M56S Series AC Servo

EtherCAT Type
Hardware Manual

SHANGHAI AMP&MOONS' AUTOMATION CO.,LTD.

Contents

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Revision History

Date of Revision	Version	Description
2023.05	1.0	First released

1 Introduction

Thank you for purchasing the M56S EtherCAT series servo, this is a high-end 220V/400V AC servo designed based on global leading stardards and application rquirements. It is featured with high speed, high precision, high performance, and complete certifications.

The servo drive covers a power range from 50W to 7.5kW and with EtherCAT communication interfaces to work with the host controller for a network operation of multiple servo drives. The drive adopts advanced motion control algorithms, coupled with a 26-bit high precision encoder motor, the velocity loop bandwidth is up to 3.5KHz. Efficient automatically adjusts the loop gain, superior vibration suppression and external disturbance compensation performance. The drive supports full closed-loop control, built-in regenerative energy absorption resistor, STO safety function and dynamic braking module (for certain models). It supports the control mode of position, velocity, torque and Q programming.

M56S Servo System is widely used in solar processing equipment, battery processing equipment, semiconductor equipment, medical equipment, industrial robots and custom equipment etc.

1.1 About This Manual

This manual describes the M56S Series Servo.

It provides the information required for installation, configuration and basic operation of the M56S series AC servo drive.

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

1.2 Documentation Set for M56S EtherCAT Servo

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

● M56S EtherCAT Hardware Manual. This includes hardware selection, installation, wiring and basic operation.
● M56S AC Servo Drive UserManual. This includes a detailed description on drive configuration, debugging, and exception handling.
● M56S EtherCAT Type AC Servo Drive EtherCAT Commnunication Manual. This introduces a detailed on the EtherCAT communication function of the drive.
● Luna Software user manual.

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.

⚡ M56S EtherCAT utilizes hazardous voltages. Be sure the drive is properly grounded.

Before you install the M56S EtherCAT products, 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   ⚡ Dangerous Voltage   ⏚ Earth   ♨ Caution, Hot Surface

1.5 Safety Precautions

1.5.1 Installation Precautions

⚠	◆ 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.
	◆ DO NOT directly connect the servo motor to the main 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
	◆ During installation, avoid metal shavings and other conductive objects from entering the drive.
	◆ DO NOT touch the rotating shaft when the motor is running.
	◆ DO NOT strike the motor when mounting as the motor shaft. The encoder may be damaged.
	◆ During the first test run, first disconnect the coupling or belt of the mechanical equipment so that the motor is in a no-load state.
	◆ Incorrect parameters will result in abnormal operation under load.
	◆ DO NOT Touch either the drive heat sink or the motor and regenerative resister during operation as they may become hot.
	◆ DO NOT pull the motor lead during transportation and installation

1.5.2 Wiring

⚠	◆ DO NOT connect any power supplies to the U,V,W terminals.
	◆ Please connect the output UVW of the drive and the UVW of the servo motor directly without passing through an electromagnetic contactor.
	◆ Please tighten the fixing screws of the power supply and motor output terminals, otherwise it may cause a fire.
	◆ Please do not switch the main power supply of the drive frequently. If you really need to switch the power supply repeatedly, please control it once a minute.
	◆ 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.
	◆ When wiring, please remove the terminal block from the servo drive.
	◆ One wire insertion port of the terminal block, please insert only one wire.
	◆ When inserting the wire, please do not short-circuit the core wire with the adjacent wire.
	◆ Make sure both the drive and the motor grounded well.
	◆ Please ensure grounding wires are securely connected when power up.

1.5.3 Pilot Run

⚠	◆ DO NOT touch the rotating shaft when the motor is running.
	◆ In order to prevent accidents, the initial trial run for servo motor should be conducted under no load conditions
	◆ Incorrect parameters will cause abnormal operation under load.
	◆ The temperature of the drive radiator, motor, and external regenerative resistor will rise during operation, please avoid touching.
	◆ Before the machine starts to run, please confirm whether the emergency stop device can be activated at any time
	◆ Use servo motors with brakes on vertical loads to prevent equipment from falling when alarms, failures, or power failures occur.

1.6 Certified Specifications

M56S Series servo products are designed to meet the following standards.

		Drive	Motor
Europe	EMC Directive	EN 61800-3	EN 60034-1
			EN 6100-6-2
			EN 6100-6-4
	LVD	EN 61800-5-1	EN 60034-1
			EN 60034-5
Functional Safety(STO)		UL61800-5-2(SIL 3)	
		IEC61508(SIL 3)	
		ISO13849-1(PL e)	
UL Standard		UL 61800-5-1	UL 1004-1
			UL 1004-6
		File No.E332730	File No.525873
CSA Standard		C22.2 No.274.13	CSA C22.2 No.100

Note: The 3kW and above servo products are currently undergoing UL certification.

1.7 Maintenance and Inspection

1.7.1 Check Iems and Cycle

The normal use conditions of the servo are as follows: Annual average environmental temperature: 30℃, Average load rate: below 80%, Daily running time: less than 20 hours

The items of daily inspection are as follows:

Type	Inspection cycle	Check item
Daily inspection	Daily	◆ Confirm the ambient temperature, humidity, dust, foreign matter, and dew condensation
		◆ Whether there is abnormal vibration or noise
		◆ Power supply voltage
		◆ Odor
		◆ Whether the fan is working normally and whether there is any foreign matter in the vent
		◆ Whether the connector is loose
		◆ Whether there is foreign matter between the cable and the connector, and whether the cable conductor is exposed outside
		◆ Whether the fastening part is loose

1.7.2 Replacement of Parts

The internal components of the servo product will wear out or aging, and the replacement time of components will vary according to environmental conditions and usage methods. If you need to replace it, please contact our company or our agent.

Except for our company, please do not disassemble and repair by yourself.

Item	Part	Standard replacement cycle	Notice
Drive	Filter capacitor	About 6 years	The standard replacement cycle is for reference only. Even if the standard replacement cycle is not full, it needs to be replaced once an abnormality occurs.
	Aluminum electrolytic capacitors	About 6 years	
	Power-on buffer relay	About 100,000 times(According to the conditions of use)	
	Power-on buffer resistance	About 20,000 times(According to the conditions of use)	
	Fan	2~3 years (10000~30000 hours)	
Motor	Oil seal	5,000 hours	
	Absolute value encoder battery	Lifetime depends on usage conditions	

2 Product Introduction

2.1 Unpacking Check

Please refer to the following chapters to confirm the model of servo drive and motor.

A complete and operable servo system should include the following parts:

● Servo drive and servo motor with matching power
● Motor power cable for connecting the drive and servo motor (optional)
● Encoder cable used to connect the drive and servo motor (optional)
● Mini USB communication cable for CN1 port to PC (optional)
● I/O connector for CN2 port (Included)
● Encoder connector for CN3 port (optional)
● The second encoder connector for CN4 port (applicable to the drive with full closed loop function, optional)
● STO connector for CN5 port (applicable to drive with STO function, Included)
● RJ-45 connectors for IN (CN7) and OUT (CN6) ports for EtherCAT communication (optional)
● Drive power input connector for P1 port
● Motor power and regeneration resistor connector for P2 port

2.2 Servo Drive Model Introduction

2.2.1 Drive Name Plate Description

2.2.2 Drive Model Description

M56S - 2 3A0 EC X - ***
①   ② ③ ④ ⑤   ⑥

① M56S Series

② Supply Voltage *1

    2 --- Single/Three-Phase 220VAC

    3 --- Three-Phase 400VAC

④ Function Type

⑤ Model Type

⑥ Customization

*1 Line to line voltage
*2 Use single/three-phase 220VAC input
*3 Available for single-phase while the motor power is under 1.5kW

③ Current

	Supply Voltage	Current	Rated Current A(rms)	Peak Current A(rms)	Rated Power
*2	2	1A8	1.8	5.4	200W
*2		3A0	3	12	400W
*2		4A5	4.5	15	750W
*2		6A0	6	21	1.0kW
*3		10A	10	30	1.5kW
*3		13A	13	45	2.5kW
	3	6A0	6	18	1.5kW
		17A	17	42.5	5.0kW
		21A	21	52.5	6.0kW
		26A	26	65	7.5kW

		PUSH-IN Spring Type I/O Connector (26pin)	
⑤ Model Type		X	N
④ Function Type		EC	
Control Mode	Position Mode	√	√
	Velocity Mode	√	√
	Torque Mode	√	√
	Q Program Control	√	√
	Closed Loop	√	
Interface	2 Analog Inputs	√	
	2 Analog Outputs	√	
	8 Inputs /4 Outputs(Digital)	√	√
	The Second Encoder Input	√	
Communication Interface	USB(Software Config)	√	√
	EtherCAT	√	√
Safety Function	Dynamic Braking	√	
	STO	√	

2.2.3 Drive Specification

2.2.3.1 AC220V Electrical Specifications

■   Single/three phase 220VAC servo drive

Drive Model	M56S-21A8EC◆	M56S-23A0EC◆	M56S-24A5EC◆	M56S-26A0ECX	M56S-210AECX
Main circuit power supply	Single / Three-phase, AC200 ~ 240V±10%, 50/60Hz				
Control circuit power supply	Single-phase, AC200 ~ 240V±10%，50/60Hz				
Continuous Output Current A(rms)	1.8	3	4.5	6	10
Max. Output CurrentA(rms)	5.4	12	15	21	30
Insulation Voltage	Primary to earth: withstand 1500 VAC, 1 min, (Leakage current: 20 mA) [220V Input]				

◆: Model Type

MOONS'

■ Three phase 220VAC servo drive

Drive Model	M56S-213AECX
Main circuit power supply	Three-phase, AC200 ~ 240V±10%，50/60Hz
Control circuit power supply	Single-phase, AC200 ~ 240V±10%，50/60Hz
Continuous Output Current A(rms)	13
Max. Output CurrentA(rms)	45
Insulation Voltage	Primary side to ground: withstand voltage 1500VAC, 1 min, (leakage: 20mA) 【220V Input】

2.2.3.2 AC220V Common Specifications

Environment	Temperature		● Ambient temperature: 0°C ~ 55°C (If the ambient temperature of servo drive is higher than 45°C, please install the drive in a well-ventilated location) ● Storage temperature: -20°C ~ 65°C
	Humidity		Both operating and storage : 10 ~ 85%RH or less
	Altitude		Derating is not required for altitudes not higher than 1000m Derating 1% for every additional 100m for altitudes between 1000m and 2000m
	Vibration		9.8m/s^2 or less, 10 ~ 60Hz (Do not use continuously at resonance frequency)
Control Mode			IGBT: PWM Control
Motor Encoder Feedback			● 26-bit multi-turn absolute optical encoder ● 21-bit multi-turn absolute magnetic encoder ● 17-bit battery-less multi-turn absolute encoder
Second Encoder Feedback[1]			A/B/Z phase signal differential input
I/O	Digital Signal	Input	8 Configurable optically isolate digital general inputs, 24VDC, 20mA
		Output	4 Configurable optically isolate digital general outputs, Max. 30VDC，100mA
	Analog Signal	Input	2 Analog inputs, -10 ~ +10V, 12bit
		Output[2]	2 Analog outputs, -10 ~ +10V, Max.10mA
Comm Port	USB		Connection with PC for configuration
	EtherCAT		EtherCAT Communication
Front Panel			4 Keys (MODE, UP, DOWN, SET) 5 Digital LED Display
Regeneration Resistor			● -X Type regenerative resistor ● -N Type only 750W built-in regenerative resistor ● All models can be equipped with external absorption resistors
Control Mode			CoE(Complies with CiA402 standard), Support PP, PV, TQ, CSP, CSV, CST and HM mode, Full Closed Loop Control Mode[3], Q programs that are pre-stored in the drive can also be started by command
Control Input Signal			Alarm Reset, CW/CCW Limit, Gain Select, Zero Speed Clamp, Emergency Stop, CW/CCW Torque Limit, Speed Limit, General Purpose Input
Control Output Signal			Warning Output, Fault Output, Servo Ready, Velocity Reached, Torque Reached, Position Reached, Servo-on Status, Brake Release, Dynamic Position Error Following, Positioning Complete, Zero Speed Detected, Velocity Coincidence, Torque Coincidence, Velocity limit, Torque limit, Homing Finished, Soft Limit CW/CCW, General Purpose Output
Protection			Over Current, Over Voltage,Under Voltage, Over Temperature, Bad Encoder Feedback, Over Load, Over Speed, Positon Error, STO, CW/CCW Limit, Full Closed-loop Hybrid Deviation Fault, Main Power Phase Loss
Dynamic Brake			-X Built-in
STO			-X Built-in
Weight			M56S-21A8EC◆: 0.8Kg M56S-26A0ECX: 1.9Kg M56S-23A0EC◆: 1.1Kg M56S-210AECX: 1.9Kg M56S-24A5EC◆: 1.6Kg M56S-213AECX: 1.9Kg

Note: *1，*2，*3 Certain models don't support this function ◆: Model Type

2.2.3.3 AC400V Electrical specifications

■ Theree phase 400VAC servo drive

Drive Model	M56S-36A0ECX	M56S-313AECX	M56S-317AECX	M56S-321AECX	M56S-326AECX
Main circuit power supply	Three-phase, AC380 ~ 480V±10%, 50/60Hz				
Control circuit power supply	Single-phase, AC380 ~ 480V±10%, 50/60Hz				
Continuous Output Current A(rms)	6	13	17	21	26
Max. Output CurrentA(rms)	18	40	42.5	52.5	65
Insulation Voltage	Primary side to ground: withstand voltage 1800VAC, 1 min, (leakage: 20mA)【400V Input】				

2.2.3.4 400VAC Common Specifications

Environment	Temperature		● Ambient temperature: 0°C ~ 55°C (If the ambient temperature of servo drive is higher than 45°C, please install the drive in a well-ventilated location) ● Storage temperature: -20°C ~ 65°C
	Humidity		Both operating and storage : 10 ~ 85%RH or less
	Altitude		Derating is not required for altitudes not higher than 1000m Derating 1% for every additional 100m for altitudes between 1000m and 2000m
	Vibration		$9.8m/s^2$ or less, 10 ~ 60Hz (Do not use continuously at resonance frequency)
Control Mode			IGBT: PWM Control
Motor Encoder Feedback			● 23-bit multi-turn absolute optical encoder ● 21-bit multi-turn absolute magnetic encoder
Second Encoder Feedback			A/B/Z phase signal differential input
I/O	Digital Signal	Input	8 Configurable optically isolate digital general inputs, 24VDC, 20mA
		Output	4 Configurable optically isolate digital general outputs, Max. 30VDC，100mA
	Analog Signal	Input	2 Analog inputs, -10 ~ +10V, 12bit
		Output	2 Analog outputs, -10 ~ +10V, Max.10mA
Comm Port	USB		Connection with PC for configuration
	EtherCAT		EtherCAT Communication
Front Panel			4 Keys (MODE, UP, DOWN, SET) 5 Digital LED Display
Regeneration Resistor			Built-in regenerative resistor (All models can be equipped with external absorption resistors)
LED			Port IN/OUT link display, RUN display, ERROR display
Control Mode			CoE(Complies with CiA402 standard), Support PP, PV, TQ, CSP, CSV, CST and HM mode, Full Closed Loop Control Mode, Q programs that are pre-stored in the drive can also be started by command
Control Input Signal			Alarm Reset, CW/CCW Limit, Gain Select, Zero Speed Clamp, Emergency Stop, CW/CCW Torque Limit, Speed Limit, General Purpose Input
Control Output Signal			Warning Output, Fault Output, Servo Ready, Velocity Reached, Torque Reached, Position Reached, Servo-on Status, Brake Release, Dynamic Position Error Following, Positioning Complete, Zero Speed Detected, Velocity Coincidence, Torque Coincidence, Velocity limit, Torque limit, Homing Finished, Soft Limit CW/CCW, General Purpose Output
Protection			Over Current, Over Voltage,Under Voltage, Over Temperature, Bad Encoder Feedback, Over Load, Over Speed, Positon Error, STO, CW/CCW Limit, Full Closed-loop Hybrid Deviation Fault, Main Power Phase Loss
Dynamic Brake			Built-in
STO			Built-in
Weight			M56S-36A0ECX: 1.9Kg M56S-321AECX: 3.8Kg M56S-313AECX: 1.9Kg M56S-326AECX: 3.8Kg M56S-317AECX: 3.8Kg

2.2.4 EtherCAT Communication Specification

Communication standards	IEC 61158 Type12，IEC 61800-7 CiA402 Drive Profile
Physical Layer	100Base - Tx
Communication port	RJ45 x 2 (Input: IN，Output: OUT)
Communication speed	2 x 100 Mbps (Full duplex)
Communication cable	Shielded twisted pair cable CAT5e (through/crossover)
Transmission Distance	Max.100m Between nodes/daisy chain
Sync Manager	SM0: Output mail SM1: Input mail SM2: Output process data SM3: Input process data
FMMU	FMMU0: Map to process data (RxPDO) receiving area FMMU1: Map to process data (TxPDO) sending area FMMU2: Map to mailbox status
Application layer protocol	CoE: CANopen over EtherCAT VoE: Vendor over EtherCAT *
Synchronous mode	Free Run SM Event DC SYNC Event
Communication object	SDO: Non periodic data PDO: Periodic data EMCY: Emergency
LED indicator light	EtherCAT RUN x 1 EtherCAT ERR x 1 EtherCAT Link/Activity x 2
Working mode	Profile Position Mode(PP) Profile Velocity Mode(PV) Profile Torque Mode(TQ) Homing Mode(HM) Cycle Synchronized Postion Mode(CSP) Cycle Synchronized Velocity Mode(CSV) Cycle Synchronized Torque Mode(CST)

*: Support to upgrade firmware via EtherCAT

2.2.5 Regeneration resistor specification

When the output torque of the motor shaft is opposite to the direction of rotation, the energy is feedback from the motor load end to the drive bus capacitor, which makes the bus voltage increase. When it reaches the braking voltage point, the energy can only be consumed by the regeneration resistor, otherwise it will damage the servo drive. The regeneration resistor can be built-in or the user can be connected externally; the built-in and external regeneration resistors cannot be used simultaneously. The related specifications of the built-in regeneration resistor in the M56S EtherCAT series servo drive are as follows:

Drive P/N	Built-in Resistor		External Resistor
	ohm （Ω）	Power (W)	Minimal Value （Ω）
M56S-21A8ECN	No built-in		40
M56S-21A8ECX	200	40	40
M56S-23A0ECN	No built-in		40
M56S-23A0ECX	200	40	40
M56S-24A5ECN	100	60	40
M56S-24A5ECX	100	60	40
M56S-26A0ECX	25	80	15
M56S-210AECX	25	80	15
M56S-213AECX	25	80	15
M56S-36A0ECX	25	80	15
M56S-313AECX	25	80	15
M56S-317AECX	35	100	35
M56S-321AECX	35	100	25
M56S-326AECX	35	100	25

