

M2 Series AC Servo

User Manual



SHANGHAI AMP&MOONS' AUTOMATION CO.,LTD.

Content

1 Introduction	8
1.1 About This Manual	8
1.2 Documentation Set for M2 series AC servo	8
1.3 Safety	8
1.4 Safety Symbols	8
1.5 Safety Instructions.....	9
1.6 Standards Compliance	9
2. Product Description.....	10
2.1 Unpacking Check	10
2.2 Servo Drive Model Introduction	10
2.2.1 Drive Name Plate Description	10
2.2.2 Drive Model Description	11
2.2.3 Drive specification	12
2.2.4 Drive Dimensions (Unit: mm)	13
2.2.4.1 50W 100W 200W Type	13
2.2.4.2 400W Type	13
2.2.4.3 750W Type	13
2.3 Servo Motor Model Introduction	14
2.3.1 Motor Name Plate Description	14
2.3.2 Motor Model Description	14
2.3.3 Motor Specification And Dimension.....	15
2.3.3.1 □40mm Specification and Dimension	15
2.3.3.2 □60mm Specification and Dimension	17
2.3.3.3 □80mm Specification and Dimension	19
2.4 Servo Drive and Servo Motor Combinations	21
2.5 System Configuration	22
3. Installation.....	23
3.1 Storage Conditions.....	23
3.2 Installation Conditions	23
3.3 Drive Dimensions (Unit: mm)	24
3.3.1 50W 100W 200W Type	24
3.3.2 400W Type	24
3.3.3 750W Type	24
3.4 Installation Space	25
3.5 Motor Installation.....	26
4. Connections and Wiring.....	27
4.1 Connecting to Peripheral Devices.....	27
4.1.1 System Configuration	27
4.1.2 Servo Drive Connectors and Terminals.....	28
4.1.3 Connections and Wiring Notes.....	28

4.1.4 Wiring Methods For Power supply P1	29
4.1.4.1 Single-Phase Power Supply Connection (AC220V)	29
4.1.4.2 Three-Phase Power Supply Connection (AC220V)	30
4.2 Wiring to the Connector, P2	31
4.2.1 Motor Power Cable Configuration	31
4.2.2 Motor Power Cable Connector Specifications	31
4.2.3 Wiring Diagram Of Motor Extend Cable	32
4.3 Encoder Connector CN3	32
4.3.1 Motor Encoder Feedback Cable Configuration	32
4.3.2 The Layout of CN3 Connector	33
4.3.3 Connect to Motor Encoder	33
4.3.4 Specifications of Encoder Connector	34
4.3.5 Wiring Diagram of Motor Encoder Extend Cable	35
4.4 Electromagnetic Brake	36
4.4.1 Wiring Diagram.....	36
4.4.2 Notice for the Brake Motor	36
4.4.3 The Timing Charts Of The Electromagnetic Brake	37
4.5 Regenerative Resister.....	38
4.6 Recommend Cable Specifications	38
4.7 Connect to Host Computer, CN1.....	39
4.8 Input and Output Signal Interface Connector, CN2.....	39
4.8.1 Input and Output Interface Specifications and Diagram.....	39
4.8.2 Signals Description of Connector CN2.....	41
4.8.2.1 The Layout of CN2 Connector	41
4.8.2.2 Input Signals	41
4.8.2.3 Inputs Function List.....	43
4.8.2.4 Output Signals	43
4.8.2.5 Outputs Function List.....	44
4.8.3 Input Signal Interface Connector, CN2.....	44
4.8.3.1 Position pulse signal input	44
4.8.3.2 Analog Signal Input For Velocity And Torque Mode	46
4.8.3.3 High Speed Input Port X1,X2,X3,X4	47
4.8.3.4 General Digital Input X5、X6、X7、X8	49
4.8.3.5 X9、X10、X11、X12 Input With Common Com Port.....	51
4.8.4 CN2 Output Signal Specification	53
4.8.4.1 CN2 Output Signal Diagram	53
4.8.4.2 Y1、Y2、Y5、Y6 Output Connection Diagram	53
4.8.4.3 Y3、Y4 Connection Examples	54
4.8.5 Encoder Feedback Output	54
4.8.5.1 A/B/Z Connection Diagram	54
4.8.5.2 Z Phase Open Collector Output.....	54
4.9 STO Connector	55
4.9.1 Safety Precautions	55

4.9.2 STO Input/Output Signals	55
4.9.2.1 STO Internal Circuit Diagram	55
4.9.2.2 CN5 Connector diagram.....	55
4.9.2.3 STO Signal Definition	56
4.9.2.4 STO Connection Diagrams	56
4.10 EMC Control.....	57
4.10.1 Noise filter	57
4.10.2 Recommended EMI noise filter	58
4.10.3 Clamp noise filter for cable.....	58
4.10.4 Recommended clamp noise filter	58
5. Display and Operation	59
5.1 Description of Control Panel.....	59
5.2 Mode Switch Control	59
5.3 LED display description.....	61
5.3.1 Decimal Point And Negative Sign Description.....	61
5.3.2 Parameter View Setting.....	61
5.3.3 Parameter Save Setting	61
5.3.4 Point To Point Motion Mode	61
5.3.5 Jog Mode.....	62
5.3.6 Control Panel Lock.....	62
5.4 Status Monitoring Selection Mode.....	62
5.5 Function Mode Control.....	64
5.5.1 Function Mode Description.....	64
5.5.2 Operation Flow Chart	65
5.6 Parameter Setting Mode	66
5.6.1 Parameter Setting Description	66
5.6.2 Parameter Editing Examples.....	67
5.7 Control Panel Lock.....	68
5.8 Warning And Fault Display	68
6. Preoperational mode.....	70
6.1 Inspection Before Trail Run	70
6.2 Trail Run Procedure	70
6.3 Motor Configuration Manually	71
6.3.1 Use Drive Control Panel To Setup.....	71
6.3.2 Use Software To Config Motor	72
6.4 Operations of JOG Mode	73
6.5 Configuration by Personal Computer	74
7. Operation Mode Selection	75
7.1 General Function Setting.....	75
7.1.1 Drive Servo on settings	75
7.1.2 Alarm Reset.....	76
7.1.3 CW/CCW limit	77

7.1.4 Global Gain Switch Function	78
7.1.5 Control Mode Switch	79
7.1.6 Drive On Fault Output	80
7.1.7 Motor Brake Control	81
7.1.8 Servo Ready Output	82
7.2 Position Mode	82
7.2.1 Digital Pulse Position Mode Connection Diagram.....	83
7.2.2 Input Pulse Type And Input Noise Filter	83
7.2.2.1 Input Pulse Type Setting	84
7.2.2.2 Input Noise Filter Setting.....	84
7.2.2.3 Parameter P-43 (SZ) Setting	85
7.2.3 Control Pulse Dividing Switch Function.....	86
7.2.4 Pulse Inhibition Function	87
7.2.5 Electronic Gearing Ratio	87
7.2.6 Jerk Smoothing Filter	88
7.2.7 In Position Error Output.....	89
7.2.8 Gain Parameters For Position Control Mode	89
7.2.9 Software Configuration For Position Mode.....	90
7.3 Velocity Mode	91
7.3.1 Velocity Mode Connection Diagram	92
7.3.2 Parameter Settings For Analog Velocity Control Mode	93
7.3.3 Basic Settings For Analog Velocity Control Mode	93
7.3.3.1 Command Signal For Analog Velocity Mode.....	93
7.3.3.2 Analog Velocity Gain	94
7.3.3.3 Analog Input Voltage Offset	95
7.3.3.4 Analog Input Deadband	96
7.3.3.5 Run/Stop And Direction Signal	97
7.3.3.6 Torque Limit	98
7.3.3.7 Target Velocity Reach	99
7.3.4 Analog Input Filter	100
7.3.5 Software Configuration For Analog Velocity Mode	101
7.4 Torque Mode	102
7.4.1 Analog Torque Mode Connection Diagram.....	103
7.4.2 Parameters For Analog Torque Mode	104
7.4.3 Basic Settings For Analog Torque Mode	104
7.4.3.1 Command Signal For Analog Torque Mode	104
7.4.3.2 Analog Torque Gain	105
7.4.3.3 Analog Input Offset	106
7.4.3.4 Analog Deadband	106
7.4.3.5 Run/Stop and Direction signal	107
7.4.3.6 Velocity Limit	107
7.4.3.7 Torque Reach	108
7.4.4 Software Configuration For Analog Torque Mode	109

7.5 Position Table Mode Instruction	110
7.5.1 Linear motion.....	110
7.5.1.1 Linear Motion Software Configuration	110
7.5.1.2 Basic Configuration	112
7.5.1.3 Homing settings:.....	112
7.5.1.4 Print	113
7.5.1.5 Position Definition.....	113
7.5.1.6 Simulate	114
7.5.1.7 Linear motion input definition	114
7.5.2 Rotary motion	115
7.5.2.1 Rotary motion software configuration.....	115
7.5.2.2 Rotary motion input definition.....	116
8. Parameters and Functions	117
8.1 Parameter Category.....	117
8.2 Parameter List.....	118
8.3 Parameter Description.....	122
9. Communication	144
9.1 RS-232 communication	144
9.1.1 What is SCL.....	144
9.1.2 RS-232 Connections	144
9.2 RS-485 Communication	144
9.2.1 RS-485 PIN definition	145
9.2.2 RS-485 Connection Method	145
9.3 ModBUS/RTU Communication.....	146
9.3.1 Data Encode.....	146
9.3.2 Communication Address	147
9.3.3 Communication Baud Rate And Framing	147
9.3.4 Power Up Mode	147
9.3.5 Modbus/RTU Data Framing	147
9.3.6 M2 Series AC Servo Drive Register Address And Function List:.....	148
9.3.7 Command Opcode description.....	154
9.3.8 Function Code	155
9.3.8.1 Function Code 0X03, Reading Multiple Holding Registers	155
9.3.8.2 Function Code 0x06, Writing Single Register	156
9.3.8.3 Function Code 0X10, Writing Multiple Registers	157
9.3.9 Modbus/RTU Applications	158
9.3.9.1 Position Control	158
9.3.9.2 JOG mode.....	161
9.4 CANopen Communication.....	164
9.4.1 RJ45(8p8c)Pin Definitions.....	164
9.4.2 CANopen NODE-ID.....	164
9.4.3 CANopen Communication Baud Rate	164
10.Trouble Shooting.....	165

10.1 Drive Alarm List	165
11. STO function	169
11.1 Operation and maintenance procedures	169
11.1.1 The replacement of components	169
11.1.2 Prevent hazardous event	169
11.1.3 Maintenance procedures of STO faults or failures	169
11.1.4 Commissioning and testing	169
11.2. The implementation of Safety Functional	170
11.2.1 Safety Functional Specification	170
11.2.1.1 Safety input Signal	170
11.2.1.2 External device monitor (EDM)output signal	170
11.2.2 The fault reaction function	170
11.2.3 Response time.....	170
11.2.3.1 Operating timing chart for safety status	170
11.2.3.2 Return timing from safety state:	171
11.2.4 Safety function activated or prohibit	171
11.2.5 STO function as the highest priority.....	171
11.3 The safety integrity information	171
11.4 The environmental and operating conditions for safety function	171
11.4.1 The environmental and operating conditions.....	171
11.5. Safety function constraints	172
11.5.1 Failure rate	172
11.5.2 Mission time and proof test	172
11.5.3 Testing, calibration or maintenance requirements	172
11.5.4 Avoiding the systematic failure	172
11.5.5 SIL capability	172
11.5.6 Identify the hardware and software configuration.....	172
11.6 The installation and commissioning guidance	173
11.6.1 Installation	173
11.6.1.1 Example of connection to safety switch	173
11.6.1.2 Example of connection to safety Light Curtain.....	173
11.6.2 commissioning.....	174
11.7. The requirements for configuration test of safety functions,.....	174
11.7.1 General and normal running condition	174
11.7.2 Safety relevant parameters and their values	174
11.7.3 The test procedures of safety functions.....	174
11.7.4 The description of the safety related components.....	175
Appendix	176

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 resistor during operation as they may become hot.
	DO NOT hold the motor cable during the transportation or mounting.

Wiring

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

1.6 Standards Compliance

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

* Electromagnetic compatibility
Standard EN 61800-3 (2004)

* Electrical Safety: Low voltage directive
Standard IEC 61800-5-1 (2007)

2. Product Description

2.1 Unpacking Check

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

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

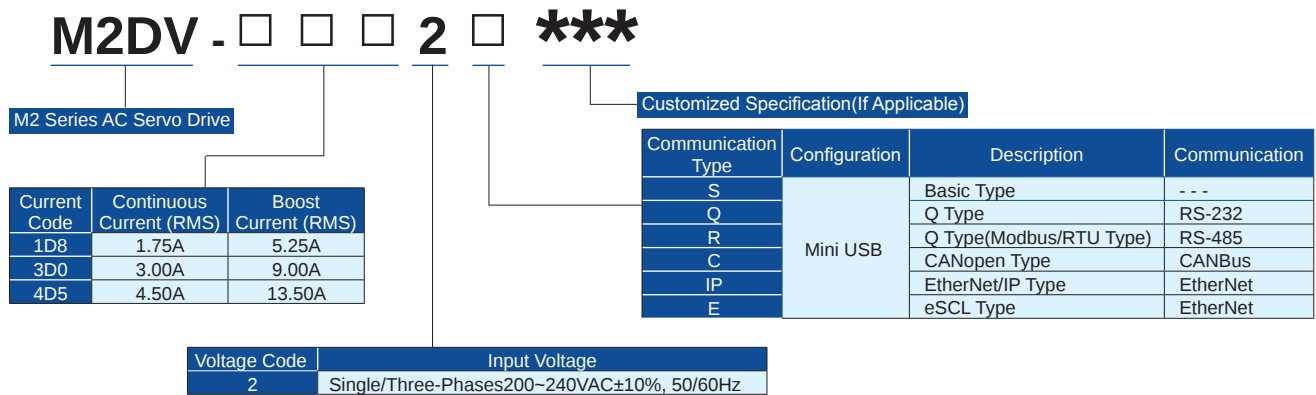
1. Matched Servo drive and Servo motor
2. A power cable connect the drive to the servo motor(Optional)
3. An feedback encoder cable connect the drive to the motor (Optional)
4. A mini USB cable connect the port CN1 to PC for communication.(Optional)
5. 50-PIN connector (For I/O connections, Port CN2)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

2.2 Servo Drive Model Introduction

2.2.1 Drive Name Plate Description

   Designed in California by  Applied Motion Products Assembled in China			
M2 AC SERVO DRIVE Model No. XXXX-XXXXX Serial No. 09450001			
Model No.			
Input/Output Voltage	VOLT.	200-240VAC	0-240VAC
Phase	PHASE	1 ϕ /3 ϕ	3 ϕ
Rated Current	F.L.C	2.6 A/1.5A	1.8 A
Frequency	FREQ.	50/60Hz	0-400Hz
Rated Power	POWER		200W

2.2.2 Drive Model Description

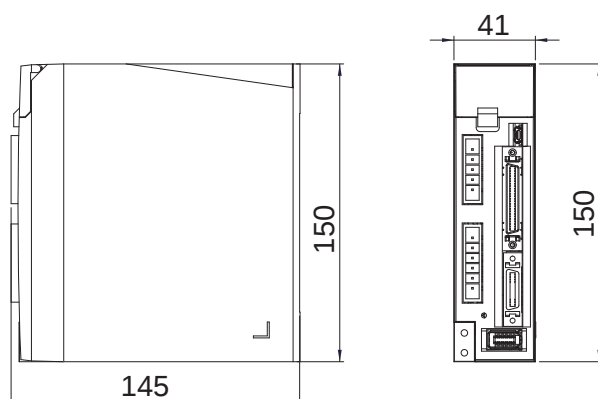


2.2.3 Drive specification

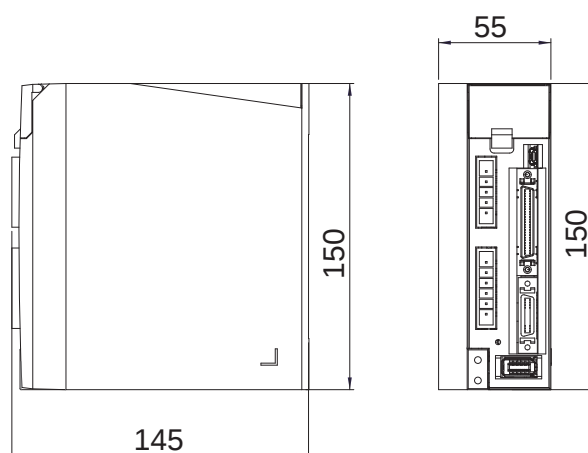
Basic Specification	Input Power	200W	Main Circuit	Single/3-phase, 200 - 240V ±10%, 50/60Hz
			Control Circuit	Single phase, 200 - 240V ±10%, 50/60Hz
		400W	Main Circuit	Single/3-phase, 200 - 240V ±10%, 50/60Hz
			Control Circuit	Single phase, 200 - 240V ±10%, 50/60Hz
		750W	Main Circuit	Single/3-phase, 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		1g
	Control method			IGBT PWM Sinusoidal wave drive
	Encoder feedback			2500 line incremental encoder 15-wire or 9-wire
	I/O	Control Signal	Input	8 Configurable Optically isolate digital general inputs, 5-24VDC, max input current 20mA 4 Configurable Optically isolate digital high speed inputs, 5-24VDC, max input current 20mA
			Output	5 Configurable optically isolated digital outputs, 30VDC, max output current 30mA One motor brake control output, 30VDC 100mA max
		Analog signal	Input	2 inputs (12Bit A/D:2 input)
		Pulse signal	Input	2 inputs (Photo-coupler input, Line receiver input) Photocoupler input is compatible with both line driver I/F and open collector I/F. Line receiver input is compatible with line driver I/F.
			Output	4 outputs (Line driver: 3 outputs, open collector: 1 outputs)
	Communication	USB Mini		Connection with PC or 1:1 communication to a host.
		RS232		RS-232 Communication
		RS485		RS-485 Communication
		CAN bus		CANopen Communication
		Ethernet		EtherNET/IP, eSCL
	Front panel			1. 4 keys (MODE, UP, DOWN, SET) 2. LED (5-digit)
	Regeneration Resistor			Built-in regenerative resistor (external resistor is also enabled.)
	Control mode			(1) Position mode (2) Analog Velocity mode (3) Analog Position mode (4) Position mode (5) Velocity Change mode (6) Command Torque mode (7) Command Velocity mode
		Control input		(1) Servo-ON input (2) Alarm clear input (3) CW/CCW Limit (4) Pulse& Direction or CW/CCW input (5) Gain Switch (6) Control mode Switch (7) Pulse Inhibition (8) General Input
		Control output		(1) Alarm output (2) Servo-Ready output (3) External brake release (4) Speed arrival output (5) Torque arrival output (6) Tach Out (7) General Output (8)Position arrival output

2.2.4 Drive Dimensions (Unit: mm)

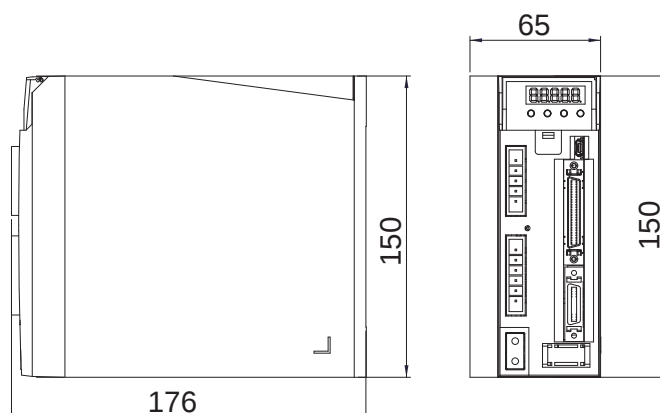
2.2.4.1 50W 100W 200W Type



2.2.4.2 400W Type



2.2.4.3 750W Type

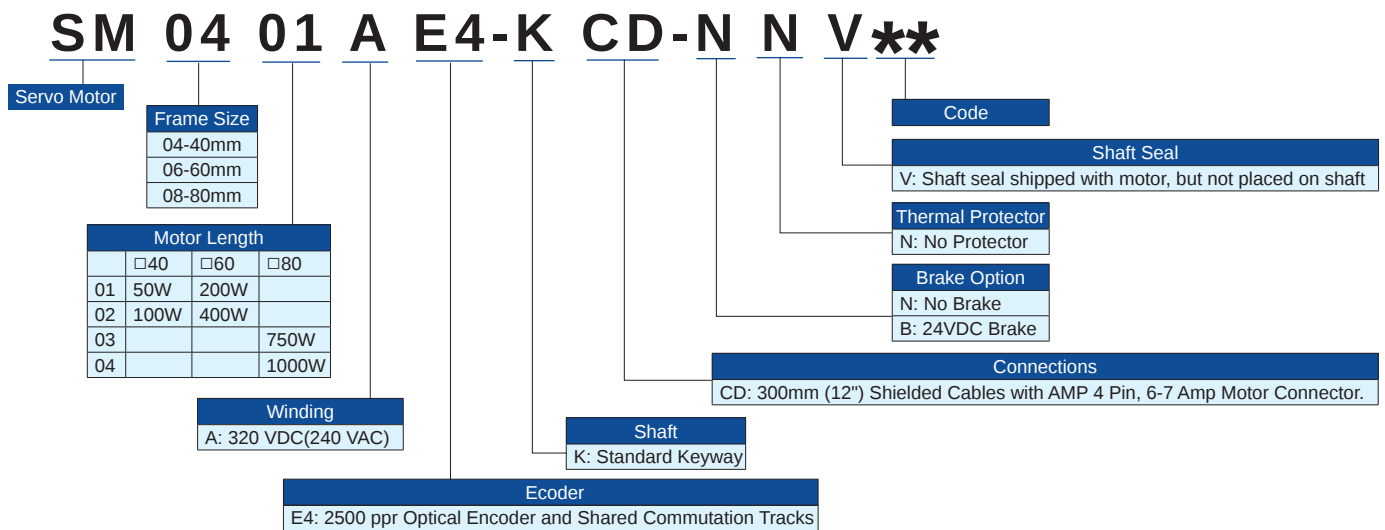


2.3 Servo Motor Model Introduction

2.3.1 Motor Name Plate Description

MOONS'		
AC SERVO MOTOR		
Model NO.	Model NO.SM0602AE2-KCD-NNV15	
Series NO.	Ser NO.	12110027
Rated Torque	Rated Torque	1.27N·m
Input Current	Input	3ØAC 220V 2.8A
Output Power	Output	400W
Rated Speed	Rated Rev.	3000r/min

2.3.2 Motor Model Description



2.3.3 Motor Specification And Dimension

2.3.3.1 □40mm Specification and Dimension

□ 40mm Series



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

□ 40mm Series

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

Shaft Load: (L₁₀ life, 20,000 hours, 2,000 RPM)

2.3.3.2 □60mm Specification and Dimension

□ 60mm Series



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

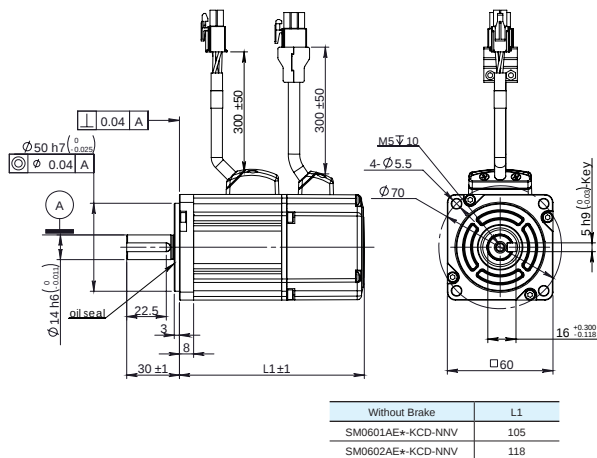
□ 60mm Series

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

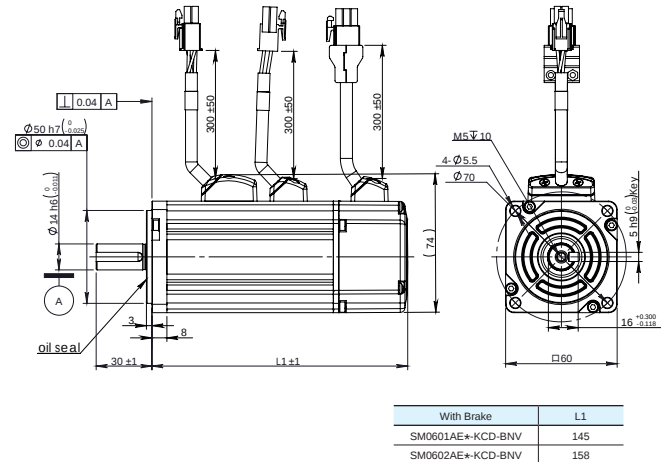
Shaft Load: (L₁₀ life, 20,000 hours, 2,000 RPM)

□ 60mm Dimension

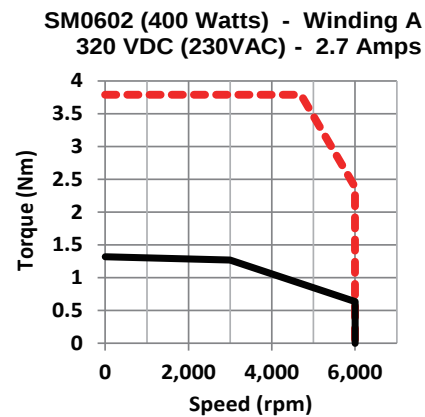
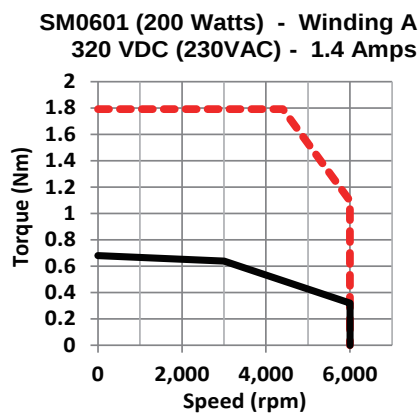
1) Motor Dimensions – No Brake: mm



2) Motor Dimensions – Brake: mm



□ 60mm Torque curve



----- Max. Intermittent Torque
————— Max. Continuous Torque

2.3.3.3 □80mm Specification and Dimension

□ 80mm Series



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

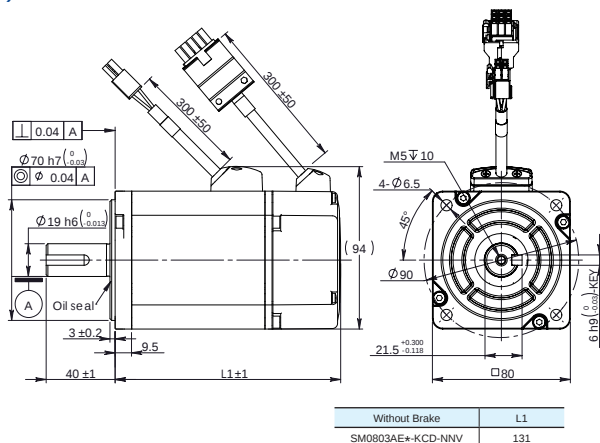
□ 80mm Series

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

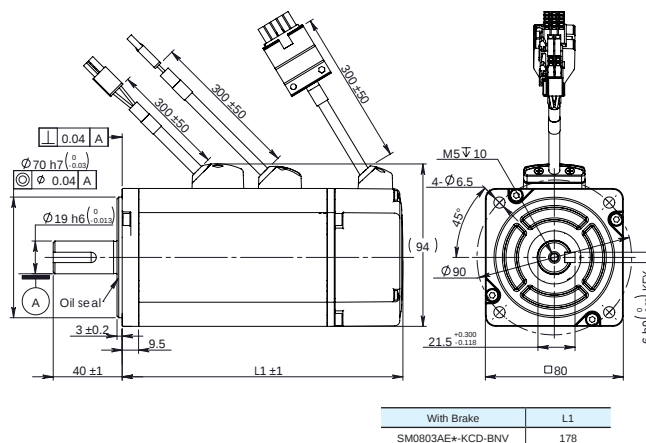
Shaft Load: (L₁₀ life, 20,000 hours, 2,000 RPM)

