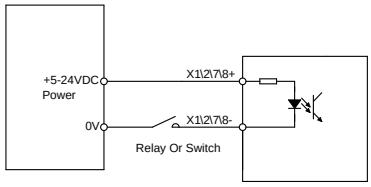
B. High Speed Input Connection Diagram



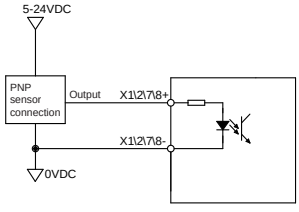
Host Sink Mode



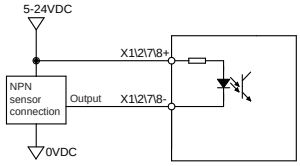
Host Sourcing Mode



Sensor And Switch Connection



NPN Sensor Connection



NPN Sensor Connection

4.8.3.2 X3、X4、X5、X6 Input With Common Com Port

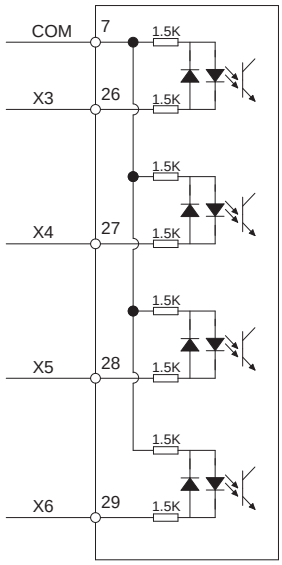
M2 series AC drive also has 4 single ended optically isolated inputs connecting with single common node ‘COM’. They can be used with sourcing or sinking signals, 5-24V. This allows connection to PLCs, sensors, relays and mechanical switches. Because the input circuits are isolated, they require a source 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?

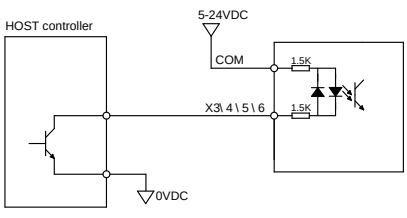
“Common” is an electronics term for an electrical connection to a common voltage. Sometimes “common” means the same thing as “ground”, but not always. If you are using sinking (NPN) signals, then COM must connect to power supply +. If you are using sourcing (PNP) input signals, then you will want to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

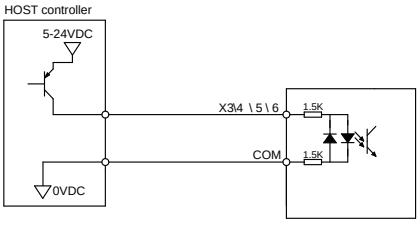
X3、X4、X5、X6 Circuit Are As Follows:



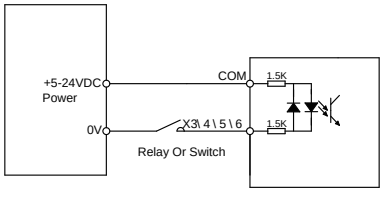
X3、X4、X5、X6 Input Port Connection Diagram



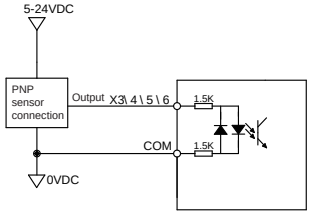
Host Sink Mode



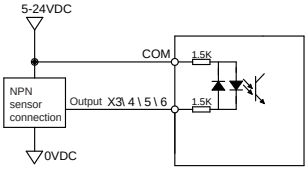
Host Sourcing Mode



Sensor And Switch Connection



PNP Sensor Connection

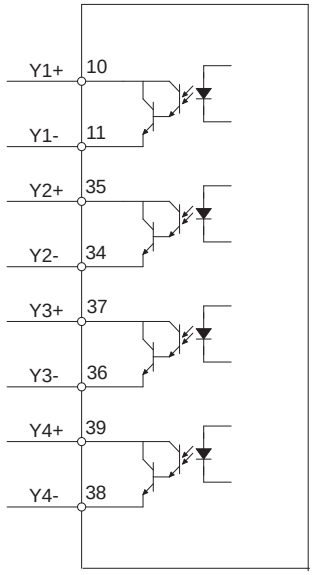


NPN Sensor Connection

4.8.4 CN2 Output Signal Specification

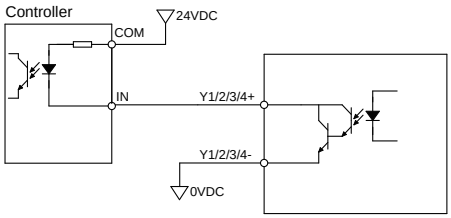
M2 series AC servo drive features 4 optically isolated digital outputs. They can be configured via M Servo Suite. Y1、Y2、Y3、Y4 are differential output signals, they can be used for both sourcing or sinking signals.

4.8.4.1 CN2 Output Signal Diagram

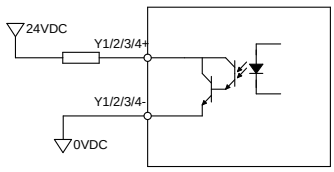


4.8.4.2 Output Connection Diagram

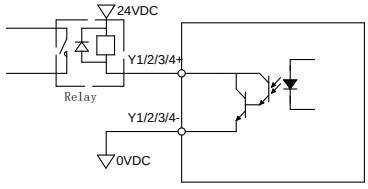
NOTE: Maximum output current is 30VDC 30mA.



Opt Coupler Circuity



Connect To External Load



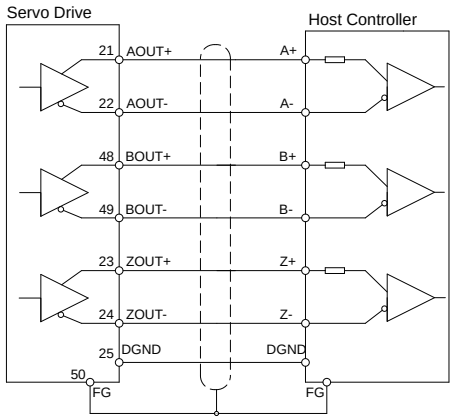
Connect To Relay Circuity

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.

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

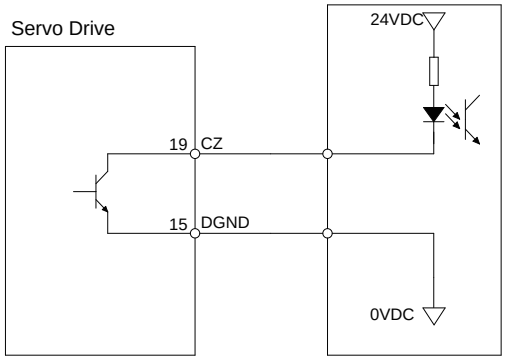
4.8.5.1 A/B/Z Connection Diagram



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

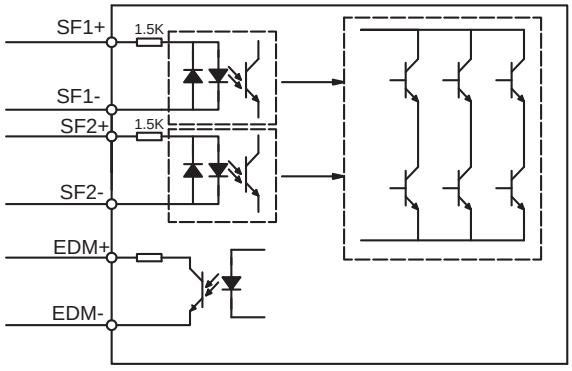
On the M2AC series servo drives, the STO (Safe Torque Off) function is connected via port CN5. The STO function shuts off the motor current turning off the motor output torque by forcibly turning off the signal of the servo driver power transistor. This is done internally through the STO Input/Output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

4.9.1 Safety Precautions

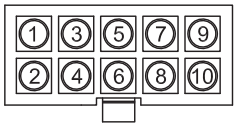
- If the STO function does not trigger, make sure the STO connector is plugged into CN5 on the drive correctly.
- When using the STO function, perform an equipment risk assessment to ensure that the system conforms to the safety requirements.
- Even when the STO function is enabled, the servo motor may 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



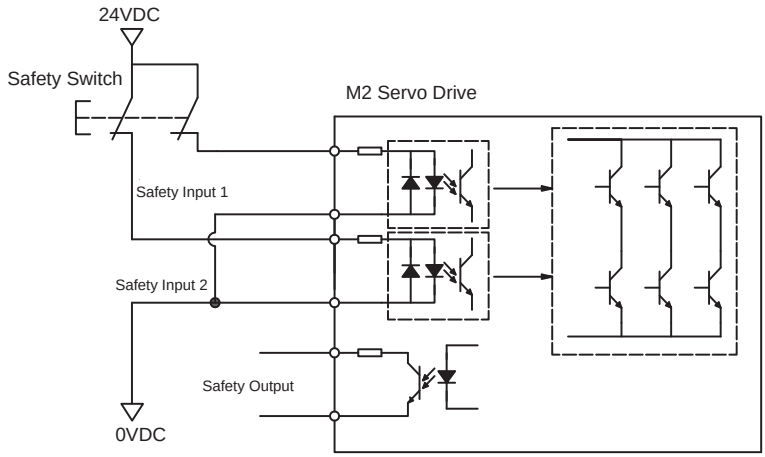
Item	Part number	Vendor
Housing	43025-1000	Molex
Crimp	43030-0005	Molex

4.9.2.3 STO Signal Definition

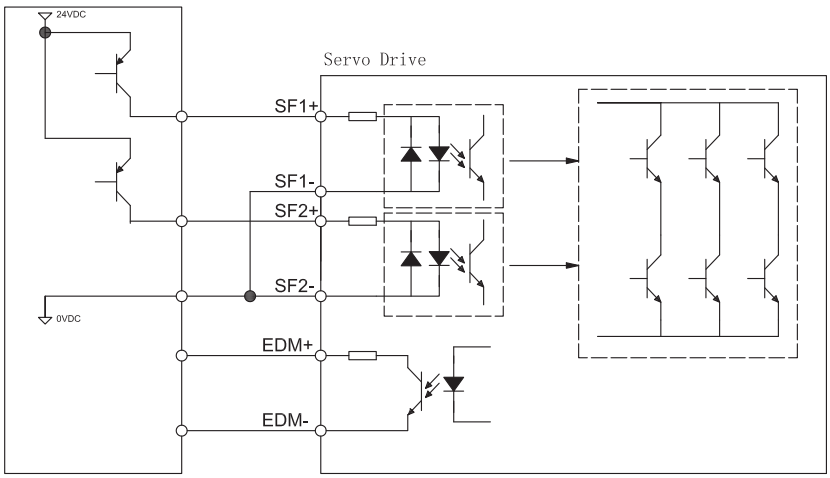
Signal	Symbol	Pin	Description	Control Mode
Safety Input SF1	SF1+	1	When SF1 has no input signal, e.g. the port is disconnected, SF1 will be considered OFF. The upper half of the internal power transistor will be shut off.	Compatible with all control modes
	SF1-	5		
Safety Input SF2	SF2+	3	When SF2 has 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

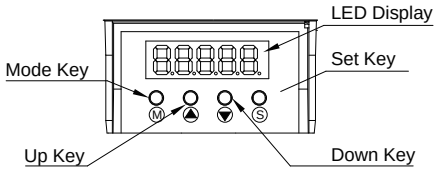


Safety light curtain connection



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 a). Monitoring selection mode b). Function selection mode c). Parameter setting mode 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 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.