2.2.6 Drive Mechanical Dimensions(Unit: mm)

■ M56S-21A8EC◆（200W）
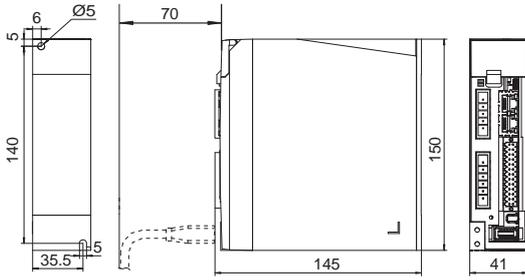
■ M56S-23A0EC◆（400W）
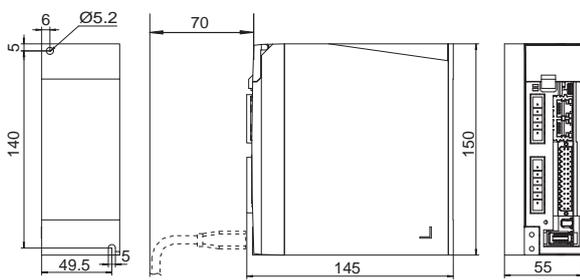
■ M56S-24A5EC◆（750W）
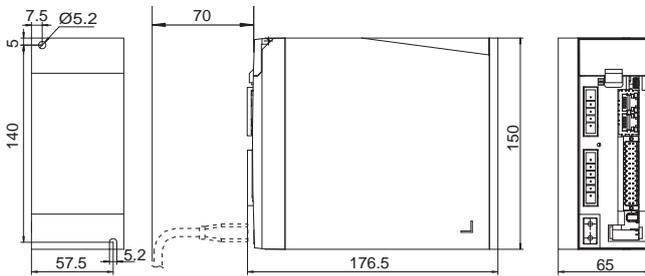
■ M56S-26A0ECX（1.0kW）
■ M56S-210AECX（1.5kW）
■ M56S-213AECX（2.5kW）
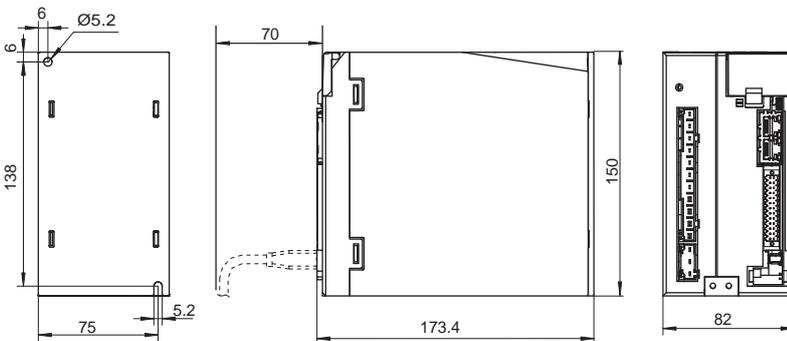
◆ Model Type

■ M56S-36A0ECX（1.5kW）

M56S-313AECX（3.0kW）
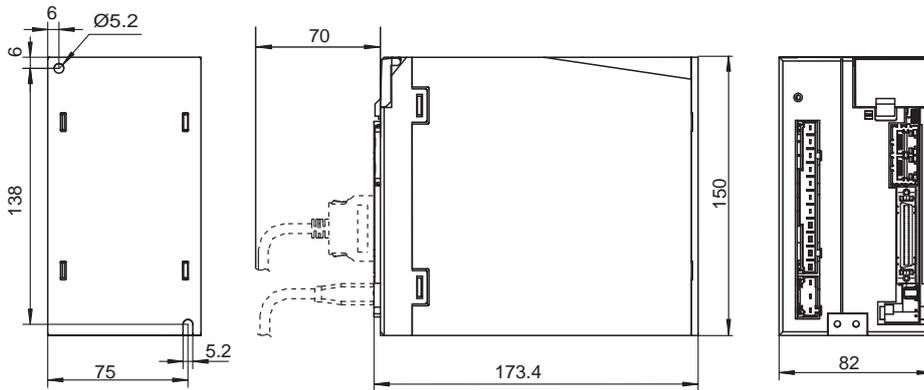
■ M56S-317AECX（5.0kW）

■ M56S-321AECX（6.0kW）

■ M56S-326AECX（7.5kW）
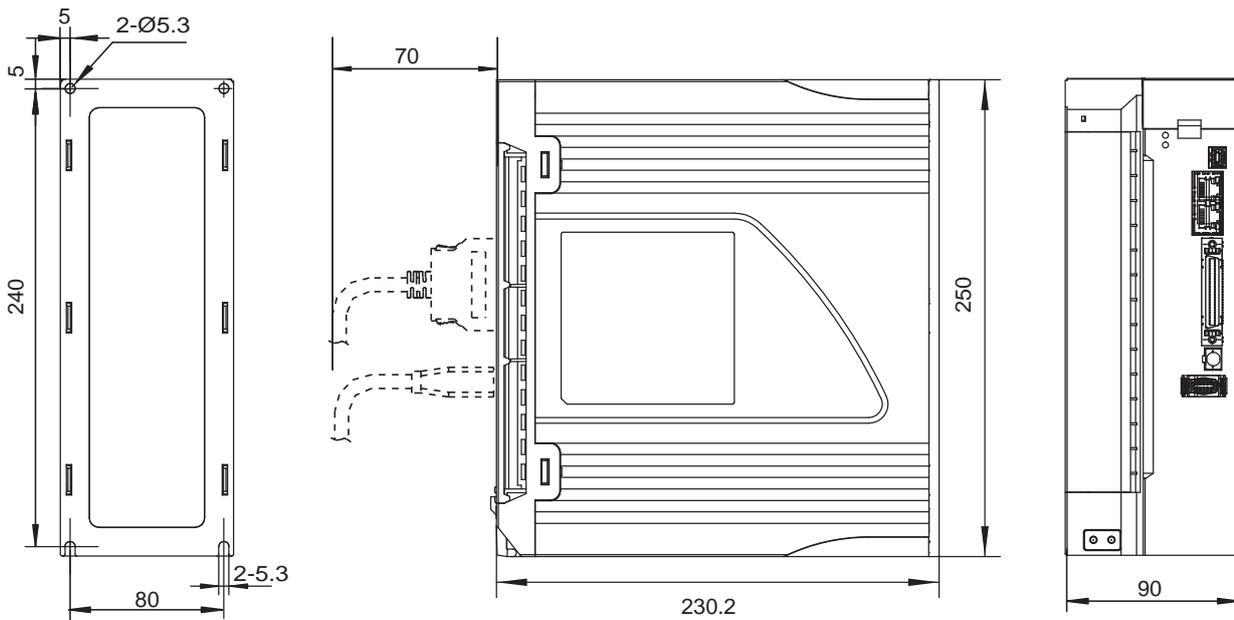
2.3 Motor Model Introduction

2.3.1 Motor Name Plate Description

Model Number	**AC SERVO MOTOR**
Input Voltage	Model No:SM3L-061AANDV
	Input:3ΦAC 208~240V 1.5A
	DC Source 320V
Rated Power	Rated Output:200W
Rated Torque	Rated Torque:0.64Nm
Rated Speed	Rated Speed:3000rpm
Max. Speed	Max Speed:6000rpm
Protection Class	Ins.Class:B IP65 Ambient:40℃
Design	Designed by AMP&MOONS'
Producer	Made in China
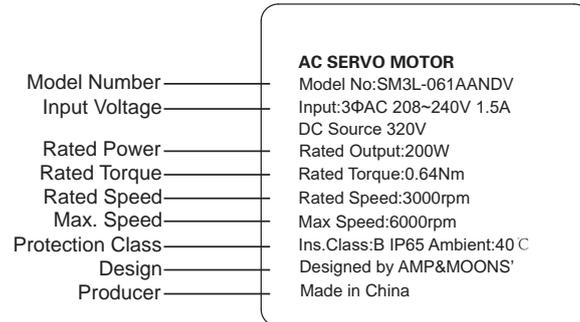
2.3.2 Motor Part Numbering

SM3 L - 13 2 A X N U V - ***

Servo Motor

SM3 Series	

Inertia Type

L	Low Inertia
M	Medium Inertia
H	High Inertia

Frame Size

04	40mm
06	60mm
08	80mm
10	100mm
13	130mm
18	180mm

Motor Length

1	1 Stacks
2	2 Stacks
3	3 Stacks
4	4 Stacks
5	5 Stacks

Winding Voltage

A	220VAC
Y	400VAC

Custom Code

Shaft

N	Circular shaft without oil seal
V	Keyway without oil seal
K	Keyway with installed oil seal

Connector & Rear Cover Type

D	Direct-mount with sealed plastic connector, metal rear cover
P	Direct-mount with sealed plastic connector, standard rear cover
U	Direct-mount with sealed metal straight connector, standard rear cover

Brake

N	No brake
B	With brake(24VDC)

Encoder

T[*1]	26-bit multi-turn absolute optical encoder
X	21-bit multi-turn absolute magnetic encoder
B	17-bit battery-less multi-turn absolute encoder

Note: *1 For 100/130/180mm frame size motor, the encoder resolution is 23-bit.

2.3.3 □40mm Frame Low Inertia 220VAC winding

□ Specification

Type*		SM3L - 042A◇□D△
Rated Output Power	watts	100
Rated Speed	rpm	3000
Max.Speed	rpm	6000
Rated Torque	N·m	0.32
Peak Torque	N·m	1.28
Rated Current	A (rms)	1.2
Peak Current	A (rms)	5.9
Voltage Constant ±5%	V (rms) / K rpm	16.8
Torque Constant ±5%	N·m / A (rms)	0.267
Rotor Inertia	Kg·m^2	0.038×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	0.0433×10^{-4}
Shaft Load - Axial	N (max.)	50
Shaft Load - Radial (End of Shaft)	N (max.)	60
Weight	Kg	0.49
Weight - With Brake	Kg	0.73

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)
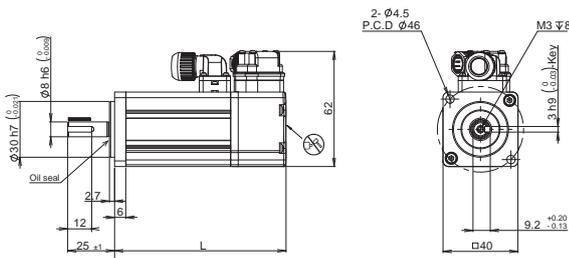
1) Without Brake

Without Brake	L
SM3L-042A◇ND△	91.5
SM3L-042ABND△	100

2) With Brake
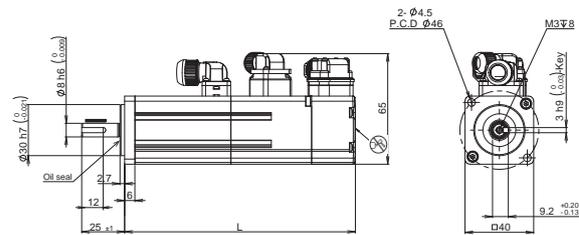
With Brake	L
SM3L-042A◇BD△	134.5
SM3L-042ABBD△	143

□ Torque Curves

SM3L-042 (100Watts)
DC Bus: 320VDC (230VAC) - 1.2 Amps
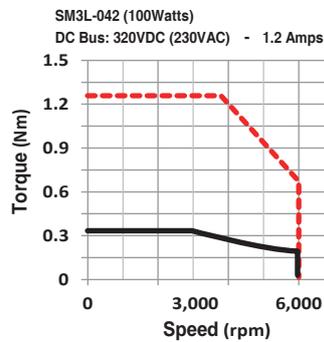
- - - - Max. Intermittent Torque
——— Max. Continuous Torque

2.3.4 □40mm Frame High Inertia 220VAC winding

□ Specification

Type*		SM3H - 041A◇□P△	SM3H - 042A◇□P△
Rated Output Power	watts	50	100
Rated Speed	rpm	3000	3000
Max.Speed	rpm	6000	6000
Rated Torque	N·m	0.16	0.32
Peak Torque	N·m	0.64	1.28
Rated Current	A (rms)	1.4	1.4
Peak Current	A (rms)	4.8	5.7
Voltage Constant ±5%	V (rms) / K rpm	9.24	14.8
Torque Constant ±5%	N·m / A (rms)	0.277	0.277
Rotor Inertia	Kg·m^2	0.0383×10^{-4}	0.0702×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	0.0395×10^{-4}	0.0724×10^{-4}
Shaft Load - Axial	N (max.)	50	50
Shaft Load - Radial (End of Shaft)	N (max.)	60	60
Weight	Kg	0.31	0.42
Weight - With Brake	Kg	0.55	0.66

***◇Encoder Options；□Brake Options；△Oil Seal Options**

□ Dimensions (Unit: mm)

1) Without Brake
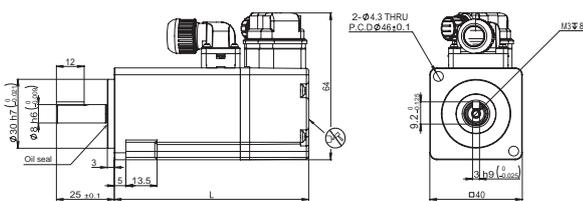
2) With Brake

Without Brake	L
SM3H-041A◇NP△	70
SM3H-042A◇NP△	84
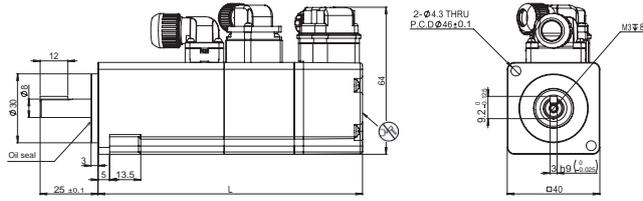
With Brake	L
SM3H-041A◇BP△	100.3
SM3H-042A◇BP△	114.3

□ Torque Curves

SM3H-041 (50Watts)
DC Bus: 320VDC (230VAC) - 1.4 Amps

SM3H-042 (100Watts)
DC Bus: 320VDC (230VAC) - 1.4 Amps
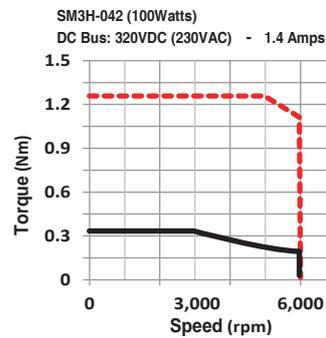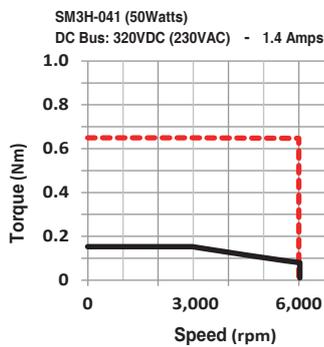
- - - - - Max. Intermittent Torque
——— Max. Continuous Torque

2.3.5 □60mm Frame Low Inertia 220VAC winding

□ Specification

Type*		SM3L - 061A◇□P△	SM3L - 062A◇□P△
Rated Output Power	watts	200	400
Rated Speed	rpm	3000	3000
Max.Speed	rpm	6000	6000
Rated Torque	N·m	0.64	1.27
Peak Torque	N·m	1.9	3.8
Rated Current	A (rms)	1.5	2.8
Peak Current	A (rms)	5.4	10
Voltage Constant ± 5%	V (rms) / K rpm	26.5	28.3
Torque Constant ± 5%	N·m / A (rms)	0.427	0.454
Rotor Inertia	Kg·m^2	0.152×10^{-4}	0.237×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	0.182×10^{-4}	0.268×10^{-4}
Shaft Load - Axial	N (max.)	70	70
Shaft Load - Radial (End of Shaft)	N (max.)	200	240
Weight	Kg	0.85	1.2
Weight - With Brake	Kg	1.3	1.7

*◇Encoder Options：□Brake Options：△Oil Seal Options

□ Dimensions (Unit: mm)

1) Without Brake
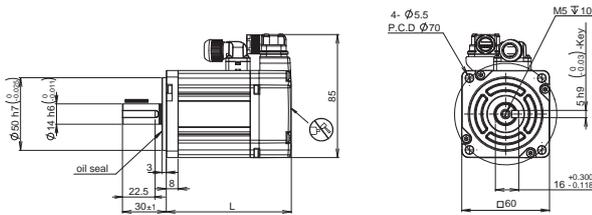
2) With Brake

Without Brake	L
SM3L - 061A◇NP△	84.5
SM3L - 061ABND△	85.5
SM3L - 062A◇NP△	103
SM3L - 062ABND△	104
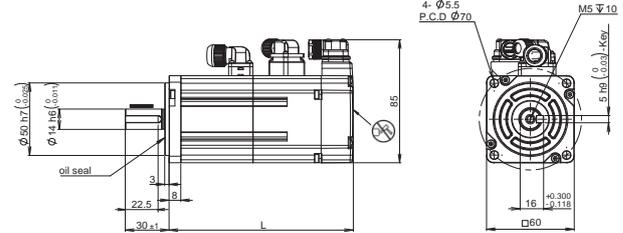
With Brake	L
SM3L - 061A◇BP△	125
SM3L - 061ABBD△	126
SM3L - 062A◇BP△	143.5
SM3L - 062ABBD△	144.5

□ Torque Curves

SM3L-061 (200Watts)
DC Bus: 320VDC (230VAC) - 1.5 Amps

SM3L-062 (400Watts)
DC Bus: 320VDC (230VAC) - 2.8 Amps

- - - - - Max. Intermittent Torque
——— Max. Continuous Torque
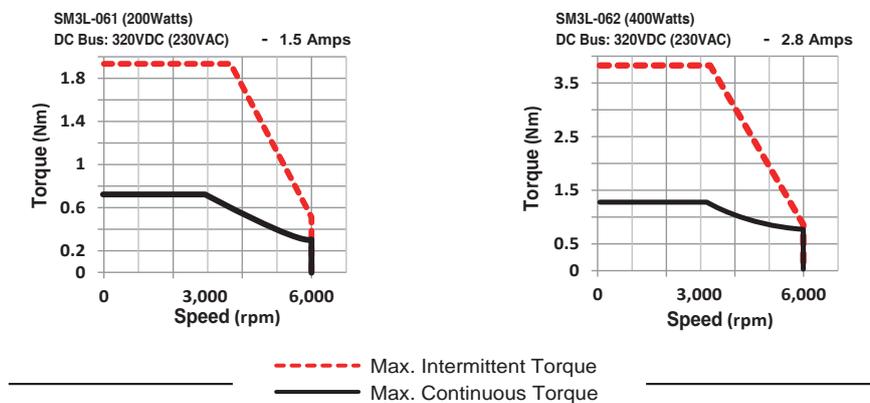
2.3.6 □60mm Frame High Inertia 220VAC winding