□ 80mm Dimension

1) Motor Dimensions – No Brake: mm

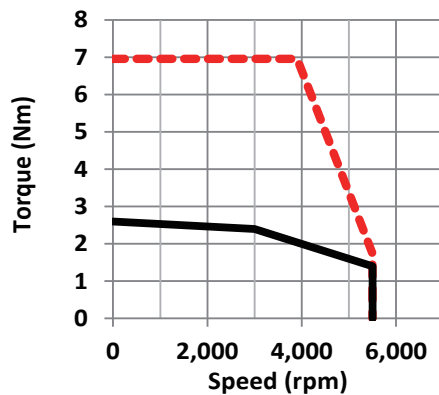


2) Motor Dimensions – Brake: mm



□ 80mm Torque Curve

SM0803 (750 Watts) - Winding A
320 VDC (230VAC) - 4.5 Amps

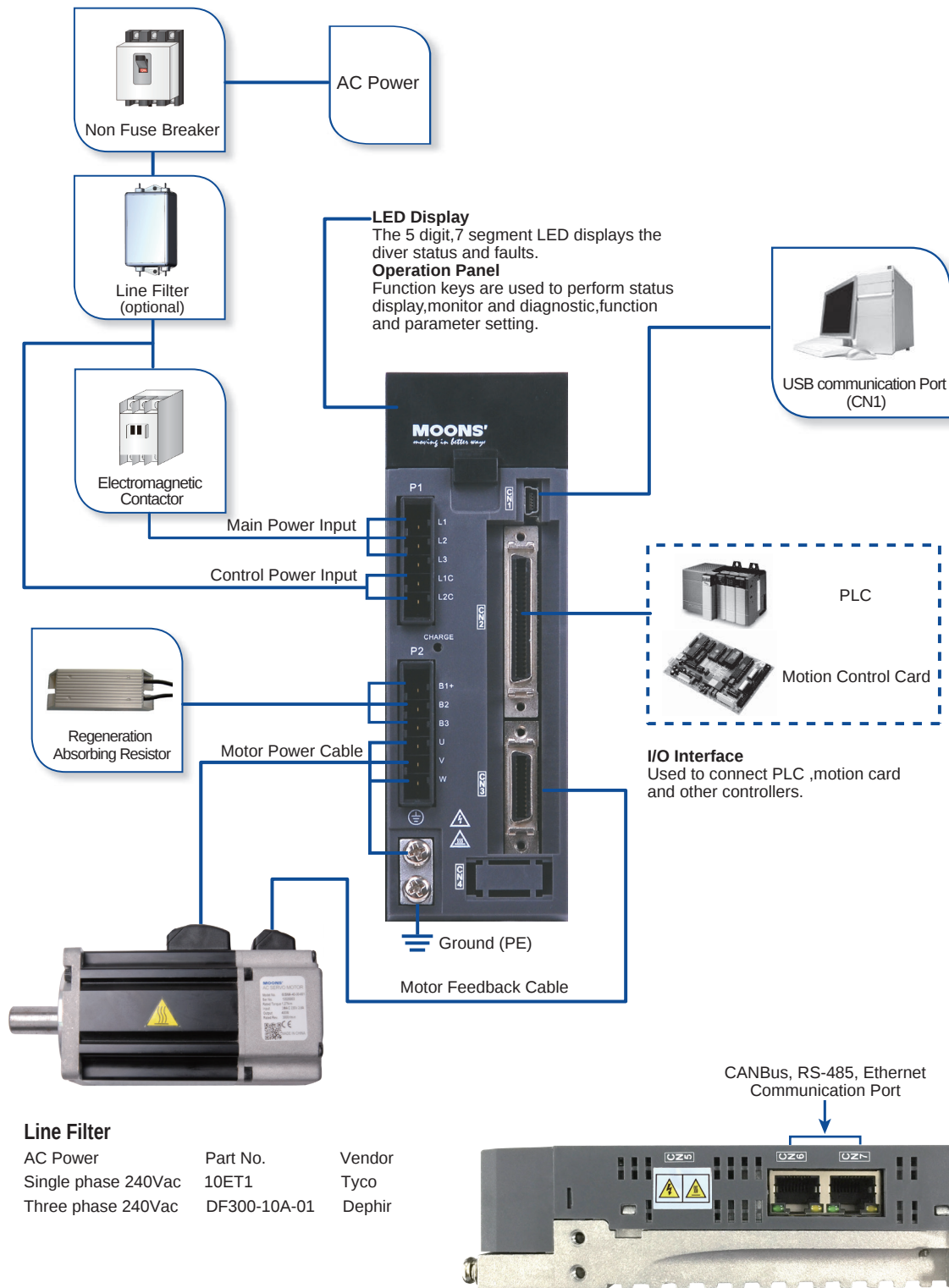


----- Max. Interimittent Torque
————— Max. Continuous Torque

2.4 Servo Drive and Servo Motor Combinations

Specification				50W	100W	200W	400W	750W
				Motor Model Numbers				
AC Servo Motor	2500ppr Increment Encoder (9PIN AMP connector)	Without Brake		SM0401AE4-KCD-NNV09	SM0402AE4-KCD-NNV09	SM0601AE4-KCD-NNV09	SM0602AE4-KCD-NNV09	SM0803AE4-KCD-NNV09
		With Brake		SM0401AE4-KCD-BNV09	SM0402AE4-KCD-BNV09	SM0601AE4-KCD-BNV09	SM0602AE4-KCD-BNV09	SM0803AE4-KCD-BNV09
	Rated Speed	(RPM)		3000				
	Maximum Speed	(RPM)		6000				
	Rated Torque	(N·m)		0.19	0.32	0.64	1.27	2.4
	Maximum Torque	(N·m)		0.48	0.93	1.9	3.8	6.9
	Rated Current	(A)		0.7	1.2	1.5	2.75	4.5
	Maximum Current	(A)		1.75	3.6	4.5	8.3	13.5
	Rotor Inertia	Kg·m ²		0.0232×10 ⁻⁴ *0.0298×10 ⁻⁴ (*With Brake)	0.0428×10 ⁻⁴ *0.0494×10 ⁻⁴ (*With Brake)	0.165×10 ⁻⁴ *0.22×10 ⁻⁴ (*With Brake)	0.272×10 ⁻⁴ *0.326×10 ⁻⁴ (*With Brake)	0.89×10 ⁻⁴ *0.97×10 ⁻⁴ (*With Brake)
	Insulation Class			Class B				
	Protection Class			IP65(except shaft through hole and cable end connector)				
	Oil Seal			With Oil seal				
AC Servo Drive				Drive Model Numbers				
	Pulse&Direction Type	USB Mini	Basic Type	M2DV-1D82S	M2DV-1D82S	M2DV-1D82S	M2DV-3D02S	M2DV-4D52S
			Q Type	M2DV-1D82Q	M2DV-1D82Q	M2DV-1D82Q	M2DV-3D02Q	M2DV-4D52Q
	Fieldbus Type	RS-485	SCL	M2DV-1D82R	M2DV-1D82R	M2DV-1D82R	M2DV-3D02R	M2DV-4D52R
			Modbus RTU					
		CAN	CANopen	M2DV-1D82C	M2DV-1D82C	M2DV-1D82C	M2DV-3D02C	M2DV-4D52C
		Ethernet	Ethernet/IP	M2DV-1D82IP	M2DV-1D82IP	M2DV-1D82IP	M2DV-3D02IP	M2DV-4D52IP
			eSCL	M2DV-1D82E	M2DV-1D82E	M2DV-1D82E	M2DV-3D02E	M2DV-4D52E

2.5 System Configuration



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°C to +65°C
- Store within a relative humidity rang of 10% to 85% and non-condensing
- DO NOT store in a place subjected to corrosive gasses

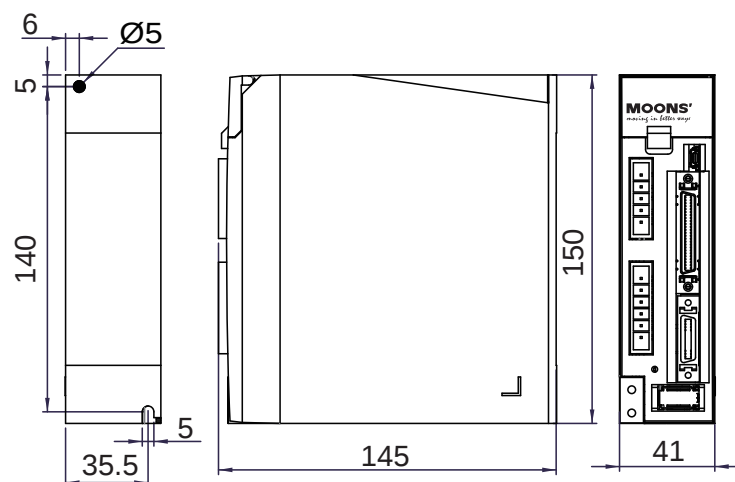
3.2 Installation Conditions

The operation ambient conditions are followed:

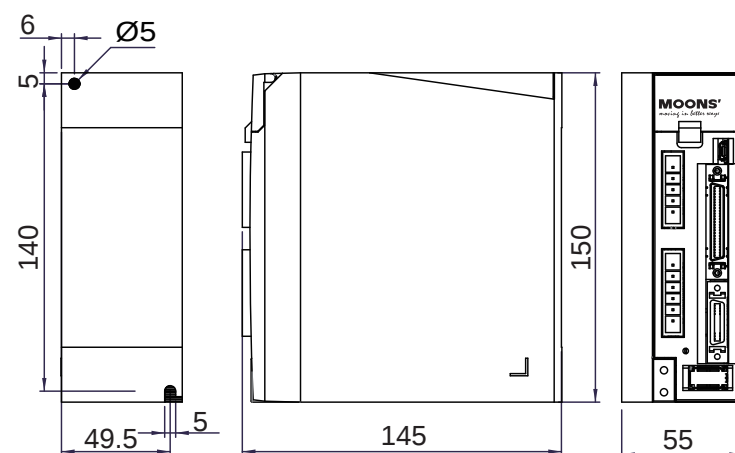
- Temperature range of 0°C to 50°C . If the ambient temperature of servo drive is greater than 45°C , please install the drive in a well-ventilated location.
The ambient temperature of servo dive for long-term reliability should be under 45°C .
- The servo drive and motor will generate heat. If they are installed in a control panel, please ensure sufficient space around the units for heat dissipation.
- Operation within a relative humidity rang of 10%to 93% and non-condensing
- The vibration 1g
- DO NOT mount the servo drive and motor in a location subjected to corrosive gasses or flammable gases, and combustibles.
- Please mount the servo drive and motor to an indoor electric control cabinet without liquid and direct sunlight
- DO NOT mount the servo drive and motor in a location subjected to airborne dust.

3.3 Drive Dimensions (Unit: mm)

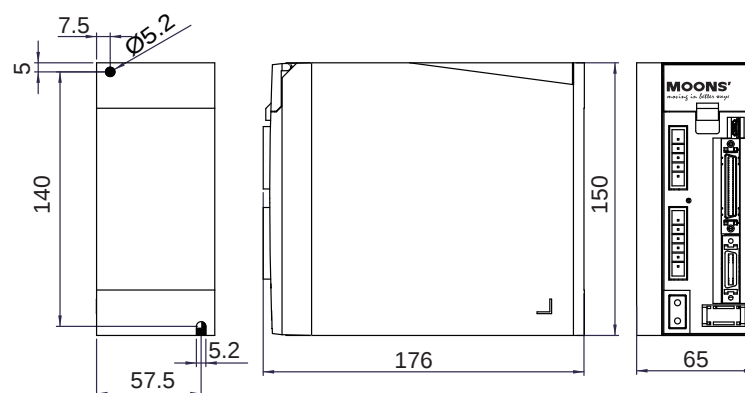
3.3.1 50W 100W 200W Type



3.3.2 400W Type

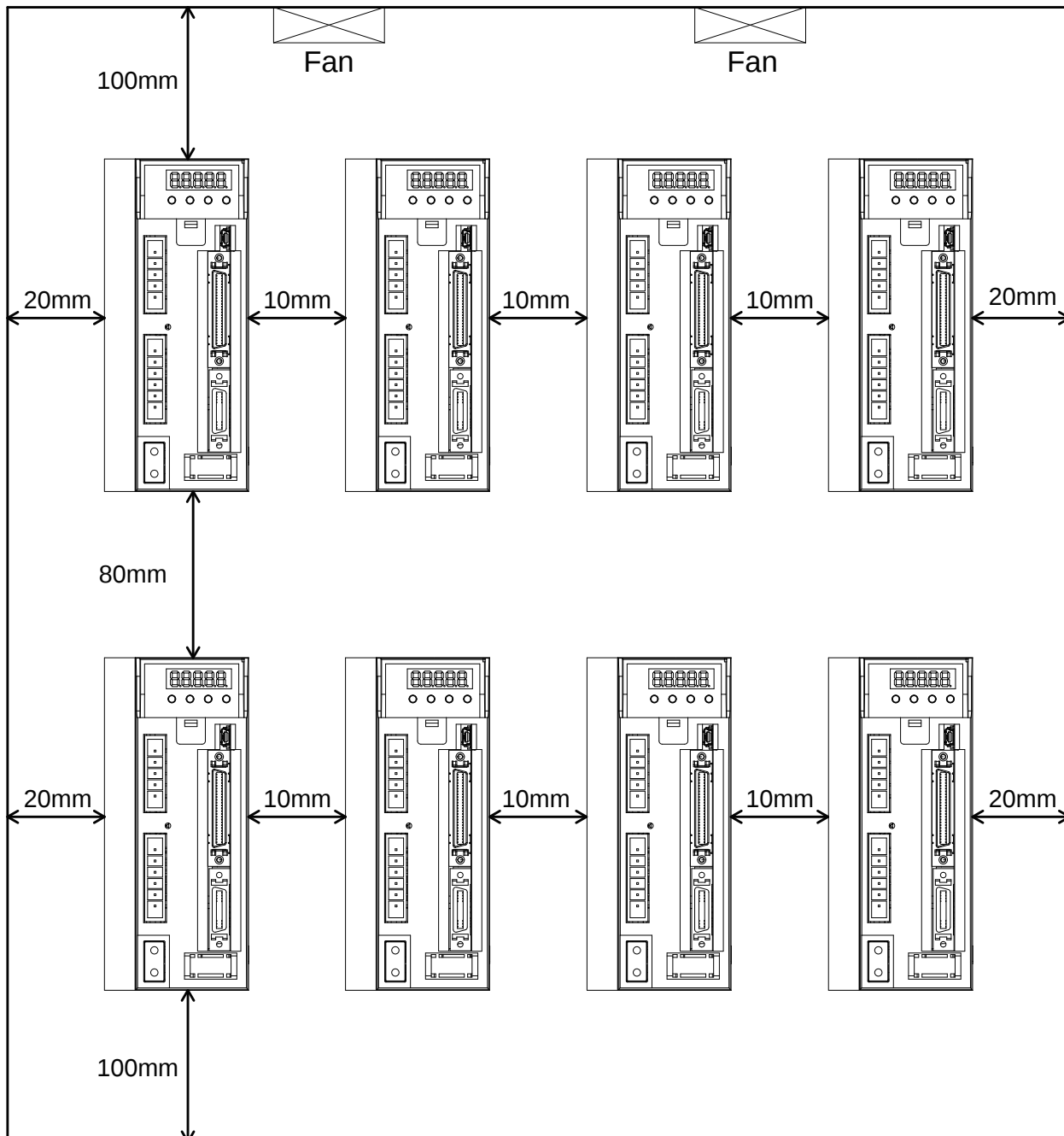


3.3.3 750W Type



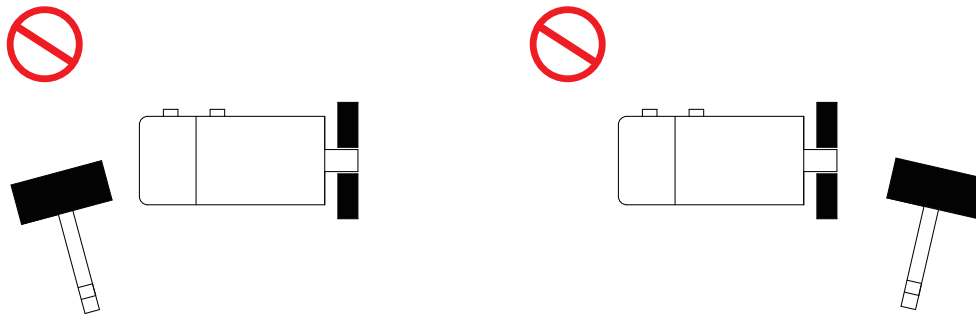
3.4 Installation Space

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



3.5 Motor Installation

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

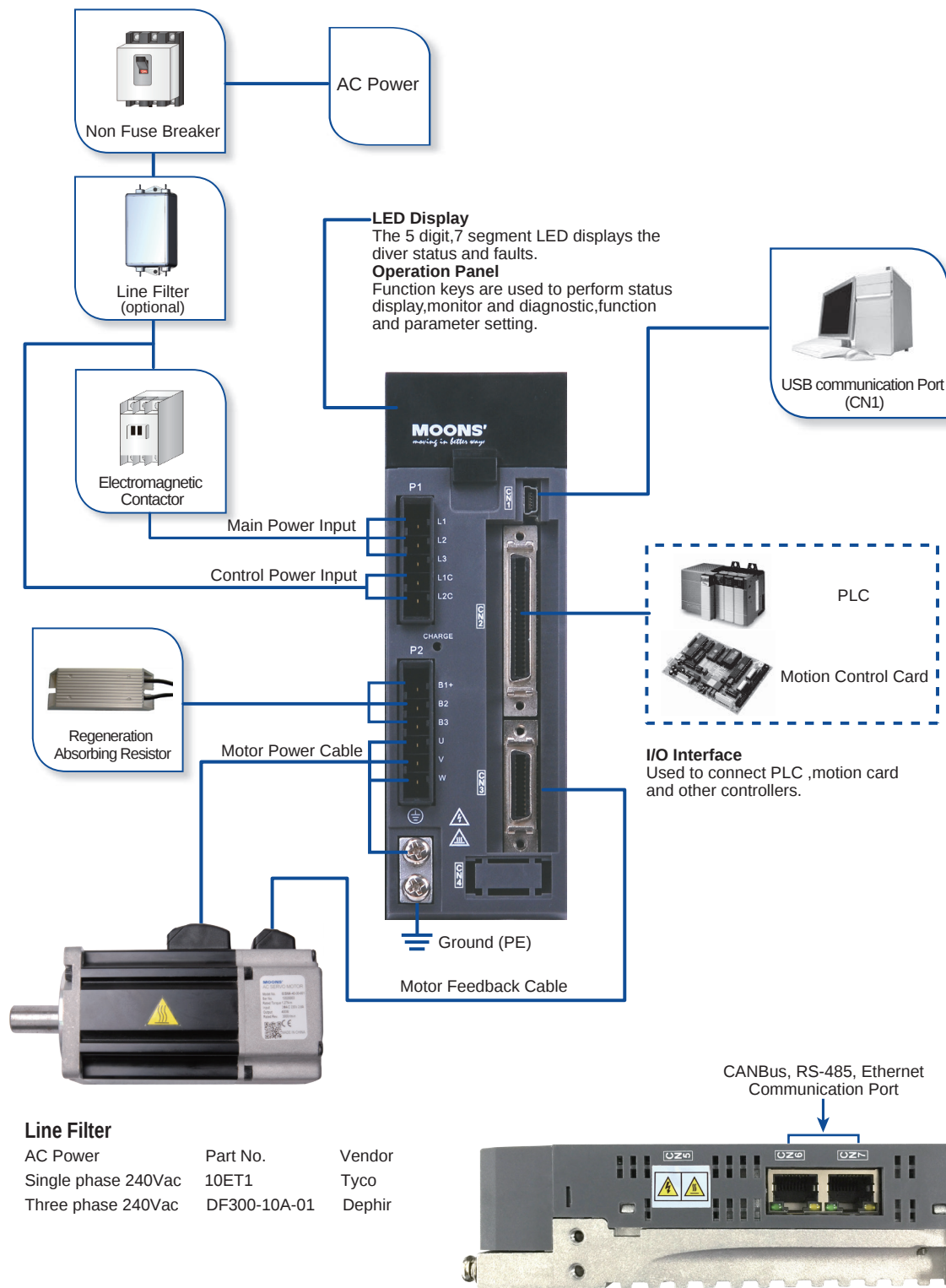


- DO NOT use cables soaked in water or oil.
- Avoid a stress application to the cable outlet and connecting portion by bending.
- Please use flexible cables when using cable carrier, make sure the minimum cable bending diameter is 200mm.
- The shaft through hole and cable end connector is not IP65 design.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

4. Connections and Wiring

4.1 Connecting to Peripheral Devices

4.1.1 System Configuration



4.1.2 Servo Drive Connectors and Terminals

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

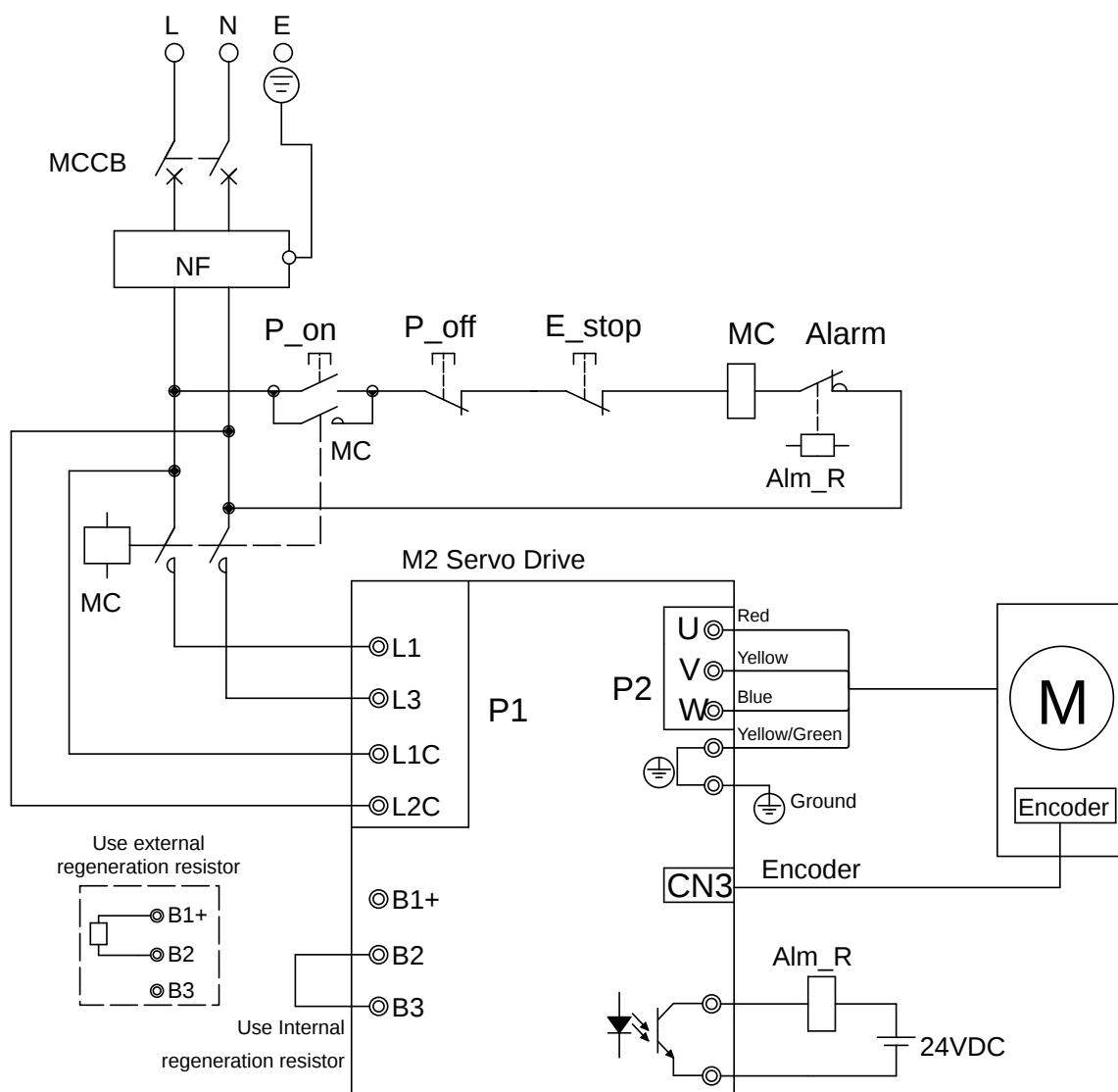
4.1.3 Connections and Wiring Notes

- Please ensure grounding wires are securely connected, wires with more than 2.0mm² 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/BLUE. 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 emergency stop circuitry to switch off the power supply when fault occurs.
- Please DO NOT touch drive or motor's connector terminals 5 minutes after drive and motor is powered off. There are electrical charge components in the circuitry. Therefore, even power is off, there might still be hazardous voltages within the circuitry, before its total discharge.
- Install the encoder cables in a separate conduit from the motor power cables to avoid signal noise. Separate the conduits by 30cm (11.8inches) above.
- Use multi-stranded twisted-pair wires or multi-core shielded-pair wires for signal, encoder feedback cables.
- The maximum length of signal input/output cable is 5 meters, and the maximum length of encoder (PG) feedback cables is 15 meters.

4.1.4 Wiring Methods For Power supply P1

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

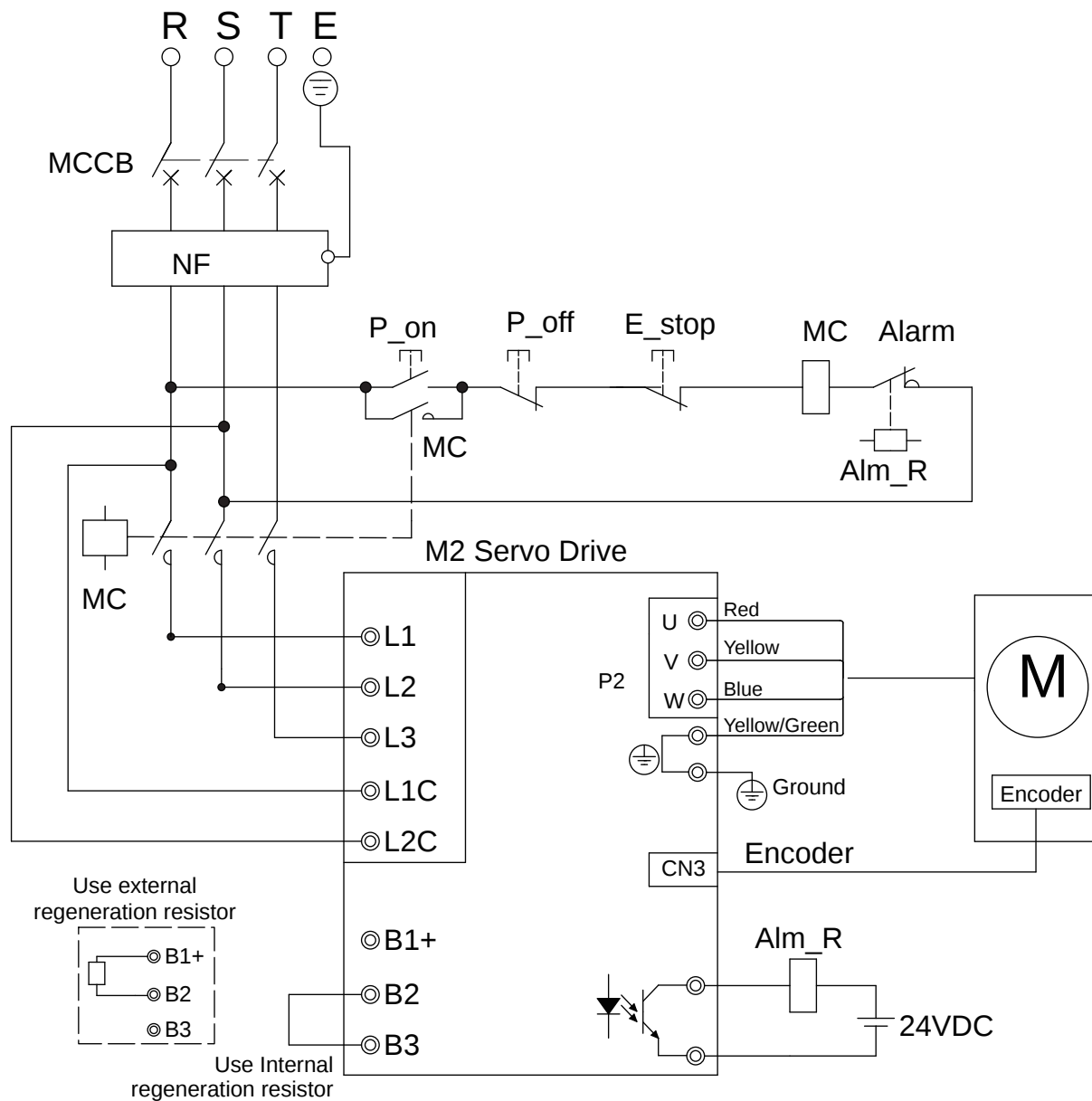
4.1.4.1 Single-Phase Power Supply Connection (AC220V)



Note:

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

4.1.4.2 Three-Phase Power Supply Connection (AC220V)

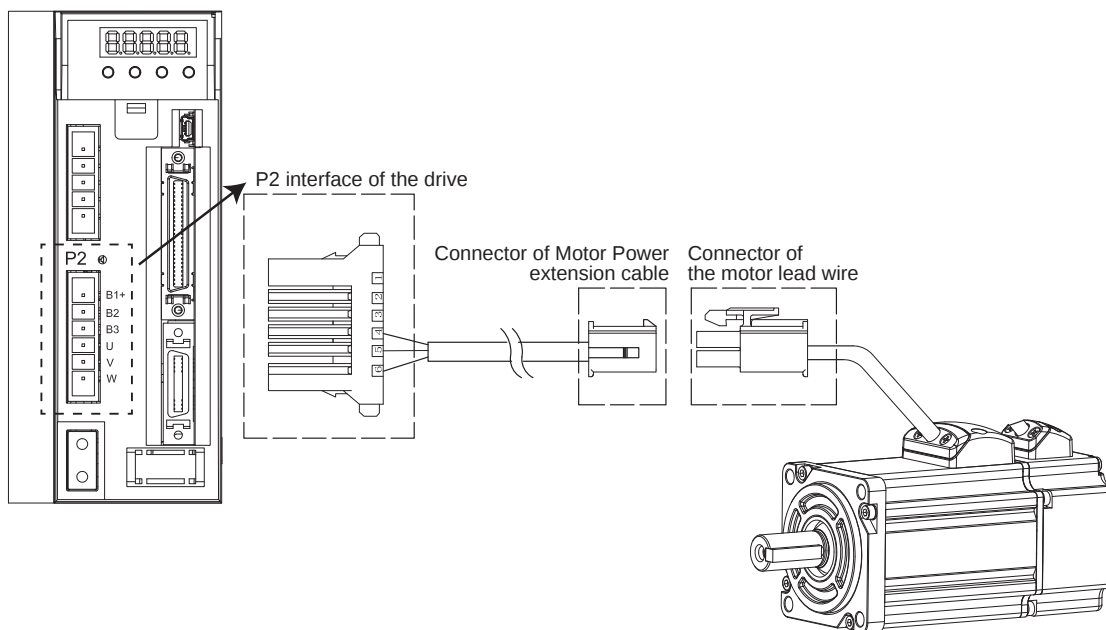


Note:

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

4.2 Wiring to the Connector, P2

4.2.1 Motor Power Cable Configuration

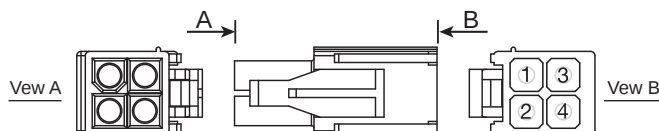


PIN	1	2	3	4
Signal	U	V	W	PE
Colour	Red	Yellow	Blue	Yellow/Green

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

4.2.2 Motor Power Cable Connector Specifications

◆ PIN Assignment

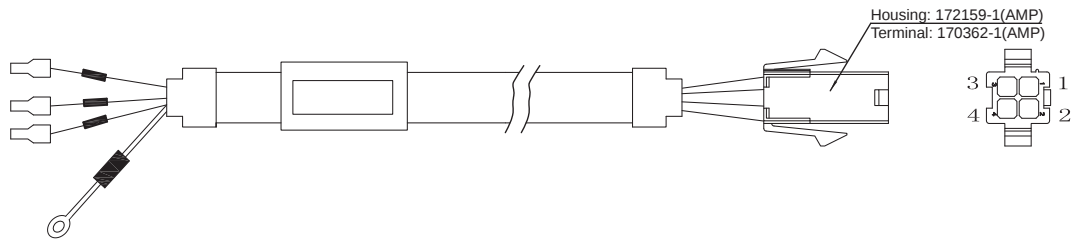


Type	Motor Side(Plug)	Plug-in(Housing)
Housing	AMP 172167-1	AMP 172159-1
Terminal	AMP 170360-1	AMP 170362-1

◆ Model of Motor Connector

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

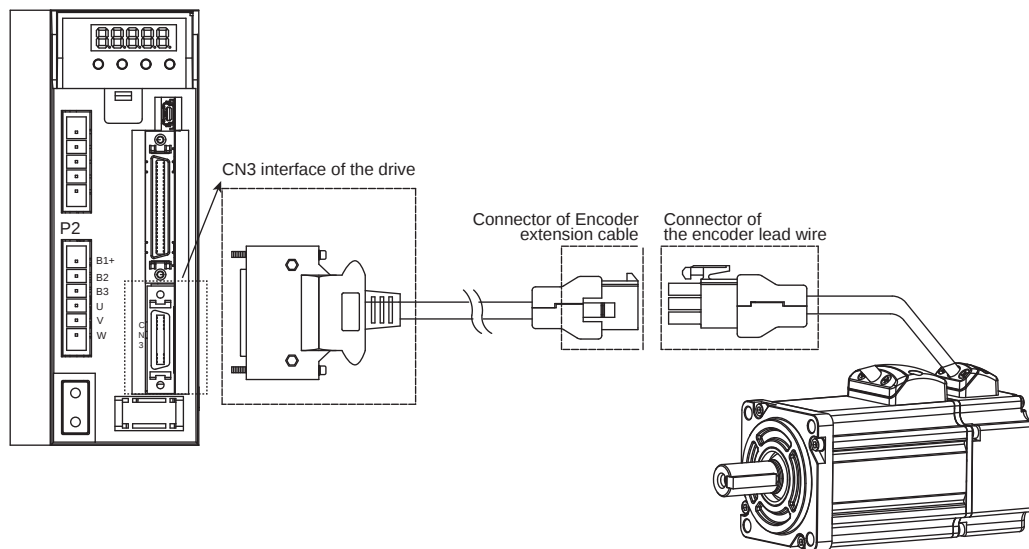
4.2.3 Wiring Diagram Of Motor Extend Cable



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

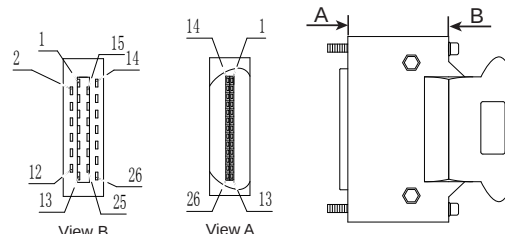
4.3 Encoder Connector CN3

4.3.1 Motor Encoder Feedback Cable Configuration



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

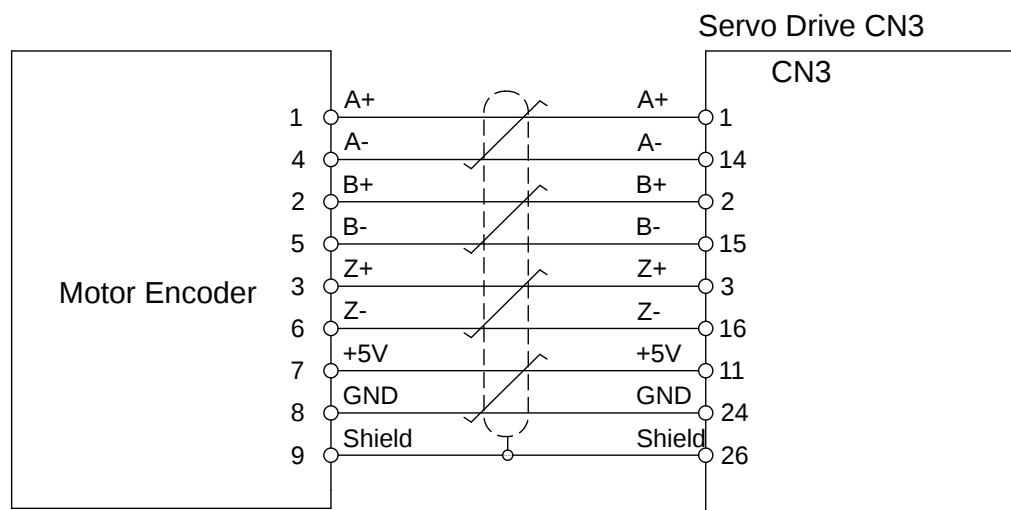
4.3.2 The Layout of CN3 Connector



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

4.3.3 Connect to Motor Encoder

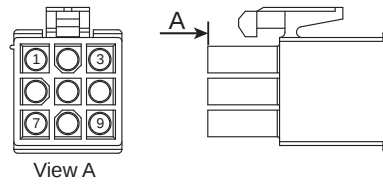
A. Connect to 2500ppr Increment Encoder (9PIN AMP connector)



4.3.4 Specifications of Encoder Connector

A. 9 PIN AMP Connector

PIN Assignment



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

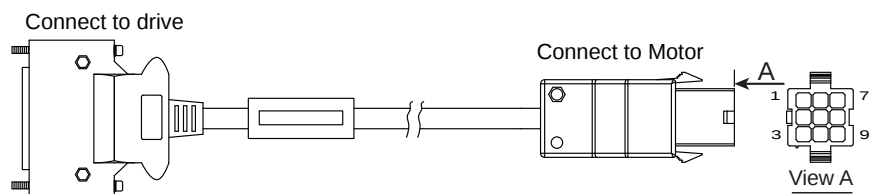
NOTE: The HALL signal U/V/W ONLY appears for 1.5 second after encoder powered on, it will then covert to A/B/Z signals.

Specification of 9PIN AMP Connector

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

4.3.5 Wiring Diagram of Motor Encoder Extend Cable

A. Diagram of 9PIN Encoder Cable



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

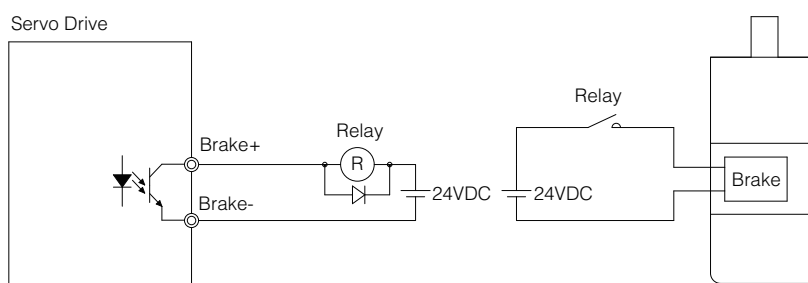
4.4 Electromagnetic Brake

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

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

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

4.4.1 Wiring Diagram



4.4.2 Notice for the Brake Motor

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

The brake coil has no polarity.

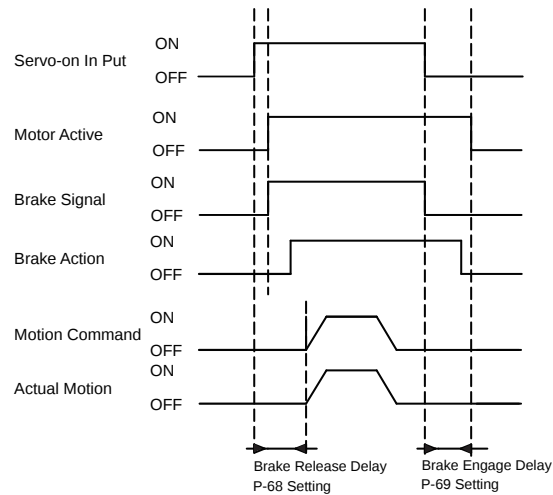
During the brake/release action, there might be “Ka-Da” sounds occurring, this does not affect the use of brake.

Specification of brakes are as follows:

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

4.4.3 The Timing Charts Of The Electromagnetic Brake

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



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

Input & Output

Digital Input
Digital Output
Analog Input

Y1	General Purpose	Y4	General Purpose
Y2	Closed to release brake	Y5	General Purpose
Y3	General Purpose	Y6	General Purpose

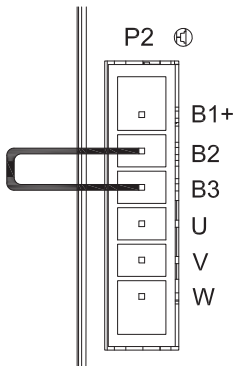
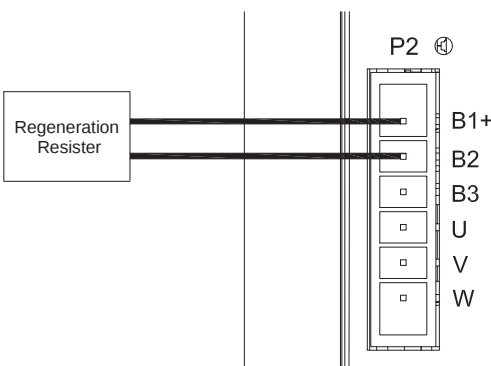
Brake Out Settings

Wait 0 ms before moving for brake to release

Wait 0 ms for brake to engage before disabling servo

4.5 Regenerative Resistor

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 resistor.	Ensure the circuit is opened between B2 and B3, and connect regenerative resistor between B1+ and B2 when using external resistor.
	

4.6 Recommend Cable Specifications

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

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

4.7 Connect to Host Computer, CN1

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

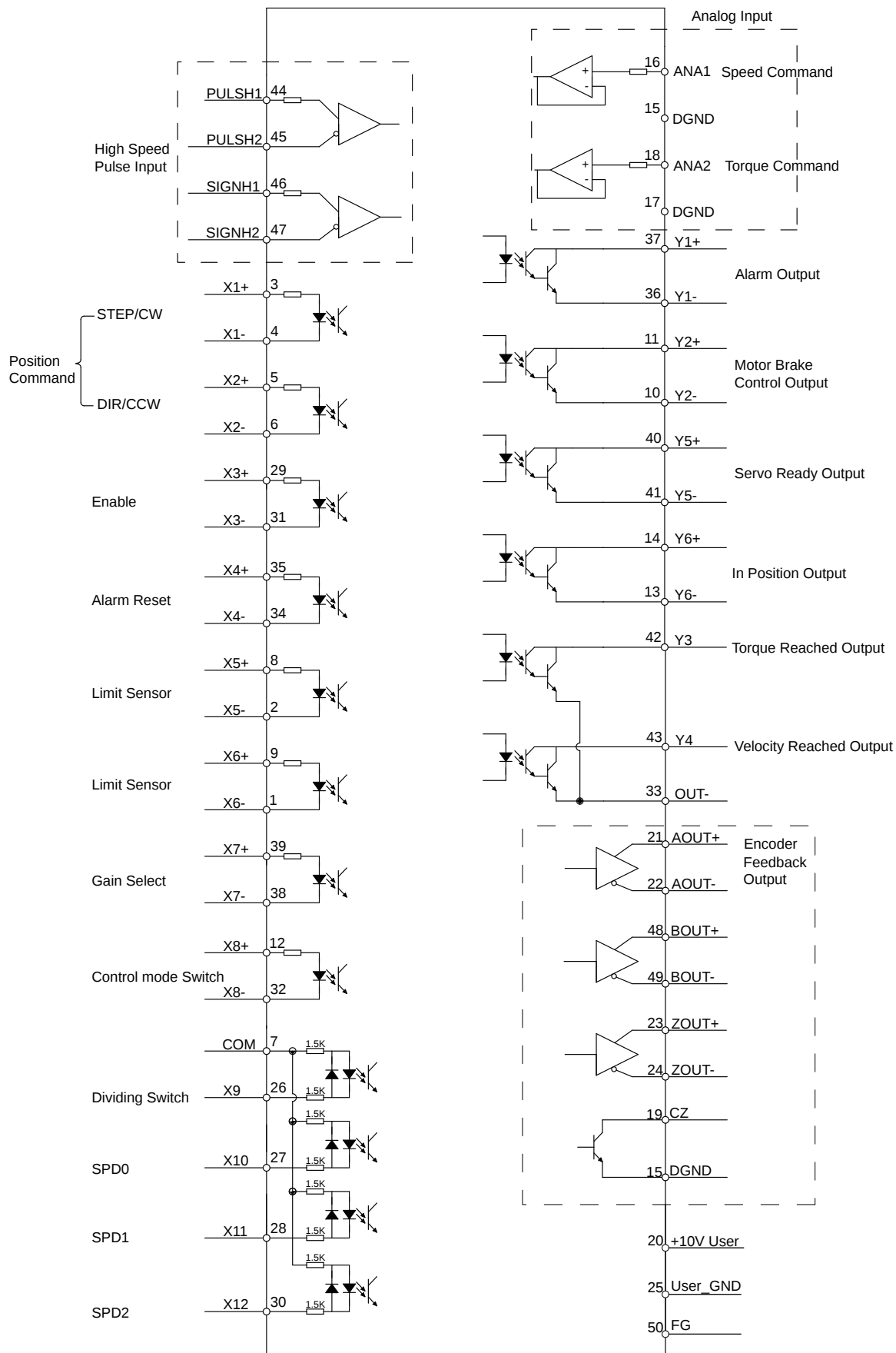
PIN	Symbol	Function
1	+5V	+5V Power Supply
2	D-	Data -
3	D+	Data +
4	—	Reserved
5	GND	Ground

4.8 Input and Output Signal Interface Connector, CN2

4.8.1 Input and Output Interface Specifications and Diagram

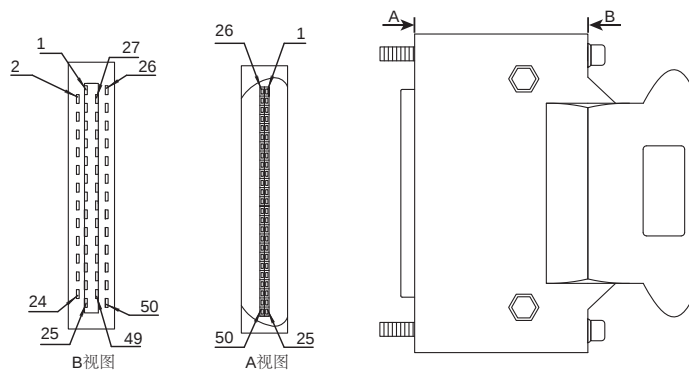
Port CN2 on M2 series AC servo drives is used for input/output signals. Details are shown in table below:

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



4.8.2 Signals Description of Connector CN2

4.8.2.1 The Layout of CN2 Connector



4.8.2.2 Input Signals

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

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

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

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

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

4.8.2.3 Inputs Function List

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

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

4.8.2.4 Output Signals

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

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

4.8.2.5 Outputs Function List

Output Pin	Y1	Y2	Y3	Y4	Y5	Y6
Function						
Alarm Output	●	+	+	+	+	+
InPosition error	—	+	+	+	+	●
Dynamical Position error	—	+	+	+	+	—
Tach Out	—	+	+	+	+	●
Brake	—	+	●	+	+	—
Torque Reach	—	+	+	●	+	—
Servo Ready	—	+	+	+	+	—
Velocity Reach	—	+	+	+	+	—
General Output	●	+	+	+	+	+

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

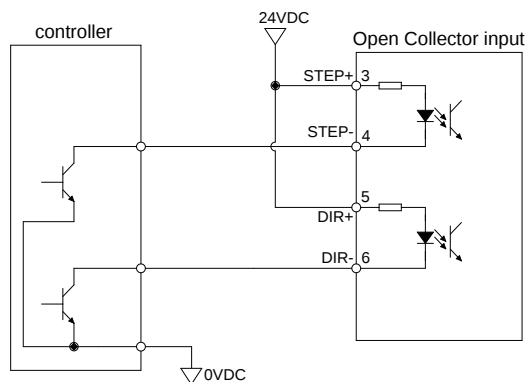
4.8.3 Input Signal Interface Connector, CN2

4.8.3.1 Position pulse signal input

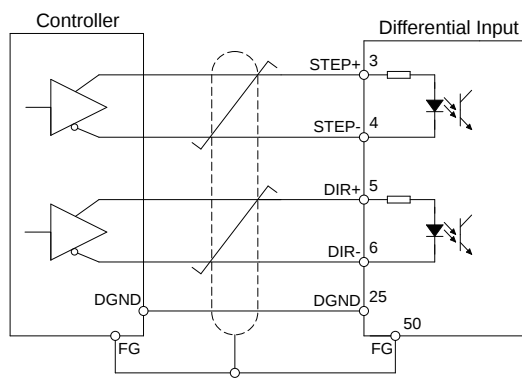
M2 series AC servo has two high speed pulse inputs, STEP/DIR and PULSH/SIGNH. STEP/DIR supports 5-24VDC up to 500Hz open collector input signal or differential input signal through line driver. PULSH/SIGNH supports 5VDC up to 2MHz with differential line driver input.

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

A. Open Collector Input Signal Diagram

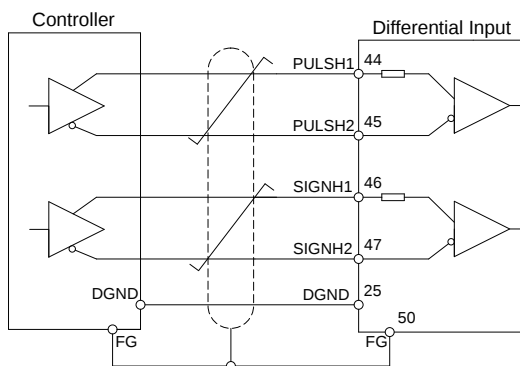


B. Differential Input Signal Diagram



C. High Speed Differential Signal Input Diagram

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



D. Pulse Input Description

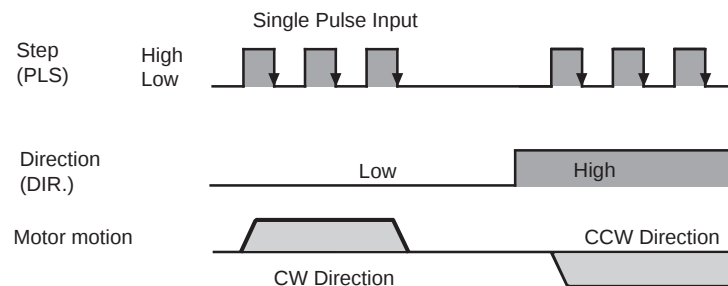
STEP/DIR Pulse Input

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

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

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

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

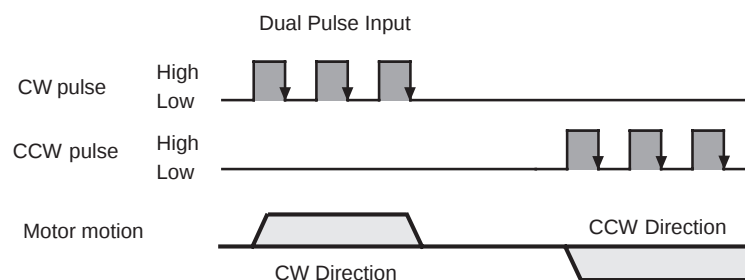


CW/CCW Pulse

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

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

*Motor direction can be configured via M servo suite.

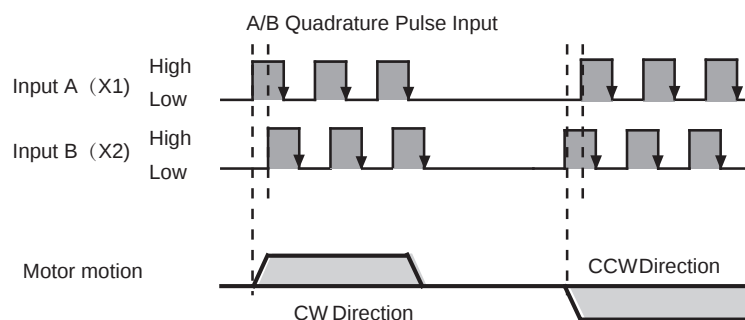


A/B Quadrature

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

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

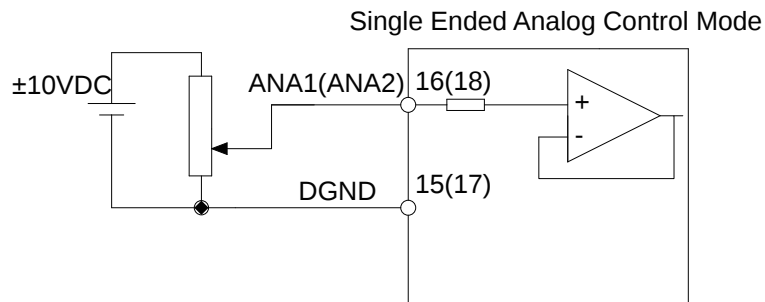
The following graph represents motor rotates in CW direction when X1 is leading X2.



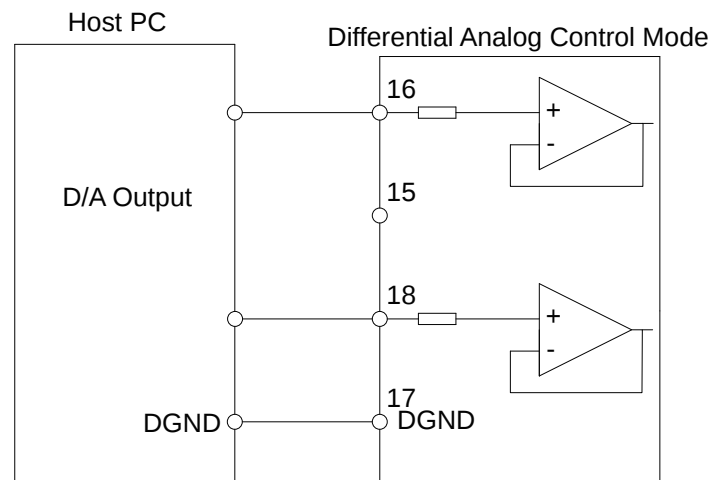
4.8.3.2 Analog Signal Input For Velocity And Torque Mode

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

A.Single Ended Analog Input



B. Differential Analog Input



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

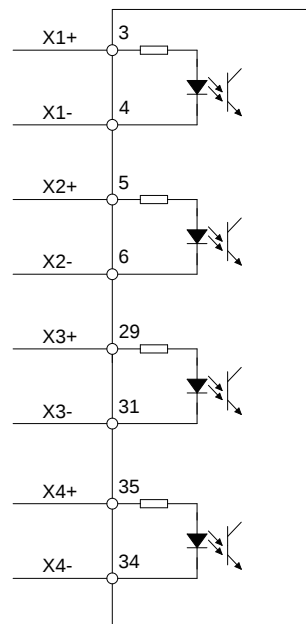
A. High Speed Input Port

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

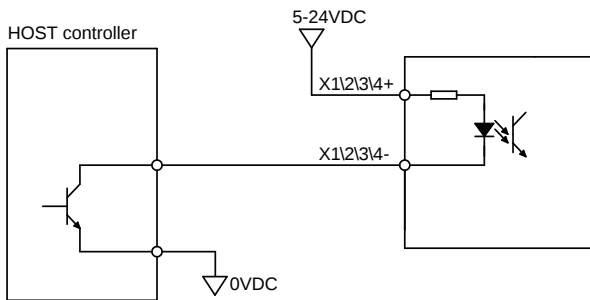
NOTE: When drive is in position mode, X1, X2 can ONLY be set as STEP/DIR signal.

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

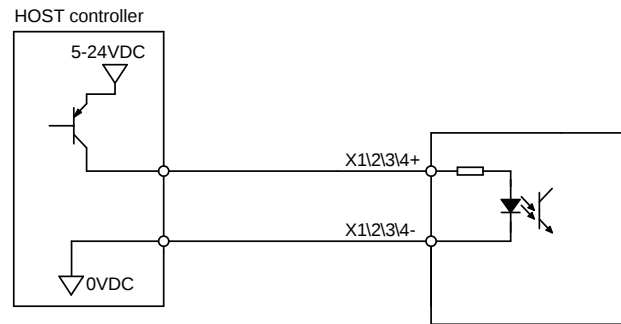
X1、X2、X3、X4 Circuit Are As Follows:



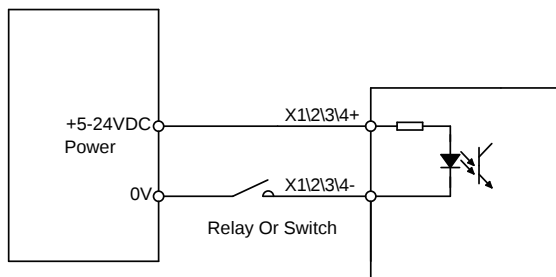
B. High Speed Input Connection Diagram



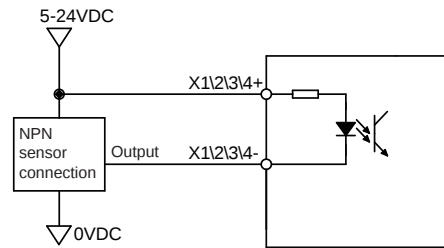
Host Sink Mode



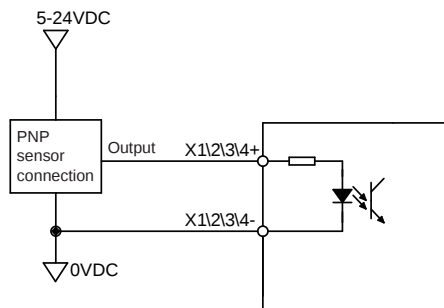
Host Sourcing Mode



Sensor And Switch Connection



NPN Sensor Connection

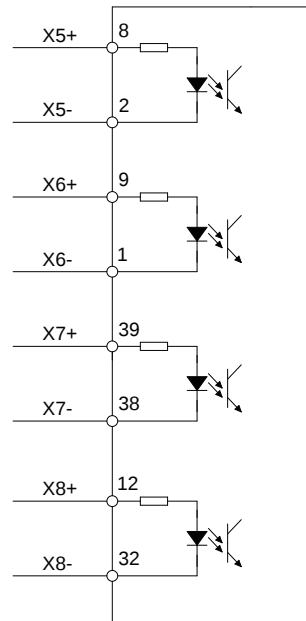


PNP Sensor Connection

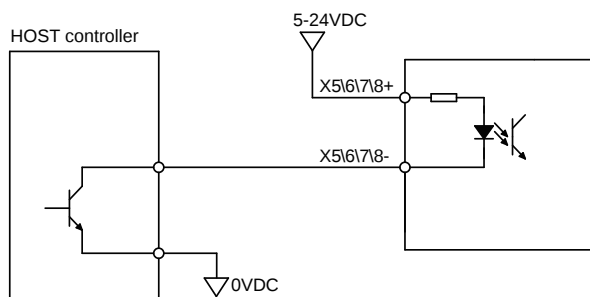
4.8.3.4 General Digital Input X5、X6、X7、X8

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

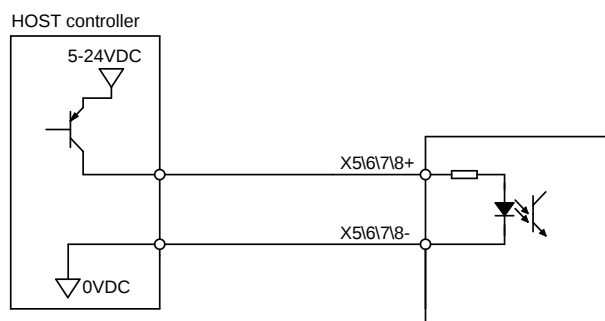
X5、X6、X7、X8 Circuit Are As Follows:



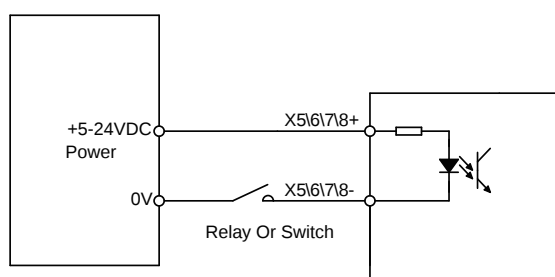
X5、X6、X7、X8 Input Port Connection Diagram



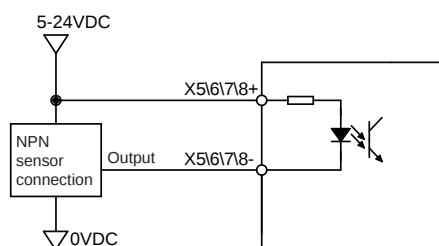
Host Sink Mode



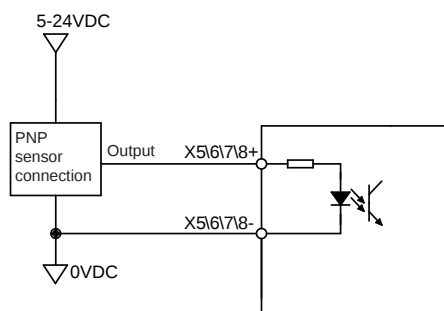
Host Sourcing Mode



Sensor And Switch Connection



NPN Sensor Connection



PNP Sensor Connection

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

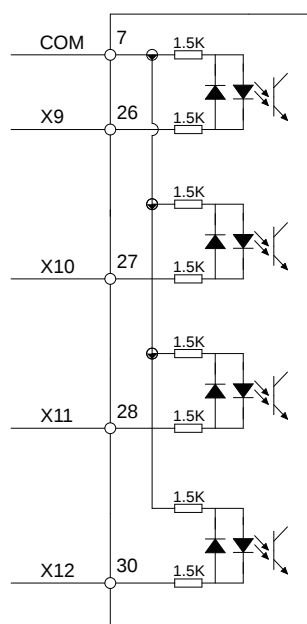
M2 series AC drive also has 4 single ended optically isolated inputs connecting with single common node 'COM'. They can be used with sourcing or sinking signals, 5-24V. This allows connection to PLCs, sensors, relays and mechanical switches. Because the input circuits are isolated, they require a source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

What is COM?