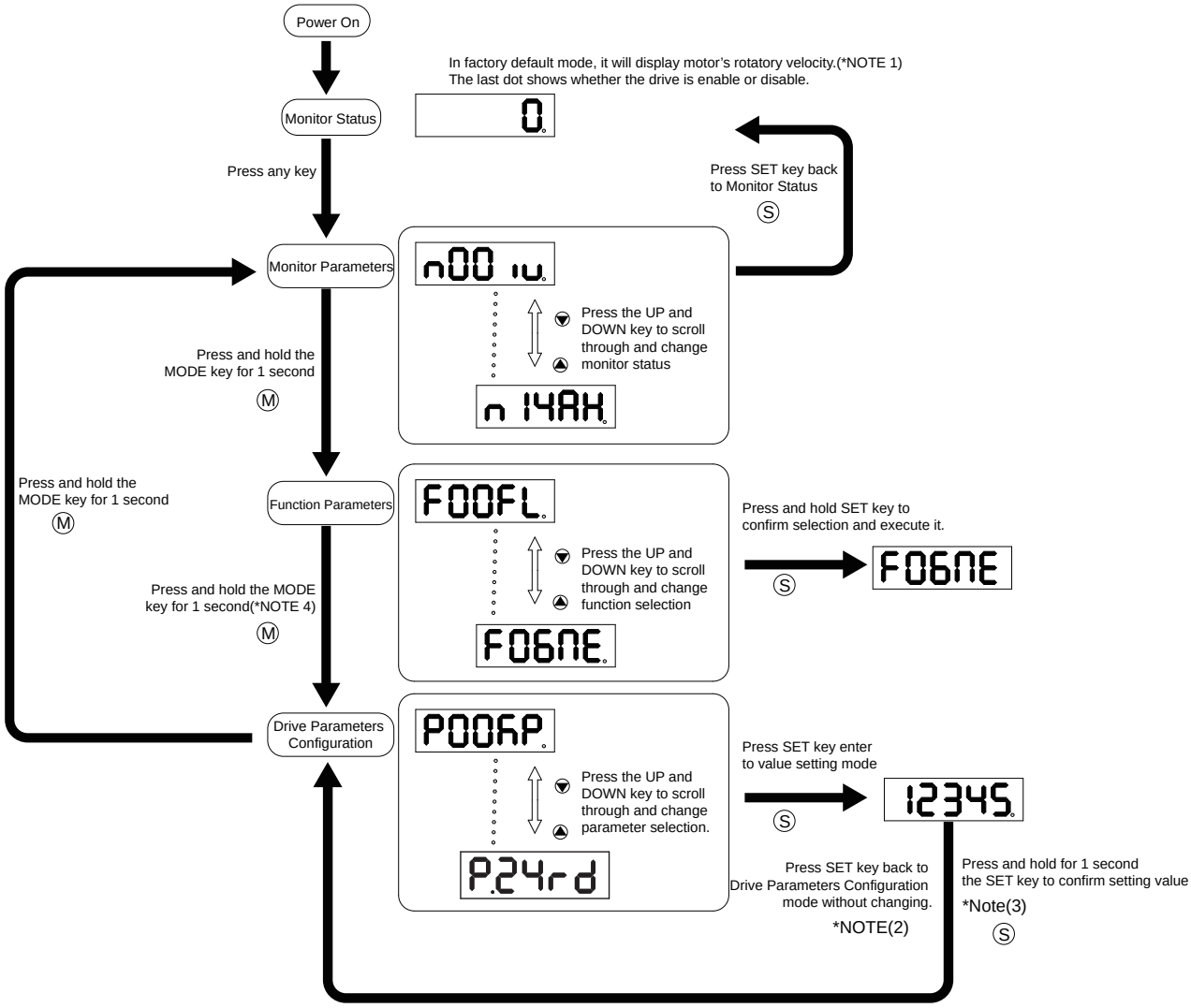
3) If any of the following warnings are detected by the drive, the LED display on the drive will switch into warning or fault display mode immediately. Press any key on the drive will switch back to previous display mode.

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.

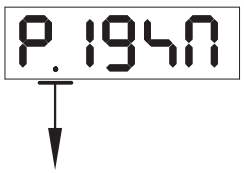
2) In parameter setting mode, press (S) key will quit from parameter setting mode, and return back to parameter selection mode, and changes will not be saved.

3) In parameter setting mode, press and hold (S) 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 (S) button to save the parameter change.

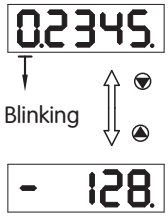
4) When drive is connected to the host computer with M servo suite on, parameter setting mode CANNOT accessed directly on drive's control panel.

5.3 LED display description

5.3.1 Decimal Point And Negative Sign Description

LED display	Description
	Negative sign: when display value ≥-9999, the highest digit will show as '-'. i.e.  , as '-9999' When display value≤-10000, the negative sign will be shown,  , as "-10000"
	There are only 5 digits on the LED display. In the parameter setting mode, when the highest dot lights, it means this paramter is bigger than 99. Please add 100 on the display parameter. Parameter NO.119 is shown.

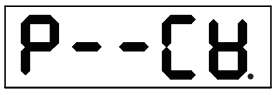
5.3.2 Parameter View Setting

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

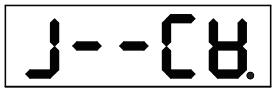
5.3.3 Parameter Save Setting

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

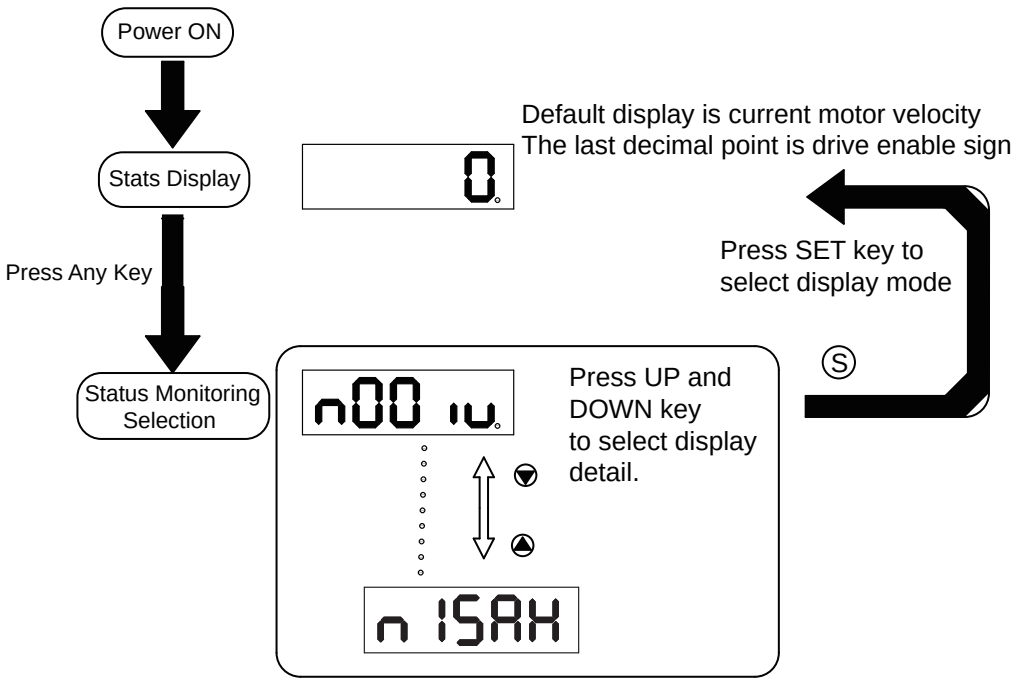
LED display	Description
	J—CW means motor rotating in CW direction under JOG mode
	J—CCW means motor rotating in CCW direction under JOG mode

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

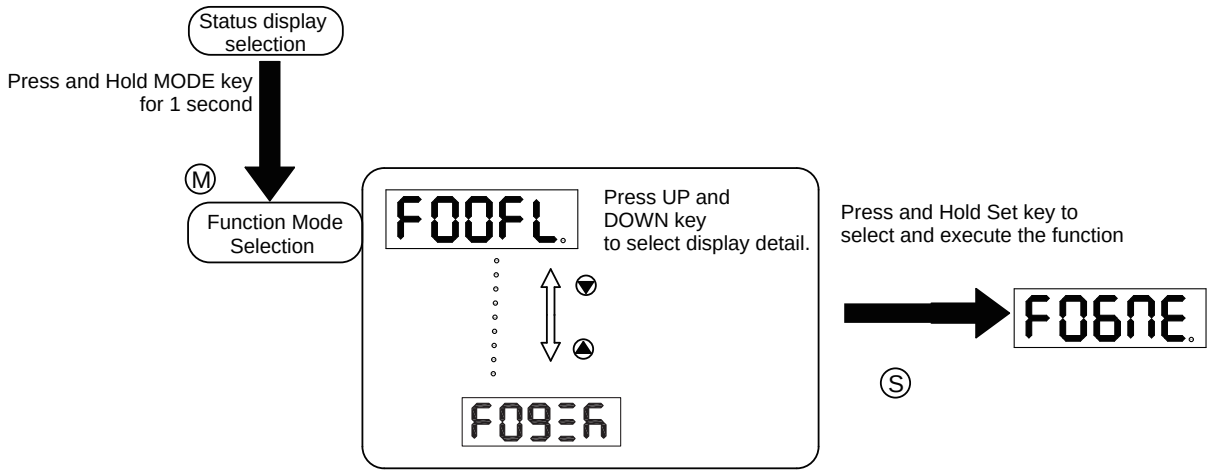
To change the status monitoring type, please press M to enter monitoring selection mode, and then use ▲▼ to make selections, and press S to confirm. Steps are shown as follows:



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		Communication address	
n-08		Fault History 1	
n-09		Fault History 2	
n-10		Fault History 3	
n-11		Fault History 4	
n-12		Fault History 5	
n-13		Fault History 6	
n-14		Fault History 7	
n-15		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 Ⓜ for 1 second will enter function control mode. Press ▲ ▼ to select function, and then press and hold Ⓢ to confirm or execute the function. (**NOTE: F-00(FL) and F-01(CJ) excepted**)

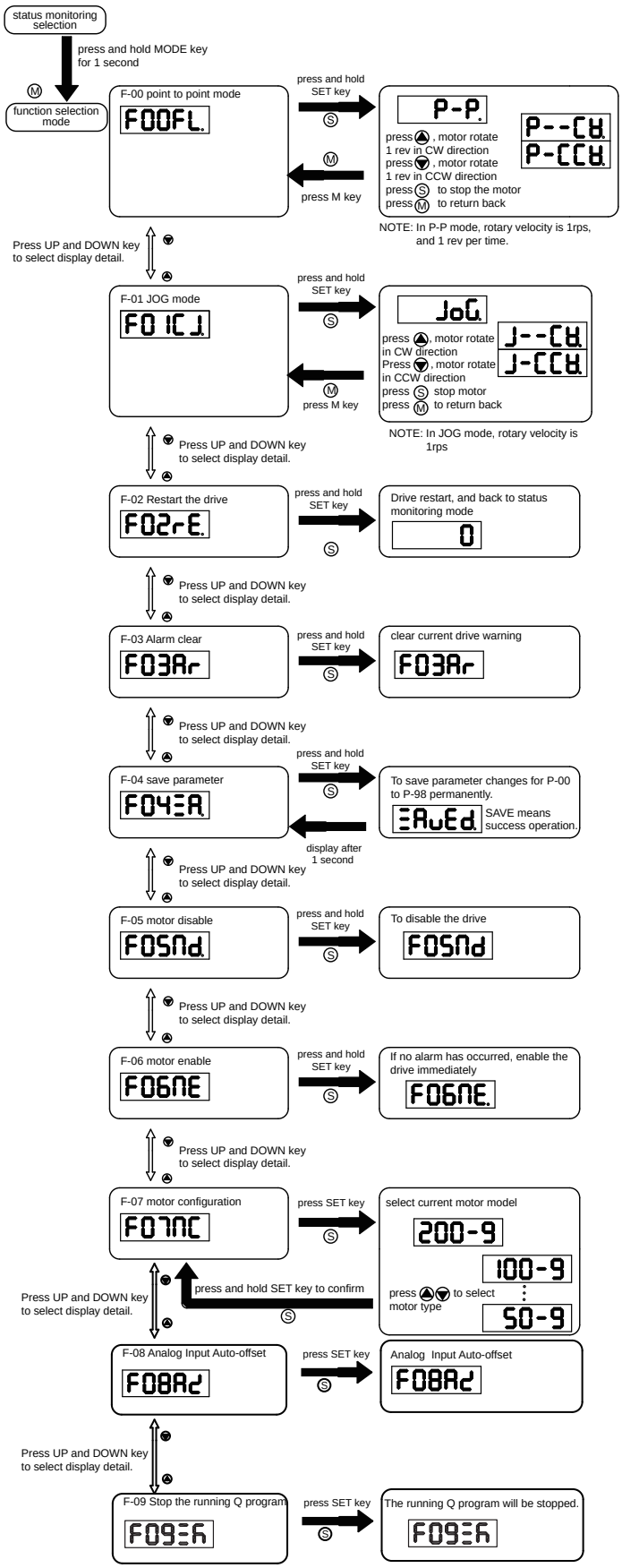


5.5.1 Function Mode Description

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	F07nC	(F-07MC) Select motor specification
F-08	F08Az	(F-08AZ)Analog auto tunning
F-09	F09SK	(F-09SK) Stop the runing Q program