□ Specification

Type*		SM3H - 061A◇□P△	SM3H - 062A◇□P△
Rated Output Power	watts	200	400
Rated Speed	rpm	3000	3000
Max.Speed	rpm	6000	6000
Rated Torque	N·m	0.64	1.27
Peak Torque	N·m	2.24	4.445
Rated Current	A (rms)	1.7	2.8
Peak Current	A (rms)	5.9	9.8
Voltage Constant ±5%	V (rms) / K rpm	24.3	28.9
Torque Constant ±5%	N·m / A (rms)	0.376	0.423
Rotor Inertia	Kg·m^2	0.31×10^{-4}	0.566×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	0.32×10^{-4}	0.62×10^{-4}
Shaft Load - Axial	N (max.)	70	70
Shaft Load - Radial (End of Shaft)	N (max.)	200	240
Weight	Kg	0.79	1.2
Weight - With Brake	Kg	1.15	1.5

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)
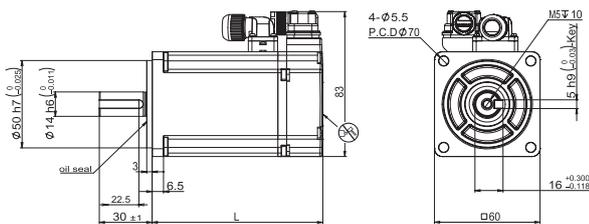
1) Without Brake

Without Brake	L
SM3H-061A◇NP△	77
SM3H-062A◇NP△	97

2) With Brake
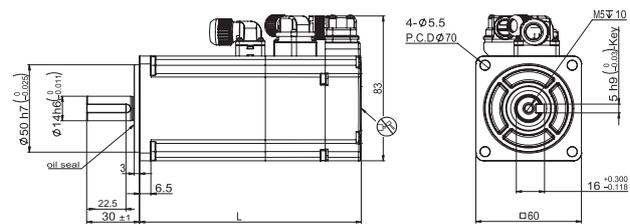
With Brake	L
SM3H-061A◇BP△	106
SM3H-062A◇BP△	126

□ Torque Curves

SM3H-061 (200Watts)
DC Bus: 320VDC (230VAC) - 1.7 Amps

SM3H-062 (400Watts)
DC Bus: 320VDC (230VAC) - 2.8 Amps
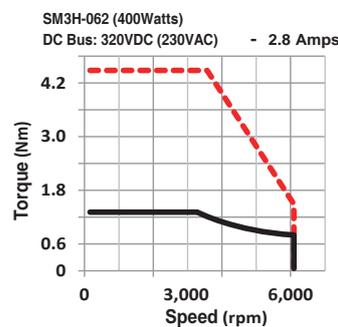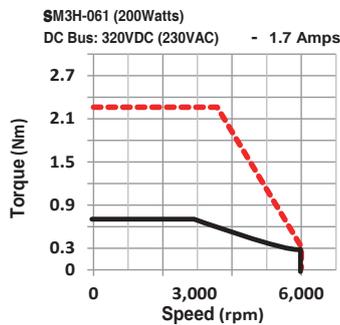
------- Max. Intermittent Torque
——— Max. Continuous Torque

2.3.7 □80mm Frame Low Inertia 220VAC winding

□ Specification

Type*		SM3L - 083A◇□P△	SM3L - 084A◇□P△
Rated Output Power	watts	750	1000
Rated Speed	rpm	3000	3000
Max.Speed	rpm	6000	6000
Rated Torque	N·m	2.4	3.2
Peak Torque	N·m	6.7	9.6
Rated Current	A (rms)	4.5	5.6
Peak Current	A (rms)	14	19
Voltage Constant ± 5%	V (rms) / K rpm	33.9	36.65
Torque Constant ± 5%	N·m / A (rms)	0.533	0.63
Rotor Inertia	Kg·m^2	0.829×10^{-4}	1.01×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	0.961×10^{-4}	1.12×10^{-4}
Shaft Load - Axial	N (max.)	90	90
Shaft Load - Radial (End of Shaft)	N (max.)	270	270
Weight	Kg	2.29	2.77
Weight - With Brake	Kg	3.1	3.62

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)

1) Without Brake
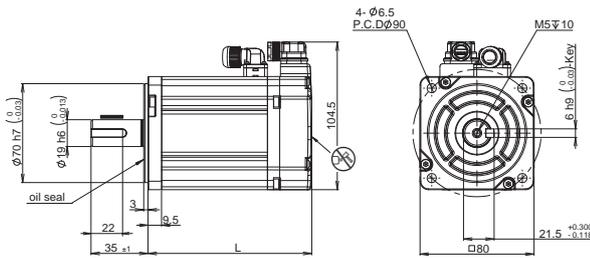
2) With Brake

Without Brake	L
SM3L-083A◇NP△	115
SM3L-083ABND△	115
SM3L-084A◇NP△	129
SM3L-084ABND△	129
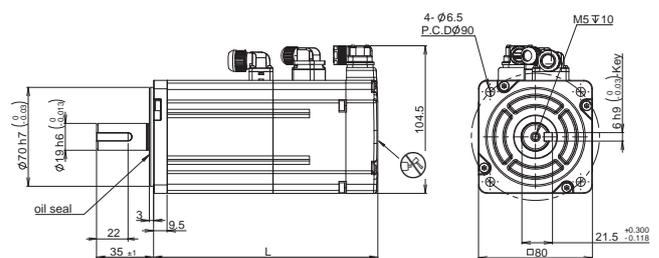
With Brake	L
SM3L-083A◇BP△	157
SM3L-083ABBP△	157.5
SM3L-084A◇BP△	171
SM3L-084ABBD△	171.5

□ Torque Curves

SM3L-083 (750Watts)
DC Bus: 320VDC (230VAC) - 4.5 Amps

SM3L-084 (1000Watts)
DC Bus: 320VDC (230VAC) - 5.6 Amps
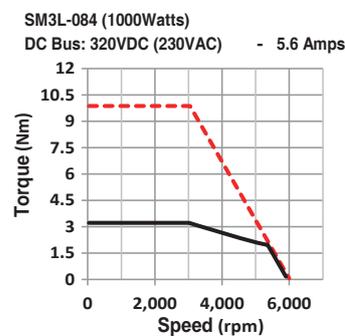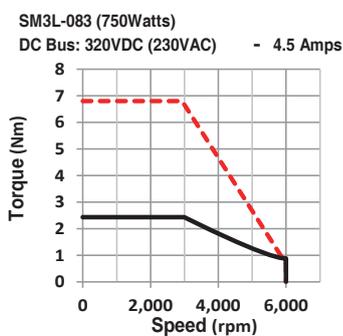
- - - - - Max. Intermittent Torque
───── Max. Continuous Torque

2.3.8 □80mm Frame High Inertia 220VAC winding

□ Specification

Type*		SM3H - 083A◇□P△
Rated Output Power	watts	750
Rated Speed	rpm	3000
Max.Speed	rpm	6000
Rated Torque	N·m	2.4
Peak Torque	N·m	8.4
Rated Current	A (rms)	4.5
Peak Current	A (rms)	16.7
Voltage Constant ±5%	V (rms) / K rpm	32.3
Torque Constant ±5%	N·m / A (rms)	0.53
Rotor Inertia	Kg·m^2	1.46×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	1.63×10^{-4}
Shaft Load - Axial	N (max.)	90
Shaft Load - Radial (End of Shaft)	N (max.)	270
Weight	Kg	2.1
Weight - With Brake	Kg	2.85

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)

1) Without Brake
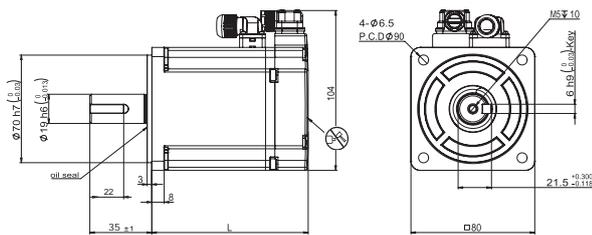
2) With Brake

Without Brake	L
SM3H-083A◇NP△	101
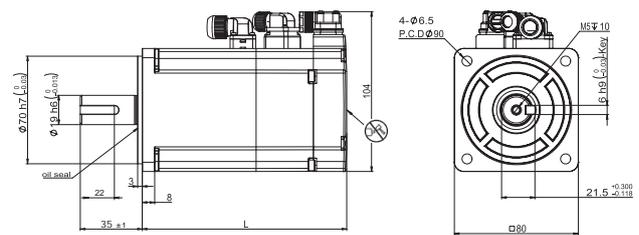
With Brake	L
SM3H-083A◇BP△	132

□ Torque Curves

SM3H-083 (750Watts)
DC Bus: 320VDC (230VAC) - 4.5 Amps
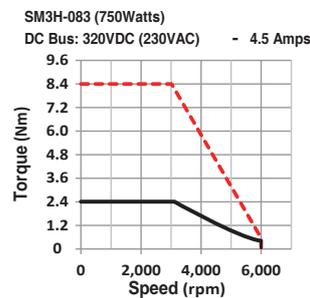
------ Max. Intermittent Torque
—— Max. Continuous Torque

2.3.9 □100mm Frame Low Inertia 220VAC winding

□ Specification

Type*		SM3L - 102A◇□U△	SM3L - 103A◇□U△	SM3L - 104A◇□U△	SM3L - 105A◇□U△
Rated Output Power	watts	1000	1500	2000	2500
Rated Speed	rpm	3000	3000	3000	3000
Max.Speed	rpm	6000	5700	5600	5600
Rated Torque	N·m	3.2	4.9	6.4	8
Peak Torque	N·m	9.6	14.7	19.2	24
Rated Current	A (rms)	6.0	9.6	12.7	13
Peak Current	A (rms)	21	36.5	44	45
Voltage Constant ± 5%	V (rms) / K rpm	33	34.1	34.3	37.4
Torque Constant ± 5%	N·m / A (rms)	0.543	0.563	0.565	0.61
Rotor Inertia	Kg·m^2	1.79×10^{-4}	2.37×10^{-4}	2.98×10^{-4}	3.68×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	2.67×10^{-4}	3.25×10^{-4}	3.86×10^{-4}	4.56×10^{-4}
Shaft Load - Axial	N (max.)	90	90	90	90
Shaft Load - Radial (End of Shaft)	N (max.)	270	270	270	270
Weight	Kg	4	4.39	5.2	6.3
Weight - With Brake	Kg	5.2	5.64	6.12	7.6

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)

1) Without Brake

2) With Brake

Without Brake	L
SM3L-102A◇NU△	137
SM3L-103A◇NU△	152
SM3L-104A◇NU△	168
SM3L-105A◇NU△	186
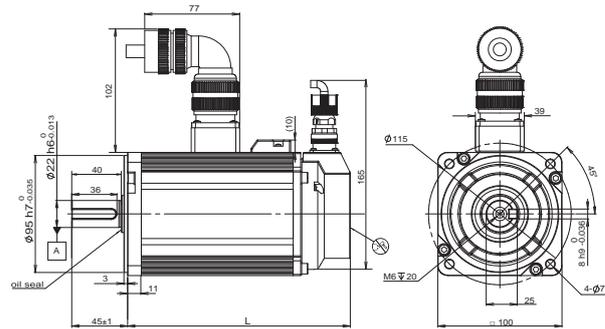
With Brake	L
SM3L-102A◇BU△	179
SM3L-103A◇BU△	194
SM3L-104A◇BU△	210
SM3L-105A◇BU△	228

□ Torque Curves

SM3L-102A (1000Watts)
DC Bus: 320VDC (230VAC) - 6.0 Amps

SM3L-103A (1500Watts)
DC Bus: 320VDC (230VAC) - 9.6 Amps

SM3L-104A (2000Watts)
DC Bus: 320VDC (230VAC) - 12.7 Amps

SM3L-105A (2500Watts)
DC Bus: 320VDC (230VAC) - 13 Amps
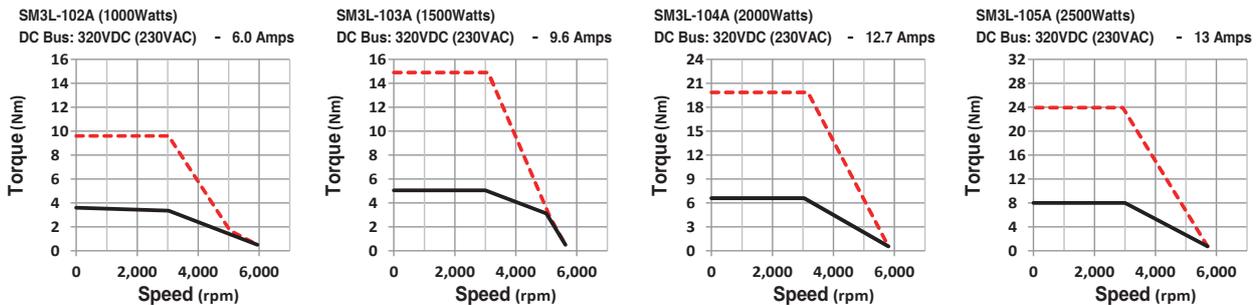
- - - - - - Max. Intermittent Torque
———— Max. Continuous Torque

2.3.10 □100mm Frame Low Inertia 400VAC winding

□ Specification

Type*		SM3L - 102Y◇□U△	SM3L - 103Y◇□U△	SM3L - 104Y◇□U△	SM3L - 105Y◇□U△
Rated Output Power	watts	1000	1500	2000	2500
Rated Speed	rpm	3000	3000	3000	3000
Max.Speed	rpm	6000	6000	6000	5600
Rated Torque	N·m	3.2	4.9	6.4	8
Peak Torque	N·m	9.6	14.7	19.2	24
Rated Current	A (rms)	3.8	5.7	7.4	13
Peak Current	A (rms)	14	21	25.5	45
Voltage Constant ± 5%	V (rms) / K rpm	59	59.2	60.5	37.4
Torque Constant ± 5%	N·m / A (rms)	0.842	0.86	0.86	0.61
Rotor Inertia	Kg·m^2	1.79×10^{-4}	2.37×10^{-4}	2.98×10^{-4}	3.68×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	2.67×10^{-4}	3.25×10^{-4}	3.86×10^{-4}	4.56×10^{-4}
Shaft Load - Axial	N (max.)	90	90	90	90
Shaft Load - Radial (End of Shaft)	N (max.)	270	270	270	270
Weight	Kg	4	4.39	5.2	6.3
Weight - With Brake	Kg	5.2	5.64	6.12	7.6

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)

1) Without Brake

2) With Brake

Without Brake	L
SM3L-102Y◇NU△	137
SM3L-103Y◇NU△	152
SM3L-104Y◇NU△	168
SM3L-105Y◇NU△	186
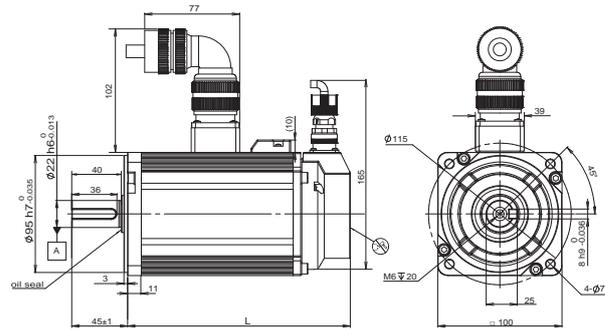
With Brake	L
SM3L-102Y◇BU△	179
SM3L-103Y◇BU△	194
SM3L-104Y◇BU△	210
SM3L-105Y◇BU△	228

□ Torque Curves

SM3L-102Y (1000Watts) DC Bus: 540VDC (400VAC) - 3.8 Amps

SM3L-103Y (1500Watts) DC Bus: 540VDC (400VAC) - 5.7 Amps

SM3L-104Y (2000Watts) DC Bus: 540VDC (400VAC) - 7.4 Amps

SM3L-105Y (2500Watts) DC Bus: 540VDC (400VAC) - 13 Amps
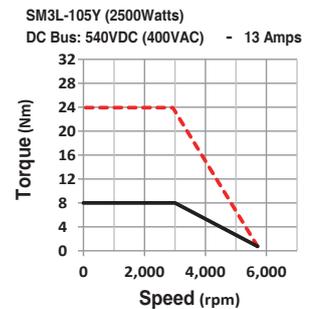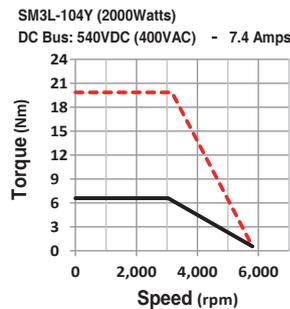
- - - - - Max. Intermittent Torque
———— Max. Continuous Torque

2.3.11 □130mm Frame Medium Inertia 220VAC winding

□ Specification

Type*		SM3M - 132A◇□U△	SM3M - 133A◇□U△	SM3M - 134A◇□U△
Rated Output Power	watts	1000	1500	2000
Rated Speed	rpm	2000	2000	2000
Max.Speed	rpm	3000	3000	3000
Rated Torque	N·m	4.77	7.16	9.55
Peak Torque	N·m	14.3	21.5	28.6
Rated Current	A (rms)	5.4	8.5	11
Peak Current	A (rms)	16.9	26	32.7
Voltage Constant ± 5%	V (rms) / K rpm	55.3	54.2	55.5
Torque Constant ± 5%	N·m / A (rms)	0.883	0.843	0.87
Rotor Inertia	Kg·m^2	13×10^{-4}	18.3×10^{-4}	24.4×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	15.2×10^{-4}	20.5×10^{-4}	26.6×10^{-4}
Shaft Load - Axial	N (max.)	196	343	396
Shaft Load - Radial (End of Shaft)	N (max.)	490	686	980
Weight	Kg	5.33	6.67	9.1
Weight - With Brake	Kg	7.25	8.47	10.75

*◇**Encoder Options**；□**Brake Options**；△**Oil Seal Options**

□ Dimensions (Unit: mm)

1) Without Brake

2) With Brake

Without Brake	L
SM3M-132A◇NU△	138
SM3M-133A◇NU△	152
SM3M-134A◇NU△	169

With Brake	L
SM3M-132A◇BU△	171
SM3M-133A◇BU△	185
SM3M-134A◇BU△	202

□ Torque Curves

SM3M-132 (1000Watts)
DC Bus: 320VDC (230VAC) - 5.4 Amps

SM3M-133 (1500Watts)
DC Bus: 320VDC (230VAC) - 8.5 Amps

SM3M-134 (2000Watts)
DC Bus: 320VDC (230VAC) - 11 Amps
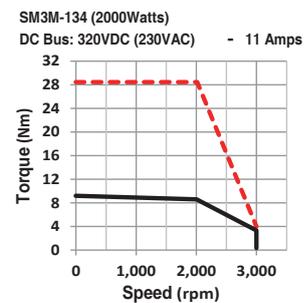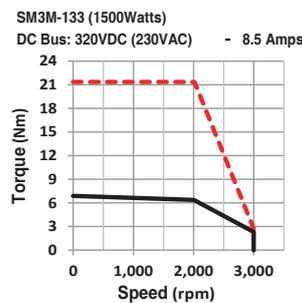
- - - - - Max. Intermittent Torque
───── Max. Continuous Torque