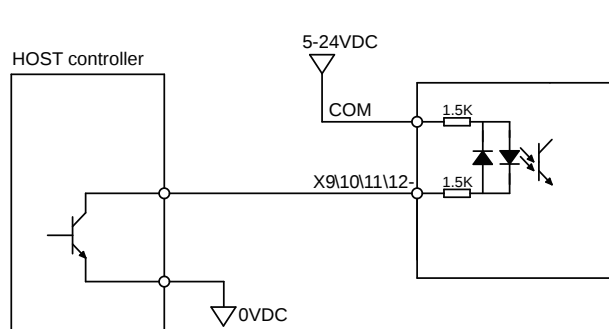
“Common” is an electronics term for an electrical connection to a common voltage. Sometimes “common” means the same thing as “ground”, but not always. If you are using sinking (NPN) signals, then COM must connect to power supply +. If you are using sourcing (PNP) input signals, then you will want to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

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

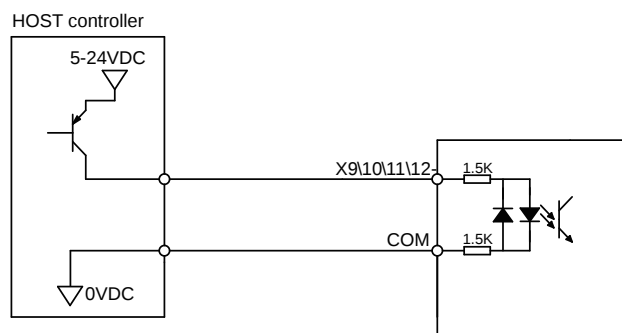
X9、X10、X11、X12 Circuit Are As Follows:



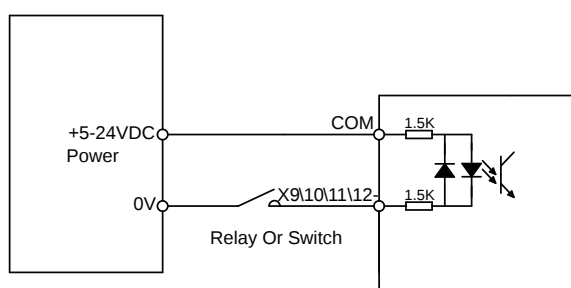
X9、X10、X11、X12 Input Port Connection Diagram



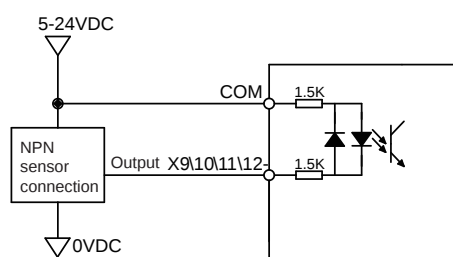
Host Sink Mode



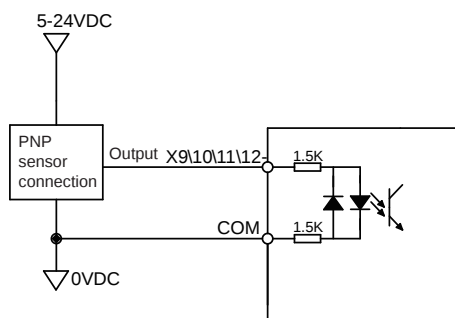
Host Sourcing Mode



Sensor And Switch Connection



NPN Sensor Connection

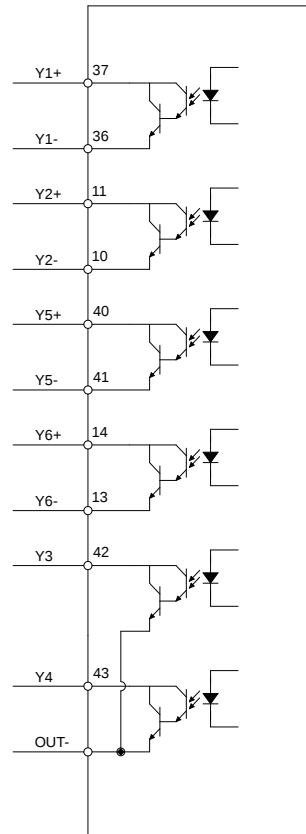


PNP Sensor Connection

4.8.4 CN2 Output Signal Specification

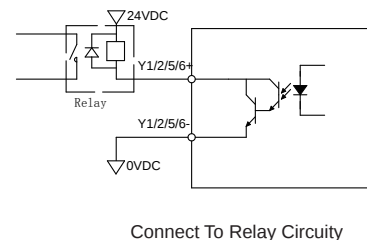
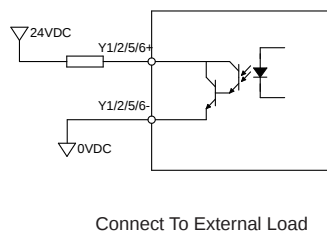
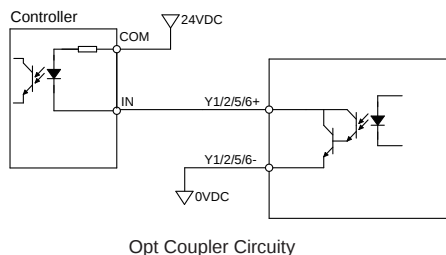
M2 series AC servo drive features 6 optically isolated digital outputs. They can be configured via M Servo Suite. Y1、Y2、Y5、Y6 are differential output signals, they can be used for both sourcing or sinking signals. Y3、Y4 common ground outputs, they can be used for sinking signals.

4.8.4.1 CN2 Output Signal Diagram

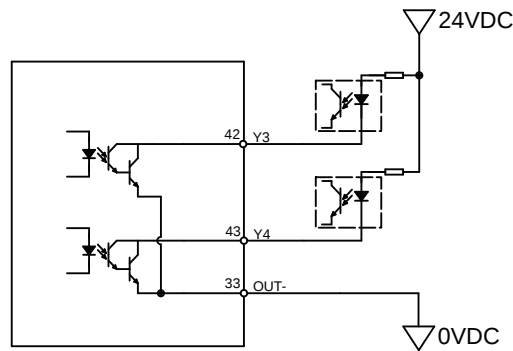


4.8.4.2 Y1、Y2、Y5、Y6 Output Connection Diagram

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



4.8.4.3 Y3、Y4 Connection Examples

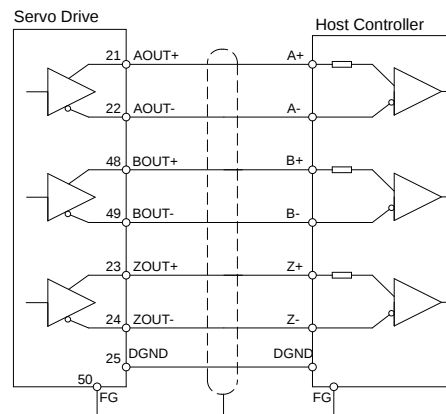


4.8.5 Encoder Feedback Output

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

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

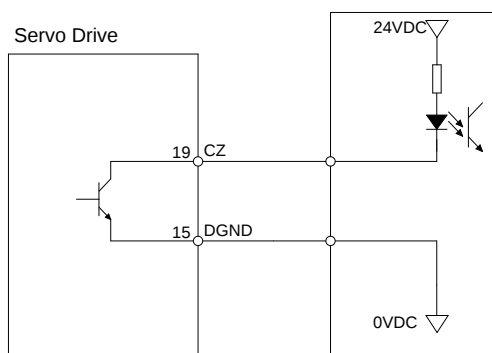
4.8.5.1 A/B/Z Connection Diagram



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

4.8.5.2 Z Phase Open Collector Output

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



4.9 STO Connector

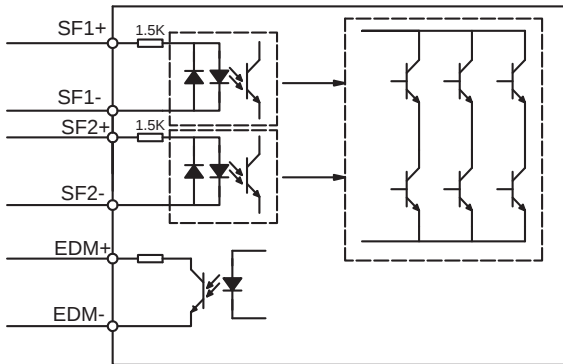
On the M2AC series servo drives, the STO (Safe Torque Off) function is connected via port CN5. The STO function shuts off the motor current turning off the motor output torque by forcibly turning off the signal of the servo driver power transistor. This is done internally through the STO Input/Output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

4.9.1 Safety Precautions

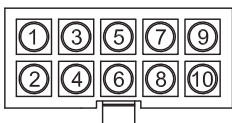
- If the STO function does not trigger, make sure the STO connector is plugged into CN5 on the drive correctly.
- When using the STO function, perform an equipment risk assessment to ensure that the system conforms to the safety requirements.
- Even when the STO function is enabled, the servo motor may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



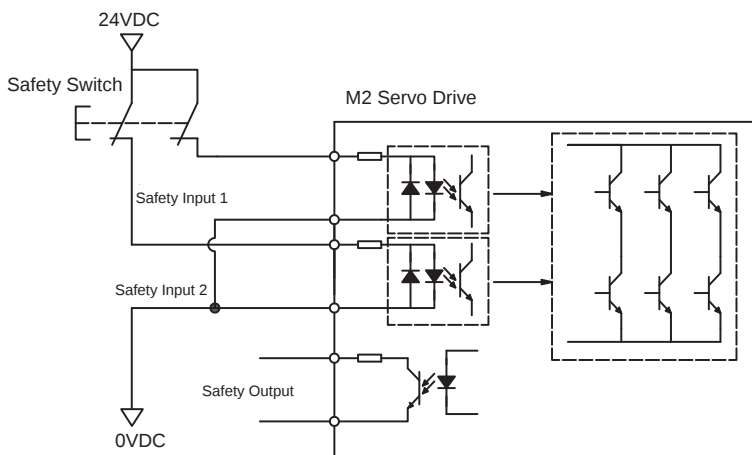
Item	Part number	Vendor
Housing	43025-1000	Molex
Crimp	43030-0005	Molex

4.9.2.3 STO Signal Definition

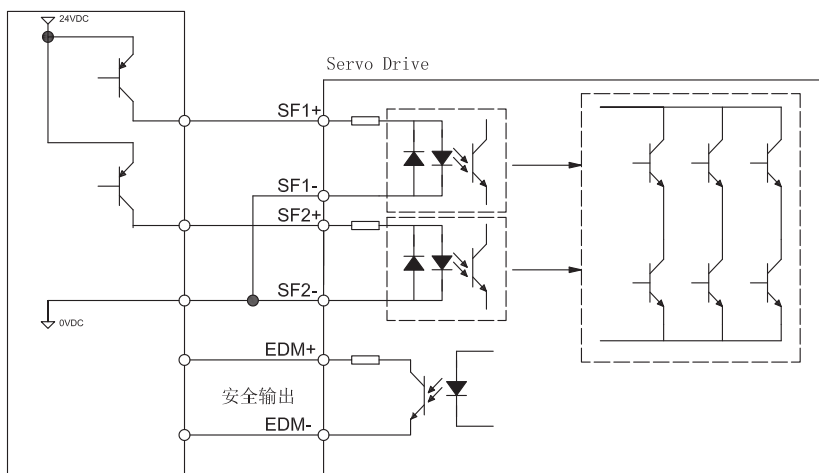
Signal	Symbol	Pin	Description	Control Mode
Safety Input SF1	SF1+	1	When SF1 has no input signal, e.g. the port is disconnected, SF1 will be considered OFF. The upper half of the internal power transistor will be shut off.	Compatible with all control modes
	SF1-	5		
Safety Input SF2	SF2+	3	When SF2 has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



4.10 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

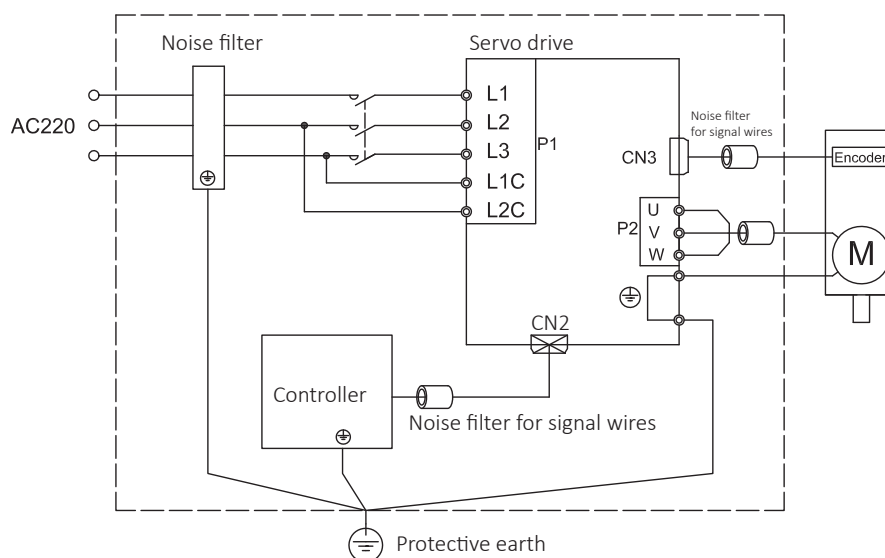
To prevent the noise the servo pack and peripheral devices from causing a malfunction, Take the following precautions against noise as required.

- 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.

4.10.1 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.

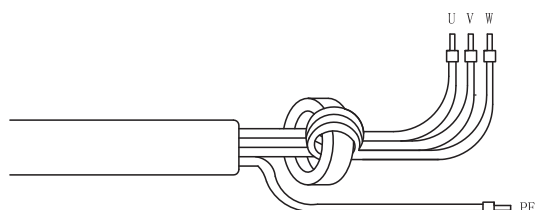
4.10.2 Recommended EMI noise filter

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

4.10.3 Clamp 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 together, except the PE cable.
Encoder cable	Wind cables the 2-3 turns to form the signal noise filter.

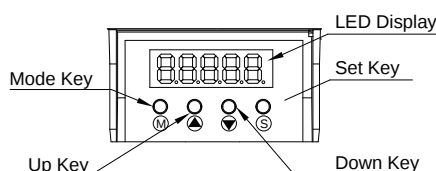


4.10.4 Recommended clamp noise filter

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

5. Display and Operation

5.1 Description of Control Panel

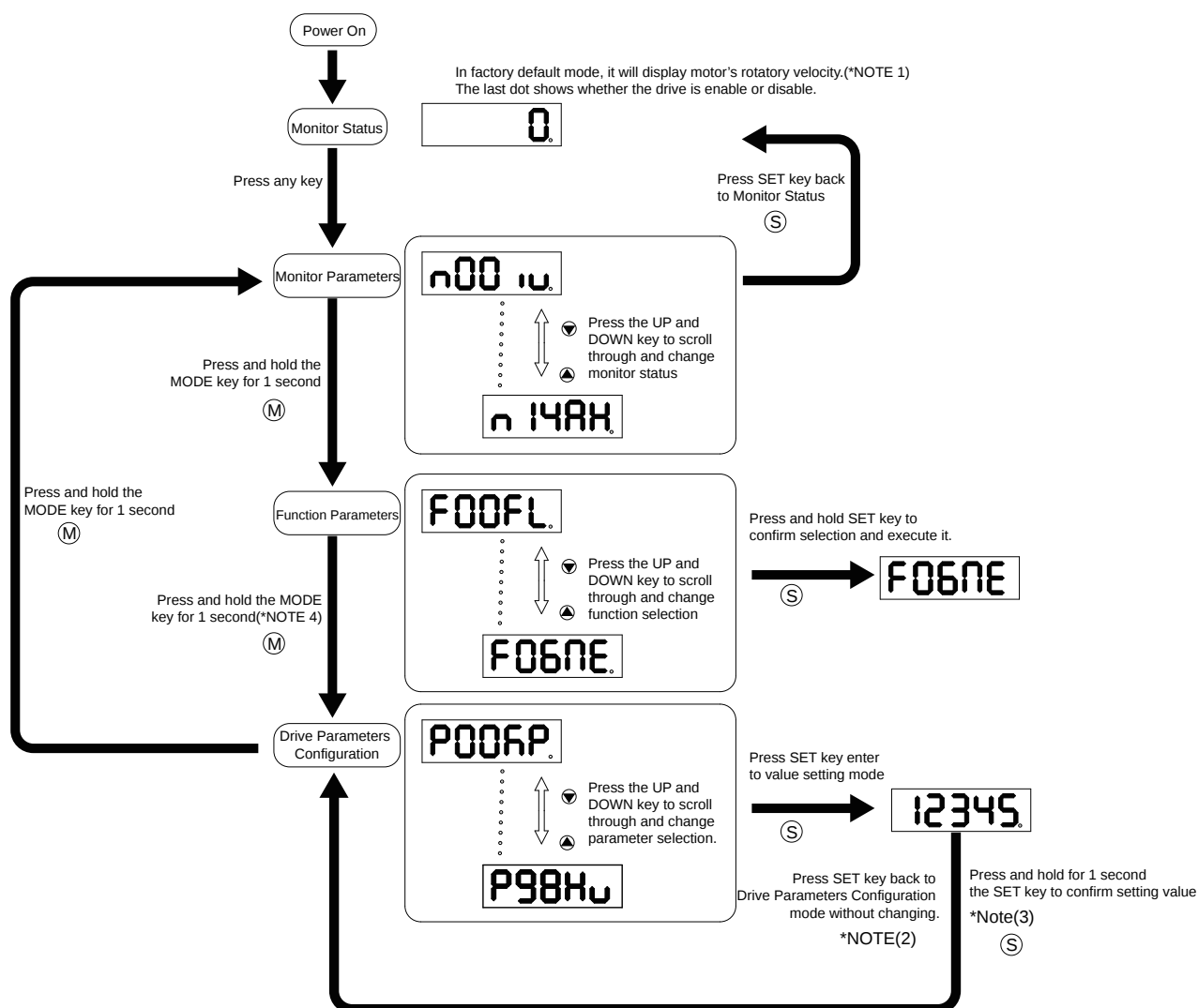


Symbol	Name	Details
	LED Display	The LCD display (5 digits, 7 segments) show the drive's operating condition and warning codes, parameters and settings values.
	MODE Key	Press and hold on mode button to switch LED display mode a). Monitoring selection mode b). Function selection mode c). Parameter setting 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 "F04ER", and then press and hold **[S]** button to save the parameter change.

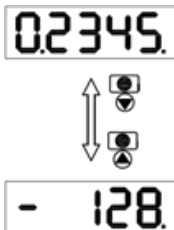
4) When drive is connected to the host computer with M servo suite on, parameter setting mode CANNOT accessed directly on drive's control panel.

5.3 LED display description

5.3.1 Decimal Point And Negative Sign Description

LED display	Description
 negative sign motor enable sign	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"

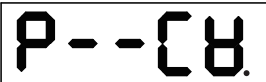
5.3.2 Parameter View Setting

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

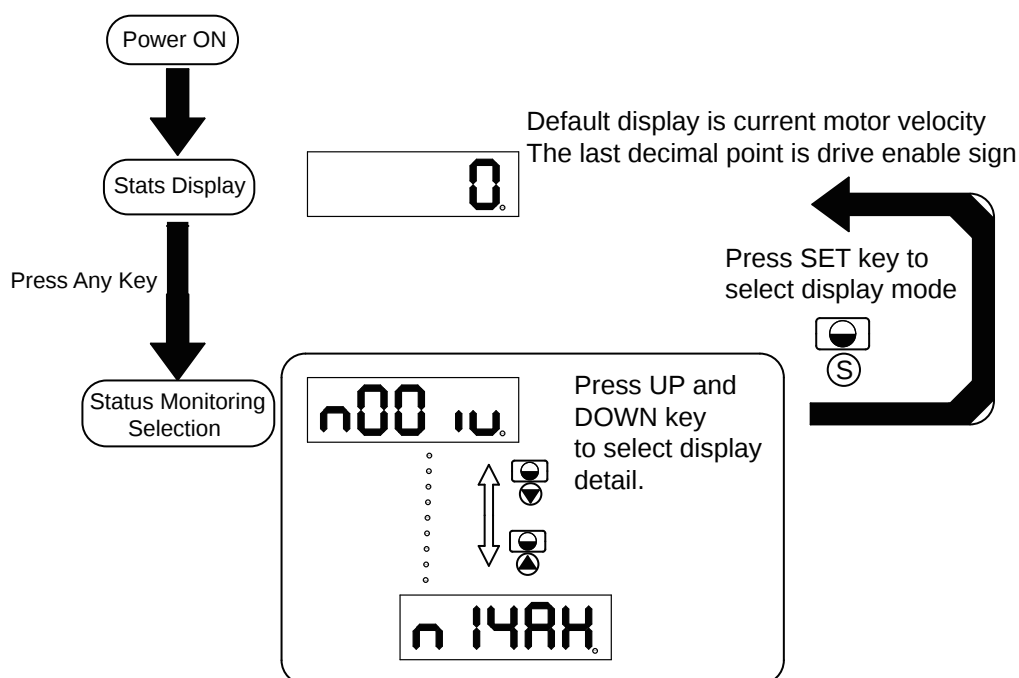
LED display	Description
	J—CW means motor rotating in CW direction under JOG mode
	J—CCW means motor rotating in CCW direction under JOG mode

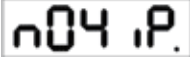
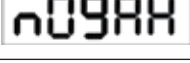
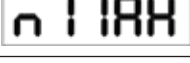
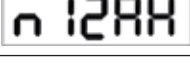
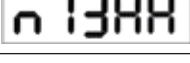
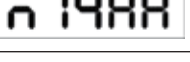
5.3.6 Control Panel Lock

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

5.4 Status Monitoring Selection Mode

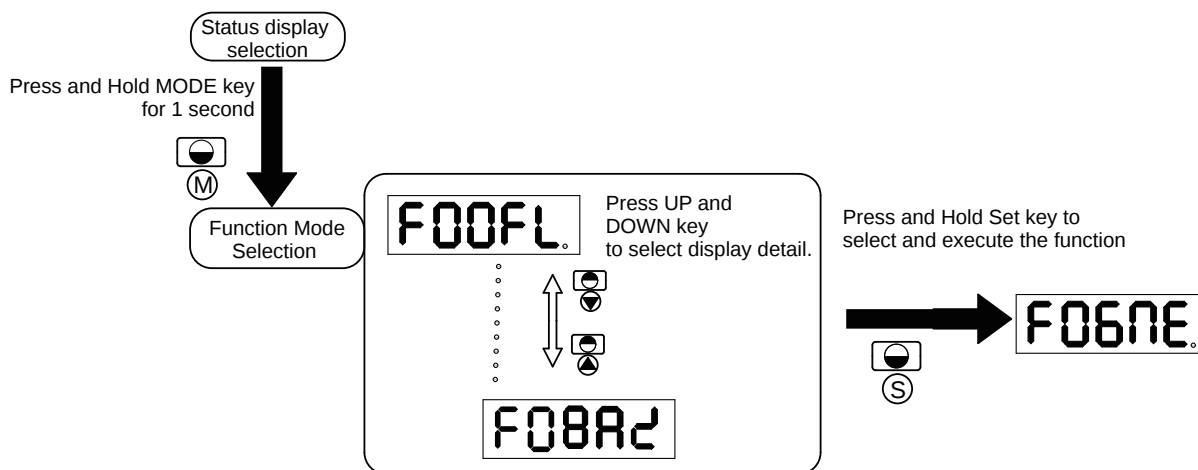
To change the status monitoring type, please press  to enter monitoring selection mode, and then use   to make selections, and press  to confirm. Steps are shown as follows:



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

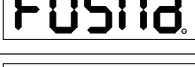
5.5 Function Mode Control

In function mode (display F+ parameter number), you can select functions for preoperational mode, restart the drive, enable or disable the drive and so on. In status monitoring mode, press and hold  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)

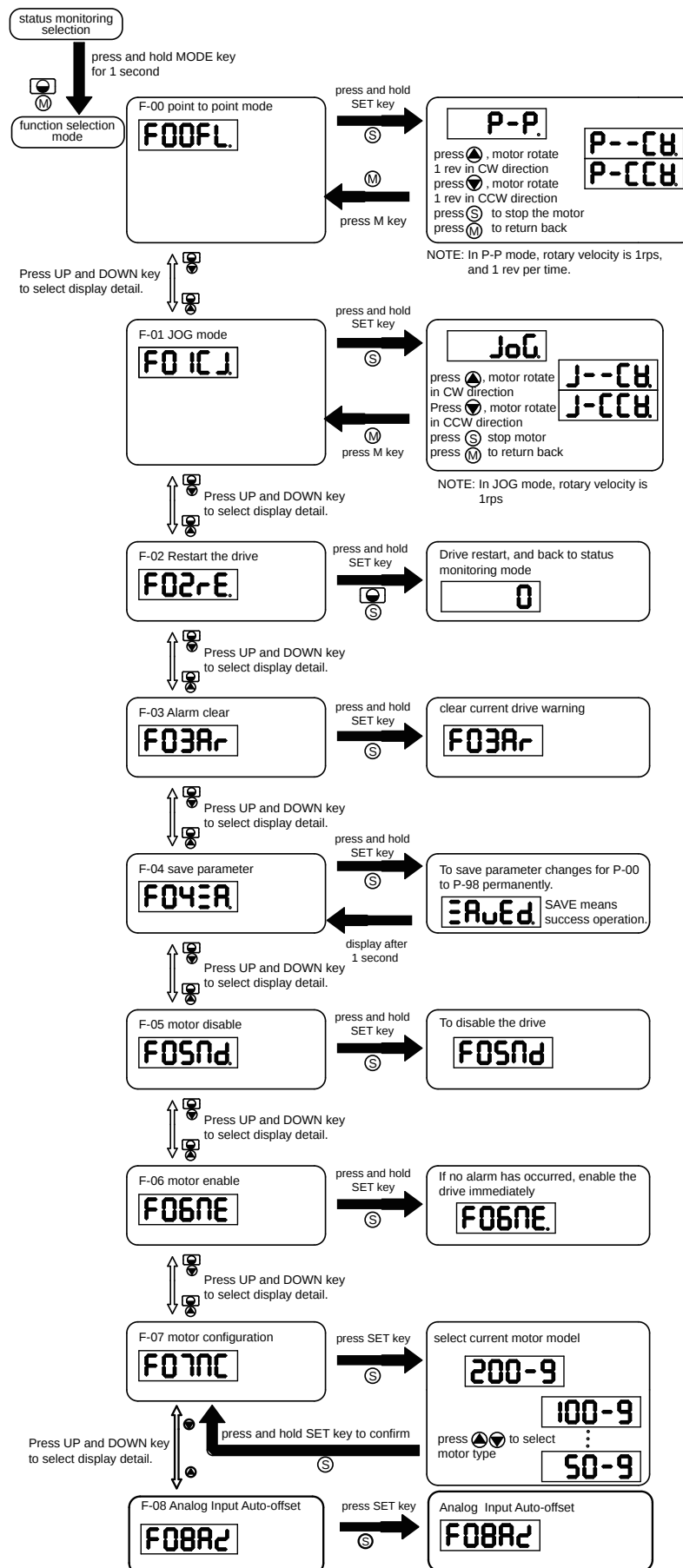


5.5.1 Function Mode Description

Function mode details are as follows:

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

5.5.2 Operation Flow Chart



5.6 Parameter Setting Mode

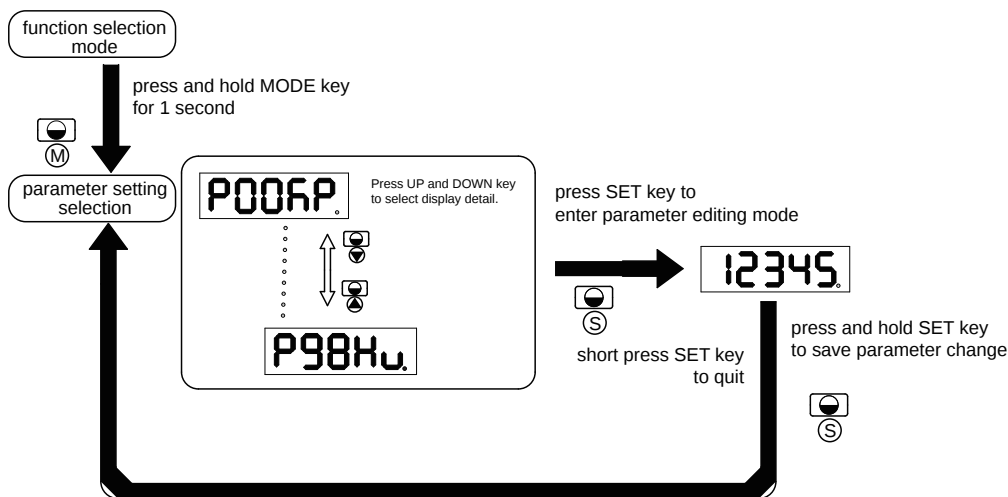
5.6.1 Parameter Setting Description

The parameter setting mode (P+parameter number) allows you to select, display and edit the required parameter. In function control mode, press and hold  for 1 second to enter parameter setting mode.