5.5.3 Operation flow diagram

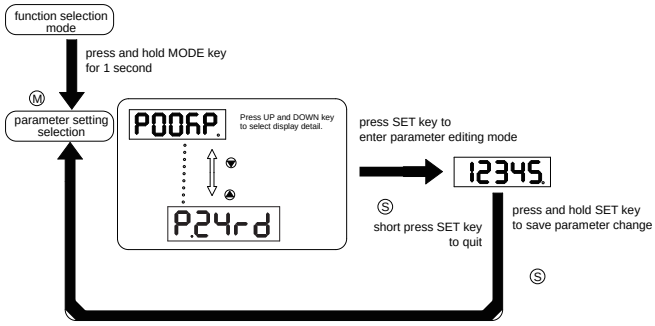


5.6 Parameter Setting Mode

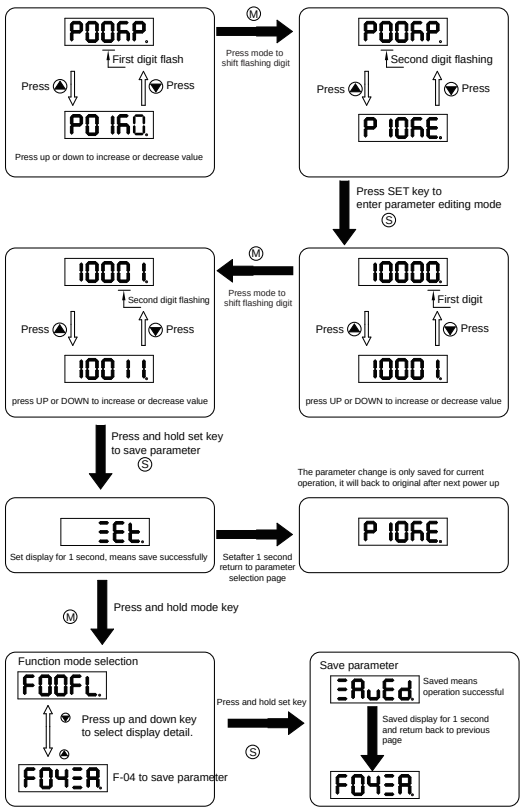
5.6.1 Parameter Setting Description

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.

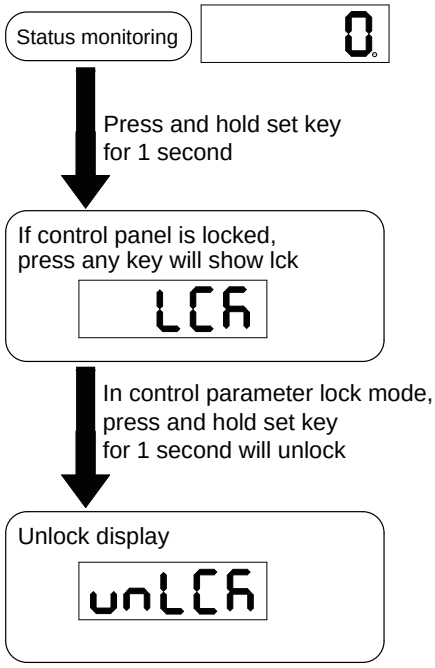


5.6.2 Parameter Editing Examples



5.7 Control Panel Lock

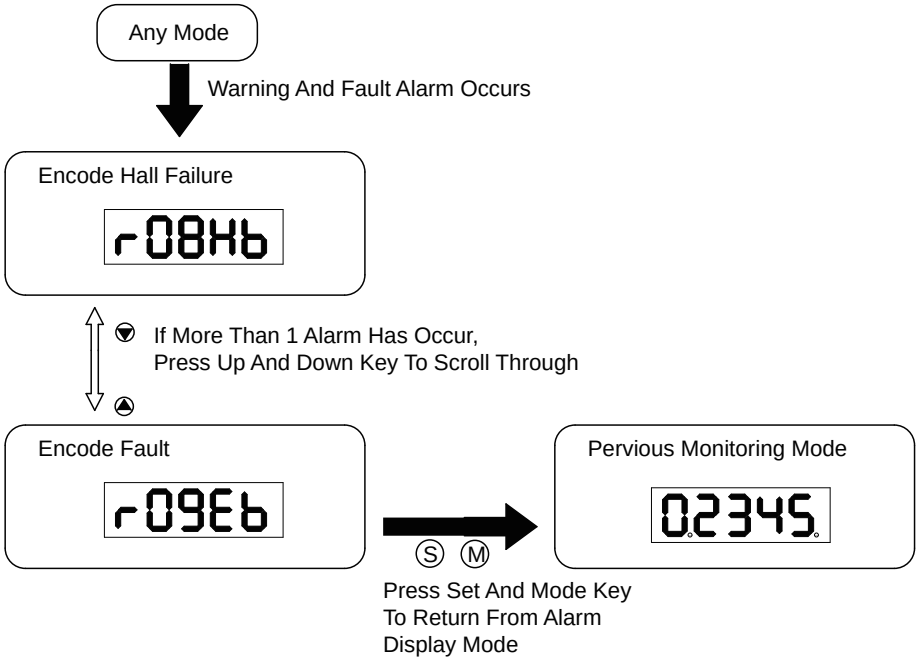
In order to prevent faulty use on key panel, key panel lock is featured on all M2AC servo drives. When lock function is on, no function can be changed directly on drive's control panel.

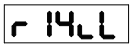
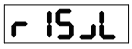
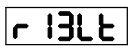


5.8 Warning And Fault Display

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
	Drive over temperature		CW limit is activated
	Internal voltage fault		CCW limit is activated
	Over voltage		Current limit
	Over current		Communication error
			Parameter save failed
			Phase loss of the main circuit
	Bad hall sensor		STO is activated
	Encoder error		Regeneration failed
	Position error		Low voltage
	Low voltage		Q program is empty
	Velocity limited		Motion Command Received While Motor in Disable
	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

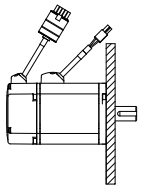
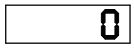
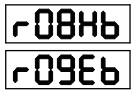
Check and ensure voltage supplies between L1/L2/L3, meets drive's power supply specifications.

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. 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. 2.Ensure to connect encoder cable to CN2 connector correctly.
3	Please make sure the main power circuit wiring connect correctly.	Refer to Section 4.1 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:  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. 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. 3. Please refer to Section 20 Trouble shooting.
6	User need to setup a motor brake control circuit when using a electromagnetic brake motor.	Please refer to Section 4.4 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
	SM0401AE4-KCD-NNV
	SM0402AE4-KCD-NNV
	SM0601AE4-KCD-NNV
	SM0602AE4-KCD-NNV
	SM0801AE4-KCD-NNV
	SM0802AE4-KCD-NNV
	SM0803AE4-KCD-NNV

For example: To setup a drive for model: SM0402AE4-KCD-NNV09 motor. These are the following steps:

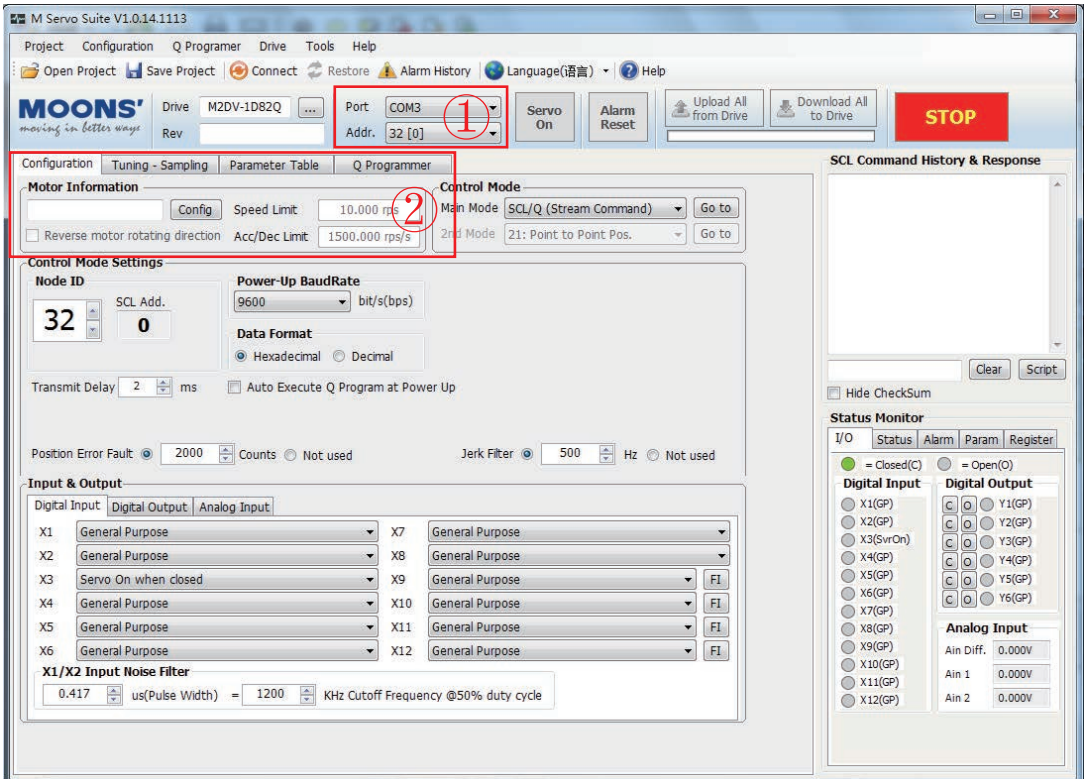
Step	LED display	Description
1		Press  into the Function Parameters mode at the Monitor Status mode
2		Press the  and  key to select F07 (MC)
3		Press  key into value setting mode.
4		Press  、  key to change value.
5		Press and hold  key for 1 second to confirm motor configuration.
6		
		Parameter is effective only after the servo drive is restarted.