2.3.12 □130mm Frame Medium Inertia 400VAC winding

□ Specification

Type*		SM3M - 132Y◇□U△	SM3M - 133Y◇□U△	SM3M - 134Y◇□U△
Rated Output Power	watts	1000	1500	2000
Rated Speed	rpm	2000	2000	2000
Max.Speed	rpm	3000	3000	3000
Rated Torque	N·m	4.77	7.16	9.55
Peak Torque	N·m	14.3	21.5	28.6
Rated Current	A (rms)	3.3	5.1	6.5
Peak Current	A (rms)	10	16	18.6
Voltage Constant ± 5%	V (rms) / K rpm	101	97	101
Torque Constant ± 5%	N·m / A (rms)	1.45	1.4	1.47
Rotor Inertia	Kg·m^2	13×10^{-4}	18.3×10^{-4}	24.4×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	15.2×10^{-4}	20.5×10^{-4}	26.6×10^{-4}
Shaft Load - Axial	N (max.)	196	343	396
Shaft Load - Radial (End of Shaft)	N (max.)	490	686	980
Weight	Kg	5.33	6.67	9.1
Weight - With Brake	Kg	7.25	8.47	10.75

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)

1) Without Brake

2) With Brake

Without Brake	L
SM3M-132Y◇NU△	138
SM3M-133Y◇NU△	155
SM3M-134Y◇NU△	169
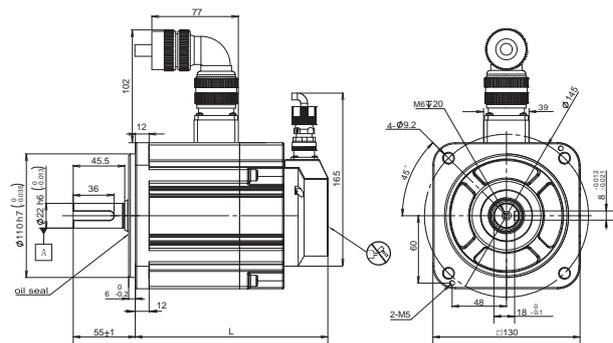
With Brake	L
SM3M-132Y◇BU△	171
SM3M-133Y◇BU△	185
SM3M-134Y◇BU△	202

□ Torque Curves

SM3M-132 (1000Watts)
DC Bus: 540VDC (400VAC) - 3.3 Amps

SM3M-133 (1500Watts)
DC Bus: 540VDC (400VAC) - 5.1 Amps

SM3M-134 (2000Watts)
DC Bus: 540VDC (400VAC) - 6.5 Amps

- - - - - Max. Intermittent Torque
——— Max. Continuous Torque
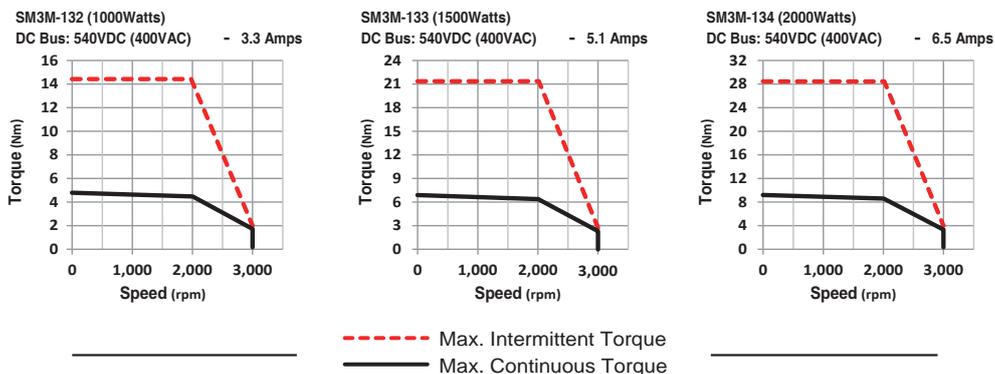
☐ Specification

Type*		SM3M - 135Y◇☐M△
Rated Output Power	watts	3000
Rated Speed	rpm	2000
Max.Speed	rpm	3000
Rated Torque	N·m	14.3
Peak Torque	N·m	42.9
Rated Current	A (rms)	10.5
Peak Current	A (rms)	30
Voltage Constant ± 5%	V (rms) / K rpm	93.2
Torque Constant ± 5%	N·m / A (rms)	1.47
Rotor Inertia	Kg·m^2	36.4 × 10^{-4}
Rotor Inertia - With Brake	Kg·m^2	38.6 × 10^{-4}
Shaft Load - Axial	N (max.)	396
Shaft Load - Radial (End of Shaft)	N (max.)	980
Weight	Kg	12.05
Weight - With Brake	Kg	13.95

*◇**Encoder Options**；☐**Brake Options**；△**Oil Seal Options**

☐ Dimensions (Unit: mm)
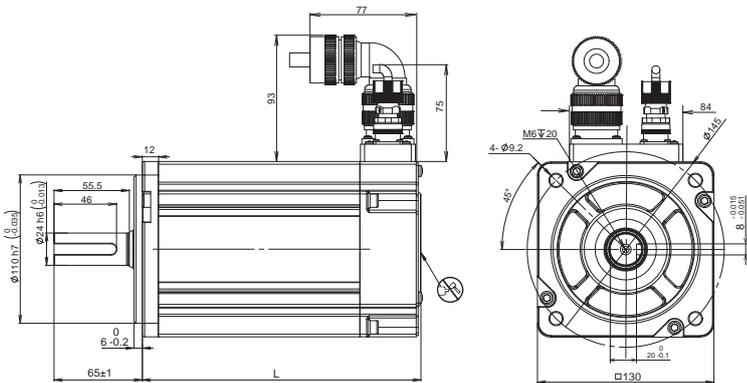
Model		L
Without Brake	SM3M-135Y◇NM△	205
With Brake	SM3M-135Y◇BM△	238

☐ Torque Curves

SM3M-135 (3000Watts)
DC Bus: 540VDC (400VAC) - 10.5 Amps
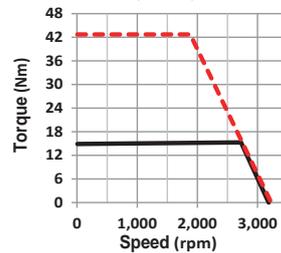
- - - - - Max. Intermittent Torque
───── Max. Continuous Torque

2.3.13 □130mm Frame High Inertia 220VAC winding

□ Specification

| Type*		SM3H - 132A◇□U△	SM3H - 133A◇□U△	SM3H - 134A◇□U△
Rated Output Power	watts	850	1300	1800
Rated Speed	rpm	1500	1500	1500
Max.Speed	rpm	3000	3000	3000
Rated Torque	N·m	5.39	8.34	11.5
Peak Torque	N·m	16.2	25	34.5
Rated Current	A (rms)	6	9.6	13
Peak Current	A (rms)	19	29.6	45
Voltage Constant ±5%	V (rms) / K rpm	55.3	54.2	51
Torque Constant ±5%	N·m / A (rms)	0.891	0.869	0.88
Rotor Inertia	Kg·m²	13×10^{-4}	18.3×10^{-4}	24.4×10^{-4}
Rotor Inertia - With Brake	Kg·m²	15.2×10^{-4}	20.5×10^{-4}	26.6×10^{-4}
Shaft Load - Axial	N (max.)	196	343	396
Shaft Load - Radial (End of Shaft)	N (max.)	490	686	980
Weight	Kg	5.92	7	8.5
Weight - With Brake	Kg	7.84	8.8	10.15

*◇Encoder Options；□Brake Options；△Oil Seal Options

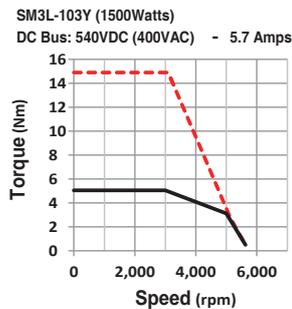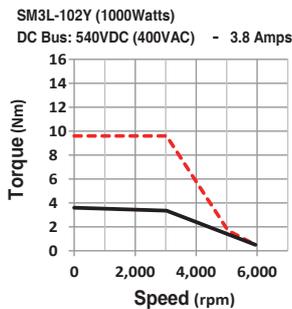### □ Dimensions (Unit: mm)

1) Without Brake

2) With Brake

Without Brake	L
SM3H-132A◇NU△	138
SM3H-133A◇NU△	152
SM3H-134A◇NU△	169
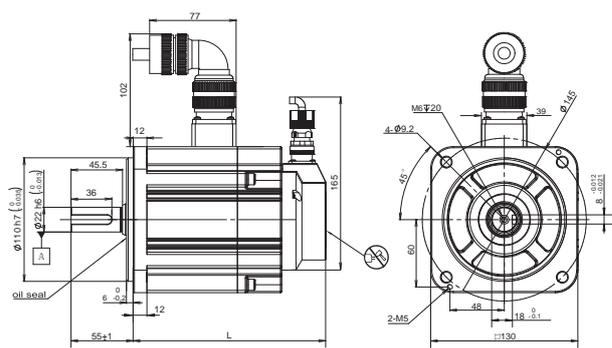
With Brake	L
SM3H-132A◇BU△	171
SM3H-133A◇BU△	185
SM3H-134A◇BU△	202

□ Torque Curves
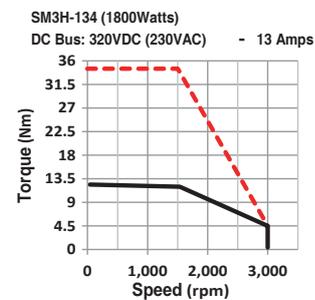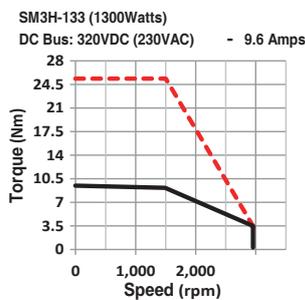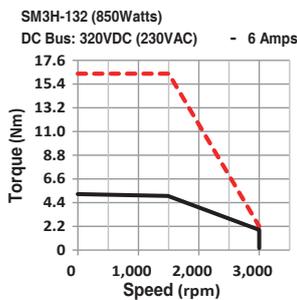
- - - - - Max. Intermittent Torque
———— Max. Continuous Torque

2.3.14 □130mm Frame High Inertia 400VAC winding

□ Specification

Type*		SM3H - 132Y◇□U△	SM3H - 133Y◇□U△	SM3H - 134Y◇□U△
Rated Output Power	watts	850	1300	1800
Rated Speed	rpm	1500	1500	1500
Max.Speed	rpm	3000	3000	3000
Rated Torque	N·m	5.39	8.34	11.5
Peak Torque	N·m	16.2	25	34.5
Rated Current	A (rms)	3.6	5.8	8.1
Peak Current	A (rms)	11	17.5	23.2
Voltage Constant ±5%	V (rms) / K rpm	101	97	96
Torque Constant ±5%	N·m / A (rms)	1.5	1.44	1.42
Rotor Inertia	Kg·m^2	13×10^{-4}	18.3×10^{-4}	24.4×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	15.2×10^{-4}	20.5×10^{-4}	26.6×10^{-4}
Shaft Load - Axial	N (max.)	196	343	396
Shaft Load - Radial (End of Shaft)	N (max.)	490	686	980
Weight	Kg	5.92	7	8.5
Weight - With Brake	Kg	7.84	8.8	10.15

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)

1) Without Brake

2) With Brake

Without Brake	L
SM3H-132Y◇NU△	138
SM3H-133Y◇NU△	152
SM3H-134Y◇NU△	169
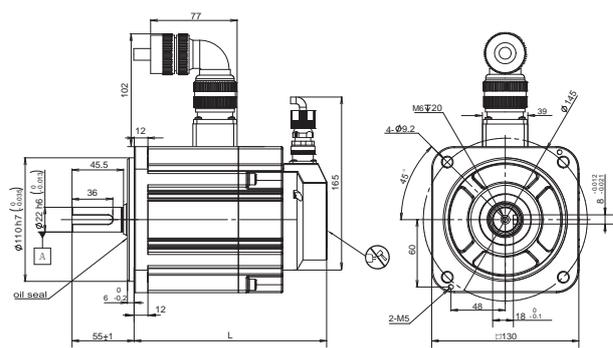
With Brake	L
SM3H-132Y◇BU△	171
SM3H-133Y◇BU△	185
SM3H-134Y◇BU△	202

□ Torque Curves

SM3H-132 (850Watts)
DC Bus: 540VDC (400VAC) - 3.6 Amps

SM3H-133 (1300Watts)
DC Bus: 540VDC (400VAC) - 5.8 Amps

SM3H-134 (1800Watts)
DC Bus: 540VDC (400VAC) - 8.1 Amps
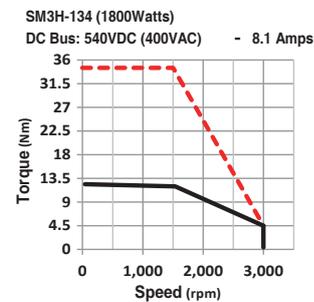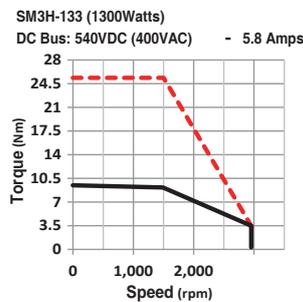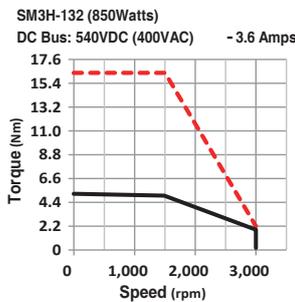
- - - - - Max. Intermittent Torque
——— Max. Continuous Torque

2.3.15 □180mm Frame High Inertia 400VAC winding

□ Specification

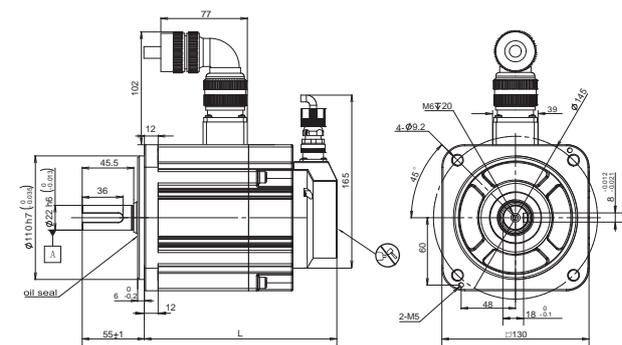| Type*		SM3H - 182Y◇□U△	SM3H - 183Y◇□U△
Rated Output Power	watts	2900	4400
Rated Speed	rpm	1500	1500
Max.Speed	rpm	3000	3000
Rated Torque	N·m	18.5	28
Peak Torque	N·m	55.5	84
Rated Current	A (rms)	10.5	16.7
Peak Current	A (rms)	35.5	54.7
Voltage Constant ± 5%	V (rms) / K rpm	115	117
Torque Constant ± 5%	N·m / A (rms)	1.76	1.68
Rotor Inertia	Kg·m^2	46×10^{-4}	67.5×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	51×10^{-4}	72.5×10^{-4}
Shaft Load - Axial	N (max.)	490	490
Shaft Load - Radial (End of Shaft)	N (max.)	1470	1470
Weight	Kg	13.9	17.4
Weight - With Brake	Kg	15.9	19.4

*◇Encoder Options；□Brake Options；△Oil Seal Options
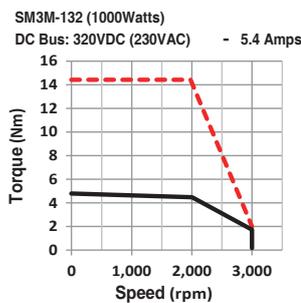
□ Dimensions (Unit: mm)
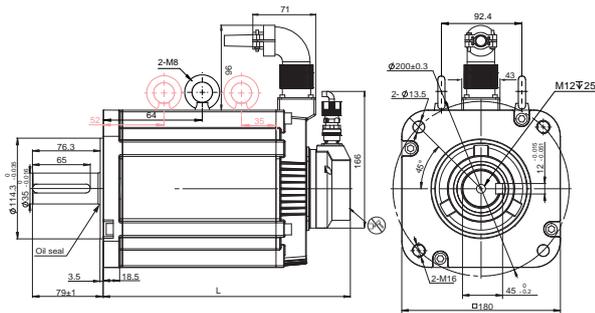
1) Without Brake

Without Brake	L
SM3H-182Y◇NU△	190
SM3H-183Y◇NU△	215

Note : The red note indicates the mounting position of the ring for SM3H-183Y◇NU△
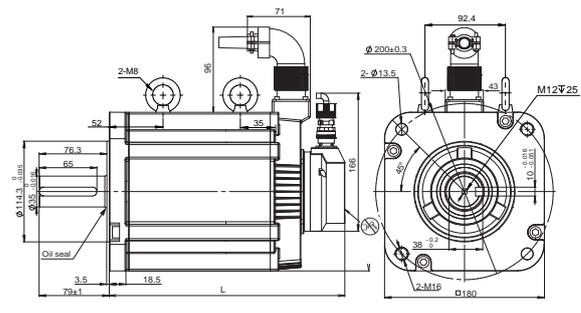
2) With Brake

With Brake	L
SM3H-182Y◇BU△	245
SM3H-183Y◇BU△	265

□ Torque Curves

SM3H-182 (2900Watts)
DC Bus: 540VDC (400VAC)   - 10.5 Amps

SM3H-183 (4400Watts)
DC Bus: 540VDC (400VAC)   - 16.7 Amps
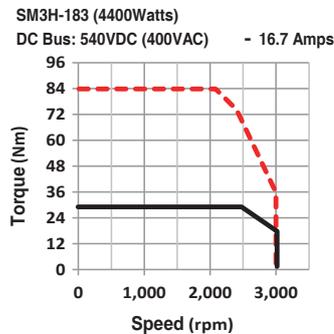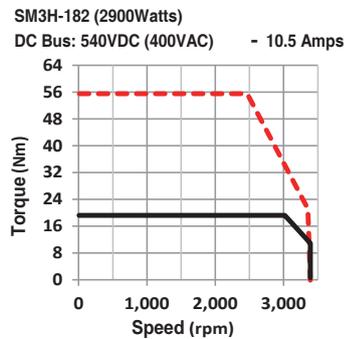
- - - - - Max. Intermittent Torque
———— Max. Continuous Torque

2.3.16 □180mm Frame High Inertia 400VAC winding

□ Specification

Type*		SM3H - 184Y◇□U△	SM3H - 185Y◇□U△
Rated Output Power	watts	5500	7500
Rated Speed	rpm	1500	1500
Max.Speed	rpm	3000	3000
Rated Torque	N·m	35	48
Peak Torque	N·m	105	120
Rated Current	A (rms)	20.9	25.2
Peak Current	A (rms)	69.9	73.4
Voltage Constant ±5%	V (rms) / K rpm	114	115
Torque Constant ±5%	N·m / A (rms)	1.67	1.93
Rotor Inertia	Kg·m^2	89×10^{-4}	125×10^{-4}
Rotor Inertia - With Brake	Kg·m^2	92×10^{-4}	145×10^{-4}
Shaft Load - Axial	N (max.)	588	588
Shaft Load - Radial (End of Shaft)	N (max.)	1764	1764
Weight	Kg	21	26.8
Weight - With Brake	Kg	23	28.9