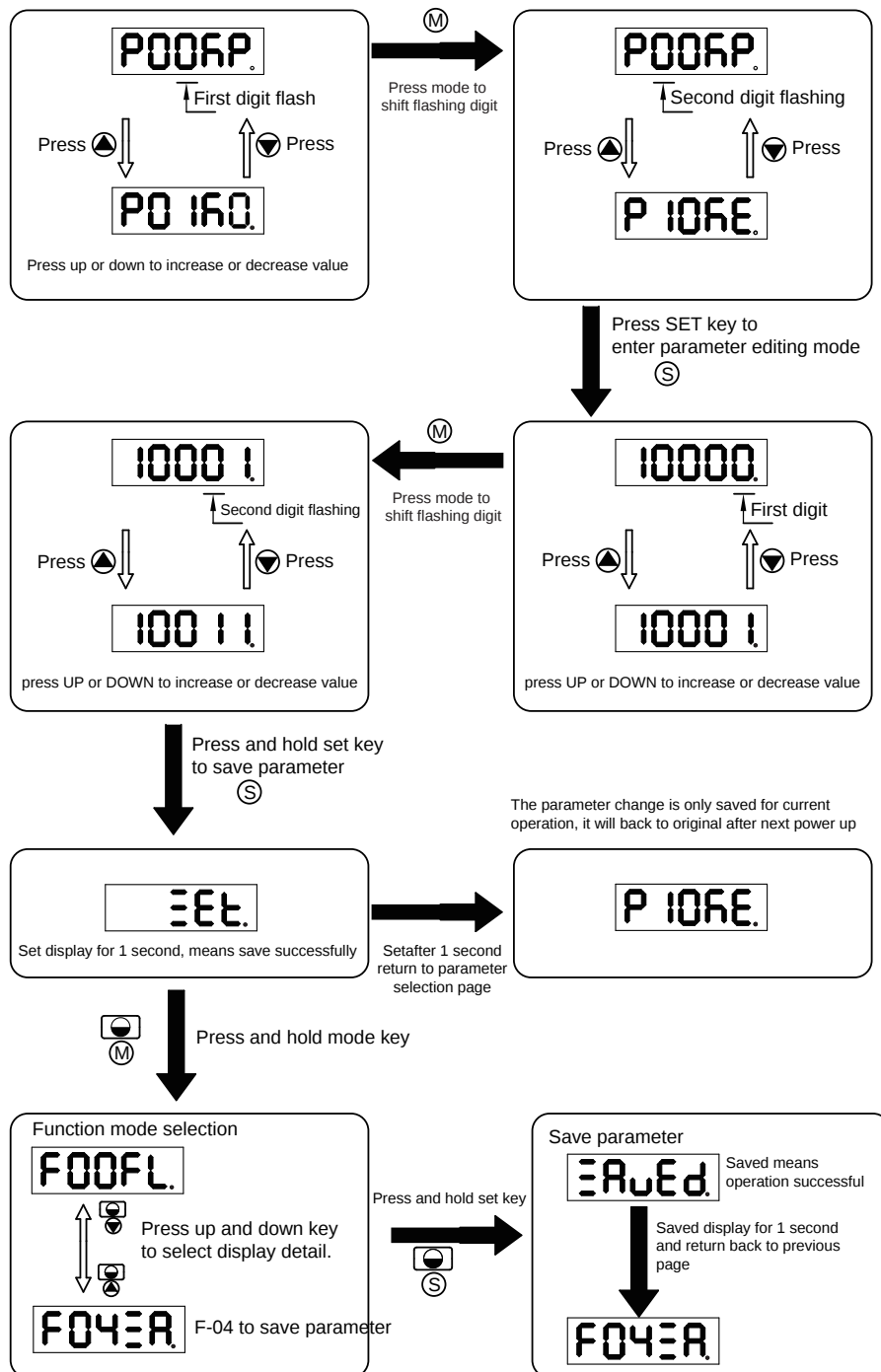
Use   to select required parameter, and press  to view or edit the parameter. Press 

again to quit and no change will be saved. Press and hold  for 1 second to save the parameter change. However this change will NOT be saved at next power on.

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

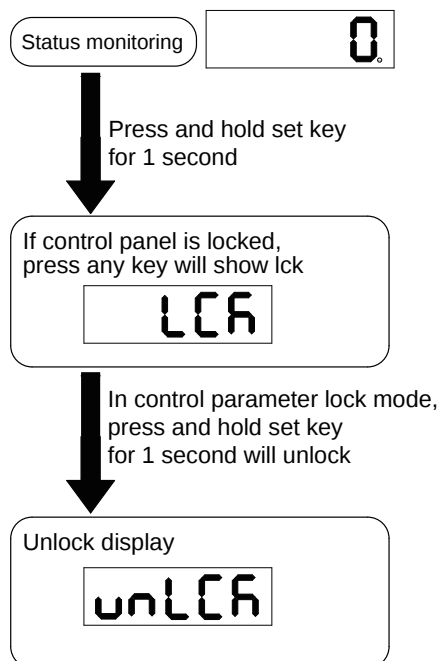


5.6.2 Parameter Editing Examples



5.7 Control Panel Lock

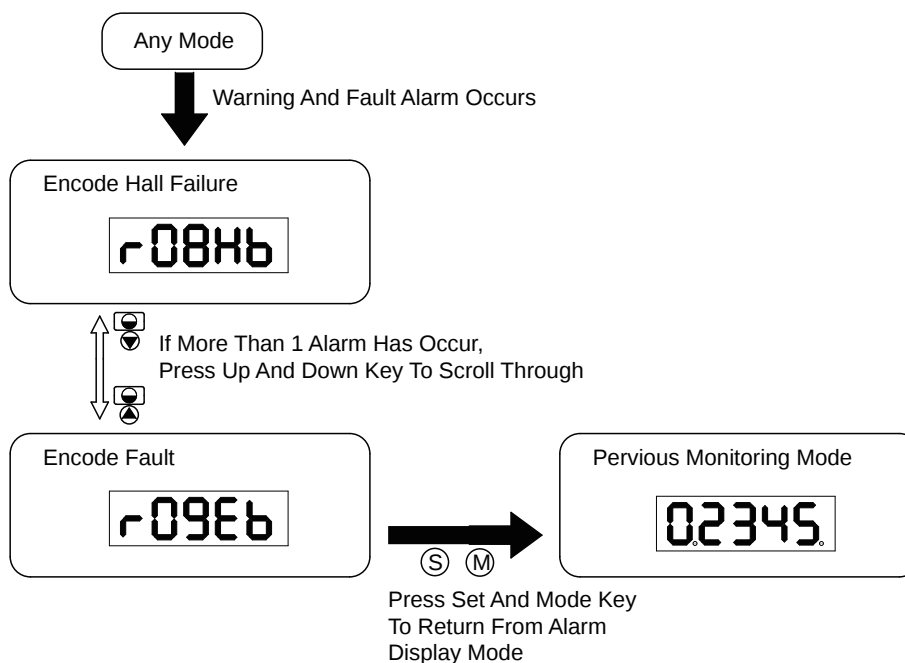
In order to prevent faulty use on key panel, key panel lock is featured on all M2AC servo drives. When lock function is on, no function can be changed directly on drive's control panel.



5.8 Warning And Fault Display

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

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



LED display	Description	LED display	Description
r01ot	Drive over temperature	r14LL	CW limit is activated
r02ur	Internal voltage fault	r15JL	CCW limit is activated
r03uH	Over voltage	r16CL	Current limit
r04HC	Over current	r17CE	Communication error
r05LC		r18EF	Parameter save failed
r06rC		r19LP	Phase loss of the main circuit
r08Hb	Bad hall sensor	r20to	STO is activated
r09Eb	Encoder error	r21rF	Regeneration failed
r10PL	Position error	r22uH	Low voltage
r11Lu	Low voltage	r239E	Q program is empty
r12ou	Velocity limited	r24dd	Motion Command Received While Motor in Disable
r13Lt	CW limit or CCW limit activated		

6. Preoperational mode

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

6.1 Inspection Before Trail Run

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

1) Connection inspections

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

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

2) Power supply inspection

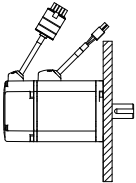
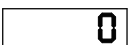
Check and ensure voltage supplies between L1/L2/L3, meets drive's power supply specifications.

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

3) Ensure secure installation of servo drive and motor.

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

6.2 Trail Run Procedure

Step	Details	Description
1	Please securely install the motor. 	1) The motor can be installed on the machine. 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 3.1 Connecting to Peripheral Devices to confirm the main power circuit wiring connect correctly.
4	Supply the Power	Do not supply 380VAC power supply into the servo system.
5	The LED Display will show as follows without alarm:  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 the other alarm trouble shooting10.
6	User need to setup a motor brake control circuit when using a electromagnetic brake motor.	Please refer to Section 3.4 Electromagnetic Brake for more details.
7	Motor Configuration	Configure the correct motor that has been used with the M2 Servo Suit or the operation panel. Please refer to Motor Configuration 6.3
8	JOG Trail Run without Load	Ready to run JOG trail if all steps above are done.

6.3 Motor Configuration Manually

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

6.3.1 Use Drive Control Panel To Setup

Motor information and LED display list:

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

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

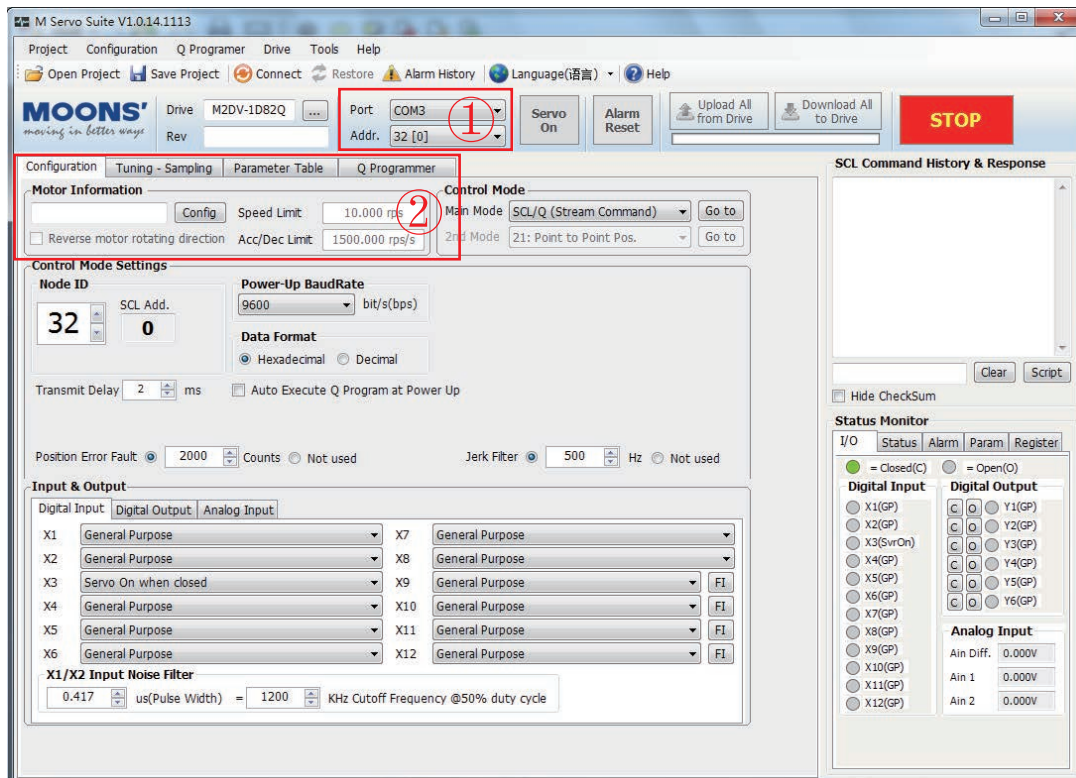
Step	LED display	Description
1	F00FL	Press  into the Function Parameters mode at the Monitor Status mode
2	F07n	Press the  and  key to select F07 (MC)
3	200-9	Press  key into value setting mode.
4	100-9	Press  、  key to change value.
5	ErEd	Press and hold  key for 1 second to confirm motor configuration.
6	F07n	
		Parameter is effective only after the servo drive is restarted.

6.3.2 Use Software To Config Motor

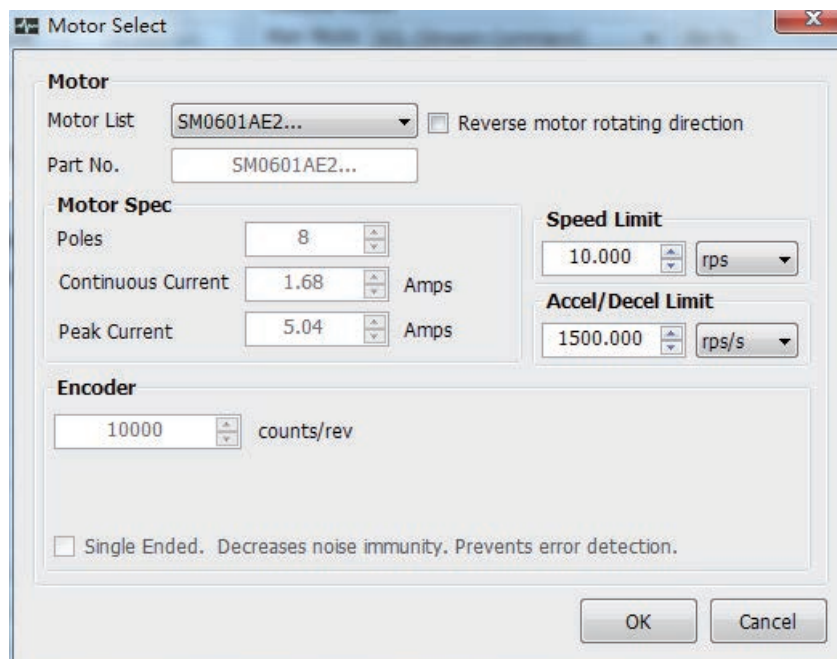
User can also use M Servo Suite to configure motor information

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	P006P	Press  to switch the Monitor Status mode into the Drive Parameters Configuration mode
2	P6 12 .	Scroll  、  key to select parameter P62 (SI)
3	2	Press  key into value setting mode
4	3	Scroll  、  key to change values.
5	SET	Press and hold  key for 1 second to confirm the setting value.
6	F00FL	Press  key into the Function Operation mode.
7	F06NE	Scroll  、  key to select Function F06 (MC) to enable the motor.
8	F06NE.	Press and hold SET key for 1 second, the drive will be enabled. The last dot will light to shows the drive is enabled.
9	F01CJ	Scroll the  、  key into function F01 (CJ) to run JOG mode.
10	JOG	Press the  key into JOG mode
11	J--CH	Press the  key ,the motor will rotate at CW direction with the speed 1rps.
12	J-CH	Press the  key ,the motor will rotate at CCW direction with the speed 1rps.
13	JOG	Press the  key to stop the motor
14	F01CJ	Press the  key back to the Function Operation mode.

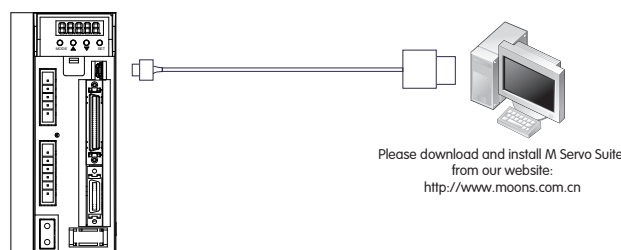
6.5 Configuration by Personal Computer

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

The screenshot shows the M2 Servo Suite software interface with the following sections and callouts:

- Callout 1:** Motor Information section, showing motor model SM0601AE2...
- Callout 2:** Control Mode section, showing Main Mode as Position (IO Controlled) and 2nd Mode as 21: Point to Point Pos.
- Callout 3:** Control Mode Settings section, showing Pulse & Direction selected for Position Control, and Direction is CW when X2 is closed.
- Callout 4:** Input & Output section, showing Digital Input and Digital Output configurations for X1 through X12.
- Callout 5:** Tuning - Sampling section, highlighted in the top navigation bar.

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

7. Operation Mode Selection

7.1 General Function Setting

7.1.1 Drive Servo on settings

To control servo motor enable/disable switch

1) servo on signal

In default setting, servo ON signal configured as follows:

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

2) Definition for Servo On signal

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

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

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

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

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

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

3) Software Configuration

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

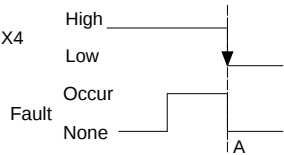
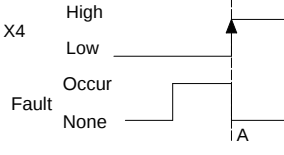
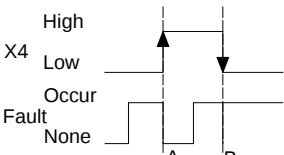
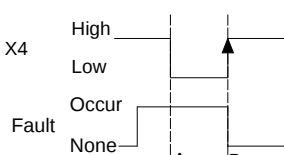
Input & Output

Digital Input Digital Output Analog Input

X1	Pulse	X7	General Purpose
X2	Direction	X8	General Purpose
X3	Servo On when closed	X9	General Purpose
X4	General Purpose	X10	General Purpose
X5	General Purpose	X11	General Purpose
X6	General Purpose	X12	General Purpose

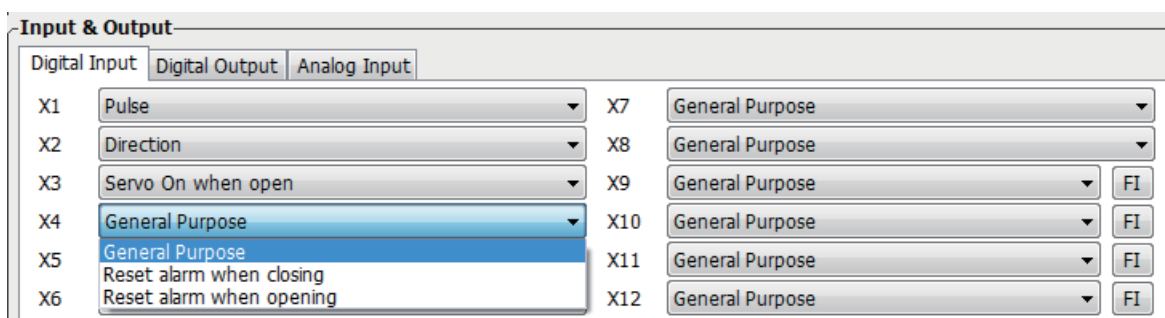
7.1.2 Alarm Reset

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

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

Software Configuration

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



7.1.3 CW/CCW limit

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

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

Software Configuration

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

Position: General Purpose

Jerk Filter: 500 Hz (Not used)

Input & Output:

- X1: General Purpose
- X2: General Purpose
- X3: General Purpose
- X4: General Purpose
- X5: General Purpose
- X6: General Purpose
- X7: General Purpose
- X8: General Purpose
- X9: General Purpose
- X10: General Purpose
- X11: General Purpose
- X12: General Purpose

7.1.4 Global Gain Switch Function

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

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

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

Software Configuration

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

Input & Output

Digital Input: Digital Output: Analog Input:

- X1: Pulse
- X2: Direction
- X3: Servo On when open
- X4: Reset alarm when closing
- X5: General Purpose
- X6: General Purpose
- X7: General Purpose
- X8: General Purpose
- X9: Gain Select when closed
Gain Select when open
- X10: General Purpose
- X11: General Purpose
- X12: General Purpose

7.1.5 Control Mode Switch

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

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

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

Software Configuration

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

Input & Output

Digital Input Digital Output Analog Input

X1	Pulse	X7	General Purpose
X2	Direction	X8	General Purpose
X3	Servo On when open	X9	General Purpose
X4	Reset alarm when closing	X10	Change Control Mode when closed
X5	General Purpose	X11	General Purpose
X6	General Purpose	X12	General Purpose

FI FI

7.1.6 Drive On Fault Output

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

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

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

Software Configuration

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

Input & Output

Digital Input
Digital Output
Analog Input

Y1
General Purpose

Y2
General Purpose
Closed on fault
Open on fault

Y3

Y4
General Purpose

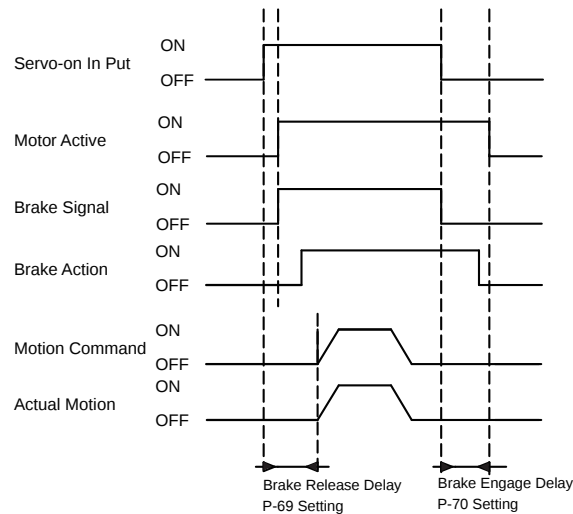
Y5
General Purpose

Y6
General Purpose

7.1.7 Motor Brake Control

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

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

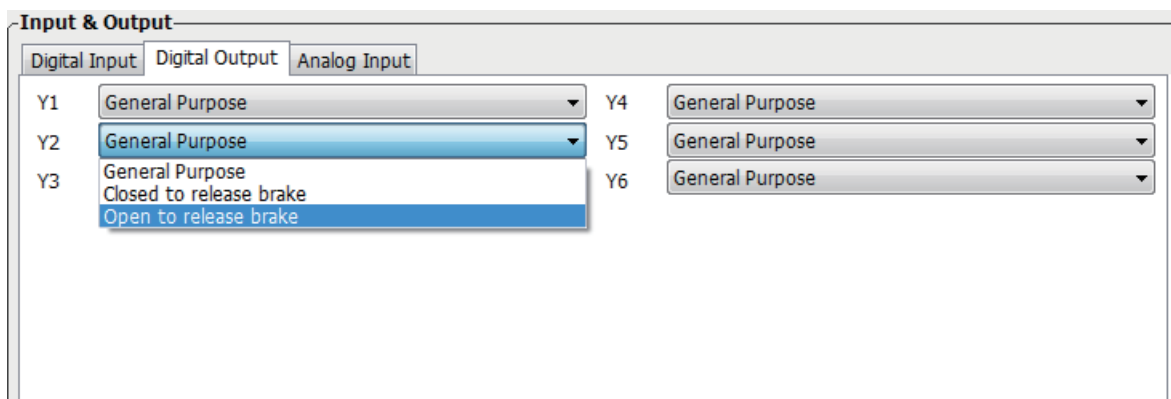


Brake disengage delay and engage delay can be configured via M servo suite software, or change parameters P-69 (BD) and P-70 (BE) directly from the drive.

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

Software Configuration

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



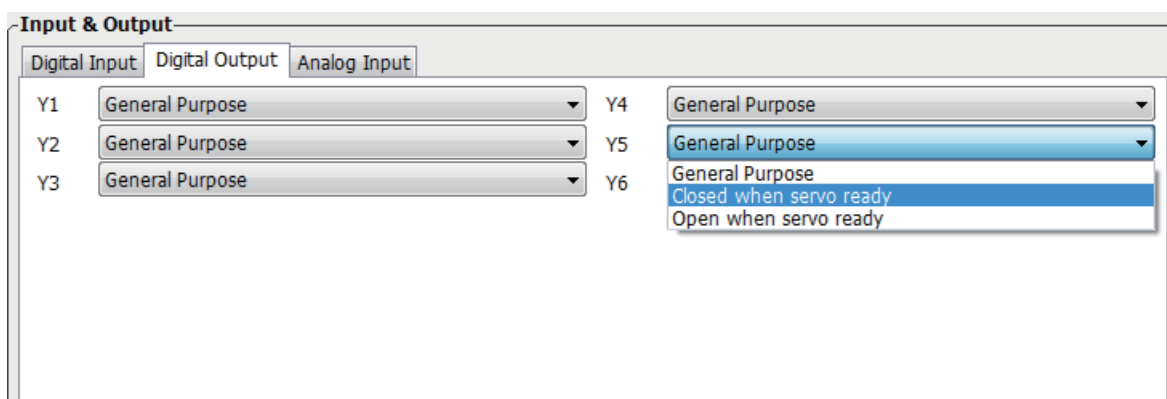
7.1.8 Servo Ready Output

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

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

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

Software Configuration



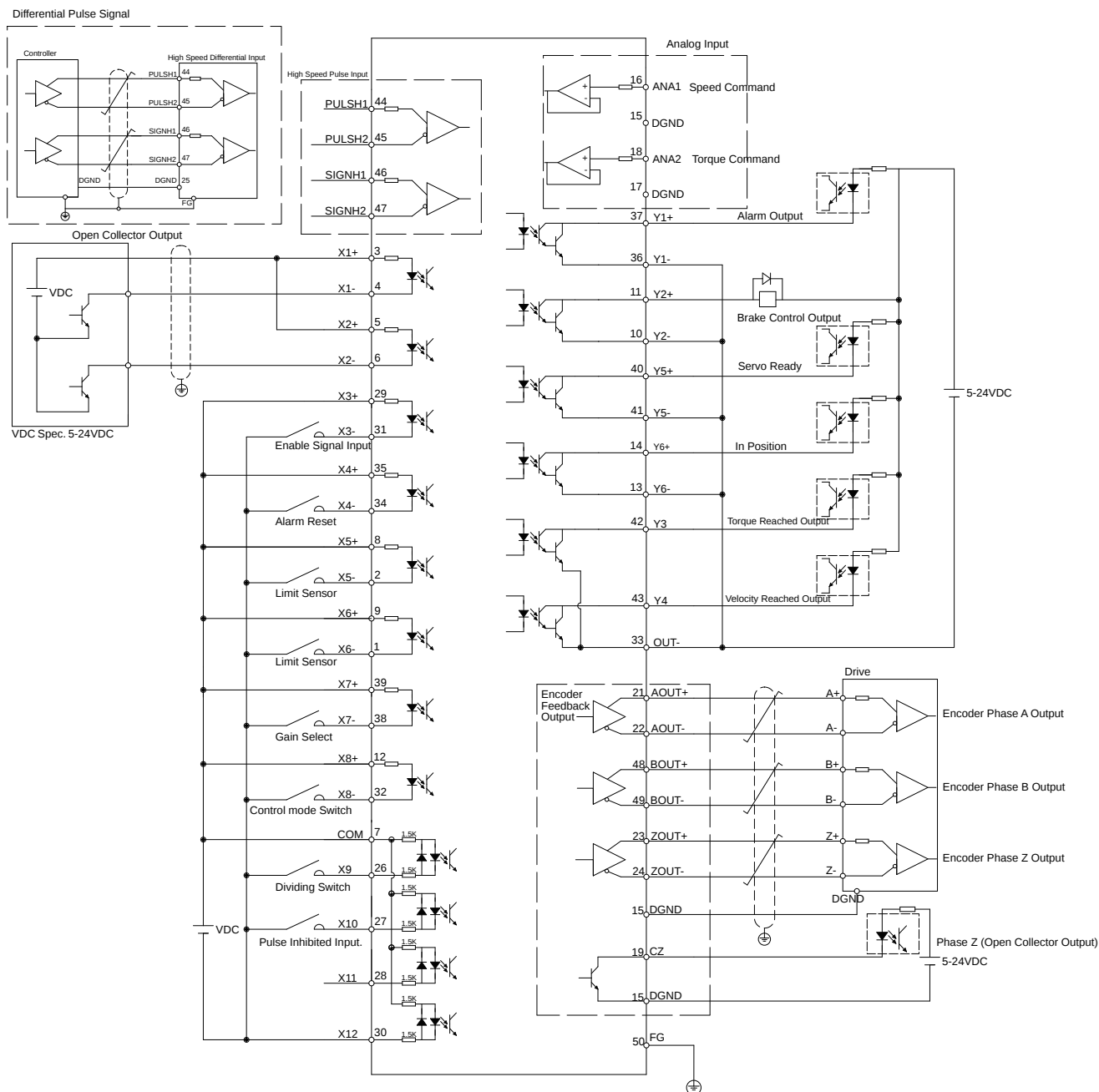
7.2 Position Mode

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

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

NOTE: Configuration setting by M servo suite is recommended.