6.3.2 Use Software To Config Motor

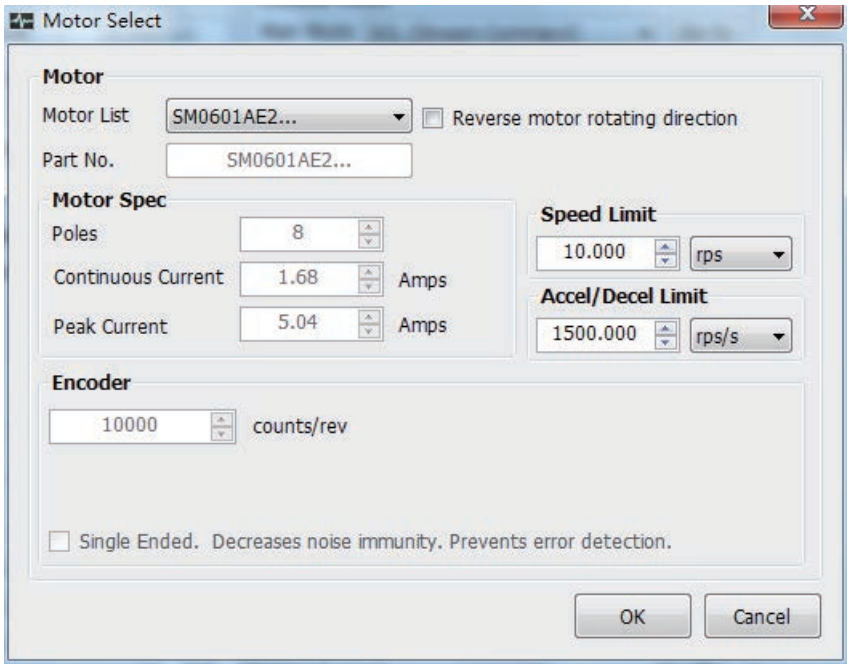
User can also use M Servo Suite to configure motor information

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	F01 CJ	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	F01 CJ	Press the M key back to the Function Operation mode.

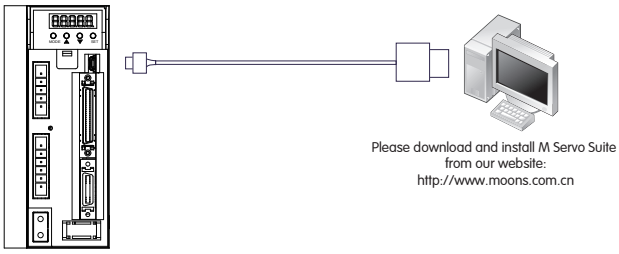
6.5 Configuration by Personal Computer

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:

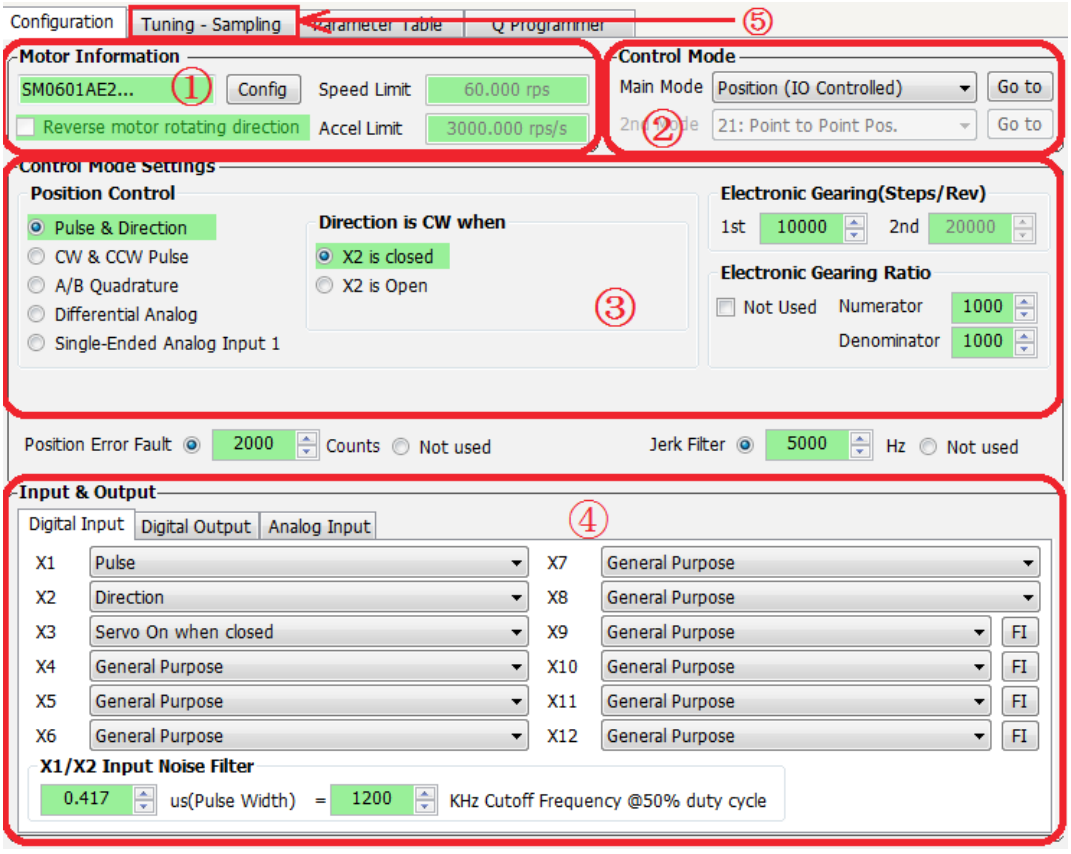
1. Servo Motor model selection and configuration
2. Operational mode selection
3. Define drive’s input/output mode
4. Apply auto tuning function on PID parameters for optimized motor performance.

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

Connect to Personal Computer



Interface of M2 Servo Suite



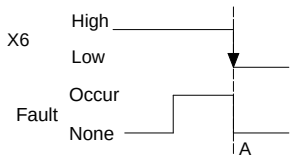
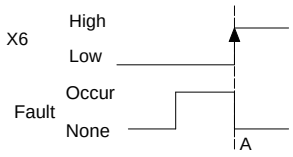
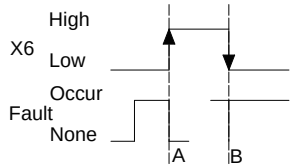
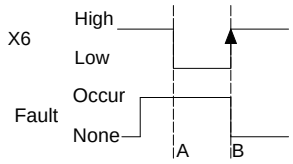
Configuration Steps	Details
Step 1	Motor Configuration
Step 2	Select Control Mode
Step 3	Further configuration
Step 4	I/O configuration
Step 5	Tuning

7. Operation Mode Selection

7.1 General Function Setting

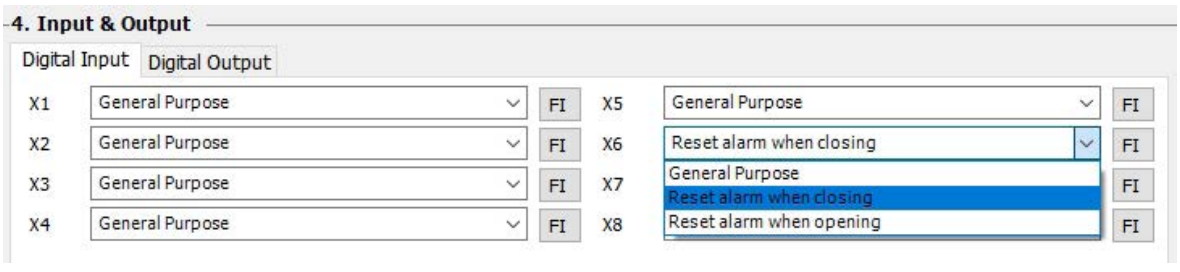
7.1.1 Alarm Reset

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">X6</td><td rowspan="6">29 (X6)
7
(XCOM)</td><td rowspan="3">1</td><td colspan="2">During normal operation, input X6 must keep Open (HIGH). Change will ONLY be trigged at the change of signal. When X6 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) X6 at HIGH, alarm NOT cleared
2) At point A, X6 change from HIGH to LOW, alarm is cleared</td><td>1) X6 is low, alarm NOT cleared
2) At point A, X6 change from LOW to HIGH, alarm NOT cleared
3) At point B, X6 change from HIGH to LOW, alarm cleared</td></tr>
<tr><td rowspan="3">2</td><td colspan="2">During normal operation, input X6 must keep CLOSED (LOW). Change will ONLY be trigged by the change of signal. When X6 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) X6 at LOW, alarm NOT cleared
2) At point A, X6 change from LOW to HIGH, alarm cleared
3) At point B, X6 level from high to low, the alarm does not clear</td><td>1) X6 is HIGH, alarm NOT cleared
2) At point A, X6 change from HIGH to LOW, alarm NOT cleared
3) At point B, X6 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 X6 functions to setup.



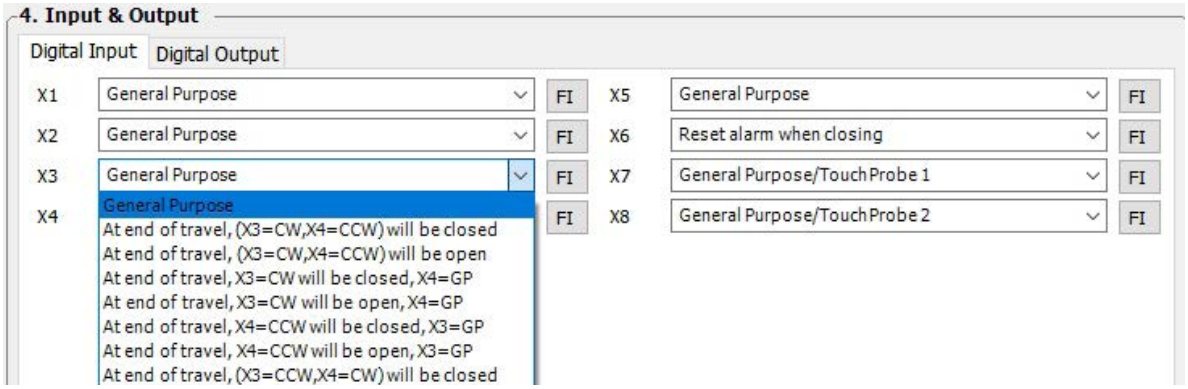
7.1.3 CW/CCW limit

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	X3 sets CW limit X4 sets CCW limit Effects when X5/X6 is closed	Closed	X3	Stop in CW direction, CW limit warning ON
			X4	Stop in CCW direction, CCW limit warning ON
		Open	X3	Rotating in CW direction as normal
			X4	Rotating in CCW direction as normal
2,5	X3 sets CW limit X4 sets CCW limit Effects when X5/X6 is open	Closed	X3	Rotating in CW direction as normal
			X4	Rotating in CCW direction as normal
		Open	X3	Stop in CW direction, CW limit warning ON
			X4	Stop in CCW direction, CCW limit warning ON
3,6,13,16	X3, X4 as general purpose input (default)			
7	X3 sets CW limit Effects when X3 is closed X4 as general purpose input	Closed	X3	Stop in CW direction, CW limit warning ON
		Open	X3	Rotating in CW direction as normal
8	X3 sets CW limit Effects when X3 is open X4 as general purpose input	Closed	X3	Rotating in CW direction as normal
		Open	X3	Stop in CW direction, CW limit warning ON
9	X4 sets CCW limit Effects when X4 is closed X3 as general purpose input	Closed	X4	Stop in CCW direction, CCW limit warning ON
		Open	X4	Rotating in CCW direction as normal
10	X4 sets CCW limit Effects when X4 is closed X3 as general purpose input	Closed	X4	Rotating in CCW direction as normal
		Open	X4	Stop in CCW direction, CCW limit warning ON
11,13	X4 sets CW limit X3 sets CCW limit Effects when X3 is closed	Closed	X4	Stop in CCW direction, CCW limit warning ON
			X3	Stop in CCW direction, CCW limit warning ON
		Open	X4	Rotating in CW direction as normal
			X3	Rotating in CCW direction as normal
12,16	X4 sets CW limit X3 sets CCW limit Effects when X3 is open	Closed	X4	Rotating in CW direction as normal
			X3	Rotating in CCW direction as normal
		Open	X4	Stop in CW direction, CW limit warning ON
			X3	Stop in CCW direction, CCW limit warning ON
17	X3 sets CW limit Effects when X3 is closed X4 as general purpose input	Closed	X3	Stop in CW direction, CW limit warning ON
		Open	X4	Rotating in CW direction as normal
18	X3 sets CW limit Effects when X6 is open X4 as general purpose input	Closed	X4	Rotating in CW direction as normal
		Open	X3	Stop in CW direction, CW limit warning ON
19	X4 sets CW limit Effects when X4 is closed X3 as general purpose input	Closed	X4	Stop in CCW direction, CCW limit warning ON
		Open	X3	Rotating in CCW direction as normal
20	X4 sets CCW limit Effects when X4 is open X3 as general purpose input	Open	X3	Rotating in CCW direction as normal
		Open	X4	Stop in CCW direction, CCW limit warning ON