*◇Encoder Options；□Brake Options；△Oil Seal Options

□ Dimensions (Unit: mm)
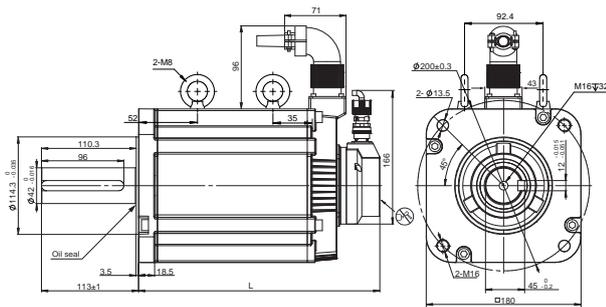
1) Without Brake

Without Brake	L
SM3H-184Y◇NU△	230
SM3H-185Y◇NU△	281

2) With Brake
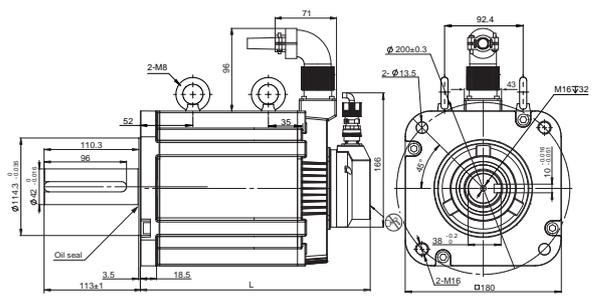
With Brake	L
SM3H-184Y◇BU△	280
SM3H-185Y◇BU△	316

□ Torque Curves

SM3H-184 (5500Watts)
DC Bus: 540VDC (400VAC) - 20.9 Amps

SM3H-185 (7500Watts)
DC Bus: 540VDC (400VAC) - 25.2 Amps
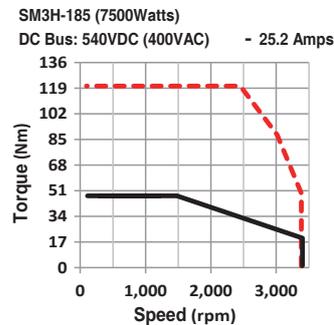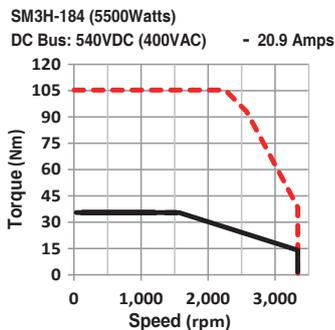
- - - - - Max. Intermittent Torque
——— Max. Continuous Torque

2.4 Motor Common Specification

Encoder Type	26-bit, 21-bit, 17-bit multi-turn absolute encoder
Insulation Class	Class F (155℃)
Protection Level	IP67 (Except transfixion part of shaft)
Installation Conditions	Indoor installation, avoiding direct sunlight, corrosive and flammable gas
Ambient Temperature	Working temperature: 0℃~ 40℃ Storage temperature: -20℃ ~ 60℃
Humidity	Storage and usage: 20 ~ 85%RH (no condensation)
Altitude	Derating is not required for altitudes not higher than 1000m Derating 1% for every additional 100m for altitudes between 1000m and 2000m
Vibration	Under 49m/s², 10 ~ 60Hz(Do not use continuously at resonance frequency)

2.5 Motor Encoder Specification

Item	Content		
Motor Model	SM3*-****T***	SM3*-****X***	SM3*-****B***
Power Supply VCC	DC 4.5V～5.5V (Typ 5V)		
External Battery Voltage	DC 3.3～5.5V (Typ 3.6V)		——
Power Supply Voltage VCC Consumes Current	Typ 160mA		
External Battery Consumption Current	Typ 15µA		——
Number of Pulses per Revolution	67108864 (26-bit)	1048576 (21-bit)	131072 (17-bit)
Number of Multi-turn Gyrometers	65536 (16-bit)		
Communication Mode	Half-duplex acyclic serial communication		
Baud Rate	4Mbps		
Operation Temperature	0～105℃		

2.5.1 Motor Brake Specifications

Motor brake is used to prevent motor from rotating by power off the servo system. The most common way of use is in vertical application, when the motor is disabled or powered off, in order to prevent the displacement of the mechanical mechanism driven by the motor due to gravity and other reasons, the servo motor with brake needs to be used.

When the brake is powered on, the armature is retracted, the brake pad is released, and the motor can operate normally. When the brake is powered off, the armature is released, the brake pad is locked, and the motor can't rotate.

Frame	40mm	60mm	80mm	100mm	130mm	180mm
Static Friction Torque (Nm)	0.32	1.5	3.2	8.0	18.5	60
Rated Voltage (VDC)	24					
Power Waste (W @ 20℃)	6.3	7.2	9.6	14.4	24.3	52
Current (A)	0.26	0.3	0.4	0.6	1.05	2.16
Braking Time	< 70ms (Standard air gap, at 20℃)					
Release Time	<25ms					
Release Voltage	18.5VDC max.(at 20℃)					
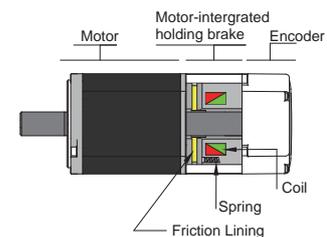
During normal operation, do not use the motor's brake to decelerate the motor, it will cause damage to the brake.

2.6 Drive Motor Matching Table

2.6.1 220VAC System

Servo Drive			
26pin Plug-in Type I/O Connector			
EtherCAT	M56S-21A8ECX	M56S-23A0ECX	M56S-24A5ECX
	M56S-21A8ECN	M56S-23A0ECN	M56S-24A5ECN
Matching Motor			
Motor Frame Size & Power			
	Frame 40, 50W, 100W	-	-
	Frame 60, 200W	Frame 40, 400W	-
	-	-	Frame 80, 750W

Low Inertia	Without Brake	SM3L-042A◇ND△ SM3L-042ABND△ SM3L-061A◇NP△	SM3L-062A◇NP△ SM3L-062ABND△	SM3L-083A◇NP△ SM3L-083ABND△
	With Brake	SM3L-042A◇BD△ SM3L-042ABBD△ SM3L-061A◇BP△	SM3L-062A◇BP△ SM3L-062ABBD△	SM3L-083A◇BP△ SM3L-083ABBD△
High Inertia	Without Brake	SM3H-041A◇NP△ SM3H-042A◇ND△ SM3H-061A◇NP△	SM3H-062A◇NP△	SM3H-083A◇NP△
	With Brake	SM3H-041A◇BP△ SM3H-042A◇BD△ SM3H-061A◇BP△	SM3H-062A◇BP△	SM3H-083A◇BP△

◇ Encoder Option   △Oil Seal Options

Servo Drive			
26pin Plug-in Type I/O Connector			
EtherCAT	M56S-26A0ECX	M56S-210AECX	M56S-213AECX
Matching Motor			
Motor Frame Size & Power			
	Frame 80, 1000W	-	Frame 100, 2000W
	Frame 100, 1000W	Frame 100, 1500W	Frame 100, 2500W
	Frame 130, 850W, 1000W	Frame 130, 1300W, 1500W	Frame 130, 1800W, 2000W
Low Inertia	Without Brake	SM3L-084A◇NP△ SM3L-102A◇NU△	SM3L-103A◇NU△	SM3L-103A◇NU△ SM3L-104A◇NU△
	With Brake	SM3L-084A◇BP△ SM3L-102A◇BU△	SM3L-103A◇BU△	SM3L-103A◇BU△ SM3L-104A◇BU△
Medium Inertia	Without Brake	SM3M-132A◇NU△	SM3M-133A◇NU△	SM3M-134A◇NU△
	With Brake	SM3M-132A◇BU△	SM3M-133A◇BU△	SM3M-134A◇BU△
High Inertia	Without Brake	SM3H-132A◇NU△	SM3H-133A◇NU△	SM3H-134A◇NU△
	With Brake	SM3H-132A◇BU△	SM3H-133A◇BU△	SM3H-134A◇BU△

◇ Encoder Option △Oil Seal Options

2.6.2 400VAC System

Servo Drive		
26pin Plug-in type I/O Connector		
EtherCAT	M56S-36A0ECX	M56S-313AECX
Matching Motor		
Motor Frame Size & Power		
	Frame 100, 1000W, 1500W	Frame 100, 2000W, 2500W
	Frame 130, 850W, 1000W 1300W, 1500W	Frame 130, 3000W
	-	Frame 180, 2900W
Low Inertia	Without Brake	SM3L-102Y◇NU△ SM3L-103Y◇NU△	SM3L-104Y◇NU△ SM3L-105Y◇NU△
	With Brake	SM3L-102Y◇BU△ SM3L-103Y◇BU△	SM3L-104Y◇BU△ SM3L-105Y◇BU△
Medium Inertia	Without Brake	SM3M-132Y◇NU△ SM3M-133Y◇NU△	SM3M-135Y◇NM△
	With Brake	SM3M-132Y◇BU△ SM3M-133Y◇BU△	SM3M-135Y◇BM△
High Inertia	Without Brake	SM3H-132Y◇NU△ SM3H-133Y◇NU△	SM3H-182YTNU△
	With Brake	SM3H-132Y◇BU△ SM3H-133Y◇BU△	SM3H-182YTBU△

◇ Encoder Option △Oil Seal Options

MOONS'

Servo Drive			
26pin Plug-in type I/O Connector			
EtherCAT	M56S-317AECX	M56S-321AECX	M56S-326AECX

Matching Motor				
Motor Frame Size & Power				
		Frame 180, 4400W	Frame 180, 5500W	Frame 180, 7500W
High Inertia	Without Brake	SM3H-183YTNU△	SM3H-184YTNU△	SM3H-185YTNU△
	With Brake	SM3H-183YTBU△	SM3H-184YTBU△	SM3H-185YTBU△

◇ Encoder Option △Oil Seal Options

2.7 Matching Cable and Connector Accessories

2.7.1 Servo Motor Matching Cable

Motor Model 1*	Description	Common Type Model	Flexible Type Model 2*	Length (Unit: m)
SM3L-042A ◇□ D△ SM3L-061A ◇□ P△ SM3L-062A ◇□ P△ SM3L-083A ◇□ P△ SM3L-084A ◇□ P△ SM3H-041A ◇□ P△ SM3H-042A ◇□ P△ SM3H-061A ◇□ P△ SM3H-062A ◇□ P△ SM3H-083A ◇□ P△	Encoder Cables With Battery Absolute Encoder Standard Shielded	2639-0100	2639-0100-C10	1
		2639-0200	2639-0200-C10	2
		2639-0300	2639-0300-C10	3
		2639-0400	2639-0400-C10	4
		2639-0500	2639-0500-C10	5
		2639-0800	2639-0800-C10	8
		2639-1000	2639-1000-C10	10
		2639-1500	2639-1500-C10	15
		2639-2000	2639-2000-C10	20
	Encoder Cables Incremental Encoder Standard Shielded	2640-0100	2640-0100-C10	1
		2640-0200	2640-0200-C10	2
		2640-0300	2640-0300-C10	3
		2640-0400	2640-0400-C10	4
		2640-0500	2640-0500-C10	5
		2640-0800	2640-0800-C10	8
		2640-1000	2640-1000-C10	10
		2640-1500	2640-1500-C10	15
		2640-2000	2640-2000-C10	20
SM3L-042AB□D△ SM3L-061AB□D△ SM3L-062AB□D△ SM3L-083AB□D△ SM3L-084AB□D△ SM3M-062AB□D△ SM3M-083AB□D△	Encoder Cables Without Battery Absolute Encoder Standard Shielded	2641-0100	2641-0100-C10	1
		2641-0200	2641-0200-C10	2
		2641-0300	2641-0300-C10	3
		2641-0400	2641-0400-C10	4
		2641-0500	2641-0500-C10	5
		2641-0800	2641-0800-C10	8
		2641-1000	2641-1000-C10	10
		2641-1500	2641-1500-C10	15
		2641-2000	2641-2000-C10	20
SM3L-042A ◇□ D△ SM3L-061A ◇□ P△ SM3L-062A ◇□ P△ SM3L-083A ◇□ P△ SM3L-084A ◇□ P△ SM3H-041A ◇□ P△ SM3H-042A ◇□ P△ SM3H-061A ◇□ P△ SM3H-062A ◇□ P△ SM3H-083A ◇□ P△ SM3L-042AB □ D△ SM3L-061AB □ D△ SM3L-062AB □ D△ SM3L-083AB □ D△ SM3L-084AB □ D△ SM3M-062AB □ D△ SM3M-083AB □ D△	Motor Cables Standard Unshielded	1672-0100	1672-0100-C10	1
		1672-0200	1672-0200-C10	2
		1672-0300	1672-0300-C10	3
		1672-0400	1672-0400-C10	4
		1672-0500	1672-0500-C10	5
		1672-0800	1672-0800-C10	8
		1672-1000	1672-1000-C10	10
		1672-1500	1672-1500-C10	15
		1672-2000	1672-2000-C10	20
	Motor Cables With Brake Cable Unshielded	1674-0100	1674-0100-C10	1
		1674-0200	1674-0200-C10	2
		1674-0300	1674-0300-C10	3
		1674-0400	1674-0400-C10	4
		1674-0500	1674-0500-C10	5
		1674-0800	1674-0800-C10	8
		1674-1000	1674-1000-C10	10
		1674-1500	1674-1500-C10	15
		1674-2000	1674-2000-C10	20

* ◇Encoder Options △Oil Seal Options
* Flexible -C10 10 million times
 Test Conditions: Bend Radius 50mm, Frequency 40 times/min, Distance 1000mm

MOONS'

Motor Model 1*	Description	Common Type Model	Flexible Type Model 2*	Length (Unit: m)
SM3L-102○◇□U△ SM3L-103○◇□U△ SM3L-104○◇□U△ SM3L-105○◇□U△ SM3M-132○◇□U△ SM3M-133○◇□U△ SM3M-134○◇□U△ SM3M-135Y◇□M△ SM3H-132○◇□U△ SM3H-133○◇□U△ SM3H-134○◇□U△ SM3H-182Y◇□U△ SM3H-183Y◇□U△ SM3H-184Y◇□U△ SM3H-185Y◇□U△	Encoder Cables With Battery Absolute Encoder Standard Shielded	2642-0100	2642-0100-C10	1
		2642-0300	2642-0300-C10	3
		2642-0500	2642-0500-C10	5
		2642-1000	2642-1000-C10	10
		2642-1500	2642-1500-C10	15
		2642-2000	2642-2000-C10	20
	Encoder Cables Incremental Encoder Standard Shielded	2643-0100	2643-0100-C10	1
		2643-0300	2643-0300-C10	3
		2643-0500	2643-0500-C10	5
		2643-1000	2643-1000-C10	10
		2643-1500	2643-1500-C10	15
		2643-2000	2643-2000-C10	20
SM3L-102A◇NU△ SM3M-132A◇NU△ SM3H-132A◇NU△	Motor Cables Standard Unshielded	1658-0100	1658-0100-C10	1
		1658-0300	1658-0300-C10	3
		1658-0500	1658-0500-C10	5
		1658-1000	1658-1000-C10	10
		1658-1500	1658-1500-C10	15
		1658-2000	1658-2000-C10	20
SM3L-102A◇BU△ SM3M-132A◇BU△ SM3H-132A◇BU△	Motor Cables With Built-in Brake Cable Standard Unshielded	1660-0100	1660-0100-C10	1
		1660-0300	1660-0300-C10	3
		1660-0500	1660-0500-C10	5
		1660-1000	1660-1000-C10	10
		1660-1500	1660-1500-C10	15
		1660-2000	1660-2000-C10	20
SM3L-103A◇NU△ SM3M-133A◇NU△ SM3H-133A◇NU△	Motor Cables Standard Unshielded	1656-0100	1656-0100-C10	1
		1656-0300	1656-0300-C10	3
		1656-0500	1656-0500-C10	5
		1656-1000	1656-1000-C10	10
		1656-1500	1656-1500-C10	15
		1656-2000	1656-2000-C10	20
SM3L-103A◇BU△ SM3M-133A◇BU△ SM3H-133A◇BU△	Motor Cables With Built-in Brake Cable Standard Unshielded	1662-0100	1662-0100-C10	1
		1662-0300	1662-0300-C10	3
		1662-0500	1662-0500-C10	5
		1662-1000	1662-1000-C10	10
		1662-1500	1662-1500-C10	15
		1662-2000	1662-2000-C10	20
SM3L-104A◇NU△ SM3L-105A◇NU△ SM3M-134A◇NU△ SM3M-135Y◇NM△ SM3H-134A◇NU△	Motor Cables Standard Unshielded	1650-0100	1650-0100-C10	1
		1650-0300	1650-0300-C10	3
		1650-0500	1650-0500-C10	5
		1650-1000	1650-1000-C10	10
		1650-1500	1650-1500-C10	15
		1650-2000	1650-2000-C10	20
SM3L-104A◇BU△ SM3L-105A◇BU△ SM3M-134A◇BU△ SM3M-135Y◇BM△ SM3H-134A◇BU△	Motor Cables With Built-in Brake Cable Standard Unshielded	1652-0100	1652-0100-C10	1
		1652-0300	1652-0300-C10	3
		1652-0500	1652-0500-C10	5
		1652-1000	1652-1000-C10	10
		1652-1500	1652-1500-C10	15
		1652-2000	1652-2000-C10	20

* ○Winding Specification ◇Encoder Options △Oil Seal Options
* Flexible -C10 10 million times
 Test Conditions: Bend Radius 50mm, Frequency 40 times/min, Distance 1000mm

Motor Model 1*	Description	Common Type Model	Flexible Type Model 2*	Length (Unit: m)
SM3H-182Y◇NU△	Motor Cables Standard Unshielded	1682-0100	1682-0100-C10	1
		1682-0300	1682-0300-C10	
		1682-0500	1682-0500-C10	
		1682-1000	1682-1000-C10	
		1682-1500	1682-1500-C10	
		1682-2000	1682-2000-C10	
SM3H-182Y◇BU△	Motor Cables With Built-in Brake Cable Standard Unshielded	1683-0100	1683-0100-C10	
		1683-0300	1683-0300-C10	
		1683-0500	1683-0500-C10	
		1683-1000	1683-1000-C10	
		1683-1500	1683-1500-C10	
		1683-2000	1683-2000-C10	
SM3H-183Y◇NU△	Motor Cables Standard Unshielded	1666-0100	1666-0100-C10	1
		1666-0300	1666-0300-C10	3
		1666-0500	1666-0500-C10	5
		1666-1000	1666-1000-C10	10
		1666-1500	1666-1500-C10	15
		1666-2000	1666-2000-C10	20
SM3H-183Y◇BU△	Motor Cables With Built-in Brake Cable Standard Unshielded	1681-0100	1681-0100-C10	1
		1681-0300	1681-0300-C10	3
		1681-0500	1681-0500-C10	5
		1681-1000	1681-1000-C10	10
		1681-1500	1681-1500-C10	15
		1681-2000	1681-2000-C10	20
SM3H-184Y◇NU△ SM3H-185Y◇NU△	Motor Cables Standard Unshielded	1667-0100	1667-0100-C10	1
		1667-0300	1667-0300-C10	3
		1667-0500	1667-0500-C10	5
		1667-1000	1667-1000-C10	10
		1667-1500	1667-1500-C10	15
		1667-2000	1667-2000-C10	20
SM3H-184Y◇BU△ SM3H-185Y◇BU△	Motor Cables With Built-in Brake Cable Standard Unshielded	1680-0100	1680-0100-C10	1
		1680-0300	1680-0300-C10	3
		1680-0500	1680-0500-C10	5
		1680-1000	1680-1000-C10	10
		1680-1500	1680-1500-C10	15
		1680-2000	1680-2000-C10	20