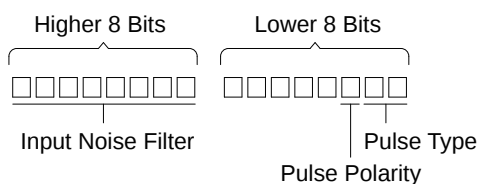
7.2.1 Digital Pulse Position Mode Connection Diagram



7.2.2 Input Pulse Type And Input Noise Filter

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

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



7.2.2.1 Input Pulse Type Setting

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

7.2.2.2 Input Noise Filter Setting

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

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

7.2.2.3 Parameter P-43 (SZ) Setting

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

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

Software Configuration

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

7.2.3 Control Pulse Dividing Switch Function

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

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

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

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

Software Configuration

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

7.2.4 Pulse Inhibition Function

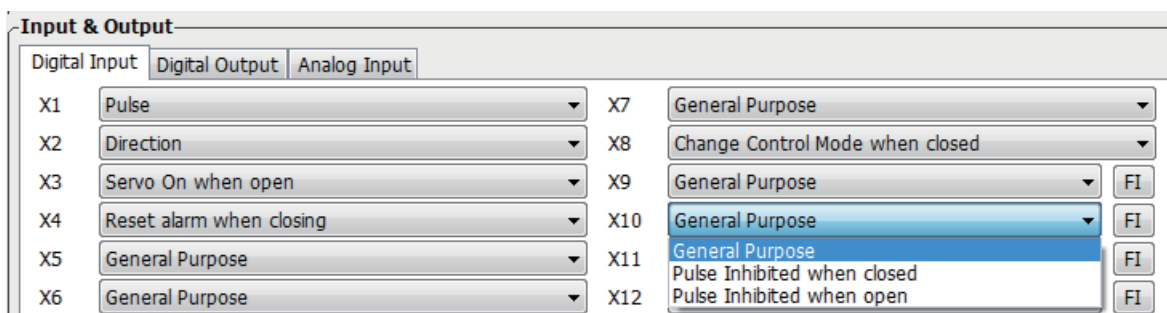
Pulse inhibition function use external input X10 in digital pulse position mode. When external input X10 is triggered, it will enforce the drive to stop receiving pulses input from any source, and stop the servo motor immediately.

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

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

Software Configuration

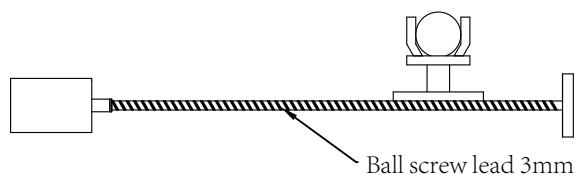
In drive configuration page-----input/output select X10 function to setup pulse inhibition function.



7.2.5 Electronic Gearing Ratio

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

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



Distance for screw lead, movements requirement 4mm

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

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

Pulse Count Requirement

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

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

If use electronic gearing ratio

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

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

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

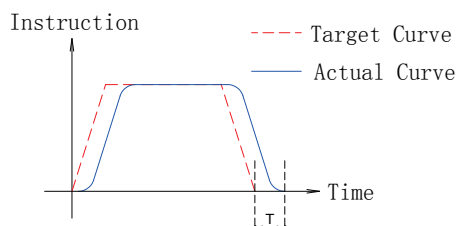
Parameters Setting

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

7.2.6 Jerk Smoothing Filter

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

Jerk smoothing filter effects are as follows :



- 1) The smaller value of P-07 (KJ), the strong effect it will be.
- 2) Jerk smoothing filter will cause command delay time T, but it will not effect in position accuracy.

Parameters Setting

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

NOTE: Setting to 0, means no filter effect.

7.2.7 In Position Error Output

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

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

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

Parameters Setting

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

7.2.8 Gain Parameters For Position Control Mode

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

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

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

7.2.9 Software Configuration For Position Mode

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

The screenshot shows the 'Configuration' tab of the M Series AC Servo software. The 'Tuning - Sampling' and 'Parameter Table' tabs are also visible. The 'Motor Information' section (1) includes a 'Config' button and a 'Reverse motor rotating direction' checkbox. The 'Control Mode' section (2) features 'Main Mode' and 'Sub Mode' dropdown menus. The 'Control Mode Settings' section (3) shows 'Position Control' options like 'Pulse & Direction' and 'CW & CCW Pulse', along with 'Direction is CW when' settings. The 'Electronic Gearing' section (4) includes 'Electronic Gearing (Steps/Rev)' and 'Electronic Gearing Ratio' settings. The 'Input & Output' section (5) displays 'Digital Input', 'Digital Output', and 'Analog Input' configurations, including a table for digital inputs X1 through X12.

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

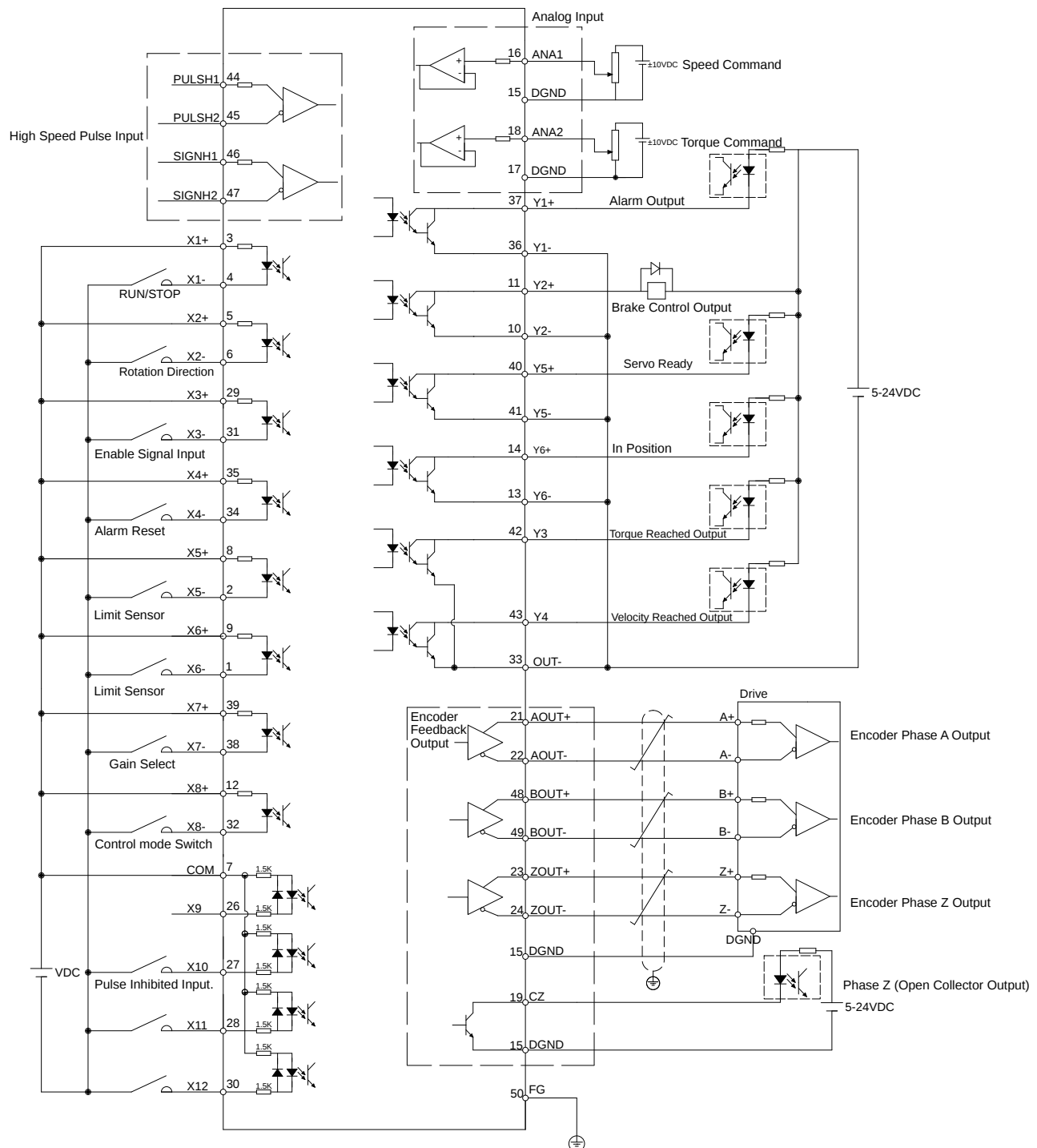
7.3 Velocity Mode

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

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

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

7.3.1 Velocity Mode Connection Diagram



7.3.2 Parameter Settings For Analog Velocity Control Mode

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

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

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

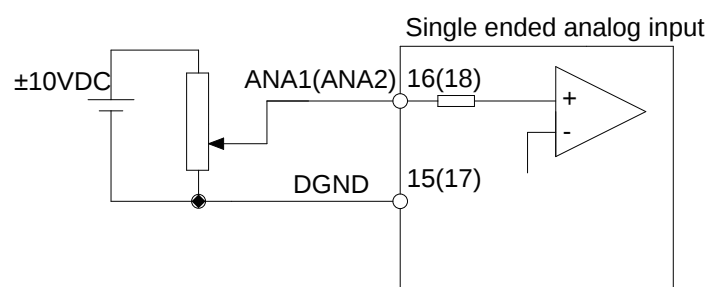
7.3.3 Basic Settings For Analog Velocity Control Mode

7.3.3.1 Command Signal For Analog Velocity Mode

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

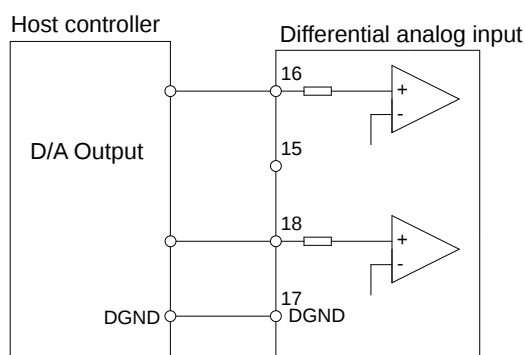
A. Single Ended Analog Input

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



B. Differential Analog Input

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



7.3.3.2 Analog Velocity Gain

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

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

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

$$\text{Drive display value} = \underline{V} \times 240$$

$\underline{V}$ is target setting velocity rev/second (rps)

Setting Via Software

Digital Input
Digital Output
Analog Input

Analog Input Filter
500 Hz

Analog Signal Type
☐ Differential ☒ Single Ended

Analog Input 1
Range: $\pm 10V$
☒ Velocity Limit 100.000 rev/sec at +10V
Offset: 0.000 V
Deadband: 50 mV

Analog Input2
Range: $\pm 10V$
☒ Torque Limit 0.65 A at +10V
Offset: 0.000 V
Deadband: 50 mV

7.3.3.3 Analog Input Voltage Offset

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

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

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

$$\text{Drive display value} = \underline{A} \times 2730$$

A is target setting offset, unit Voltage (V)

Setting Via Software

The screenshot shows the 'Analog Input' configuration window. At the top, there are tabs for 'Digital Input', 'Digital Output', and 'Analog Input'. Below the tabs, the 'Analog Input Filter' is set to 500 Hz. The 'Analog Signal Type' is set to 'Single Ended'. There are two main sections for 'Analog Input 1' and 'Analog Input 2'. Each section has a 'Range' dropdown set to '± 10V', a 'Velocity Limit' checkbox with a value of 100.000 rev/sec at +10V, a 'Torque Limit' checkbox with a value of 0.65 A at +10V, an 'Offset' input field set to 0.000 V, and a 'Deadband' input field set to 50 mV. An 'Auto Offset' button is located next to the offset input field for both inputs.

7.3.3.4 Analog Input Deadband

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

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

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

Setting Via Software

Input & Output

Digital Input

Digital Output

Analog Input

Analog Input Filter

500

Hz

Analog Signal Type

☐ Differential

☒ Single Ended

Analog Input 1

Range

± 10V

Offset

0.000

V

Auto Offset

Deadband

50

mV

Analog Input2

Range

± 10V

Offset

0.000

V

Auto Offset

Deadband

50

mV

Rev. 1.0
7/31/2019

96

400-820-9661

7.3.3.5 Run/Stop And Direction Signal

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

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

Setting Via Software

Input & Output

Digital Input Digital Output Analog Input

X1	Run/Stop input (Closed = Run)	X7	General Purpose	
X2	Not used. Motor runs continuously	X8	General Purpose	
X3	Run/Stop input (Closed = Run)	X9	General Purpose	FI
X4	Servo On when open	X10	General Purpose	FI
X5	General Purpose	X11	General Purpose	FI
X6	General Purpose	X12	General Purpose	FI

7.3.3.6 Torque Limit

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

Parameters Setting

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

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

$$\text{Drive display value} = \underline{A} \times 100$$

where $\underline{A}$ is target torque output value

Setting Via Software

The screenshot shows the 'Input & Output' configuration window with three tabs: 'Digital Input', 'Digital Output', and 'Analog Input'. The 'Analog Input' tab is selected. It contains two main sections: 'Analog Input Filter' and 'Analog Signal Type'. Below these are two columns for 'Analog Input 1' and 'Analog Input 2'.

Analog Input Filter: Set to 500 Hz.

Analog Signal Type: Radio buttons for 'Differential' and 'Single Ended' (selected).

Analog Input 1:

- Range: $\pm 10V$
- Speed: 100.000 rps at +10V
- Offset: 0.000 V (with 'Auto Offset' button)
- Deadband: 50 mV

Analog Input 2:

- Range: $\pm 10V$
- Current: 1.50 Amps at +10V
- Offset: 0.000 V (with 'Auto Offset' button)
- Deadband: 50 mV

7.3.3.7 Target Velocity Reach

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

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

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

Parameters Setting

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

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

$$\text{Velocity ripple range} = \text{LED display value} \times 240$$

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

Setting Via Software

7.3.4 Analog Input Filter

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

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

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

Where X is input filter frequency, unit Hz

Setting Via Software

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

7.3.5 Software Configuration For Analog Velocity Mode

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

The screenshot shows the 'Tuning - Sampling' tab of the software. The 'Motor Information' section (1) includes a motor ID field (SM0601AE2...) and a 'Config' button. The 'Control Mode' section (2) shows 'Main Mode' set to 'Velocity (IO Controlled)' and '2nd Mode' set to '21: Point to Point Pos.'. The 'Control Mode Settings' section (3) shows 'Velocity Control Type' set to 'Speed only', 'Accel' and 'Decel' both at 100.000 rps/s, and 'Velocity Control by' set to 'Single-Ended Analog Input 1'. The 'Input & Output' section (4) shows 'Analog Input Filter' at 500 Hz, 'Analog Signal Type' set to 'Single Ended', and 'Analog Input 1' configured with a range of ±10V, velocity of 20.000 rev/sec at +10V, and an offset of 0.000 V.

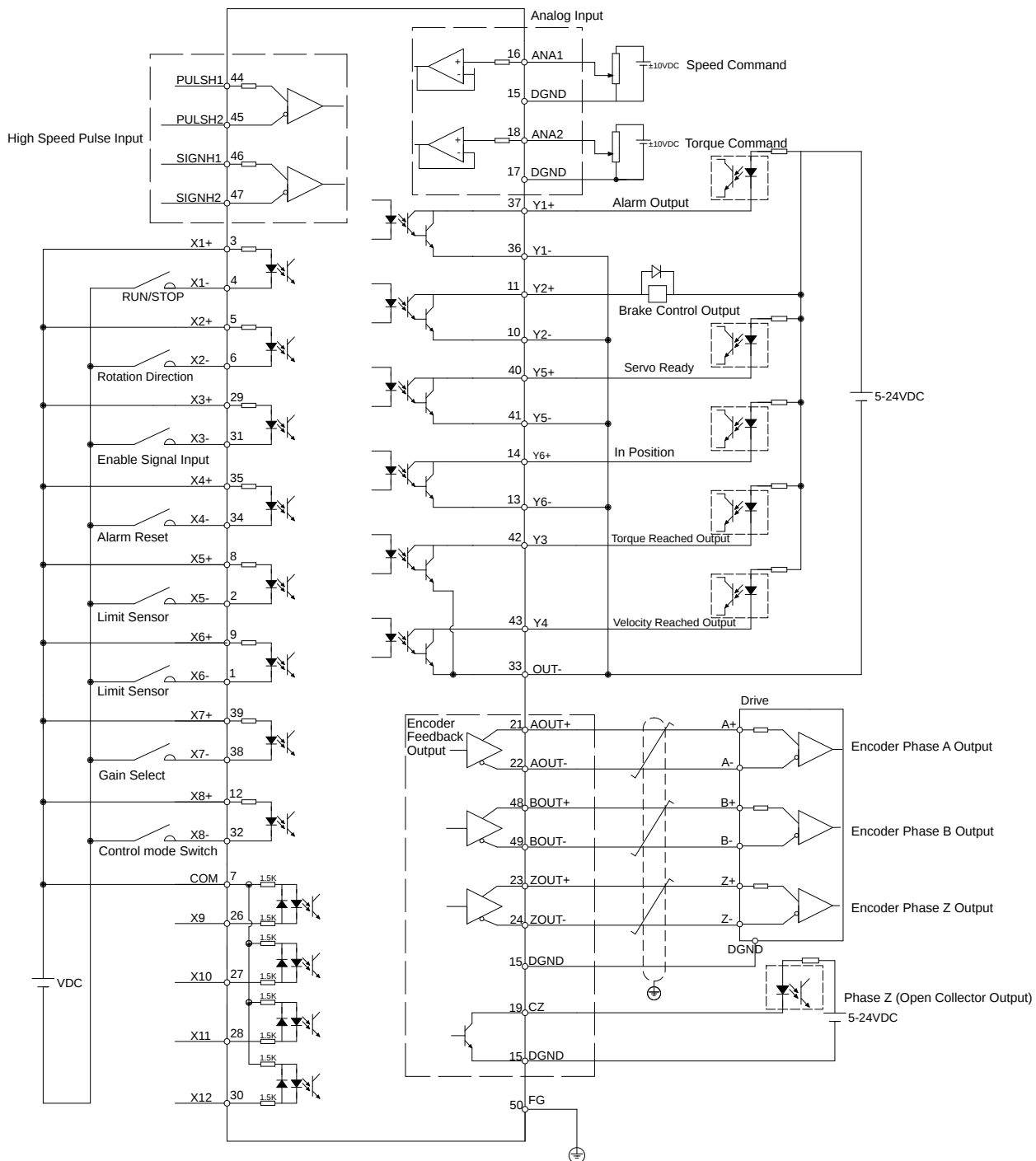
Step	Operation	Description
1st	Configure motor	choose your motor number. Please refer to 2.3 motor number for details
2nd	Choose control mode	In control mode, choose "velocity" for Velocity mode
3rd	Control mode configuration	choose specified velocity analog type, Please refer to 7.3 analog velocity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

7.4 Torque Mode

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

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

7.4.1 Analog Torque Mode Connection Diagram



7.4.2 Parameters For Analog Torque Mode

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

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

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

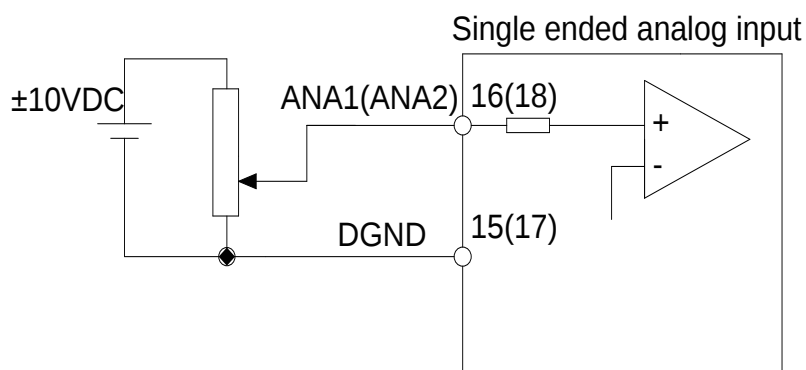
7.4.3 Basic Settings For Analog Torque Mode

7.4.3.1 Command Signal For Analog Torque Mode

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

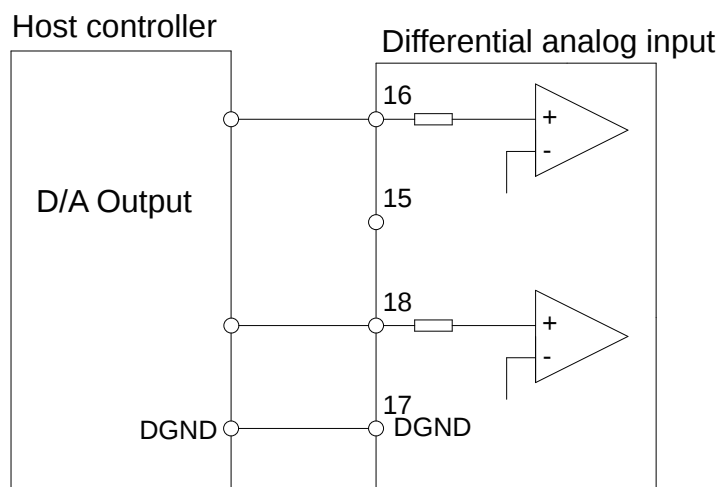
A. Single Ended Analog Input

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



B. Differential Analog Input

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



7.4.3.2 Analog Torque Gain

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

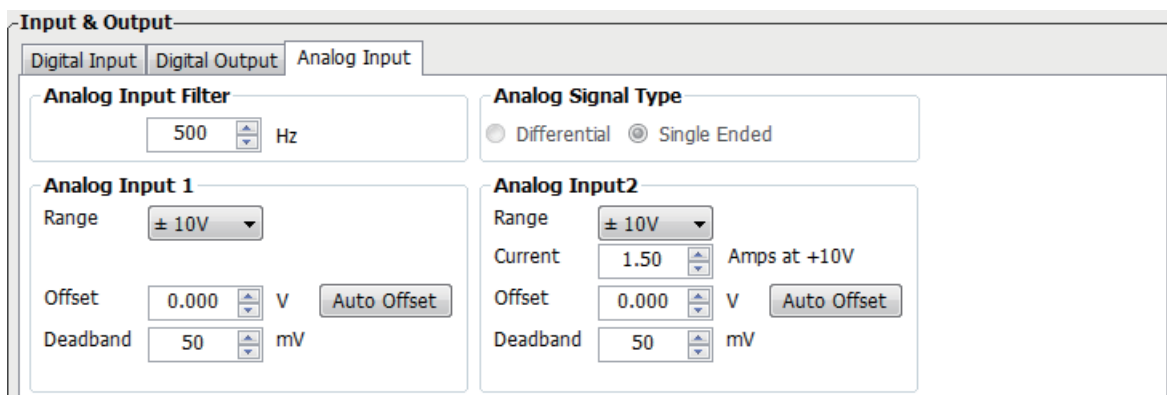
Parameter	Name	Data Range	Default value	Unit	Description
P-51 (AN)	Analog Torque Gain	-20~20	depend on current motor	A	Set the analog torque value corresponding to 10VDC.

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

$$\text{Drive display value} = \underline{a} \times 100$$

Where is target torque value unit $\underline{a}$ amps

Setting Via Software



7.4.3.3 Analog Input Offset

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

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

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

$$\text{Drive display value} = \underline{A} \times 2730$$

Where $\underline{A}$ is target setting offset, unit Voltage (V)

Setting Via Software

7.4.3.4 Analog Deadband

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

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

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

Setting Via Software

7.4.3.5 Run/Stop and Direction signal

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

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

Setting Via Software

The screenshot shows the 'Input & Output' configuration window with the 'Digital Input' tab selected. It displays settings for 12 digital inputs (X1 to X12). X1 is configured as 'Run/Stop input (Closed = Run)', X2 as 'Direction is CW when closed', and X3 as 'Servo On when open'. Inputs X4 through X12 are all set to 'General Purpose'. Each input has a corresponding 'FI' (Fault Input) button to its right.

7.4.3.6 Velocity Limit

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

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

Parameters Setting

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

Setting Via Software

The screenshot shows the 'Input & Output' configuration window with the 'Analog Input' tab selected. It displays settings for two analog inputs. For 'Analog Input 1', the range is set to ±10V, speed to 100.000 rps at +10V, offset to 0.000 V, and deadband to 50 mV. For 'Analog Input 2', the range is set to ±10V, current to 1.50 Amps at +10V, offset to 0.000 V, and deadband to 50 mV. Both inputs have 'Auto Offset' buttons. The 'Analog Signal Type' is set to 'Single Ended'.

7.4.3.7 Torque Reach

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

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

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

Parameters Setting

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

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

$$\text{LED display value} = \text{Torque ripple range} \times 100$$

Unit for torque ripple range is A (amps)

Setting Via Software

Input & Output

Digital Input
Digital Output
Analog Input

Y1

General Purpose

Y2

General Purpose

Y3

Closed to torque limit

Y4

General Purpose

Y5

General Purpose

Y6

General Purpose

Torque Reach Condition Setting

Current Ripple Range
0.00
A

7.4.4 Software Configuration For Analog Torque Mode

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

The screenshot displays the software configuration interface for the M Series AC Servo. The interface is divided into several sections, with red boxes and numbers highlighting specific configuration steps:

- Motor Information:** A red box labeled '1' highlights the 'Config' button next to the motor ID 'SM0601AE2...'.
- Control Mode:** A red box labeled '2' highlights the 'Main Mode' dropdown menu, which is set to 'Torque (IO Controlled)'.
- Control Mode Settings:** A red box labeled '3' highlights the 'Torque Control by' section, where 'Single-Ended Analog Input 2' is selected.
- Input & Output:** A red box labeled '4' highlights the 'Analog Input 1' and 'Analog Input 2' settings, including range, velocity limit, offset, and deadband.