Software Configuration

In drive configuration page-----input& output X3/X4 to select correspondent functions



7.1.4 Drive On Fault Output

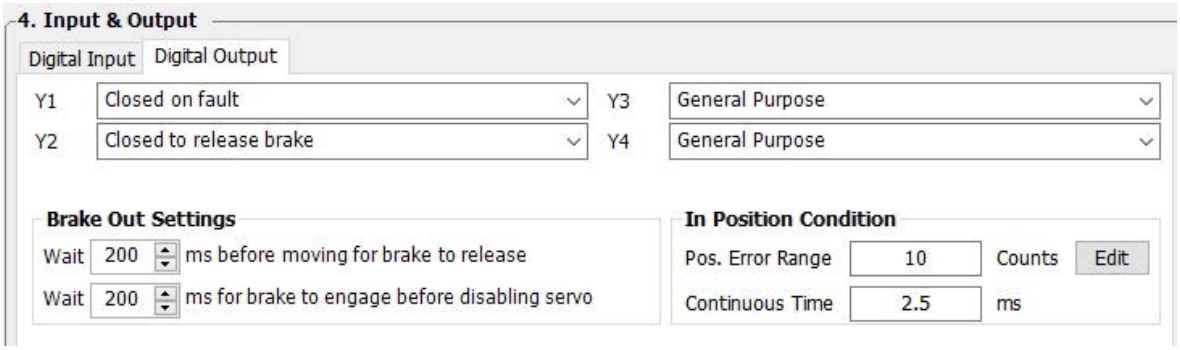
When warnings as below are shown, the drive will send “on fault” output and it will also disable the drive immediately.

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-66 (AO).

Signal Name	PIN	P-65 (AO)	Condition	Function
Y1	Y1+ (10) Y1- (11)	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

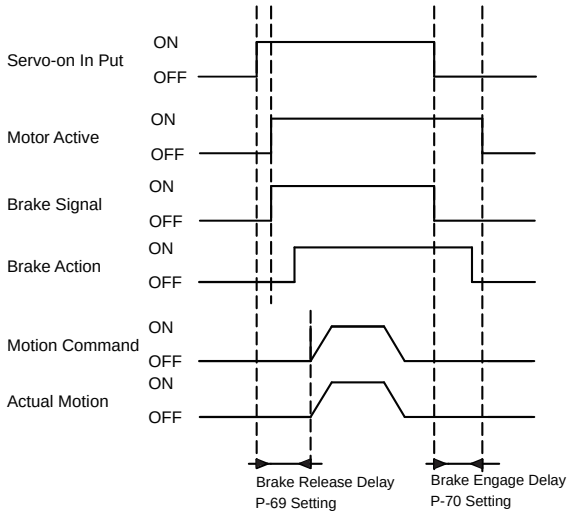
In drive configuration page-------input/output select Y1 function to setup.



7.1.4 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.

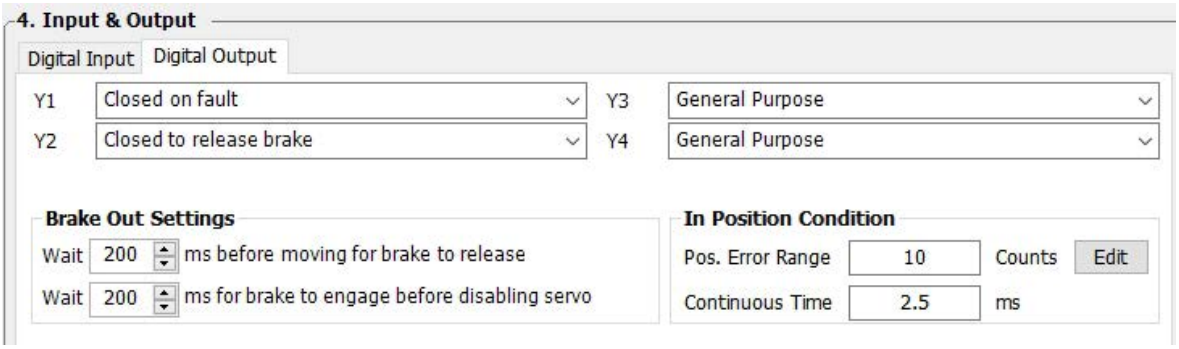


Brake disengage delay and engage delay can be configured via M servo suite software, or change parameters P-69 (BD) and P-70 (BE) directly from the drive.

Name	PIN	P-67(BO)	Condition	Function
Y2	Y2+ (35) Y2- (34)	2	Closed	Hold on brake, brake holds the motor shaft
			Open	Release brake, brake releases the motor shaft
		1 (default)	Closed	Release brake, brake releases the motor shaft
			Open	Hold on brake, brake holds the motor shaft
		3		General purpose input, output function disabled

Software Configuration

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



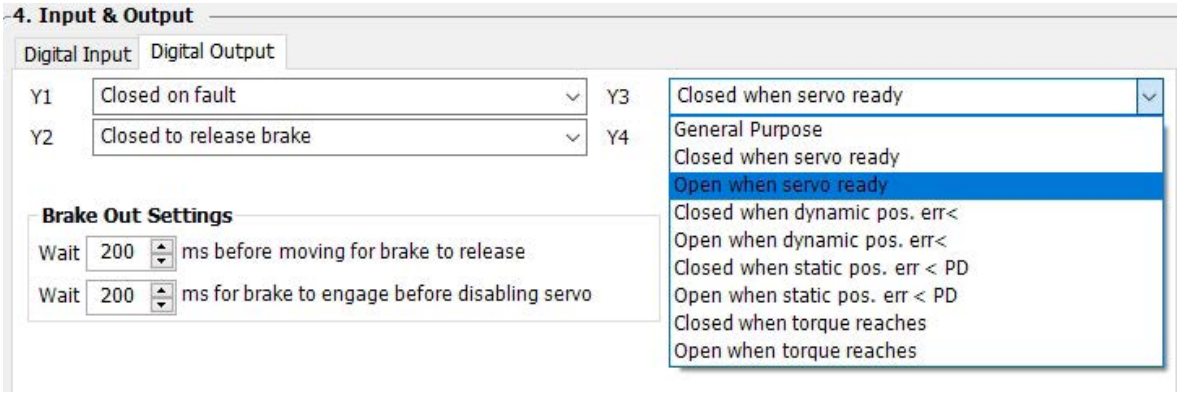
7.1.5 Servo Ready Output

When servo drive is power on, if no warning has occurred, output Y3 will output “servo ready” signal.

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

Signal Name	PIN	P-68(MO)	Condition	Function
Y3	Y3+ (37) Y3- (36)	□□□E	Closed	Closed when servo is not ready
			Open	Open when servo is ready
		□□□D (default)	Closed	Closed when servo is ready
			Open	Open when servo is not ready
		□□□3		General purpose, function disabled

Software Configuration



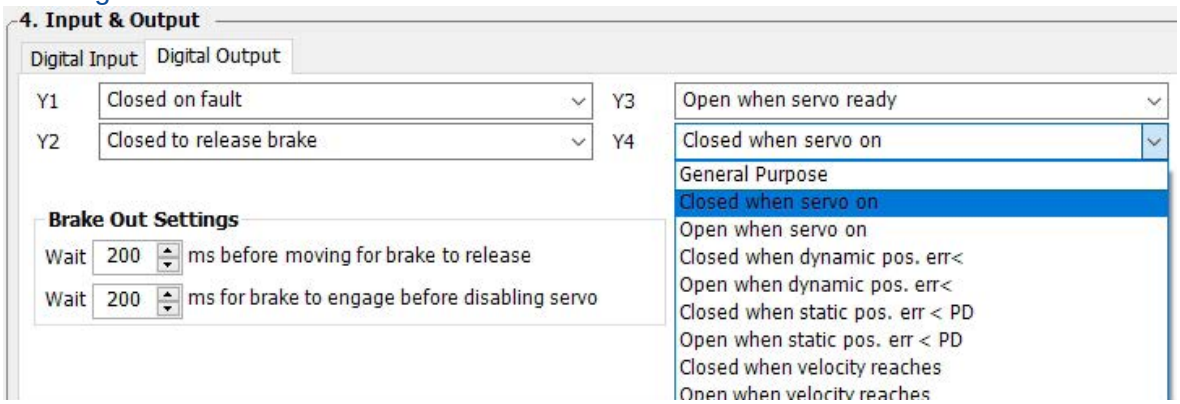
7.1.6 Servo-on status Output

Output Y4 will output “servo on status” signal when servo motor is enabled.

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

Signal Name	PIN	P-68(MO)	Condition	Function
Y4	Y4+ (39) Y4- (38)	□□2□	Closed	Closed when servo is not ready
			Open	Open when servo is ready
		□□2□	Closed	Closed when servo is ready
			Open	Open when servo is not ready
		□□1□ (default)		General purpose, function disabled

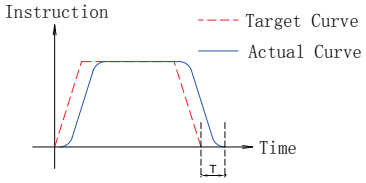
Software Configuration



7.1.7 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.

7.1.8 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 first digit of parameter P-68 (MO) defines Y3 output function. The second digit of parameter P-68 (MO) defines Y4 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
Y3	Y3+ (37) Y3- (36)	□□□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 (default)		General purpose output, function disabled

Y4	Y4+ (39) Y4- (38)	□□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□ (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.

7.1.9 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

7.1.10 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+ (39) Y4- (38)	□□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

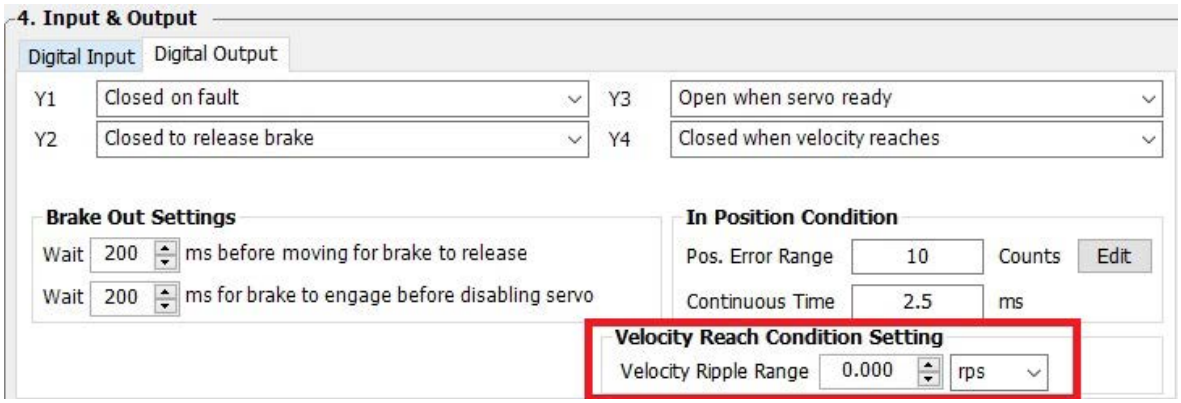
Parameter	Name	Data Range	Default value	Unit	Description
P-85 (VR)	Ripple range setting for velocity reach	0~136	0.000	Rps	The velocity ripple value around the targeted velocity. If the difference between the actual velocity and targeted velocity is within the ripple value. The driver will then define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



7.1.11 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 Y3.