* ◇Encoder Options △Oil Seal Options
* Flexible -C10 10 million times
  Test Conditions: Bend Radius 50mm, Frequency 40 times/min, Distance 1000mm

2.7.2 Drive Plug Kit

Name	P/N	Description
I/O Connector	M2-50P	CN2, 50pin Density IO connector
Motor Encoder Connector	MSOP-CN310P	CN3, Drive side motor encoder connector
Second encoder Connector	MSOP-CN408P	CN4, Full closed loop function encoder connector
STO Function Connector	STO Connector Kit	CN5, STO Connector
Drive Connector Kit	MSOP-DRPWKITA	200/400/750W drive, P1, P2 and adjusting handle
	MSOP-DRPWKITB	1.0/1.5/2.5/3.0kW drive, P1, P2 and adjusting handle

2.7.3 Motor Plug Kit

Name	P/N	Description
Motor Connetor	MSOP-MTKITA	Frame 80mm and below motor connector kit (without brake connector)
	MSOP-MTKITD	Frame 80mm and below motor connector kit (with brake connector)
	MSOP-MTKITF	Frame100mm/130mm motor connector kit (Straight)
	MSOP-MTKITE	Frame 180mm motor connector kit (Straight)

2.7.4 Absolute Value Battery Kit

Name	P/N	Description
Battery	MSOP-BA01	Used for absolute value encoder motor with battery
Battery and battery cases	MSOP-BAKIT01	

2.7.5 Communication Cable

Name	P/N	Length (m)	Description
USB Config Cable	2620-150	1.5	CN1, Servo drive and PC communication configuration cable
CN6/CN7 Communiction Cable	2012-030	0.3	Twisted-pair, Unshielded type, 0.3m servo drive and controller communication cable Communication cables between servo drives
	2012-300	3	
	2013-030	0.3	Twisted-pair, Shielded type, 0.3m servo drive and controller communication cable Communication cables between servo drives
	2013-300	3	

2.7.6 Other Cable

Name	P/N	Length (m)	Description
Second encoder feedback line	1643-300	3	Ordinary type, no need for bending times
	1643-500	5	
	1643-300-C05	3	Flexible type, 5 million times of bending
	1643-500-C05	5	

2.7.7 Regenerative Resistor

P/N	Specification	Description
REG100W120R	100W, 120Ω	Regenerative absorbing resistor
REG200W120R	200W, 120Ω	
REG300W120R	300W,120Ω	

2.7.8 Dynamic Brake Resistor

P/N	Specification	Description
DBR85W3R5	85W, 3.5Ω	1.0/1.5/2.5/3.0kW type external dynamic brake resistor

2.7.9 EMI Filter

P/N	Specification	Description
MSOP-EMI020	250VAC，20A	EMI filter for AC power of drive side(Single Phase)

3 Installation

3.1 Storage Conditions

3.1.1 Drive Storage Environment Conditions

Please note the following when storing:

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

3.1.2 Motor Storage Conditions

● Correctly packaged and stored in a clean and dry place, avoid direct sunlight.
● Store within an ambient temperature range of -20℃～+60℃.
● Store within a relative humidity rang of 20% to 85% and non-condensing.
● DO NOT store in a place subjected to corrosive gasses.

3.2 Installation Conditions

3.2.1 The Drive Operation Ambient Conditions

● The ambient temperature is 0 ℃ ~ 55 ° C. If the ambient temperature exceeds 45℃, please place it in a well-ventilated place. It is recommended to keep the ambient temperature below 45℃ for a long time operation to ensure the reliable performance of the product.
● If this product is installed in a distribution box, the distribution box must be sized and ventilated so that there is no danger of overheating of all electronic devices used inside.
● Ambient humidity is 10%~85% RH, no condensation.
● Vibration below 9.8m/s^2.
● Do not use the drive near corrosive gas, flammable gas or combustible material.
● Please install the drive in an indoor electrical control box without water and direct sunlight.
● Please avoid using the drive in dusty places.

3.2.2 The Motor Operation Ambient Conditions

● The ambient temperature is 0℃～40℃.
● Ambient humidity is 10%～85% RH, no condensation.
● Vibration below 49m/s^2.
● Do not use the motor near corrosive gas, flammable gas, or combustible materials.
● Do not use the motor in a closed environment, the closed environment will cause the motor to high temperature and shorten the service life.

3.3 Drive Installation Space

● When installing the drive, please reserve enough around space for the drive to ensure a good circulating cooling effect.
● Do not block the cooling holes of the drive.
● To ensure the temperature in the cabinet, it is recommended to install a cooling fan in the cabinet.
● Please ground the drive well during installation.
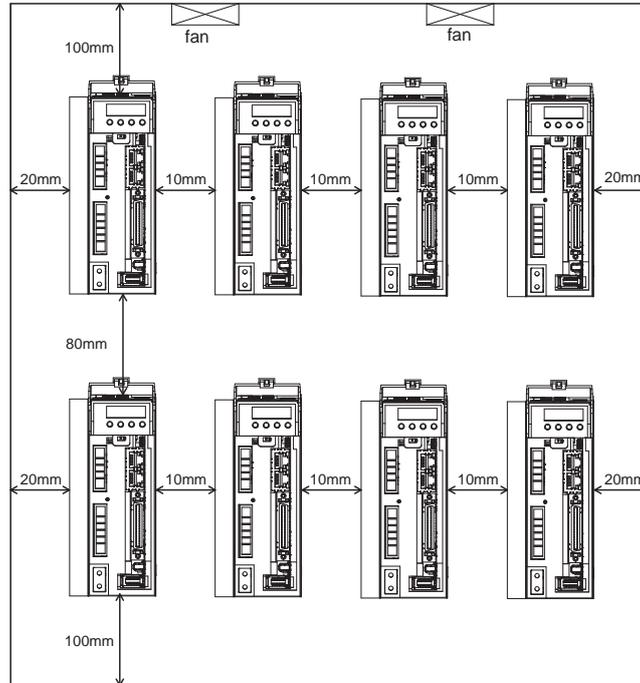
3.4 Motor Installation

3.4.1 Encoder and Bearing Protection

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

● It is recommended to use a disturbing coupling specially designed for servo motors, which can provide some cushioning during eccentricity or deflection.
● When installing the coupling, please wipe clean the anti-rust oil on the output shaft end of the motor.
● When using the keyway motor, please use the standard key in the motor box.
● When installing a pulley on a servo motor with a keyway, please use the threaded hole of the motor shaft to push the pulley into the motor shaft with a screw.
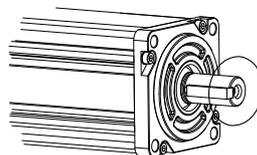
● When disassembling the pulley, please use professional tools such as pulley remover to prevent the bearing from being injured.

● When connecting the shaft, make sure to achieve the required concentricity. If the concentricity is not good, it will produce vibration and damage the bearing and encoder.

● The load applied in the axial or radial direction of the motor should not exceed the range specified in the specifications, please refer to the specifications table of each servo motor.

● The output shaft material of the servo motor does not have the ability to prevent rust. Although grease has been used for rust protection before leaving the factory, if the storage time exceeds six months, to ensure that the motor shaft is free from rust, please check the condition of the motor shaft regularly every three months and add appropriate anti-rust grease in time.

3.4.2 Precautions for Motor Use in Oil or Water Environment

● Do not allow oil and water to enter the inside of the motor.

● Do not place cables in water or oil.

● Since the through part of the motor shaft and the motor lead wires are not IP65 protected, please ensure that no water or oil enters the motor from such parts.

● The motor industrial grade skeleton oil seal can block pollutants (oil, impurities) to prolong the life of the motor. After the oil seal is installed, the oil seal will produce a certain resistance and torque loss to the rotation of the motor shaft. It is recommended to use the motor in derating.

● In the application with liquid, please install the motor wiring port downward.
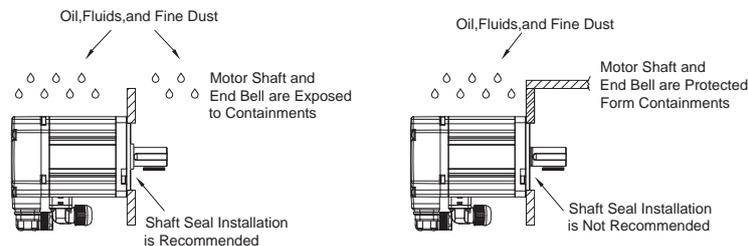
3.4.3 Wiring

● If using a cable chain, please use bending resistant cable. And ensure that there is a bending diameter of more than 100mm.

● Do not twist the cable.

● When moving the motor, do not pull on the cable.

● Do not use the same sleeve for the main circuit cable and the input/output signal cable or encoder cable, and do not bundle them together. Wiring in this case, the main circuit cable and the input/output signal cable or encoder cable should be separated by more than 30cm.

3.4.4 Motor Temperature Rise

Servo motors are rated for continuous operation when mounted on a standard heat sink and in an ambient temperature of 40°C. When the servo motor is installed in a small device, the temperature may rise significantly due to the reduced heat dissipation area of the servo motor.

The dimensions of the standard cooling plate of the servo motor are as follows:

Base series	Power	Heat sink size
40mm	50W, 100W	200*200*6 aluminum
60mm	200W, 400W	250*250*6 aluminum
80mm	750W	250*250*6 aluminum
	1kW	300*300*12 aluminum
130mm	850W～3kW	400*400*20 aluminum
180mm	2.9kW ~ 7.5kW	550*550*30 aluminum

If the installation environment makes it difficult to use a large heat sink, or if the ambient temperature exceeds the specification requirements, the following requirements need to be followed:

● Do not work at rated power, choose a motor that is 1 to 2 times larger than the actual motor power required.

● Reduce the acceleration and deceleration of the duty cycle to reduce the motor load.

● Reduce duty cycle for work.

● External forced air cooling of the servo motor using a cooling fan or other means.

● When using a motor with an oil seal, the oil seal will produce a certain resistance and torque loss to the rotation of the motor shaft, and heat is generated due to the friction between the them. The required load torque needs to be 70% of the rated torque of the motor.

Note: Do not put any thermal insulation material between the servo motor and the metal heat sink, so as to avoid the failure of the motor to dissipate heat and cause the motor temperature to rise, which may cause the motor to malfunction.

4 Wiring

4.1 EtherCAT Communication Port

4.1.1 Communication Interface
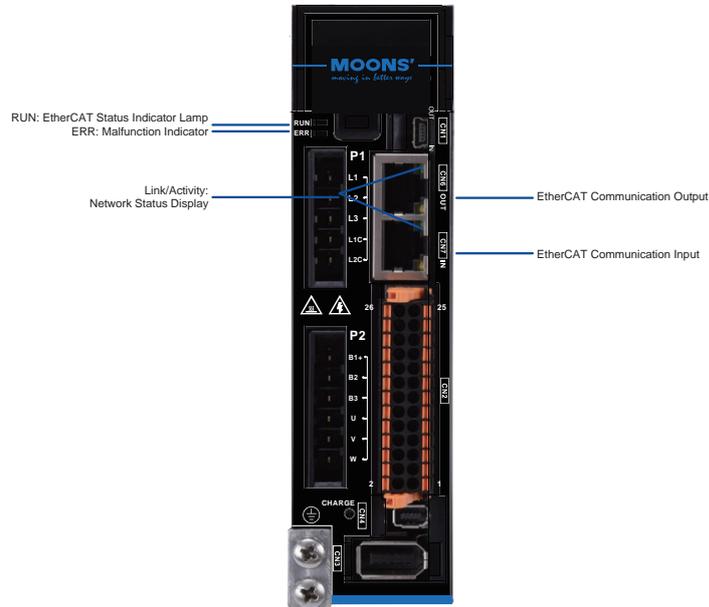
4.1.2 EtherCAT Communication Status Indicator Light

LED	Colour	Status	Description
Link/Activity	Green	OFF	No Ethernet connection
		ON	Ethernet is connected
		Flickering	Activity online
RUN	Green	OFF	Init(Initialization)
		ON	OP(Operational)
		Blinking	Pre-op(Pre-operation)
		Single Flash	Safe-Operation
ERR	Red	OFF	No error
		Blinking	General error
		Single Flash	Sync error
		Double Flash	Watch dog over time
		Flickering	Initialization Error

Note:

Flickering	**ON** **OFF**	50ms 50ms
Blinking	**ON** **OFF**	200ms 200ms
Single Flash	**ON** **OFF**	200ms 1000ms
Double Flash	**ON** **OFF**	200ms 1000ms
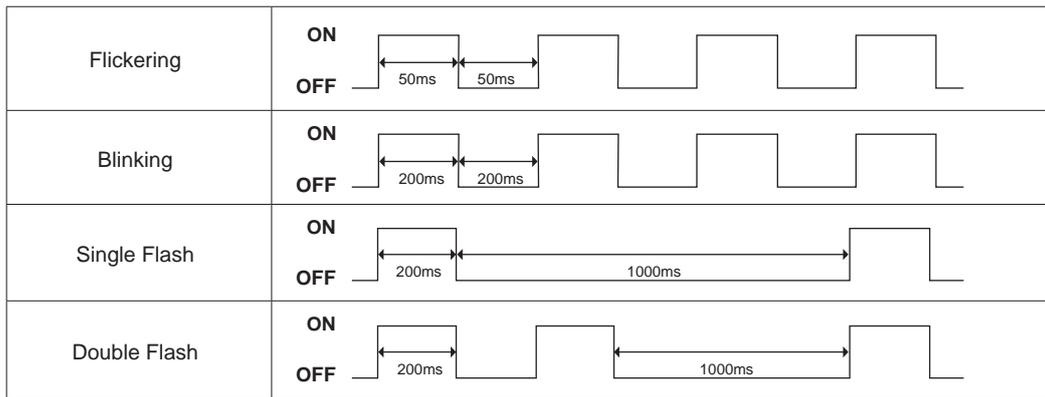
4.1.3 RJ45(8p8c) Pin Definition

PIN1   PIN8   PIN1   PIN8
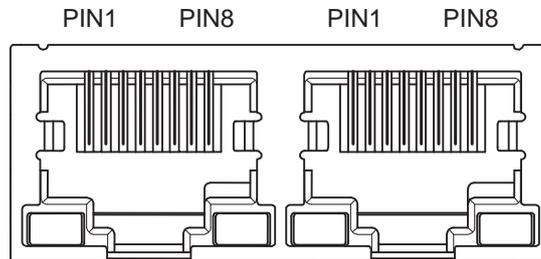
PIN NO.	Signal Name	Description
1	TX+	Transmit +
2	TX-	Transmit -
3	RX+	Receive +
4	-	-
5	-	-
6	RX-	Receive -
7	-	-
8	-	-

4.2 EMC Control

⚠	M56S servo drive uses high-speed switching elements inside, which will generate high frequency or low frequency during normal operation interference, and interfere with peripheral equipment through conduction or radiation.
	There is also a low-voltage unit inside the servo drive, which is likely to be interfered by the noise of the drive's peripheral equipment. The interfered signal may cause the device to make unexpected actions.

Please follow the electromagnetic compatibility regulations described in this manual during installation and wiring. This product can comply with the EN 61800-3 specifications.

In order to prevent mutual electromagnetic interference between the servo drive and its peripheral devices, the following countermeasures can be taken.

● Equipped with appropriate EMI noise filter on the power input side.
● Please make sure that the drive and motor are well grounded, and the grounding wire should preferably be a cable of AWG10 or above.
● Do not use the same sleeve for the main circuit cable and the input / output signal cable or encoder cable, and do not bundle them together. When wiring, the main circuit cable and the input / output signal cable or encoder cable should be separated by more than 30cm.
● For input/output signal cables and encoder cables, use twisted-pair wires or multi-core twisted-pair shielded wires.
● The length of the input and output signal cables is less than 3m, and the encoder cable is less than 20m.
● Do not use the same power source as an electric welding machine, electric discharge machine, etc. Even if it is not the same power supply, when there is a high-frequency generator nearby, please connect a noise filter to the input side of the main circuit power supply cable and the control power supply cable.

4.2.1 EMI 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.
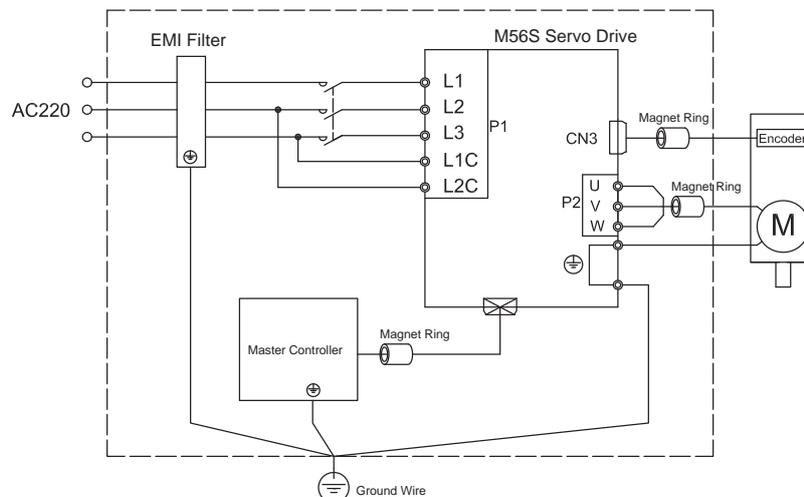
In addition to installation and wiring in accordance with the manual, you also need to pay attention to:

● Remove the paint layer on the contact surface when the drive is mounted on a metal plate.
● Servo drive and EMI filter are mounted on the same metal plate.
● Shorten the wiring length between the EMI filter and the servo drive as much as possible.
● Please route the input and output wires separately, do not bundle them together.
● The noise filter must be well grounded.
● Please install the ferrite ring as shown in the figure above for the input and output signal cables and power lines of the drive to obtain better EMC effects.

4.2.2 Grounding

Good grounding treatment can give full play to the effect of EMI filter and greatly reduce interference.