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

7.5 Position Table Mode Instruction

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

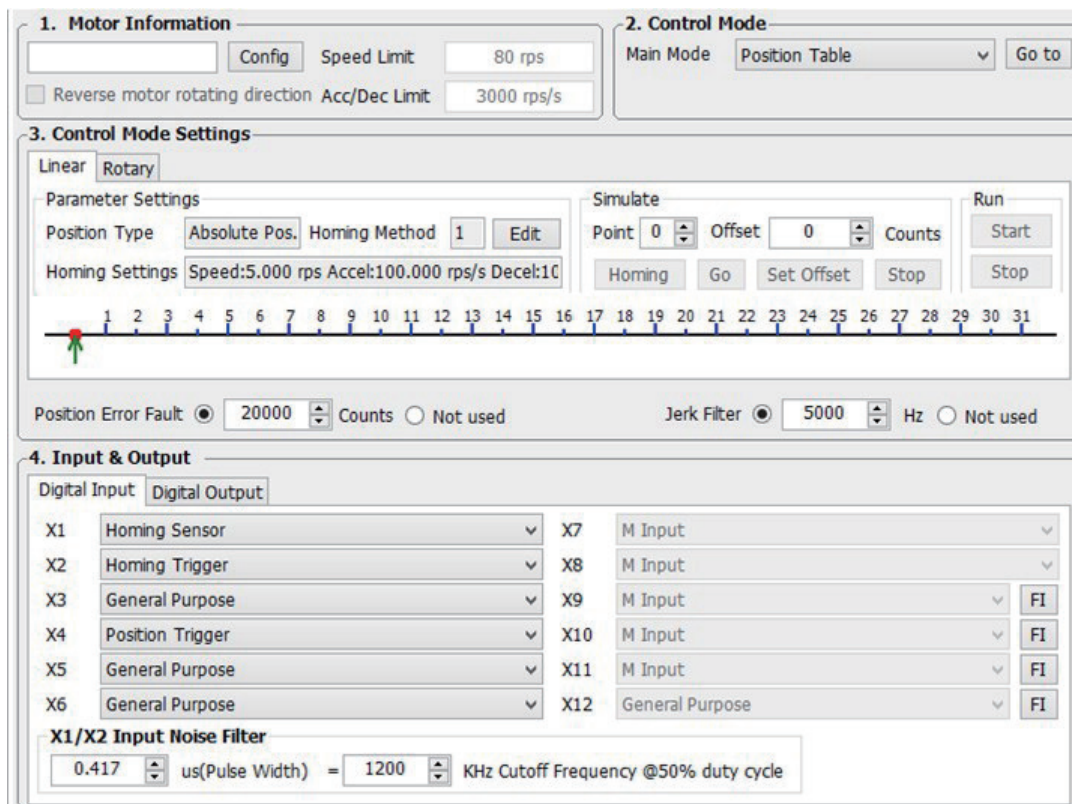


Figure 7.5.1 Position table mode

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

7.5.1 Linear motion

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

7.5.1.1 Linear Motion Software Configuration

- 1) Open M Servo Suite, connect the driver with software(refer to software manual for details)
- 2) Select “position table” control mode from”step1: configuration”-----“2. Control mode”

As shown in Figure 7.5.2 Select Position Table

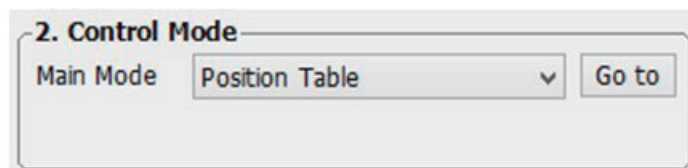


Figure 7.5.2 Select Position Table

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

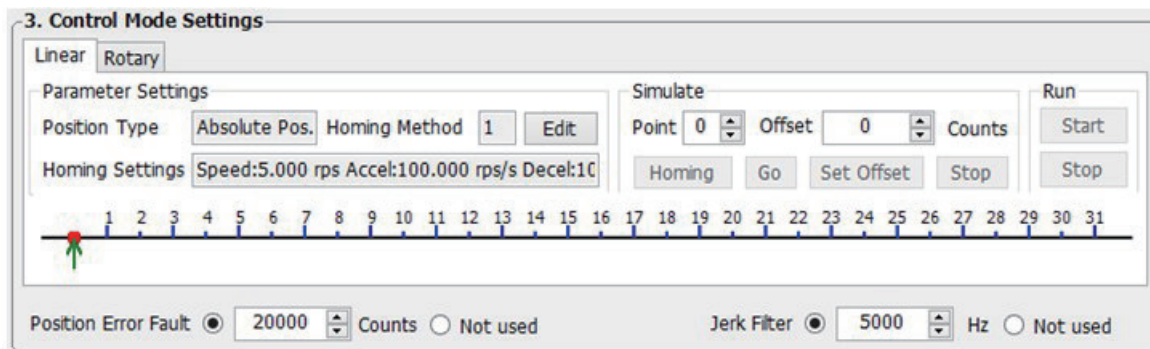


Figure 7.5.3Linear motion setting

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

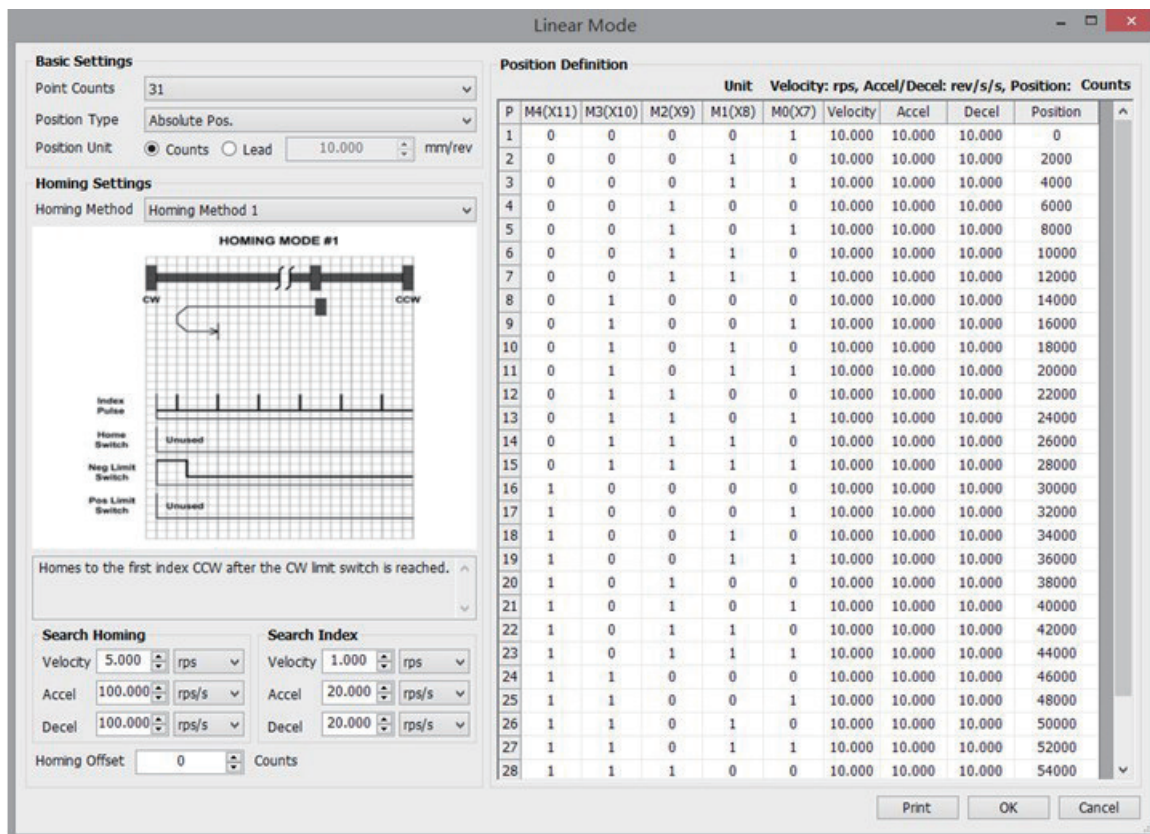


Figure 7.5.4Linear motion configuration

7.5.1.2 Basic Configuration

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

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

Example shown in Figure 7.5.5 Relative position VS Absolute position:

Set P1 position for 5 revs, P2 position for 10 revs, the difference between Relative position and absolute position are as shown in below:

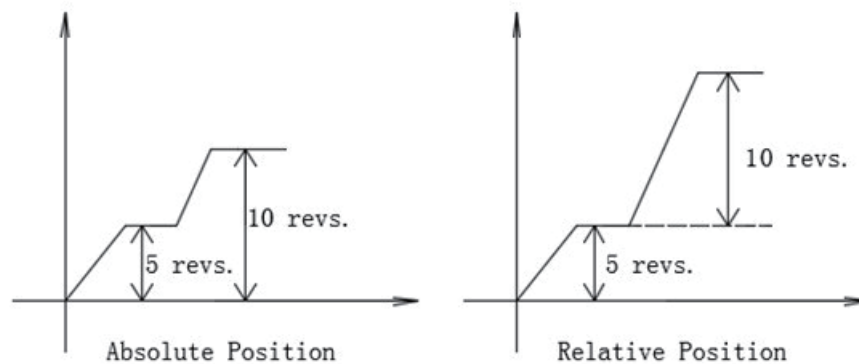


Figure 7.5.5 Relative position VS Absolute position

Position Unit Set position point Units.

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

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

7.5.1.3 Homing settings:

Homing Method: There are 12 types to homing available.

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

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

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

7.5.1.4 Print

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

Position Table Configuration. ©Shanghai AMP & MOONS' Automation Co., Ltd.

Linear Mode

Point Counts: 31

Position Type: Absolute Pos.

Homing Method: Homing Method 1

Search Homing

Velocity: 5 rev/s Accel: 100 rev/s/s Decel: 100 rev/s/s

Search Index

Velocity: 5 rev/s Accel: 100 rev/s/s Decel: 100 rev/s/s

Homing Offset: 0

Position Definition

P	M4(X11)	M3(X10)	M2(X9)	M1(X8)	M0(X7)	Unit	Velocity: rps	Accel/Decel: rev/s/s	Position:	
1	0	0	0	0	1		10.000	10.000	10.000	0
2	0	0	0	1	0		10.000	10.000	10.000	2000
3	0	0	0	1	1		10.000	10.000	10.000	4000
4	0	0	1	0	0		10.000	10.000	10.000	6000
5	0	0	1	0	1		10.000	10.000	10.000	8000
6	0	0	1	1	0		10.000	10.000	10.000	10000
7	0	0	1	1	1		10.000	10.000	10.000	12000
8	0	1	0	0	0		10.000	10.000	10.000	14000
9	0	1	0	0	1		10.000	10.000	10.000	16000
10	0	1	0	1	0		10.000	10.000	10.000	18000
11	0	1	0	1	1		10.000	10.000	10.000	20000
12	0	1	1	0	0		10.000	10.000	10.000	22000
13	0	1	1	0	1		10.000	10.000	10.000	24000
14	0	1	1	1	0		10.000	10.000	10.000	26000
15	0	1	1	1	1		10.000	10.000	10.000	28000

Figure 7.5.6 Print Position Table configuration

7.5.1.5 Position Definition

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

Position Definition

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

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

Figure 7.5.7 Position definition table

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

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

5) Click 'OK' to finish linear mode settings

6) Click 'Download to Drive' then set the drive

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

7.5.1.6 Simulate

After the configuration process, simulate function can verify the settings simulate the motions.

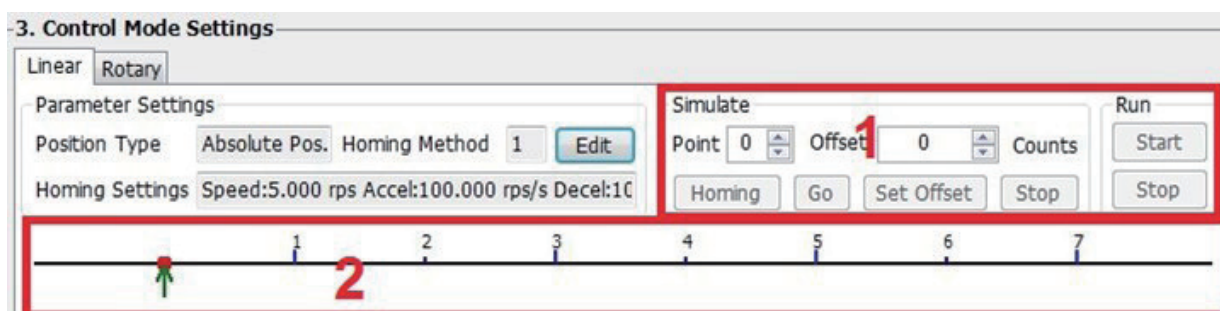


Figure 7.5.8 Linear motion Simulate

Homing: Click 'homing' to start homing process.

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

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

Stop: Stop current motion immediately

7.5.1.7 Linear motion input definition

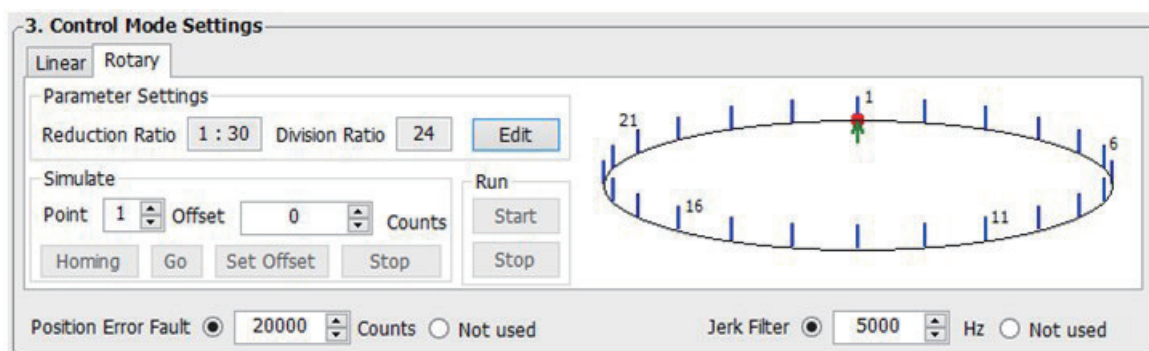
Input	Function	Description
X1	Homing Sensor	Homing sensor switch
X2	Homing Trigger	Triggering homing process
X3	General Purpose	General purpose
	Servo On When Closed	Enable the motor drive when input closed
	Servo On When Open	Enable the motor drive when input open
X4	Position Trigger	It is a trigger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

7.5.2 Rotary motion

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

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

7.5.2.1 Rotary motion software configuration



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

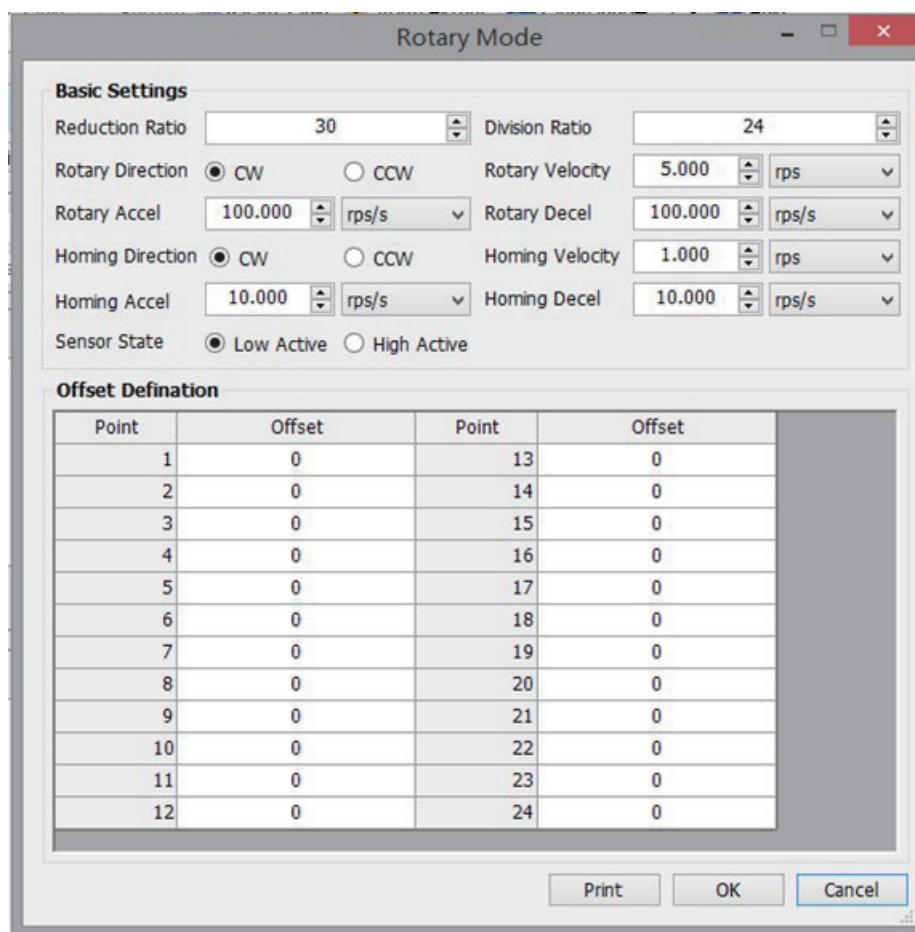


Figure 7.5.9Detail configuration for rotary motion

Reduction ratio: Set mechanical gear box ratio

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

Rotary direction: Select the direction for rotary motion

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

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

$$\text{System speed} = \text{Motor Speed} \times \text{Reduction ratio}$$

Homing direction: Set homing direction

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

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

$$\text{System speed} = \text{Motor Speed} \times \text{Reduction ratio}$$

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

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

7.5.2.2 Rotary motion input definition

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

8. Parameters and Functions

8.1 Parameter Category

M2 series AC servo drive has 4 modes.

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

8.2 Parameter List

parameter number	Type	SCL command	LED display	Function	Default value	Unit
P00	PID	KP	P00KP	Global gain 1	10000	
P01	PID	KG	P01KG	Global gain 2	12000	
P02	PID	KF	P02KF	Proportion gain	6000	
P03	PID	KD	P03KD	Deriv gain	2500	
P04	PID	KV	P04KV	Damping gain	8000	
P05	PID	KI	P05KI	Integrator gain	500	
P06	PID	KK	P06KK	Inertia Feedforward Constant	800	
P07	PID	KJ	P07KJ	Jerk Filter Frequency	5000	
P08	PID	VP	P08VP	Velocity Loop Proportional Gain	15000	
P09	PID	VI	P09VI	Velocity Loop Integral Gain	600	
P10	PID	KE	P10KE	Deriv Filter factor	15000	
P11	PID	KC	P11KC	PID Filter factor	25000	
P12	Control mode	CM	P12CM	Main control mode	7	
P13	Control mode	CN	P13CN	Secondary control mode	21	
P14	Control mode	PM	P14PM	Power-up mode	2	
P15	Control mode	JM	P15JM	Jog mode	1	
P16	Current config	GC	P16GC	Current Command of Torque Mode	0	0.01A
P17	Current config	CC	P17CC	Rated Maximum current	0.5 *	A
P18	Current config	CP	P18CP	Peak current	1.5 *	A
P20	Profile	VM	P20VM	Maximum velocity	60.000	rps
P21	Profile	AM	P21AM	Maximum acceleration/deceleration	3000	rps/s
P22	Profile	JS	P22JS	Jog speed	10.000	rps
P23	Profile	JA	P23JA	Jog acceleration	100.00	rps/s
P24	Profile	JL	P24JL	Jog deceleration	100	rps/s
P25	Profile	VE	P25VE	Point to point Velocity	5	rps

P26	Profile	AC	P26RC	Point to point acceleration	100.00	rps/s
P27	Profile	DE	P27dE	Point to point deceleration	100.00	rps/s
P28	Profile	VC	P28uC	Point to point secondary velocity	2.000	rps
P29	Profile	JC1	P29JC	Jog mode speed 1	2.000	rps
P30	Profile	JC2	P30JC	Jog mode speed 2	10.000	rps
P31	Profile	JC3	P31JC	Jog mode speed 3	20.000	rps
P32	Profile	JC4	P32JC	Jog mode speed 4	25.000	rps
P33	Profile	JC5	P33JC	Jog mode speed 5	30.000	rps
P34	Profile	JC6	P34JC	Jog mode speed 6	35	rps
P35	Profile	JC7	P35JC	Jog mode speed 7	40.000	rps
P36	Profile	JC8	P36JC	Jog mode speed 8	50.000	rps
P37	Config	ER	P37Er	Encoder resolution	10000	counts/rev
P39	Config	EG	P39EG	Electronic gearing	10000	counts/rev
P40	Config	PV	P40Pu	Secondary Electronic gearing	10000	counts/rev
P41	Config	EN	P41En	Numerator of electronic gearing ratio	1000	
P42	Config	EU	P42Eu	Denominator of electronic gearing ratio	1000	
P43	Config	SZ	P43Sz	Input Pulse Setting	1792	
P44	Config	PF	P44PF	Position Fault limit	2000	counts
P45	Config	PL	P45PL	Dynamical Position error Range	10	counts
P46	Config	PD	P46Pd	In Position Error Range	10	counts
P47	Config	PE	P47PE	In position duration count	10	counts
P48	Config	TT	P48tT	Pulses Input Completion count	2	ms
P49	Analog	AP	P49AP	Analog Position Gain	8000	counts
P50	Analog	AG	P50AG	Analog Velocity Gain	20.000	rps
P51	Analog	AN	P51An	Analog Torque Gain	1.00	A
P52	Analog	AV1	P52Au	Analog input1 offset	0.000	V

*: This parameter depends on motor models.

P53	Analog	AV2	P53R_u	Analog input2 offset	0.000	V
P54	Analog	AV3	P54R_u	Differential analog input offset	0.000	V
P55	Analog	AS	P55R_E	Analog type	0	
P56	Analog	AD1	P56R_d	Analog input1 deadband	0	mv
P57	Analog	AD2	P57R_d	Analog input2 deadband	0	mv
P58	Analog	AD3	P58R_d	Differential analog deadband	0	mv
P59	Analog	AF	P59R_F	Analog input low pass filter value	500	Hz
P60	Analog	AT	P60R_t	Analog threshold	0.000	V
P61	Analog	FA	P6 IFR	Analog 1/2 function	33	
P62	I/O	SI	P62_E ,	Servo enable input setting	2	
P63	I/O	AI	P63R ,	Alarm Reset input setting	3	
P64	I/O	DL	P64_{dL}	End-of –travel limit Setting	3	
P65	I/O	MI	P65_n ,	X7, X8, X9, X10 input function setting	3333	
P66	I/O	AO	P66R_o	Alarm output function setting	1	
P67	I/O	BO	P67_bo	Motor brake control setting	1	
P68	I/O	MO	P68_no	Y3, Y4, Y5, Y6 output function setting	3341	
P69	I/O	BD	P69_bd	Brake disengage Delay	200	ms
P70	I/O	BE	P70_bE	Brake engage delay	200	ms
P71	I/O	FI1	P7 I F ,	Input X9 noise filter	0	
P72	I/O	FI2	P72 F ,	Input X10 noise filter	0	
P73	I/O	FI3	P73 F ,	Input X11 noise filter	0	
P74	I/O	FI4	P74 F ,	Input X12 noise filter	0	
P76	communication	PR	P76P_r	Communication protocol	15	
P77	communication	TD	P77_td	Transmit delay	2	
P78	communication	BR	P78_br	Baud rate	1	
P79	communication	DA	P79_dR	RS-485 Address	32	
P80	communication	CO	P80_Co	CANopen Node ID	1	

P81	communication	CB	P81Cb	CANopen Baudrate	0	
P82	Regeneration	ZR	P82Zr	Regen resistor value	40	Ω
P83	Regeneration	ZC	P83ZC	Regen resistor continuous wattage	200	w
P84	Regeneration	ZT	P84Zt	Regen resistor peak time	125.00	ms
P85	Other	VR	P85Vr	Ripple range setting for velocity reach	0.000	rps
P86	Other	TO	P86To	Tach out counts	0	
P87	Other	TV	P87Tv	Ripple range setting for torque reach	0.00	A
P88	Other	PK	P88Pk	Parameter lock on the drive's control panel	0	
P89	Other	DD	P89Dd	LED Default status monitor type	0	
P90	Other	MA	P90Ma	LED Warning Display Mask Code	65535	
P91	Other	HA1	P91Ha	Accel of seeking end-of-travel limit during homing	100	rps/s
P92	Other	HA2	P92Ha	Accel of seeking homing switch during homing	100	rps/s
P93	Other	HA3	P93Ha	Accel of feeding to homing switch during homing	10	rps/s
P94	Other	HO1	P94Ho	Decel of seeking end-of-travel limit during homing	100	rps/s
P95	Other	HO2	P95Ho	Decel of seeking homing switch during homing	100	rps/s
P96	Other	HO3	P96Ho	Decel of feeding to homing switch during homing	10	rps/s
P97	Other	HV1	P97Hv	Velocity of seeking end-of-travel limit during homing	10	rps
P98	Other	HV2	P98Hv	Velocity of seeking homing switch during homing	5	rps
P99	Other	HV3	P99Hv	Velocity of feeding to homing switch during homing	0.5	rps
P100	Other	KL	P00Kl	Follow factor	0	

8.3 Parameter Description

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

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

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

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

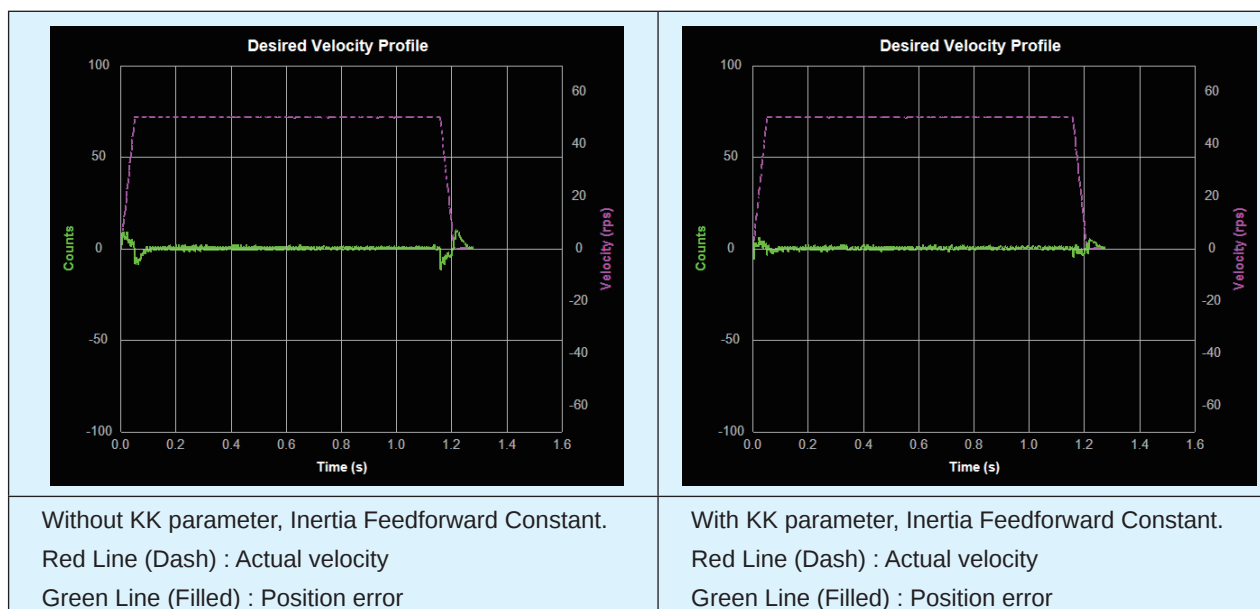
The servo control Proportional gain term of the velocity error. Gain value is relative: 0 = no gain, 32767 = full gain. KV minimizes the velocity error, and vibration in position control mode.

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

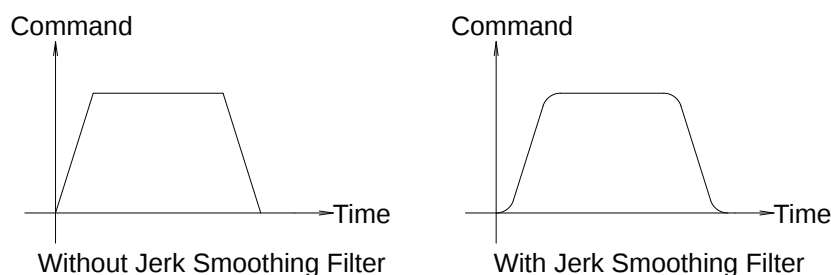
The servo control inertia feed forward gain. Gain value is relative: "0" meaning no gain, "32767" meaning full gain. KK improves acceleration control by compensating for the load inertia.



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.



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

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

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

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

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

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

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

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

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

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

Parameter mode list are as follows:

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

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

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

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

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

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

There are two Jog modes available:

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

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

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

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

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

$$\text{LED display value} = \underline{B} \times 100$$

Where $\underline{B}$ 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:

$$\text{LED display value} = \underline{B} \times 100$$

Where $\underline{B}$ 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 no 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:

$$\text{LED display value} = \underline{B} \times 100$$

Where $\underline{B}$ 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:

$$\text{LED display value} = \underline{V} \times 240$$

Where $\underline{V}$ 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 exceeds 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:

$$\text{LED display value} = \underline{B} \times 6$$

Where $\underline{B}$ 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:

$$\text{LED display value} = \underline{V} \times 240$$

Where = $\underline{V}$ 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:

$$\text{LED display value} = \underline{B} \times 6$$

Where $\underline{B}$ 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:

$$\text{LED display value} = \underline{B} \times 6$$

Where $\underline{B}$ 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:

$$\text{LED display value} = \underline{V} \times 240$$

Where $\underline{V}$ 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:

$$\text{LED display value} = \underline{B} \times 6$$

Where $\underline{B}$ 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:

$$\text{LED display value} = \underline{B} \times 6$$

Where $\underline{B}$ 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.

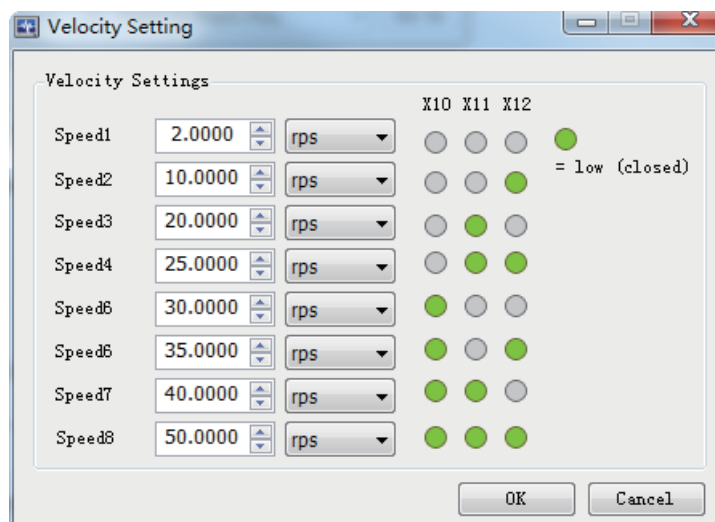
NOTE: if you need to view or set this value on drive's control panel P-28 (VC), please refer to following calculation:

$$\text{LED display value} = \underline{V} \times 240$$

Where $\underline{V}$ is target velocity setting, Unit is rps (rev/sec) .

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

NOTE: for MOONS' motor please DONOT change this parameter

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

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

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

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

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

Defines the numerator of electronic gearing ratio.

Please refer to 7.2.5 Electronic gearing ratio

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

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

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

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

Bit0~bit1: pulse type。

0 = STEP/DIR

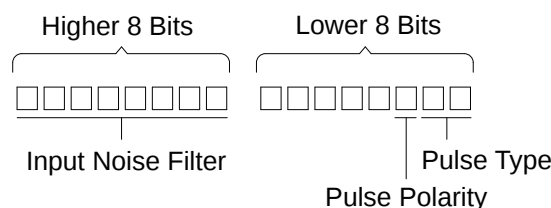
1 = CW/CCW

2 = A/B quadrature

bit2: count direction

Bit8~bit15: digital filter parameter

Please refer to 7.2.2 input pulse type and input noise filter



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

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

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

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

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

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

PI3: Input X10 is used as general purpose input.

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

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

Please refer to 7.2.7 in position error output

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

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

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

Please refer to 7.2.7 in position error output

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

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

One count equivalent to 125μs

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

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

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

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

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

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

$$\text{LED display value} = \underline{V} \times 240$$

Where $\underline{V}$ is target velocity setting, Unit is rps (rev/sec).

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

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

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

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

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

$$\text{LED display value} = \underline{A} \times 2730$$

Where $\underline{A}$ is voltage offset, Unit is V.

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

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

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

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

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

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

0: single ended input

1: differential input

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

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

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

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

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

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

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

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

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

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

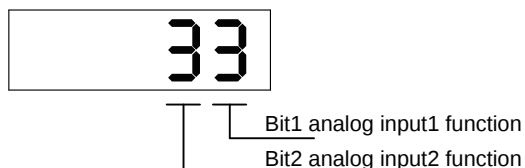
NOTE: if you need to view or set this value on drive’s control panel P-60 (AT), please refer to following calculation:

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

Where $\underline{A}$ is target voltage value, Unit is V (volts).

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

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



X1:

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

2: Not used.

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

X2:

1: Not used.

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

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

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

Configuration Tuning - Sampling Parameter Table								
Open Save Print Export			Upload from Drive Download to Drive Refresh					
SEQ	Category	Command	Unit	Software	Drive	Default	Range	Description(Double Click for Details)
060	Analog	FA1		3		3	1 - 3	Analog 1 Function
060	Analog	FA2		3		3	1 - 3	Analog 2 Function

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

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

SI1: Drive is enabled when X3 is open.

SI2: Drive is enabled when X3 is closed.

SI3: Input X3 is used as general purpose inputs.

Please refer to 7.1.1 servo on settings.