Signal Name	PIN	P-67 (MO)	Condition	Function
Y3	Y3+(37) Y3-(36)	□□□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

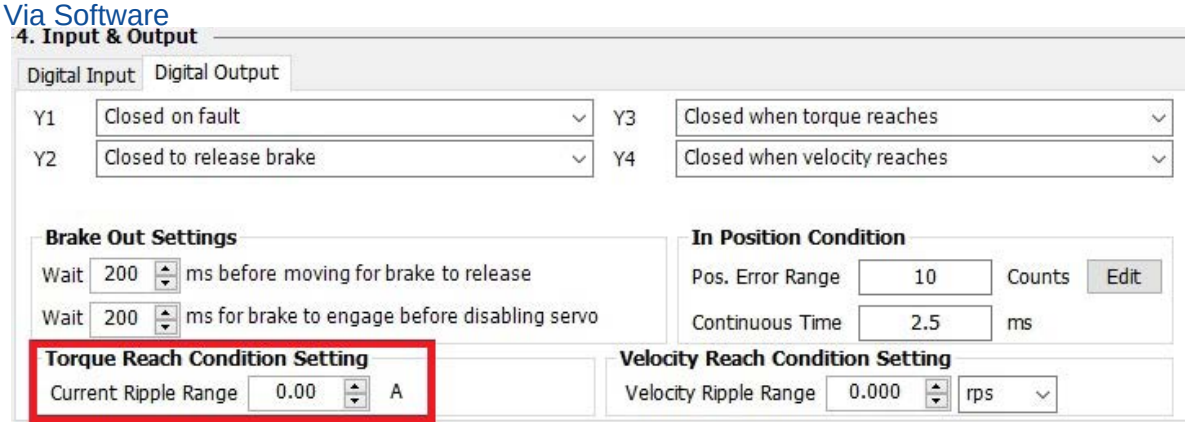
Parameter	Name	Data Range	Default value	Unit	Description
P-87 (TV)	Torque within ripple range, when torque reach function in use.	0.00~3.00	0.00	A	When actual torque output and command torque is same, and within the velocity ripple range. There will be torque reach output signal.

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



8. Parameters and Functions

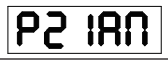
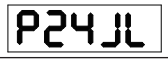
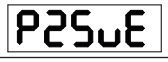
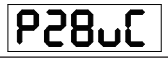
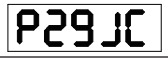
8.1 Parameter Category

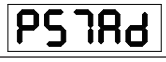
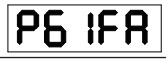
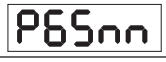
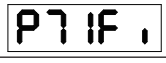
M2 series AC servo drive has 4 modes.

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	8000	
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	150	
P06	PID	KK		Feedforward Constant	0	
P07	PID	KJ		Jerk Filter Frequency	5000	
P08	PID	VP		Velocity Loop Proportional Gain	6000	
P09	PID	VI		Velocity Loop Integral Gain	300	
P10	PID	KE		Deriv Filter factor	15000	
P11	PID	KC		PID Filter factor	25000	
P12	Control mode	CM		Main control mode	21	
P13	Reserved	N/A		N/A	N/A	
P14	Control mode	PM		Power-up mode	2	
P15	Control mode	JM		Jog mode	2	

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	80.000	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	100.00	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	Reserved	N/A		N/A	N/A	N/A
P31	Reserved	N/A		N/A	N/A	N/A
P32	Reserved	N/A		N/A	N/A	N/A
P33	Reserved	N/A		N/A	N/A	N/A
P34	Reserved	N/A		N/A	N/A	N/A
P35	Reserved	N/A		N/A	N/A	N/A
P36	Reserved	N/A		N/A	N/A	N/A
P37	Config	ER		Encoder resolution	10000	counts/rev
P39	Config	EG		Electronic gearing	10000	counts/rev
P40	Reserved	N/A		N/A	N/A	N/A
P41	Config	EN		Numerator of electronic gearing ratio	1000	
P42	Config	EU		Denominator of electronic gearing ratio	1000	
P43	Reserved	N/A		N/A	N/A	N/A
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	Reserved	N/A		N/A	N/A	N/A
P50	Reserved	N/A		N/A	N/A	N/A
P51	Reserved	N/A		N/A	N/A	N/A
P52	Reserved	N/A		N/A	N/A	N/A
P53	Reserved	N/A		N/A	N/A	N/A
P54	Reserved	N/A		N/A	N/A	N/A
P55	Reserved	N/A		N/A	N/A	N/A
P56	Reserved	N/A		N/A	N/A	N/A
P57	Reserved	N/A		N/A	N/A	N/A
P58	Reserved	N/A		N/A	N/A	N/A
P59	Reserved	N/A		N/A	N/A	N/A
P60	Reserved	N/A		N/A	N/A	N/A
P61	Reserved	N/A		N/A	N/A	N/A
P62	I/O	SI		Servo enable input setting	2	
P63	I/O	AI		Alarm Reset input setting	1	
P64	I/O	DL		End-of –travel limit Setting	3	
P65	Reserved	N/A		N/A	N/A	N/A
P66	I/O	AO		Alarm output function setting	1	
P67	I/O	BO		Motor brake control setting	1	
P68	I/O	MO		Y3，Y4output function setting	33	
P69	I/O	BD		Brake disengage Delay	200	ms
P70	I/O	BE		Brake engage delay	200	ms
P71	I/O	FI1		Input X1 noise filter	0	

P72	I/O	FI2	P72F 1	Input X2 noise filter	0	
P73	I/O	FI3	P73F 1	Input X3 noise filter	0	
P74	I/O	FI4	P74F 1	Input X4 noise filter	0	
P75	I/O	FI5	P74F 1	Input X5 noise filter	0	
P76	I/O	FI6	P76F 1	Input X6 noise filter	0	
P77	I/O	FI7	P77F 1	Input X7 noise filter	0	
P78	I/O	FI8	P78F 1	Input X8 noise filter	1	
P79	Reserved	N/A	P79nn	N/A	N/A	N/A
P80	Communication	PR	P80Pr	Serial communication protocol settings	5	
P81	Communication	TD	P8 1td	Transmit Delay	2	
P82	Communication	BR	P82br	Serial baud rate	1	
P83	Communication	DA	P83dA	RS-485 Node ID	32	
P84	Communication	CO	P84Co	EtherCAT Node ID	1	
P85	Communication	CB	P85Cb	Node id addressing	0	
P86	Regeneration	ZR	P86zr	Regen resistor value	200	Ω
P87	Regeneration	ZC	P87zC	Regen resistor continuous wattage	40	w
P88	Regeneration	ZT	P88zt	Regen resistor peak time	1250	ms
P89	Other	VR	P89vr	Ripple range setting for velocity reach	0.000	rps
P90	Reserved	N/A	P90nn	N/A	N/A	
P91	Other	TV	P9 1tu	Ripple range setting for torque reach	0.00	A
P92	Other	PK	P92PA	Parameter lock on the drive's control panel	0	
P93	Other	DD	P93dd	LED Default status monitor type	0	
P94	Other	MA	P94nA	LED Warning Display Mask Code(LOW 16BIT)	64511	
P95	Other	MA	P95nA	LED Warning Display Mask Code(HIGH 16BIT)	255	rps/s
P96	Other	HA1	P96HA	Accel of seeking end-of-travel limit during homing	100	rps/s
P97	Other	HA2	P97HA	Accel of seeking homing switch during homing	100	rps/s
P98	Other	HA3	P98HA	Accel of feeding to homing switch during homing	10	rps/s

P99	Other	HL1		Decel of seeking end-of-travel limit during homing	100	rps/s
P100	Other	HL2		Decel of seeking homing switch during homing	100	rps/s
P101	Other	HL3		Decel of feeding to homing switch during homing	100	rps/s
P102	Other	HV1		Velocity of seeking end-of-travel limit during homing	10	rps
P103	Other	HV2		Velocity of seeking homing switch during homing	5	rps
P104	Other	HV3		Velocity of feeding to homing switch during homing	0.5	rps
P105	PID	KL		Position Follow factor	0	
P106	PID	XP		Gloable gain of full closed loop	6000	
P107	PID	XF		P-loop proportional gain of full closed loop	8000	
P108	PID	XD		Derivate gain of full closed loop	6000	
P109	PID	XE		Derivate filter gain of full closed loop	10000	
P110	PID	XV		V-loop proportional gain of full closed loop	1000	
P111	PID	XI		V-loop intergral gain of full closed loop	1000	
P112	PID	XK		Feedforward constant of full closed loop	0	
P113	PID	XC		PID Filter of full closed loop	10000	
P114	Reserved	N/A		N/A	N/A	
P115	Config	FF		S curve factor	0	
P116	Config	XN		Numberator of second encoder scale division	1000	
P117	Config	XU		Denominate of second encoder scale division	1000	
P118	Config	XT		Maximum position errorr per revolution of the second encoder	10	
P119	Config	XM		Control mode setup	0	
P120	Config	HX		Homing sensor	8	
P121	Config	XL		Follow factor of full closed loop	0	
P122	Config	DB		Dead time comenasation	0	
P123	Config	CL		Overload time	0	
P124	Config			Rotation direction setup	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.

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

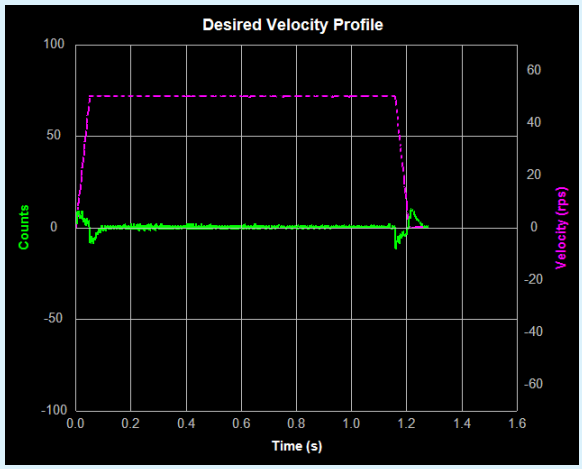
The servo control Proportional gain term of the velocity error. Gain value is relative: 0 = no gain, 32767 = full gain. KV minimizes the velocity error, and vibration in position control mode.

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

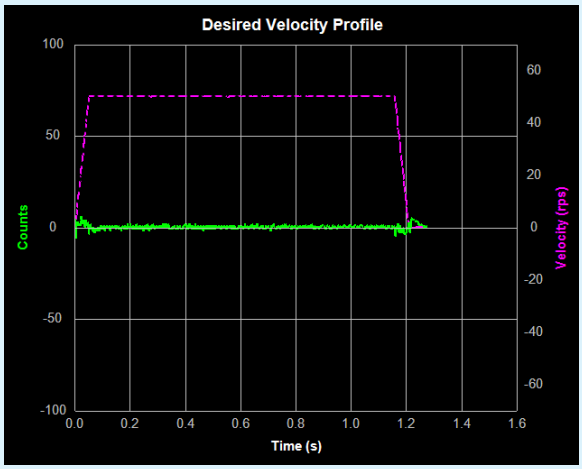
The servo control integrator gain term. Gain value is relative: “0” meaning no gain, “32767”meaning full gain. It minimizes (or may even eliminate) position errors especially when holding position.