● Must be parallel single-point grounding

Correct Grounding	Wrong Grounding
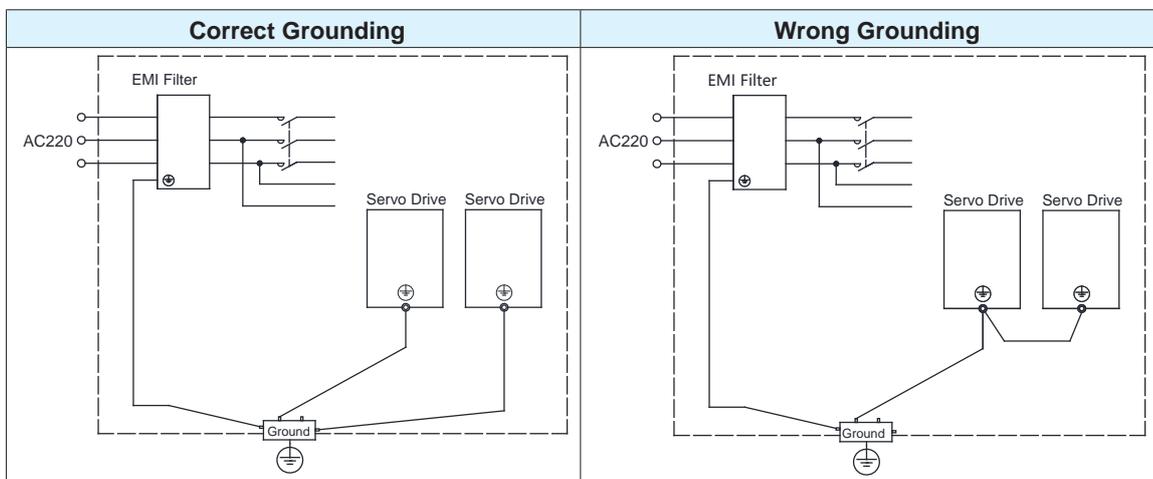
● Use a cable with a shielded net as the power extension cable between the drive and the motor.
● The shielding net of the motor power cable must be grounded or connected to the grounding terminal of the drive.

4.2.3 Motor Cable Shielding Net Processing

Choosing the motor cable with shielding net and installing the shielding net correctly can obtain better EMC effect and interference suppression effect. Please note the following:

● Use a cable with shielded net (if there is a double-layer isolation layer is better)
● The shielding nets at both ends of the motor cable must be grounded with the shortest distance and maximum contact area. Use clamps to fix the shielding nets at both ends of the motor cable to the metal plane as shown in the figure below.
● The protective paint must be removed from the fixing place between the clamp and the metal plane to ensure good contact.
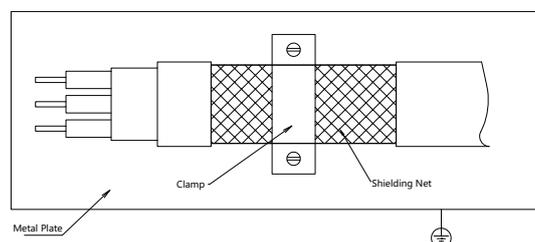
4.2.4 Recommended Model of EMI Filter

When the servo drive is running normally, electromagnetic interference will be generated. In order to prevent interference to external sensitive equipment, select appropriate EMI noise filters to minimize interference.

Note:

● Please select a noise filter that matches the power of the drive.

● Please separate the power input and output cables. Do not bundle the input and output wires together and put them in the same wire trough.

Correct Routing	Wrong Routing
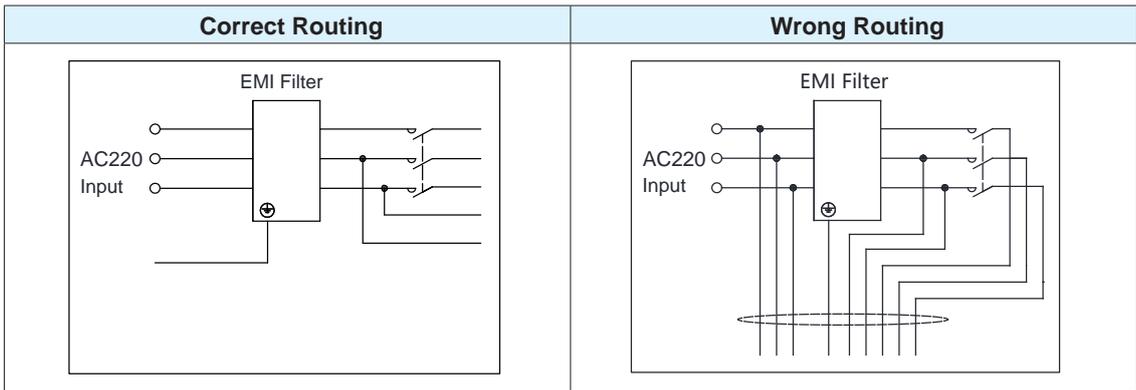
Recommended EMI Filter

MOONS' P/N	Spec.	Manufacturer	Description
MSOP-EMI020	250VAC, 20A	LCR	EMI Noise Filter (Single Phase)

Other Recommended Part number：

Drive P/N	Main circuit power	Manufacturer	EMI Filter P/N
M56S-21A8EC◆	Single Phase	TYCO	3ET1
M56S-23A0EC◆		TYCO	6ET1
M56S-24A5EC◆		TYCO	6ET1
M56S-26A0ECX		TYCO	10ET1
M56S-210AECX	Three Phase	Dephir	DF300-16A-01
M56S-213AECX		Dephir	DF300-16A-01

◆ Represents the Function type

4.2.5 Ferrite Ring

The ferrite magnetic ring can effectively absorb the radiation interference of the wire harness.

The magnetic ring has different impedance characteristics at different frequencies. Generally, the impedance is very small at low frequencies. When the signal frequency increases, the impedance shown by the magnetic ring rises sharply, which makes it easy for normal useful signals to pass through, and can effectively suppress high frequencies. The passage of interference signals solves the problem of high-frequency interference of power lines, signal lines and connectors.

When the magnetic ring suppresses common mode interference, the eddy current loss of the magnetic ring to the high-frequency signal converts the high-frequency component into heat loss, so that a low-pass filter can be formed, which makes the high-frequency noise attenuate greatly. The impedance of low-frequency useful signals can be ignored and does not affect the normal operation of the circuit.

The wire passing through the magnetic ring can be repeatedly wound on the magnetic ring to increase the inductance, thereby enhancing the use effect of the magnetic ring, but too many turns will cause excessive loss and increase the temperature of the magnetic ring.

The recommended winding method and number of turns are as follows:

Signal Cable	Wind cables the 2 to 3 turns to form the signal noise filter.
Motor Cable	Remove the cables jacket to the length so that wires can be wound on the clamp noise filter for 2 to 3 turns. For effective noise reduction, U/V/W should be wound.
Encoder Cable	Wind cables the 2 to 3 turns to form the signal noise filter.
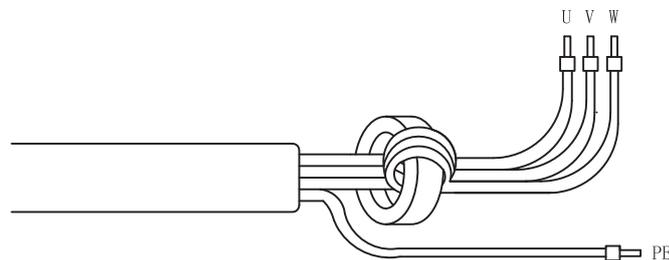
Recommended Ferrite ring:

MOONS' P/N	P/N	Manufacturer
MSOP-MR3035	ZCAT3035-1330	TDK

4.3 External Main Circuit Wiring

4.3.1 System Configuration

4.3.1.1 200/400/750W Type
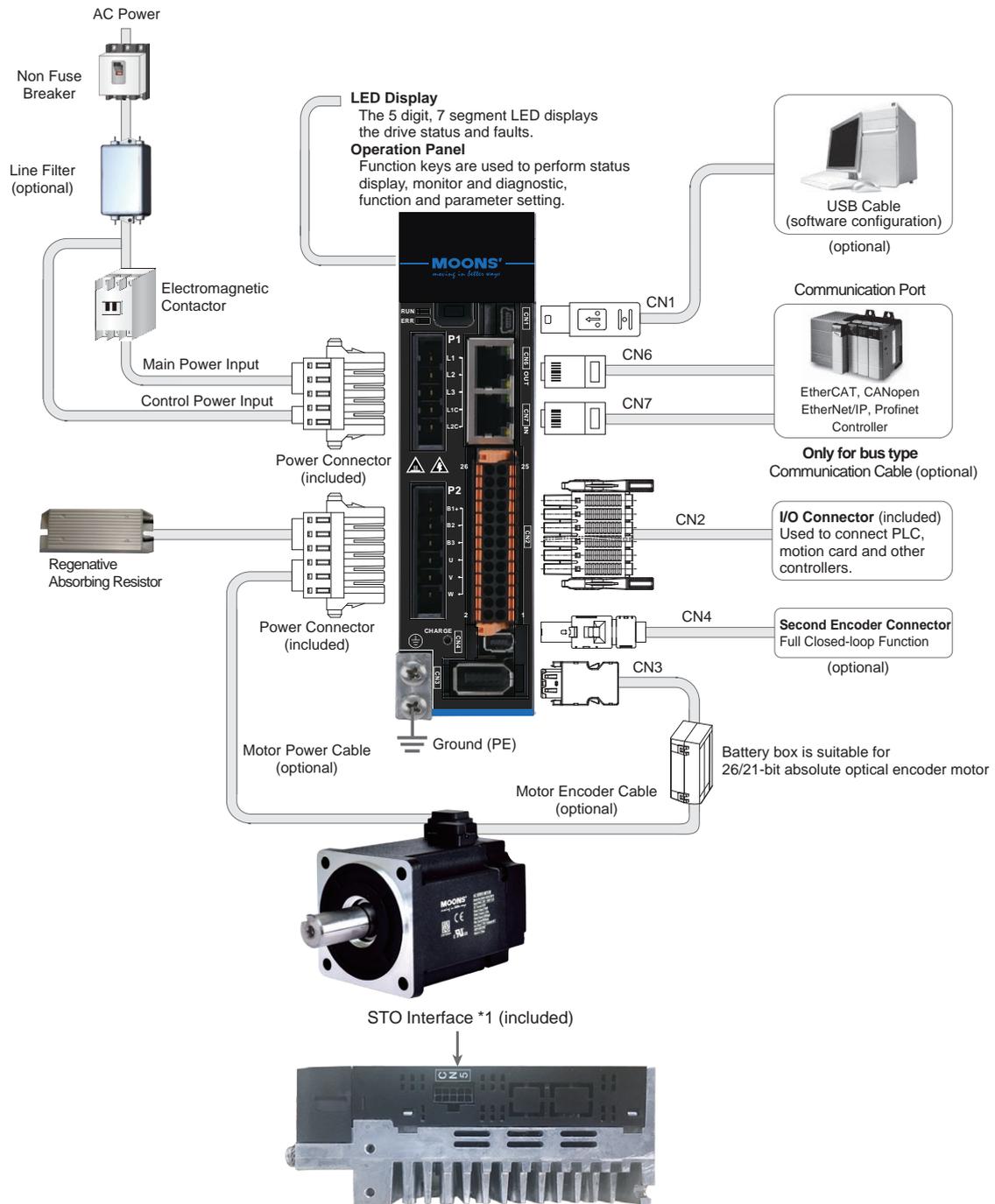
Note：*1 Certain models don't support this function, please refer to page 16.

4.3.1.2 1.0/1.5/2.5/3.0kW Type

AC Power

Non Fuse Breaker

Line Filter (optional)

Electromagnetic Contactor

Power Connector (included)

Main Power Input

Control Power Input

Regenative Absorbing Resistor (optional)

Dynamic braking Resistor (optional)

Power Connector (included)

Motor Power Cable (optional)

Ground (PE)

LED Display
The 5 digit, 7 segment LED displays the drive status and faults.
Operation Panel
Function keys are used to perform status display, monitor and diagnostic, function and parameter setting.

USB Cable (software configuration)
USB mini-B Cable (optional)

Communication Port

EtherCAT, CANopen EtherNet/IP, Profinet Controller

Only for bus type
Communication Cable (optional)

CN1

CN6

CN7

CN2

I/O Connector (included)
Used to connect PLC, motion card and other controllers.

CN4

Second Encoder Connector
Full Closed-loop Function
(optional)

CN3

Battery box is suitable for 23/21-bit absolute optical encoder motor

Motor Encoder Cable (optional)

STO Interface *1 (included)

4.3.1.3 5.0/6.0/7.5kW Type

AC Power

Non Fuse Breaker

Line Filter (optional)

Electromagnetic Contactor

Main Power Input

Power supply input

Motor Power Cable Interface

Regenerative Absorbing Resistor (optional)

Power Connector (optional)

Ground (PE)

LED Display
The 5 digit, 7 segment LED displays the drive status and faults.
Operation Panel
Function keys are used to perform status display, monitor and diagnostic, function and parameter setting.

USB Cable (software configuration)
USB mini-B Cable (optional)

CN1

Communication Port

CN6

CN7

EtherCAT, CANopen EtherNet/IP, Profinet Controller
Only for bus type
Communication Cable (optional)

CN2

I/O Connector (included)
Used to connect PLC, motion card and other controllers.

CN4

Second Encoder Connector
Full Closed-loop Function
(optional)

CN3

Battery box is suitable for 23/21-bit absolute optical encoder motor

Motor Encoder Cable (optional)

STO Interface (included)

4.3.2 Servo Drive Connectors and Terminals (750W and below Type)

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	Internal Resistor	Ensure the circuit is closed between B2 and B3, and the circuit is open between B1+ and B3.	
		External Resistor	Ensure the circuit is open between B2 and B3, and connect the external regenerative resistor between B1+ and B2.	
CN1	Mini USB Port	Connect to PC		
CN2	I/O Connector	Used to connect external controllers		
CN3	Encoder Connector	Used to connect encoder of servo motor		
CN4	Second encoder input	Second feedback input for full closed loop control		
CN5	STO Connector	STO function		
CN6(OUT)	EtherCAT OUT Port	EtherCAT output port		
CN7(IN)	EtherCAT IN Port	EtherCAT Input port		

4.3.3 Servo Drive Connectors and Terminals (1.0/1.5/2.5/3.0kW Type)

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		
	B1+、B2、B3	Internal Resistor	Ensure the circuit is closed between B2 and B3, and the circuit is open between B1+ and B3.	
		External Resistor	Ensure the circuit is open between B2 and B3, and connect the external regenerative resistor between B1+ and B2.	
	N、R1、R2	External dynamic braking resistor	When using the dynamic braking function with an external dynamic braking resistor, the resistor is connected between R1 and R2, and the resistor model is DBR85W3R5	
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	
CN1	Mini USB Interface	Connect to PC		
CN2	I/O Interface	Used to connect external controllers		
CN3	Encoder Interface	Used to connect encoder of servo motor		
CN4	Second encoder interface	Second feedback input for full closed loop control		
CN5	STO Interface	STO function		
CN6(OUT)	EtherCAT OUT Interface	EtherCAT output port		
CN7(IN)	EtherCAT IN Interface	EtherCAT Input port		

4.3.4 Servo Drive Connectors and Terminals (5.0/6.0/7.5kW Type)

Terminal Identification	Description	Details		
Power Supply	R、S、T	Used to connect three-phase AC main circuit power		
	L1C、L2C	Used to connect single-phase AC for control circuit power		
	B1+、B2、B3	Internal Resistor	Ensure the circuit is closed between B2 and B3, and the circuit is open between B1+ and B3.	
		External Resistor	Ensure the circuit is open between B2 and B3, and connect the external regenerative resistor between B1+ and B2.	
	N1、N2	External reactor	DC reactor used for suppressing high-order harmonics in power supply, connected between N1 and N2. When a reactor is not needed, short circuit between N1 and N2	
	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	
CN1	Mini USB Interface	Connect to PC		
CN2	I/O Interface	Used to connect external controllers		
CN3	Encoder Interface	Used to connect encoder of servo motor		
CN4	Second encoder interface	Second feedback input for full closed loop control		
CN5	STO Interface	STO function		
CN6(OUT)	EtherCAT OUT Interface	EtherCAT output port		
CN7(IN)	EtherCAT IN Interface	EtherCAT Input port		

MOONS'

4.3.5 Connections and Wiring Notes

● Please ensure grounding wires are securely connected, wires with more than AWG 10(5.3mm^2) on sectional area is recommended.

● Please DO NOT power on when the screws or cables are loose.

● 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.(3kW and below type)

● Ensure R/S/T and L1C/L2C are correctly wired, and voltage supplies are within the specification range.(5.0/6.0/7.5kW type)

● When using single-phase power supply, please connect to the L1, L3 pins.(1.5kW and below type)

● 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 and EMI filter are recommended on drive's power supply to ensure safety and improve its anti-interference level.

● Please setup an emergence stop circuitry to switch off the power supply when fault occurs.

● Please DO NOT touch drive or motor's connector terminals 5 minutes after drive and motor is powered off. There are electrical charge components in the circuitry. Therefore, even power is off, there might still be hazardous voltages within the circuitry, before its total discharge.

● Install the encoder cables in a separate conduit from the motor power cables to avoid signal noise. Separate the conduits by 30cm above.

● Use multi-stranded twisted-pair wires or multi-core shielded-pair wires for signal and encoder feedback cables.

● The maximum length of signal input/output cable is 3 meters, and the maximum length of encoder (PG) feedback cables is 20 meters.

MOONS'

4.3.6 Precautions for The Use of Towline Cables

When you need to move the motor cable or install the cable in a drag chain, please use a dedicated flexible cable. Ordinary cables are easy to be damaged during repeated bending, causing the servo motor to fail to work normally.

When using drag chain cables, make sure that:

● Correctly choose the cable that meets the required bending resistance.

● The bending radius of the cable is generally more than 10 times the outer diameter of the cable.

● Avoid pulling the cable. When wiring inside the drag chain, do not fix or bundle it, so as to avoid the bending radius is not enough and the cable will be pulled.

● Please bundle the cables at the two ends of the drag chain and the fixed place of the mechanical part.

Banding radius

two ends fixed
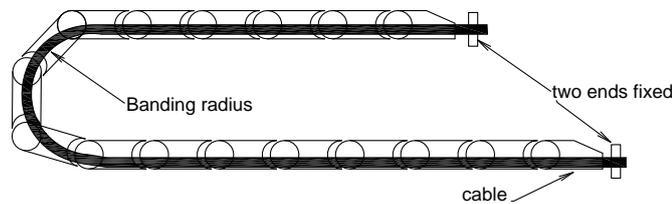
cable

● The wiring in the drag chain should not be too dense to ensure that the cable occupies less than 60% of the internal space of the drag chain.

● Avoid mixing cables with large outer diameter differences. If you really need to mix cables, please install baffles.

4.3.7 Recommended Wires

● The main circuit is recommended to use insulated wires with a withstand voltage of 600V and above 75°C.

● Be sure to choose the corresponding allowable current cable to prevent the cable from overheating.