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

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

Please refer to 7.1.2 alarm reset

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

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

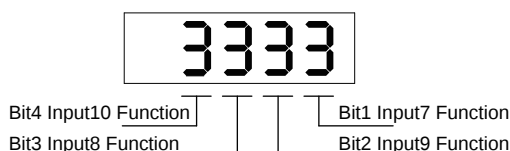
For example, define inputs X5 and X6 as dedicated end-of-travel limits. If one of these inputs is activated while defined as an end-of-travel limit, motor rotation will stop in that direction, and an alarm code will show at the drive's status LEDs.

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

Please refer to 7.1.3 CW/CCW limit

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

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



Bit1 defines X7 for control global gain selection function

- 1: When input X7 is open select parameter KG, close for parameter KP.
- 2: When input X7 is open select parameter KP, close for parameter KG.
- 3: X7 uses as general purpose, parameter KP is used.

Bit2 defines X9 for electronic gearing selection

- 1: When input X9 is open select parameter EG for electronic gearing, close for parameter PV for electronic gearing.
- 2: When input X9 is open select parameter PV for electronic gearing, close for parameter EG for electronic gearing.
- 3: X9 as general purpose, use parameter EG for electronic gearing.

Bit3 defines X8 control selection function

- 1: When input X8 is open select CN control mode, close for CM control mode.
- 2: When input X8 is open select CM control mode, close for CN control mode.
- 3: X8 as general purpose.

Bit4 defines X10 for pulse inhibition function

- 1: When X10 is closed pulse inhibition function is on
- 2: When X10 is open pulse inhibition function is on
- 3: Input X10 set as general purpose

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

Configuration Tuning - Sampling Parameter Table									
Open Save Print Export				Upload from Drive Download to Drive Refresh					
SEQ	Category	Command	Unit	Software	Drive	Default	Range	Description(Double Click for Details)	
064	I/O	DS		3		3	1 - 3	Dividing Select	
064	I/O	GS		3		3	1 - 3	Gain Select	
064	I/O	MS		3		3	1 - 3	Control Mode Select	
064	I/O	PI		3		3	1 - 3	Pulse Inhibition	

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

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

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

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

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

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

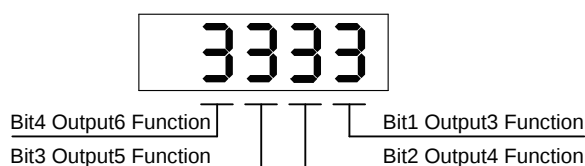
BO2: Output Y2 is open (de-energized) when drive is enabled, and closed when the drive is disabled.

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

Please also refer to 7.1.7 motor brake control

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

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



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

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

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

3: Output Y3 is used as general output.

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

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

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

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

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

3: Output Y3 is used as general output.

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

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

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

3: Output Y5 is used as general output.

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

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

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

C: When the motor is running,

3: Output Y6 is used as general output.

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

Configuration Tuning - Sampling Parameter Table								
Open			Save			Print		
			Export			Upload from Drive		
						Download to Drive		
						Refresh		
SEQ	Category	Command	Unit	Software	Drive	Default	Range	Description(Double Click for Details)
067	I/O	MO1		3		3	3, 8, 9	Motion Output 1
067	I/O	MO2		3		3	3, 6, 7, 10, 11	Motion Output 2
067	I/O	MO3		3		3	1, 2, 3	Motion Output 3
067	I/O	MO4		3		3	3, 4, 5, 12	Motion Output 4

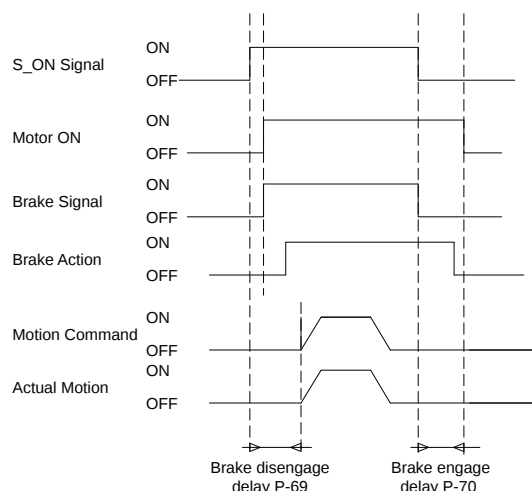
P-69 (BD)	Brake disengage Delay	Data Range	Default	Unit	Data type
		0~32000	200	ms	DEC
P-70 (BE)	Brake engage delay	Data Range	Default	Unit	Data type
		0~32000	200	ms	DEC

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

This Only takes effect if the BO command is set to 1 or 2. After a drive is commanded to be disabled, this is the time value that delays the actual disabling of the driver output. When using the dedicated brake output

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

time before turning off the motor current.



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

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

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

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

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

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

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

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

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

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

Bit 0 = Default ("Standard SCL")

bit 1 = Always use Address Character

bit 2 = Ack/Nack

bit 3 = Checksum (RESERVED)

bit 4 = RS-485 Adaptor

bit 5 = 3-digit numeric register addressing

bit 6 = Checksum Type

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

bit 8 = Four wires/two wires

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

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

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

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

1 = 9600bps

2 = 19200bps

3 = 38400bps

4 = 57600bps

5 = 115200bps

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

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

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

The CANopen NODE-ID for CANopen type drives.

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

CANopen drive supports 8 types for baud rate.

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

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

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

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

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

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

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

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

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

Please refer to 7.3.3.7 target velocity reach

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

The count value of tach out per revolution.

$$0 = 1 * \text{pole pairs}$$

- 1 = 2 * pole pairs
 2 = 4 * pole pairs
 3 = 8 * pole pairs
 4 = 16 * pole pairs
 5 = 32 * pole pairs
 6 = 64 * pole pairs
 7 = 128 * pole pairs

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

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

Please refer to 7.4.3.7 torque reach for more details.

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

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

0 = Yes

1 = No

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

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

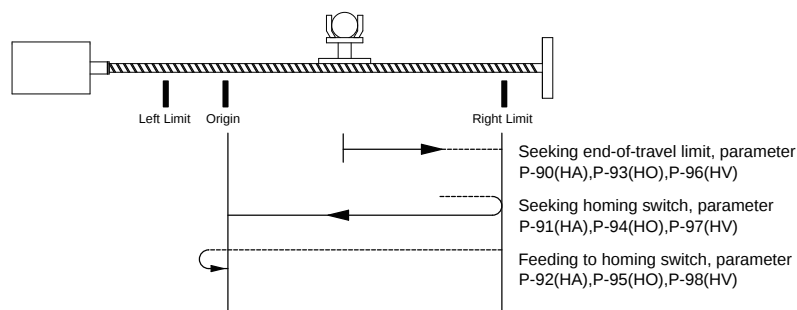
P-90 (MA)	LED Warning Display Mask Code	Data Range	Default	Unit	Data type
		0~65535	65535		DEC

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

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

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

Please refer to the graph below.



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

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

Please refer to parameter P-91 (HA)

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

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

Please refer to parameter P-91 (HA)

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

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

Please refer to parameter P-91 (HA)

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

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

Please refer to parameter P-91 (HA)

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

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

Please refer to parameter P-91 (HA)

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

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

Please refer to parameter P-91 (HA)

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

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

Please refer to parameter P-91 (HA)

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

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

Please refer to parameter P-91 (HA)

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

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

9. Communication

M2 series AC servo drive supports multiple communication interface.

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

9.1 RS-232 communication

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

9.1.1 What is SCL

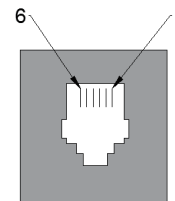
SCL or serial command language, was developed by MOONS to give users a simple way to control a motor drive via a serial port. This eliminates the need for separate motion controllers or to supply control signals, like Pulse & Direction, to your step and servo motor drives. It also provides an easy way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

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

9.1.2 RS-232 Connections

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

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

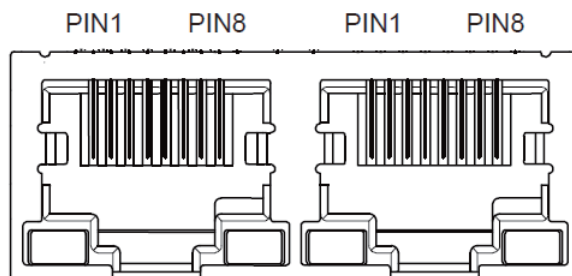


9.2 RS-485 Communication

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

9.2.1 RS-485 PIN definition

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



Pin definitions as follows:

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

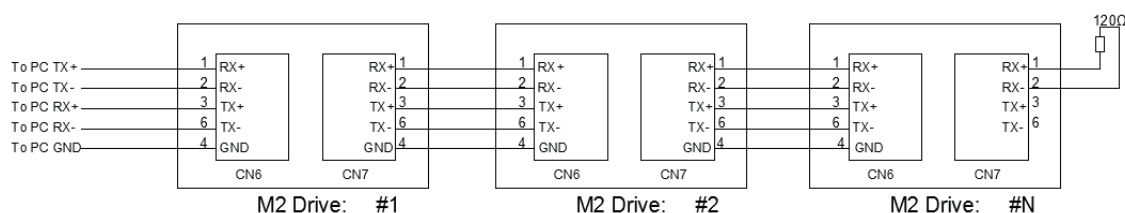
9.2.2 RS-485 Connection Method

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

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

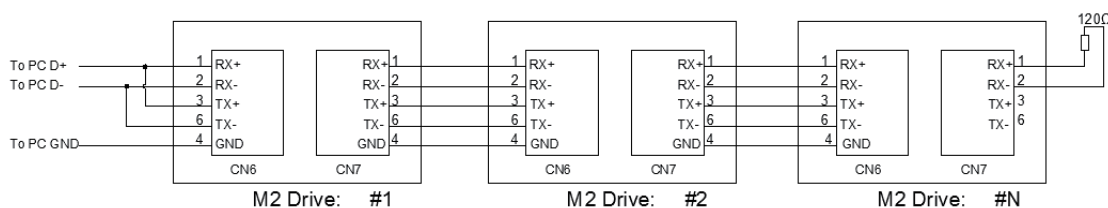
Four-Wire Configuration

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



Two-Wire Configuration

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



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

9.3 ModBUS/RTU Communication

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

9.3.1 Data Encode

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

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

Register 40031 = 0x1234

Register 40032 = 0x5678

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

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

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

Register 40031 = 0x5678

Register 40032 = 0x1234

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

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

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

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

9.3.2 Communication Address

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

9.3.3 Communication Baud Rate And Framing

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

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

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

1 = 9600bps

2 = 19200bps

3 = 38400bps

4 = 57600bps

5 = 115200bps

9.3.4 Power Up Mode

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

8 = Modbus/RTU mode when powered up.

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

9.3.5 Modbus/RTU Data Framing

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

Address	Function	Data	CRC
---------	----------	------	-----

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

Normal ModBUS response:

response function code = request function code

ModBUS error response:

response function code = request function code + 0x80

providing an error code to indicate the error reasoning.

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

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

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

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

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

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

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

9.3.7 Command Opcode description

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

1) SCL Command Encoding Table

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

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

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

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

9.3.8 Function Code

MOONS drives currently support following Modbus function code:

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

9.3.8.1 Function Code 0X03, Reading Multiple Holding Registers

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

Communication details are as follows:

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

Host Sending: 01 03 00 04 00 02 85 CA

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

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

Where XX = 01 : Function code 03 unsupported

XX = 02 : Incorrect reading on driving address or numbers

XX = 03 : Reading register address out of range

XX = 04 : Reading failure

9.3.8.2 Function Code 0x06, Writing Single Register

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

Communication Details are as follows:

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

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

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

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

Where XX = 01 : Function code 06 unsupported

XX = 02 : Incorrect writing on driving address or number

XX = 03 : Writing register address out of range

XX = 04 : Writing failure

9.3.8.3 Function Code 0X10, Writing Multiple Registers

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

Communication Details are as follows:

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

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

Drive Reply: 0A 10 00 1E 00 02 20 B5

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

Where XX = 01 : Function code 10 unsupported

XX = 02 : Incorrect reading on driving address or number

XX = 03 : Reading register address out of range

XX = 04 : Reading failure

9.3.9 Modbus/RTU Applications

9.3.9.1 Position Control

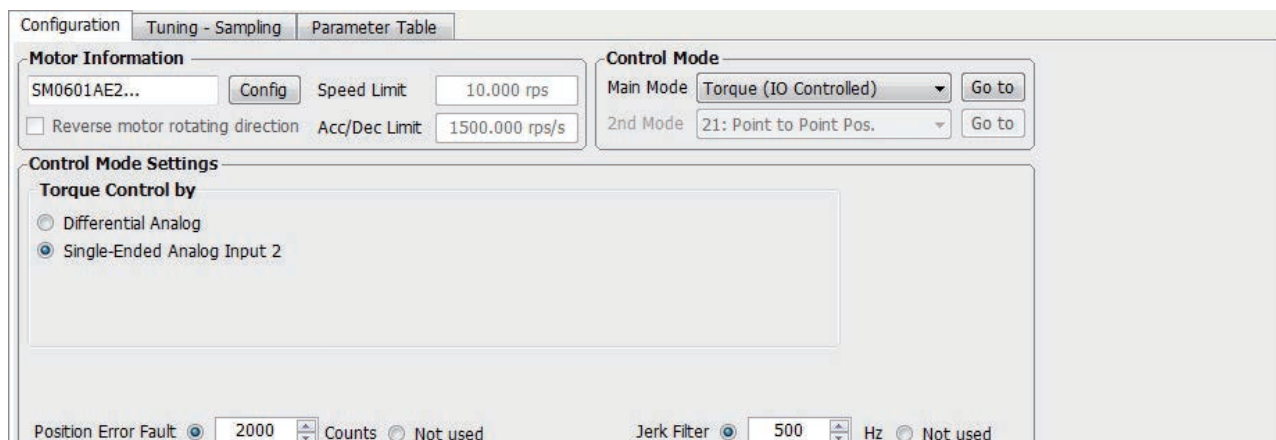
1.Target Profile Planning

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

2. Drive Setting

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

Use M servo suite software for configurations:



3. Sending Command

First Step :

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

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

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

Command Message (Master)			Command Message (Slave)		
Function	Data	Number Of Bytes	Function	Data	Number Of Bytes
Slave Address	01H	1	Slave Address	01H	1
Function Code	10H	1	Function Code	10H	1
Starting Data Address	00H (High) 1BH (Low)	2	Starting Data Address	00H (High) 1BH (Low)	2
Number of Data (In word)	00H (High) 05H (Low)	2	Number of Data (In word)	00H (High) 05H (Low)	2
Number of Data (In word)	0AH	1	CRC Check Low	70	1
Content of first Data address 40028	02 (High) 58 (Low)	2	CRC Check High	0D	1
Content of second Data address 40029	04H (High) B0H (Low)	2			
Content of third Data address 40030	09H (High) 60H (Low)	2			
Content of fourth Data address 40031	00H (High) 00H (Low)	2			
Content of fifth Data address 40032	4EH (High) 20H (Low)	2			
CRC Check Low	24	1			
CRC Check High	3B	1			

Second Step: Point To Point Motion Command

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

SCL Command Encoding Table							
Function	SCL	Ocode	Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
Feed to Length	FL	0x66	x	x	x	x	x

Host Sending: 01 06 00 7C 00 66 C8 38

Drive Reply: 01 06 00 7C 00 66 C8 38

Listed As Below:

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

9.3.9.2 JOG mode

1. JOG mode required parameters:

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

2. Drive Setting

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

Use M servo suite software for configurations:

The screenshot shows the 'Configuration' tab of the M servo suite software. The 'Motor Information' section includes a motor ID 'SM0601AE2...', a 'Config' button, 'Speed Limit' set to '10.000 rps', a checkbox for 'Reverse motor rotating direction', and 'Acc/Dec Limit' set to '1500.000 rps/s'. The 'Control Mode' section shows 'Main Mode' as 'Modbus' and '2nd Mode' as '21: Point to Point Pos.', both with 'Go to' buttons. The 'Control Mode Settings' section includes 'Node ID' set to '32', 'SCL Add.' set to '0', 'Transmit Delay' set to '2 ms', 'Power-Up BaudRate' set to '9600 bit/s(bps)', a checkbox for 'Auto Execute Q Program at Power Up', and '32 Bit Word Order' set to 'Big Endian'.

3. Sending Command

First Step:

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

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

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

Command Message (Master)			Command Message (Slave)		
Function	Data	Number Of Bytes	Function	Data	Number Of Bytes
Slave Address	01H	1	Slave Address	01H	1
Function Code	10H	1	Function Code	10H	1
Starting Data Address	00H (High) 2EH (Low)	2	Starting Data Address	00H (High) 2EH (Low)	2
Number of Data (In word)	00H (High) 03H (Low)	2	Number of Data (In word)	00H (High) 03H (Low)	2
Number of Data (In word)	06H	1	CRC Check Low	70	1
Content of first Data address 40047	02 (High) 58 (Low)	2	CRC Check High	0D	1
Content of second Data address 40048	04H (High) B0H (Low)	2			
Content of third Data address 40049	09H (High) 60H (Low)	2			
CRC Check Low	A0	1			
CRC Check High	9F	1			

Second Step : Command For Executing Point To Point Motion

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

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

Start

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

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

Stop

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

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

Starting message :

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

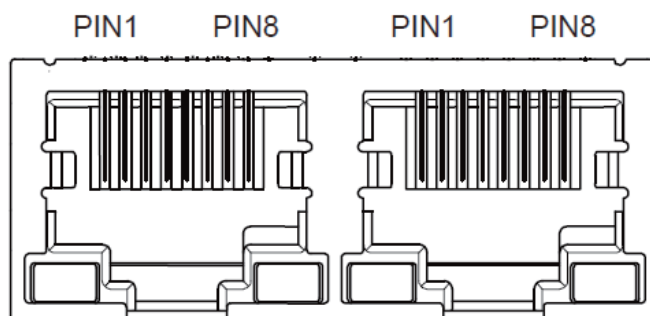
Stopping Message:

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

9.4 CANopen Communication

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

9.4.1 RJ45(8p8c)Pin Definitions



Pin definitions as follows:

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

9.4.2 CANopen NODE-ID

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

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

9.4.3 CANopen Communication Baud Rate

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

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

For more details, please refer to CANopen user manual.

10. Trouble Shooting

10.1 Drive Alarm List

LED display	Description	Alarm type	Drive status after alarm occurs
r01ot	Drive over temperature	Fault	Servo off
r02or	Internal voltage fault	Fault	Servo off
r03oH	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
r10PL	Position error	Fault	Servo off
r11Lu	Low voltage	Fault	Servo off
r12ou	Velocity limited	Warning	No change to drive's status
r13Lt	CW limit or CCW limit activated	Warning	No change to drive's status
r14LL	CW limit is activated	Warning	No change to drive's status
r15JL	CCW limit is activated	Warning	No change to drive's status
r16CL	Current limit	Warning	No change to drive's status
r17CE	Communication error	Warning	No change to drive's status
r18EF	Parameter save failed	Warning	No change to drive's status
r19LP	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
r22oH	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 noise. 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 resistor 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.
r10PL	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
r11Lu	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 4.1.5 drive power connection 3. please contact MOONS

r12ou	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.
r13Lt	CW limit or CCW limit activated	CW and CCW limit is ON	1. External limit switch is triggered. 2. Check x5 and x6 limit settings, please refer to chapter 7.1.3 Cw/ccw limit.
r14LL	CW limit is activated	CCW limit triggered	1. External limit switch is triggered. 2. Check x5 and x6 limit settings.
r15JL	CCW limit is activated	CW limit triggered	
r16CL	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/blue.
r17CE	Communication error	Drive and host communication error.	Please check wiring connection, and drive's communication address and baud rate setting.
r18EF	Parameter save failed	Saving parameter failure.	1. Please try to save again. 2. if problems is not solved, please contact MOONS
r19LP	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.
r21rF	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.
r22uH	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 4.1.5 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.

Trademarks

All marks in this manual are the property of their respective owners

Customer Service

MOONS' is committed to delivering quality customer service and support for all our products. Our goal is to provide our customers with the information and resources so that they are available, without delay, if and when they are needed.

In order to serve in the most effective way, we recommend that you contact your local sales representative for order status and delivery information, product information and literature, and application and field technical assistance. If you are unable to contact your local sales representative for any reason, please use the most relevant of the contact details below:

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	

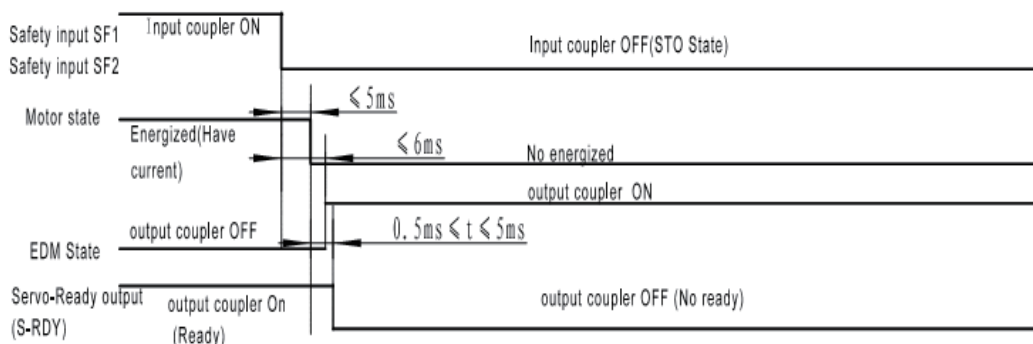
11.2.2 The fault reaction function

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

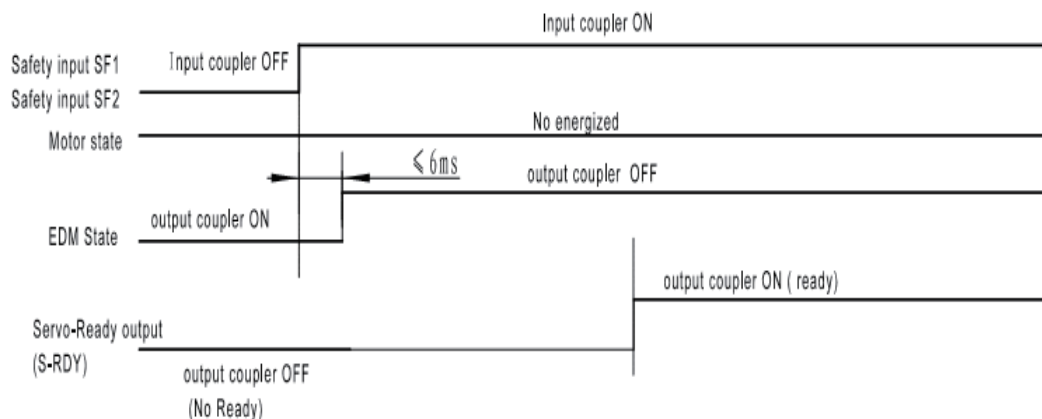
11.2.3 Response time

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 be used 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 **r20to**.

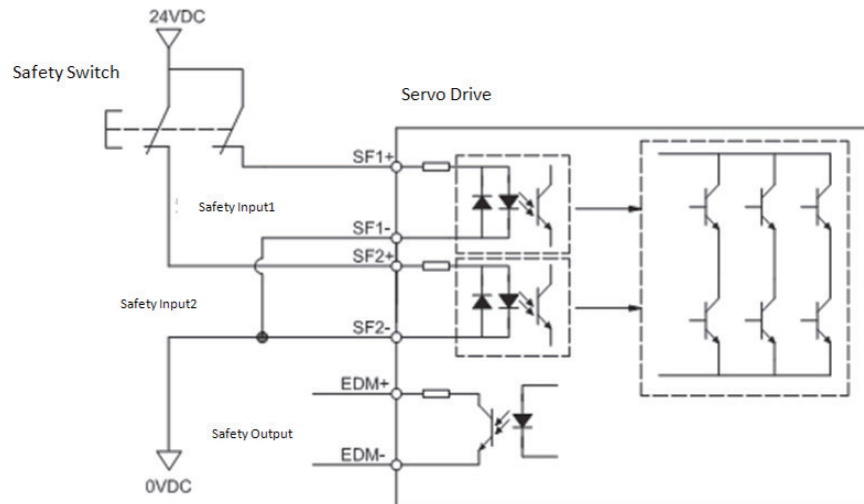
When failure occurrence, you may check the two safety input wiring and terminal block if Loosen or damaged, or contact MOONS'.

11.6 The installation and commissioning guidance

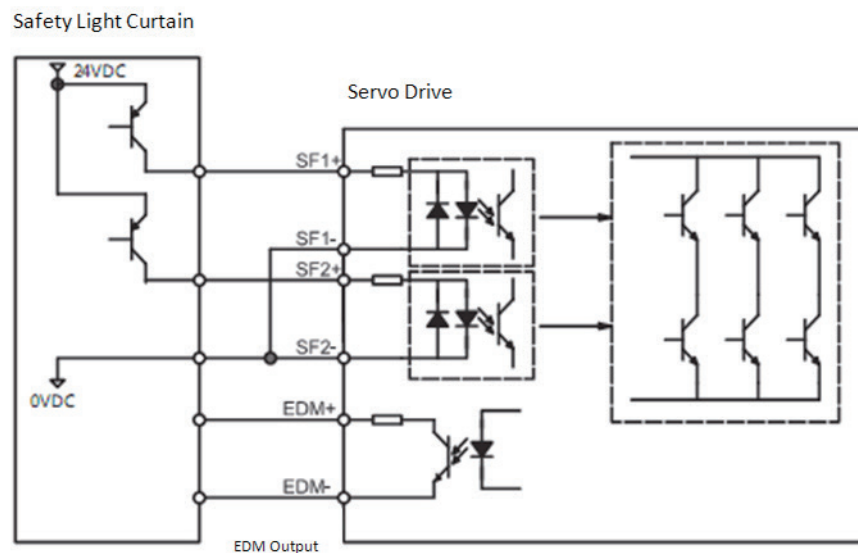
11.6.1 Installation

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, the external 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	0
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				
U	V	W	X	Y	Z				

★ **Headquarters**
SHANGHAI AMP&MOONS' AUTOMATION CO.,LTD.

No. 168 Mingjia Road Industrial Park North
Minhang District Shanghai 201107, P.R. China
Tel: +86(0)21-5263 4688
Fax: +86(0)21-6296 8682
Web: www.moonsindustries.com
E-mail: ama-info@moons.com.cn

■ **Shenzhen Branch Office**

Room 2209, 22/F, Kerry Center, No. 2008 Renminnan Road
Shenzhen 518001 P. R.China
Tel: +86 (0)755-2547 2080
Fax: +86 (0)755-2547 2081

■ **Beijing Branch Office**

Room 816, Tower B, China Electronics Plaza, 3 Danling
Street, Haidian District, Beijing 100080, P.R. China
Tel: +86 (0)10 58753312
Fax: +86 (0)10 58752279

■ **Qingdao Branch Office**

Room 1012, Zhuoyue Tower, No.16 Fengcheng Road,
Shibei District, Qingdao 266000 P. R.China
Tel: +86 (0)532-8096 9935
Fax: +86 (0)532-8091 9938

■ **Wuhan Branch Office**

Room 3001, World Trade Tower, No.686 Jiefang Avenue,
Jiangnan District, Wuhan 430022 P.R.China
Tel: +86 (0)27-8544 8742
Fax: +86 (0)27-8544 8355

■ **Cheng Du Branch Office**

Room 1917, Western Tower, 19, 4th Section of South People
Road, Wuhou District, Chengdu 610041, P.R. China
Tel: +86 (0)28 85268102
Fax: +86 (0)28 85268103

■ **Xi'an Branch Office**

Room 1006, Tower D, Wangzuo International City,
1 Tangyan Road, Xi'an 710065, P.R. China
Tel: +86 (0)29 81870400
Fax: +86 (0)29 81870340

■ **Ningbo Branch Office**

Room 309, Block B, Taifu Plaza, No. 565 Jiangjia Road
Jiangdong District Ningbo, 315040 P.R. China
Tel: +86 (0) 574-8705 2739
Fax: +86 (0) 574-8705 2365

■ **Guangzhou Branch Office**

Room 4006, Tower B, China Shine Plaza, 9 Linhe Xi Road,
Tianhe District, Guangzhou 510610, P.R. China
Tel: +86 (0)20 38010153
Fax: +86 (0)20 38103661

■ **MOONS' INDUSTRIES (AMERICA), INC.**

1113 North Prospect Avenue, Itasca, IL 60143 USA
Tel: +1 630 833 5940
Fax: +1 630 833 5946

■ **MOONS' INDUSTRIES (SOUTH-EAST ASIA) PTE LTD.**

33 Ubi Avenue 3 #08-23 Vertex Singapore 408868
Tel: +65 6634 1198
Fax: +65 6634 1138

■ **APPLIED MOTION PRODUCTS, INC.**

404 Westridge Dr. Watsonville, CA 95076, USA
Tel: +1 831 761 6555
+1 800 5251609

■ **MOONS' INDUSTRIES EUROPE S.R.L.**

Via Torri Bianche n.1 20871 Vimercate (MB) Italy
Tel: +39 039 626 0521
Fax: +39 039 963 1409

■ **LIN ENGINEERING, INC.**

16245 Vineyard Blvd., Morgan Hill, CA 95037
Tel: +1 408 9190200
Fax: +1 408 9190201

■ **MOONS' INDUSTRIES JAPAN CO., LTD**

Room 601, 6F, Shin Yokohama Koushin Building,
2-12-1, Shin-Yokohama, Kohoku-ku, Yokohama,
Kanagawa, 222-0033, Japan
Tel: +81 (0)45 4755788
Fax: +81 (0)45 4755787

<http://www.moonsindustries.com>

E-mail: ama-info@moons.com.cn

MOONS'
moving in better ways



• All the specifications, technical parameters of the products provided in this catalog are for reference only, subject to change without notice.
For the latest details, please contact our sales department.