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

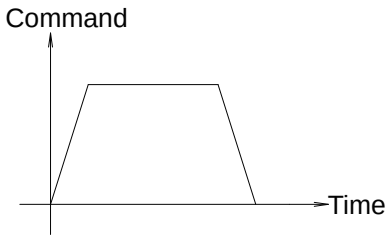


With KK parameter, Inertia Feedforward Constant.
Red Line (Dash) : Actual velocity
Green Line (Filled) : Position error

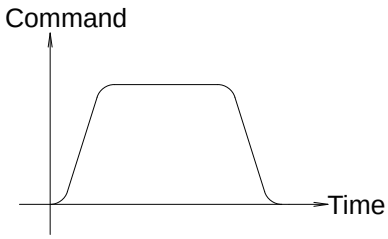
P-07 (KJ)	Jerk Filter Frequency	Data Range	Default	Unit	Data type
		0~5000	5000	------	DEC

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.

P-13 (NN)	Reserved	Data Range	Default	Unit	Data type
		N/A	N/A	------	N/A

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.

EtherCAT doesn't need to change the power up mode.

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-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 10000count (2500 line) per revolution encoder, set the encoder resolution to 10000.

NOTE: If you need to view or set this value on drive's control panel P-37 (ER), please refer to following calculation:

LED display value = *B* x 2

Where ***B*** is encoder resolution setting. Unit is lines

NOTE: For MOONS' standard motor ,please DO NOT 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.

NOTE: If you need to view or set this value on drive's control panel P-39 (EG), please refer to following calculation:

LED display value = *B* x 2

Where ***B*** is electronic gearing setting. Unit is counts

P-41 (EX)	Numerator of encoder output division	Data Range	Default	Unit	Data type
		1~1000	1000		DEC

Defines the numerator of encoder output division.

P-42 (EY)	Denominator of encoder output division	Data Range	Default	Unit	Data type
		1~1000	1000		DEC

Defines the denominator of encoder output division.

Encoder output counts per revolution = P-37 encoder revolution x (P41 / P42) x 4

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-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.

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

Defines the function of the X6 input. This input can be used to clear a drive fault and reset the Alarm Code (see AL command).

Please refer to 7.1.1 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 X3 and X4 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, X3 and X4 can be redefined as general purpose inputs.

Please refer to 7.1.3 CW/CCW limit

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.

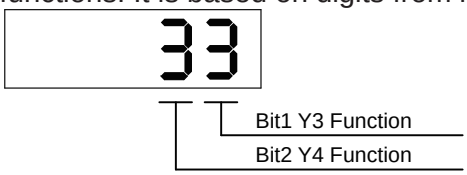
BO2: Output Y2 is open (de-energized) when drive is enabled, and closed when the drive is disabled.

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

Please also refer to 7.1.4 motor brake control

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

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



Bit 1 defines the drive's Motion Output digital output function on output Y3. There are five 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.

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.

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

D:When servo drive is power on, if no warning has occurred, output Y3 is closed.

E:When servo drive is power on, if no warning has occurred, output Y3 is open.

3: Output Y3 is used as general output.

Bit 2 defines the drive's Motion Output digital output function on output Y4. There are five Motion Output states that can be defined:

1: When the drive is enabled, output Y4 is closed.

2: When the drive is enabled, output Y4 is open.

4: When the motion is completed and the motor is in position, output Y4 is closed.

5: When the motion is completed and the motor is in position, output Y4 is open.

6: When the dynamical position error is within the range specified by PL command, output Y4 is closed.

7: When the dynamical position error is within the range specified by PL command, output Y4 is open.

A:When the actual velocity reached the targeted velocity, output Y4 is closed.

B:When the actual velocity reached the targeted velocity, output Y4 is open.

3: Output Y3 is used as general output.

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

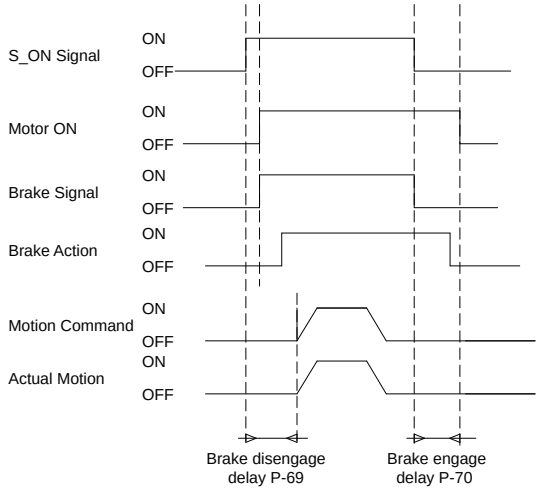
BD only takes effect if the BO command is set to 1 or 2. After a drive is enabled this is the time value that may delay a move waiting for the brake to disengage. When beginning a move the delay value must expire before a move can take place. The delay timer begins counting down immediately after the 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 X1 noise filter	Data Range	Default	Unit	Data type
		0~32767	0	---	DEC

Applies a digital filter to the input X1. 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 X2 noise filter	Data Range	Default	Unit	Data type
		0~32767	0	---	DEC

Applies a digital filter to the input X2. 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 X3 noise filter	Data Range	Default	Unit	Data type
		0~32767	0	---	DEC

Applies a digital filter to the input X3. 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 X4 noise filter	Data Range	Default	Unit	Data type
		0~32767	0	---	DEC

Applies a digital filter to the input X4. 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-75 (FI)	Input X5 noise filter	Data Range	Default	Unit	Data type
		0~32767	0	---	DEC

Applies a digital filter to the input X5. 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 (FI)	Input X6 noise filter	Data Range	Default	Unit	Data type
		0~32767	0	---	DEC

Applies a digital filter to the input X6. 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-77 (FI)	Input X7 noise filter	Data Range	Default	Unit	Data type
		0~32767	0	---	DEC

Applies a digital filter to the input X7. 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-78 (FI)	Input X8 noise filter	Data Range	Default	Unit	Data type
		0~32767	0	---	DEC

Applies a digital filter to the input X8. 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-80 (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-81 (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-82 (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-83 (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-84 (CO)	EtherCAT Node ID	Data Range	Default	Unit	Data type
		1~255	1	---	DEC

The NODE-ID for EtherCAT communications.

P-85 (CB)	Node ID addressing	Data Range	Default	Unit	Data type
		0-1	0	---	DEC

Logical addressing is used for the cyclical exchange of process data. Each datagram addresses a specific part of the process image in the EtherCAT segment, for which 4 GBytes of address space is available. During network startup, each slave device is assigned one or more addresses in this global address space. If multiple slave devices are assigned addresses in the same area, they can all be addressed with a single datagram. Since the datagrams completely contain all the data access related information, the master device can decide when and which data to access. For example, the master device can use short cycle times to refresh data on the drives, while using a longer cycle time to sample the I/O; a fixed process data structure is not necessary.

In addition to cyclical data, further datagrams can be used for asynchronous or event drive communication. Besides the logical addressing, the master device can also address a slave in two ways:

1: Auto Increment Addressing

With Auto increment addressing, the master device addresses a slave via its position in the network. This method is used during network boot-up to determine the network topology and compare it to the planned topology.

0: Fixed Node Addressing

After checking the network configuration, the master device can assign each node a configured node address and communicate with the node via this fixed address. This enables targeted access to devices, even when the network topology is changed during operation.

P-86 (ZR)	Regen resistor value	Data Range	Default	Unit	Data type
		0-1000	200	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-87 (ZC)	Regen resistor continuous wattage	Data Range	Default	Unit	Data type
		0-32000	40	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-87 (ZT)	Regen resistor peak time	Data Range	Default	Unit	Data type
		0-8000	1250	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-89 (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 7.1.11 Target velocity reach

P-91 (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 7.1.12 torque reach for more details.

P-92 (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-93 (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.

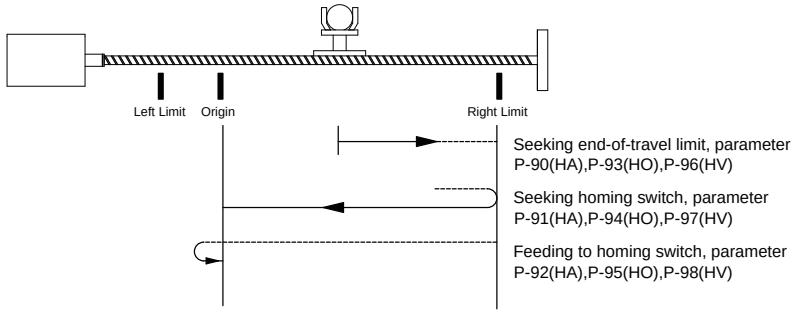
P-94,P-95(MA)	LED Warning Display Mask Code	Data Range	Default	Unit	Data type
					DEC

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-96 (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-97 (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-98 (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-99 (HL)	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-100 (HL)	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-101 (HL)	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-102 (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-103 (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-104 (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)

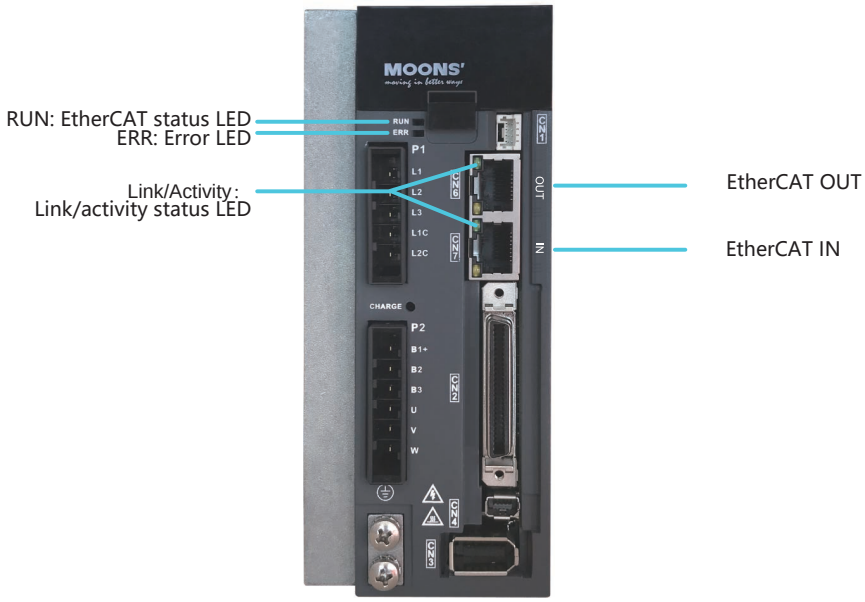
P-105 (KL)	Follow factor	Data Range	Default	Unit	Data type
		-32000~+32000	0		DEC

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

EtherCAT communication port

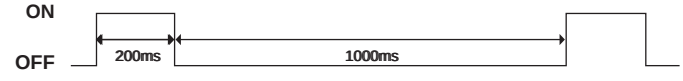
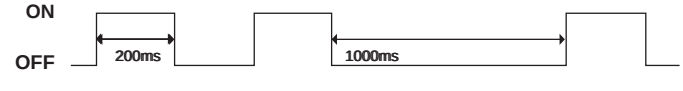
Description



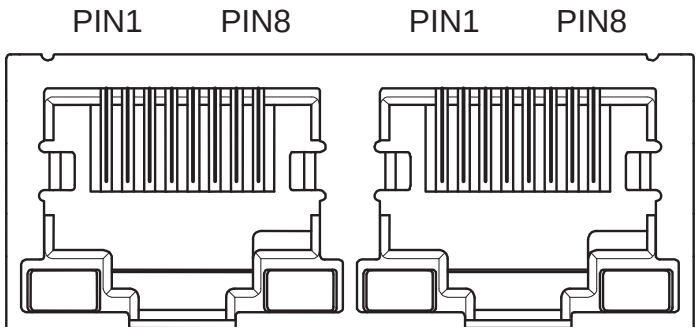
EtherCAT status LED

LED	Color	Status	Description
Link/Activity	Green	OFF	no Ethernet connection
		ON	Ethernet is connected
		Flickering	activity on line
RUN	Green	OFF	Init(Initialization)
		ON	OP(Operational)
		Blinking	Pre-op(Per-Operation)
		Single Flash	Safe-Operation
ERR	Red	OFF	no erroe
		Blinking	general error
		Single Flash	Sync error
		Double Flash	Watch dog error

Notes:

Flickering：	
Blinking：	
Single Flash	
Double Flash	

RJ45 connector Pin assignments



PIN NO.	信号名称	功能
1	TX+	Transmit+
2	TX-	Transmit-
3	RX+	Receive+
4	-	-
5	-	-
6	RX-	Receive-
7	-	-
8	-	-

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. 1. Ambient temperature has risen over the specified temperature. 2. Over-load	1. Improve the ambient temperature and cooling condition. 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 2. Please replace the drive with a new one, and contact MOONS
r03uH	Over voltage	Drive DC bus voltage is too high 220V series : 420V 1. Power supply voltage has exceeded the permissible input voltage. 2. Disconnection of the regeneration discharge resistor 3. External regeneration discharge resistor is not appropriate and could not absorb the regeneration energy. 4. Failure	Measure the voltage between lines of connector (L1, L2 and L3). 1. Enter correct voltage. 2. Measure the resistance of the internal regeneration resistor. 3. please measure the external resistor, Replace the external resistor if the value is ∞. 4. Please contact MOONS or replace the driver with a new one.
r04HC r05LC r06rC	Over current	1. Failure of servo driver (failure of the circuit, IGBT or other components) 2. Short of the motor wire (U, V and W) 3. Burnout of the motor 4. Poor contact of the motor wire. 5. Input pulse frequency is too high. 6. Motor is over load, command output torque is larger than maximum torque, for a long operating time. 7. Poor gain adjustment cause motor vibration, and abnormal nosie. 8. Machine has collided or the load has gotten heavy. Machine has been distorted. 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. 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. 3. Measure the insulation resistance between motor wires, U, V and W and earth wire. In case of poor insulation, replace the motor. 4. Check the balance of resister between each motor line, and if unbalance is found, replace the motor. 5. Check the loose connectors. If they are, or pulled out, fix them securely. 6. Adjust gain value settings. 7. Measuring brake voltage 8. Check drive and motor encoder and power wires. 9. please contact MOONS.
r08Hb	Bad hall sensor	Hall sensor fault	1. please check encoder connection 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). 2. Please check drive gain value settings. 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 2. Lack of power capacity...Power supply voltage has fallen down due to inrush current at the main power-on. 3. Failure of servo driver (failure of the circuit)	Measure the voltage between lines of connector and terminal block L1,L2,L3. 1. Increase the power capacity. Change the power supply. 2. Please check connections between L1,L2,L3. Please refer to 4.2 3. Please contact 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. 1. Avoid high velocity command 2. Check the command pulse input frequency and division/multiplication ratio. 3. Make a gain adjustment when an overshoot has occurred due to a poor gain adjustment. 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. 2. Check x3 and x4 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. 2. Check x3 and x4 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) 1. Load was heavy and actual torque has exceeded the rated torque and kept running for a long time. 2. Oscillation and hunching action due to poor gain adjustment. Motor vibration, abnormal noise. 3. Machine has collided or the load has gotten heavy. Machine has been distorted.	1. Make a gain re-adjustment. 2. Increase the capacity of the driver and motor. Set up longer acceleration/deceleration time. Lower the load. 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. 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. Please check Safety sensor setting.
r2 1rF	Regeneration failed	Regenerative energy has exceeded the capacity of regenerative resistor. 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 the lack of capacity of absorbing this energy of the regeneration discharge resistor. 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. 2. Please check external regeneration resistor connections. 3. Reduce rotary velocity and decrease acceleration and deceleration value.
r22uV	Low voltage	Drive voltage lower than 170VDC 1) Power supply voltage is low. Instantaneous power failure has occurred 2) Lack of power capacity...Power supply voltage has fallen down due to inrush current at the main power-on. 3) Failure of servo driver (failure of the circuit)	1) Increase the power capacity. Change the power supply. 2) Please check I1, I2, I3 power connections, please refer to 4.2 P1 drive power connection. 3) please contact moons.
r239E	Q program is empty	Drive in Q mode, but Q program is empty.	1. Please check Q program. 2. Please check operation mode correction. 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	

Disclaimer

The information in this manual was accurate and reliable at the time of its release. MOONS' reserves the right to change the specifications of the product described in this manual without notice at any time.

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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	

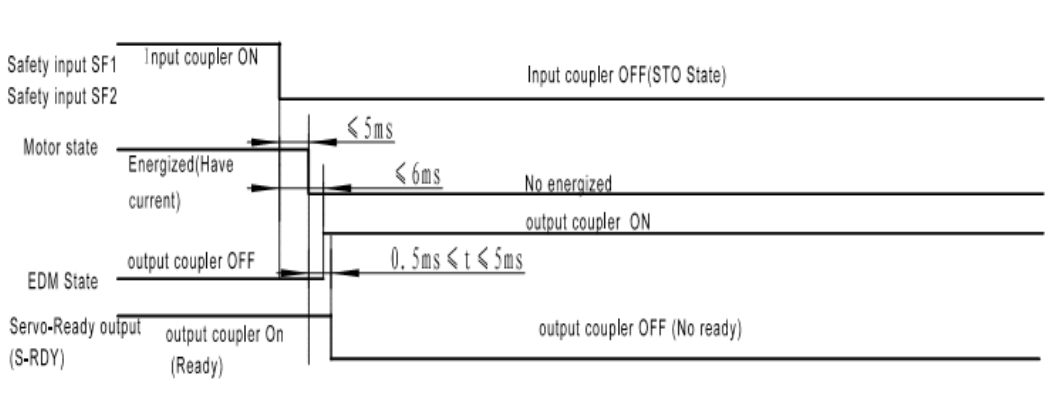
11.2.2 The fault reaction function

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

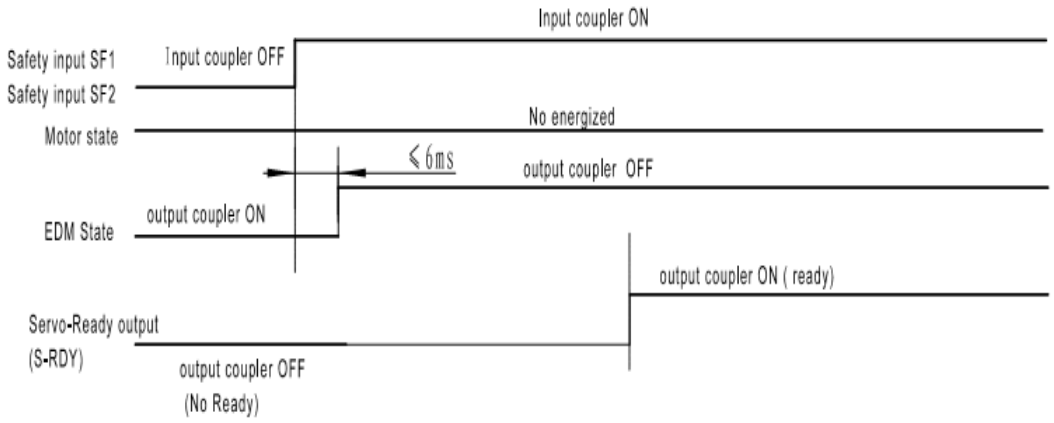
11.2.3 Response time

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  .

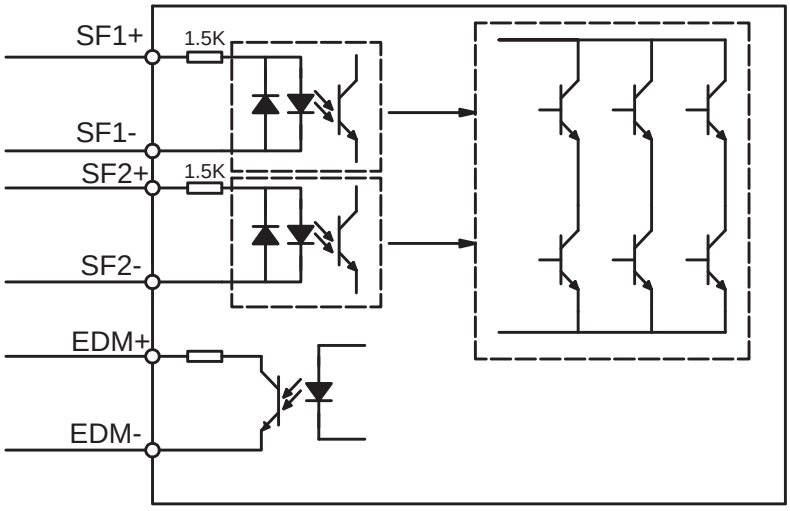
When failure occurrence, you may check the two safety input wiring and terminal block if Loosen or damaged, or contact MOONS'.

11.6 The installation and commissioning guidance

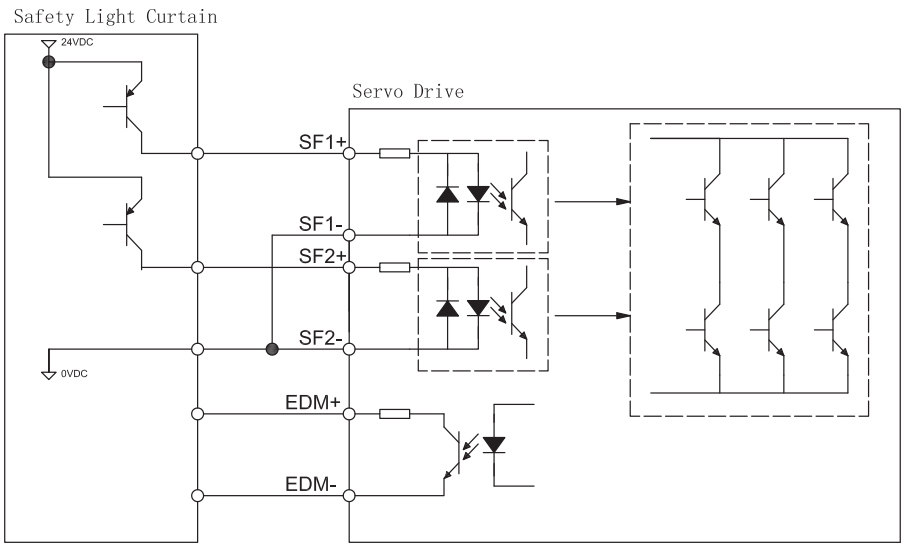
11.6.1 Installation

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 2. Main circuit voltage 3. Damage of the cables 4. Pinching of foreign object at the load 5. Loose connection or misalignment between the motor and machine or equipment.
Annual inspection	1 year	1. Loose tightening 2. Trace of overheat 3. Damage to STO terminal block 4. SF1 safety input circuit function if work normal 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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