Recommended wires for each part of the drive are as follows:

Drive and Matching Servo Motor		Rated Power (W)	Diameter of Cable (AWG)						
			Connector P1		Connector P2		Connector CN3	--	
			L1/L2/L3 R/S/T	L1C/L2C	U/V/W	B1+, B3	Encoder	Brake	GND
M56S-21A8EC◆	SM3H-041A◇□P△	50	2.0mm² AWG14	2.0mm² (AWG14)	0.75 ~ 2.0mm² AWG14 ~ 18	1.25 ~ 2.0mm² AWG14 ~ 16	0.2mm² AWG24	0.5mm² AWG20	2.0 ~ 5.3mm² AWG10 ~ 14
	SM3L-042A◇□D△	100							
	SM3H-042A◇□D△								
	SM3L-061A◇□P△	200							
	SM3H-061A◇□P△								
M56S-23A0EC◆	SM3L-062A◇□P△	400							
	SM3H-062A◇□P△								
M56S-24A5EC◆	SM3L-083A◇□P△	750							
	SM3H-083A◇□P△								
M56S-26A0ECX	SM3H-132A◇□U△	850	2.0mm² AWG14		2.0 ~ 3.5mm² AWG12 ~ 14	2.0 ~ 3.5mm² AWG12 ~ 14			
	SM3L-084A◇□U△	1000							
	SM3L-102A◇□U△								
	SM3M-132A◇□U△								
M56S-210AECX	SM3H-133A◇□U△	1300	2.0 ~ 3.5mm² AWG12 ~ 14		3.5 ~ 5.3mm² AWG10 ~ 12				
	SM3L-103A◇□U△	1500							
	SM3M-133A◇□U△								
M56S-213AECX	SM3H-134A◇□U△	1800							
	SM3L-104A◇□U△	2000							
	SM3M-134A◇□U△								
	SM3L-105A◇□U△	2500							
M56S-36A0ECX	SM3H-132Y◇□U△	850	2.0mm² AWG14		1.3mm² AWG16				
	SM3L-102Y◇□U△	1000							
	SM3M-132Y◇□U△								
	SM3H-133Y◇□U△	1300							
	SM3L-103Y◇□U△	1500							
	SM3M-133Y◇□U△								
M56S-313AECX	SM3H-182Y◇□U△	2900			2.0mm² AWG14				
	SM3M-135Y◇□M△	3000							
M56S-317AECX	SM3H-183Y◇□U△	4400	5.3mm² AWG10		5.3mm² AWG10				5.3mm² AWG10
M56S-321AECX	SM3H-184Y◇□U△	5500							
M56S-326AECX	SM3H-185Y◇□U△	7500							

◆ Model Type，◇ Encoder Options，□ Brake Options，△ Oil Seal Options

● Please use insulated pin terminals for power connectors P1 and P2

◆ Crimp Type	◆ Sleeve Type	◆ Parallel Terminal

● Please select the pin terminal according to the recommended wire

　　Connector applicable wire type: AWG14～AWG18

　　The outer diameter of the wire for the connector: ø2.1～4.2mm

4.3.8　Ground Wire Terminal

● In order to obtain a better EMC effect, please use 5.3mm^2(AWG10) dedicated copper conductor cable.
● Please use O-shaped cold pressed terminals.
● Tightening torque of ground wire terminals.

Drive Model	Grounding screw	
	Specification	Tightening torque
M56S-21A8EC◆ M56S-23A0EC◆ M56S-24A5EC◆ M56S-26A0ECX M56S-210AECX M56S-213AECX M56S-313AECX M56S-36A0ECX	M3	1.2 N.m
M56S-317AECX M56S-321AECX M56S-326AECX	M4	1.4 N.m

◆ Represents the Function type

Notes:

■ Exceeding the maximum tightening torque will cause damage to the screw hole.
■ Do not install the grounding screw when the power is on, it may cause electric sparks.
■ Please regularly check whether the grounding screw is loose.

4.4 Drive Power Supply Interface

220V AC servo drive supports single phase or three phase wiring method. Three phase wiring method for 1.5kW and above drives are recommended.

4.4.1 Single-Phase Power Supply Connection-AC220V (750W and below Type)

Notes：

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

■ Peripheral equipment capacity for wiring

Drive	Voltage (VAC)	Motor Rated Output Power (W)	Drive Power capacity kVA (Rated Load)	Circuit Breaker Rated Current (A)	Contactor Rated Current(A)
M56S-21A8EC◆	Single-Phase 220	50	0.3	6	9A (3P+1a)
		100	0.4		
		200	0.5		
M56S-23A0EC◆		400	0.9	10	
M56S-24A5EC◆		750	1.3	16	

◆ Model Type

4.4.2 Three-Phase Power Supply Connection-AC220V (750W and below Type)

Note: Three-phase 220V is the line voltage

Notes：

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

■ Peripheral equipment capacity for wiring

Drive	Voltage (VAC)	Motor Rated Output Power (W)	Drive Power capacity kVA (Rated Load)	Circuit Breaker Rated Current (A)	Contactor Rated Current(A)
M56S-21A8EC◆	Three Phase 220	100	0.4	4	9A (3P+1a)
		200	0.5		
M56S-23A0EC◆		400	0.9		
M56S-24A5EC◆		750	1.3	6	

◆ Model Type

4.4.3 Single-Phase Power Supply Connection-AC220V (1.0/1.5kW Type)

Notes：

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

■ Peripheral equipment capacity for wiring

Drive	Voltage (VAC)	Motor Rated Output Power (W)	Drive Power capacity kVA (Rated Load)	Circuit Breaker Rated Current (A)	Contactor Rated Current(A)
M56S-26A0ECX	Single Phase 220	850，1000	1.8	16	12A (3P+1a)
M56S-210AECX		1300，1500	2.3	20	18A (3P+1a)

4.4.4 Three-Phase Power Supply Connection-AC220V (1.0/1.5/2.5kW Type)

Note: Three-phase 220V is the line voltage

Notes：

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

■ Peripheral equipment capacity for wiring

Drive	Voltage (VAC)	Motor Rated Output Power (W)	Drive Power capacity kVA (Rated Load)	Circuit Breaker Rated Current (A)	Contactor Rated Current(A)
M56S-26A0ECX	Three-Phase 220	850，1000	1.8	10	9A (3P+1a)
M56S-210AECX		1300，1500	2.3	16	
M56S-213AECX		1800，2000	3.3		

4.4.5 Three-Phase Power Supply Connection-AC400V (1.5/3.0kW Type)

Note: Three-phase 400V is the line voltage

Notes：

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

■ Peripheral equipment capacity for wiring

Drive	Voltage (VAC)	Motor Rated Output Power (W)	Drive Power capacity kVA (Rated Load)	Circuit Breaker Rated Current (A)	Contactor Rated Current(A)
M56S-36A0ECX	Three-Phase 400	850, 1000 1300,1500	9.08	6	9A (3P+1a)
M56S-313AECX		2900, 3000	15.15	16	

4.4.6 Three-Phase Power Supply Connection-AC400V (5.0/6.0/7.5kW Type)

Note: Three-phase 400V is the line voltage

Notes：

Symbol	Description
MCCB	Circuit Breaker
NF	EMI Noise Filter
P_on	Power On Switch
P_off	Power Off Switch

Symbol	Description
E_stop	Emergency Stop Switch
MC	Magnetic Contactor
Alm_R	Alarm Relay
Alarm	Alarm Relay Contactor

■ Peripheral equipment capacity for wiring

Drive	Voltage (VAC)	Motor Rated Output Power (W)	Drive Power Capacity kVA (Rated Load)	Circuit Breaker Rated Current (A)	Contactor Rated Current(A)
M56S-317AECX	Three-Phase 400	4400	22.25	20	18A (3P+1a)
M56S-321AECX		5500	25	25	
M56S-326AECX		7500	31.25	32	25A (3P+1a)

4.5 Wiring to the Connector P2

4.5.1 Motor Power Cable Configuration
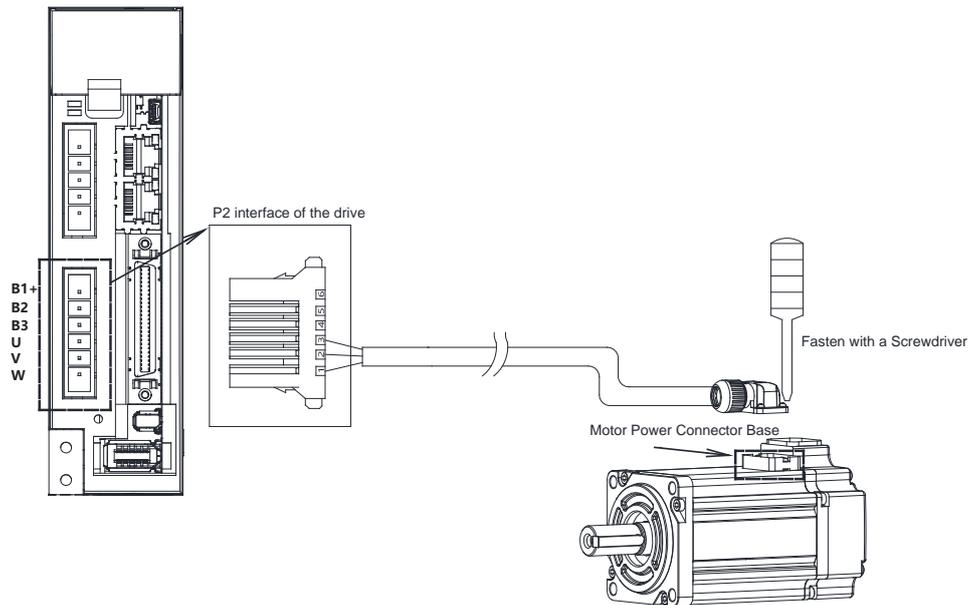
4.5.2 Motor Power Cable Connector Specifications

4.5.2.1 Motor Power Connectors Definition of Pins for □80mm and Below

Motor Model	PIN.No	Name	Define	Interface Diagram
SM3L-042A◇□D△ SM3L-061A◇□P△	1	PE	Motor ground wire	
SM3L-062A◇□P△ SM3L-083A◇□P△ SM3L-084A◇□P△	2	U	U Phase	
SM3H-041A◇□P△ SM3H-042A◇□P△	3	V	V Phase	
SM3H-061A◇□P△ SM3H-062A◇□P△ SM3H-083A◇□P△	4	W	W Phase	

◇ Encoder Options，□ Brake Options，△ Oil Seal Options

4.5.2.2 Motor Power Connectors Definition of Pins for □100mm/130mm

Motor Model		PIN.No	Name	Define	Interface Diagram
SM3L-102○◇□U△ SM3L-103○◇□U△ SM3L-104○◇□U△ SM3L-105○◇□U△	SM3M-132○◇□U△	A	PE	Motor ground wire	
	SM3M-133○◇□U△	F	U	U Phase	
	SM3M-134○◇□U△ SM3M-135Y◇□M△	I	V	V Phase	
	SM3H-132○◇□U△	B	W	W Phase	
	SM3H-132○◇□U△	C	Brake 1	Brake power supply +	
	SM3H-134○◇□U△	D	Brake 2	Brake power supply -	

○Winding Specification，◇ Encoder Options，□ Brake Options，△ Oil Seal Options

4.5.2.3 Motor Power Connectors Definition of Pins for □180mm

Motor Model	PIN.No	Name	Define	Interface Diagram
SM3H-182Y◇□U△ SM3H-183Y◇□U△ SM3H-184Y◇□U△ SM3H-185Y◇□U△	A	PE	Motor Ground Wire	Connector for Motor Use
	F	U	U Phase	
	I	V	V Phase	
	B	W	W Phase	
	D	Brake 1	Brake Power Supply +	
	E	Brake 2	Brake Power Supply -	

◇ Encoder Options，□ Brake Options，△ Oil Seal Options

4.5.3 Motor Power Cable Connector Specifications

4.5.3.1 □80mm and below Motor Power Cable Wiring Definition

Plug connector E1006(KS)

O-type plug connector
SRA-51T-4(JST)
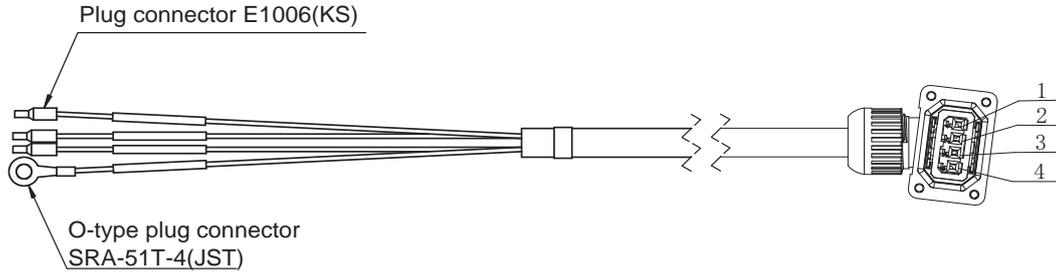
Motor Model	Drive Side	Item	Color	Motor Side
	(JST)061JFAT-SBXGF-I			DGFA4S-B1-00A(H)
SM3L-042A◇□D△ SM3L-061A◇□P△	Grounding Screw	PE	Yellow/Green	1
SM3L-062A◇□P△ SM3L-083A◇□P△	3	U	Red	2
SM3L-084A◇□P△ SM3H-042A◇□P△ SM3H-061A◇□P△	2	V	Yellow	3
SM3H-062A◇□P△ SM3H-083A◇□P△	1	W	Blue	4

□Encoder Options ◇Brake Optionst △Oil seal Options

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

4.5.3.2 □100mm/130mm Motor Power Cable Wiring Definition

100±5mm
10±3mm

A View

A View
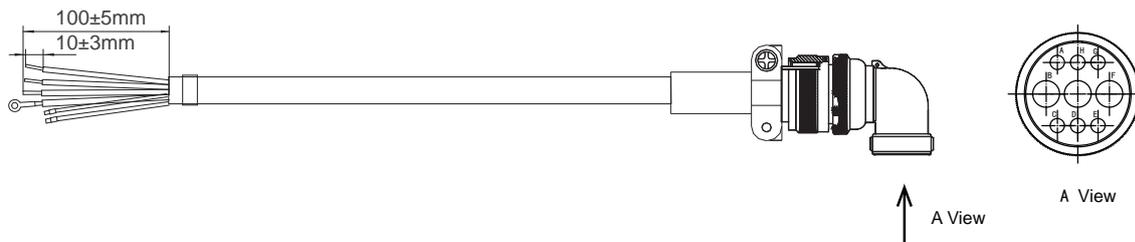
Motor Model		Drive Side	Item	Color	Motor Side
					XMS3108E20-18S
SM3L-102○◇□U△ SM3L-103○◇□U△ SM3L-104○◇□U△ SM3L-105○◇□U△	SM3M-132○◇□U△	U	U	Red	F
	SM3M-133○◇□U△	V	V	Yellow	I
	SM3M-134○◇□U△ SM3M-135Y◇□M△	W	W	Blue	B
	SM3H-132○◇□U△	Grounding Screw	FG	Yellow/Green	A
	SM3H-132○◇□U△	-	Brake 1	Red	C
	SM3H-134○◇□U△	-	Brake 2	Black	D

○Winding Specification □Encoder Options ◇ Brake Optionst △ Oil seal Options

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

4.5.3.3 □180mm Motor Power Cable Wiring Definition

A View

A View
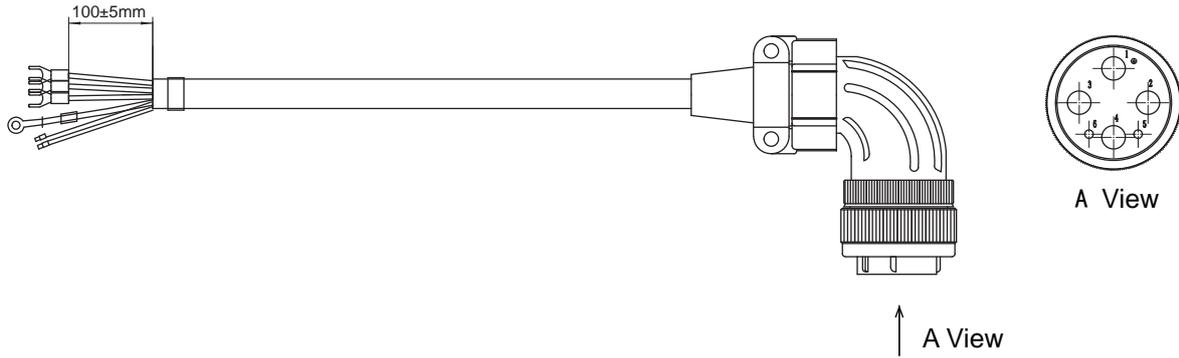
Motor Model	Drive side	Item	Color	Motor side mating connector
				WS32K6TS
SM3H-182Y◇□U△	U	U	Red	2
	V	V	Yellow	3
	W	W	Blue	4
	Grounding Screw	FG	Yellow/Green	1
	-	Brake 1	Red	5
	-	Brake 2	Black	6

□Encoder Options ◇Brake Optionst △Oil seal Options

A View

A View
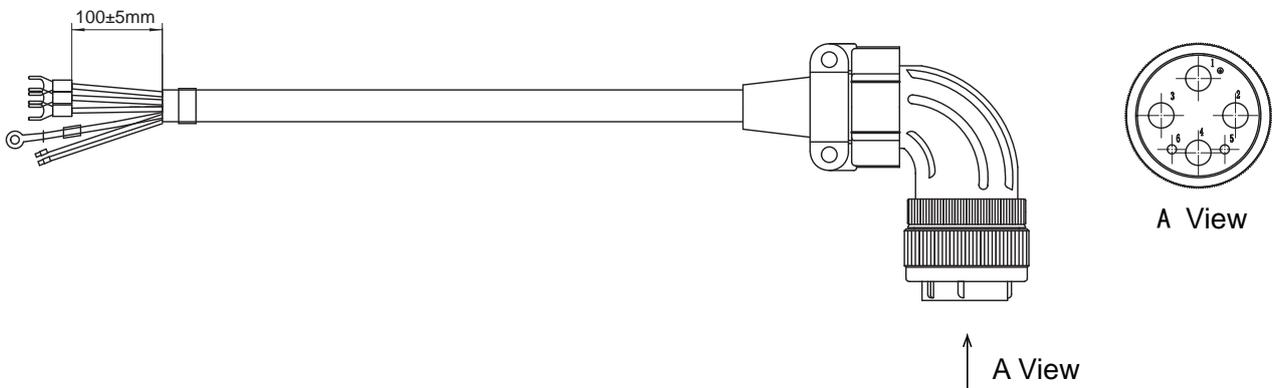
Motor Model	Drive side	Item	Color	Motor side mating connector
				WS32K6TS
SM3H-183Y◇□U△ SM3H-184Y◇□U△ SM3H-185Y◇□U△	U	U	Red	2
	V	V	Yellow	3
	W	W	Blue	4
	Grounding Screw	FG	Yellow/Green	1
	-	Brake 1	Red	5
	-	Brake 2	Black	6

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

4.6 CN3 Encoder Connector

4.6.1 Motor Encoder Feedback Cable Configuration
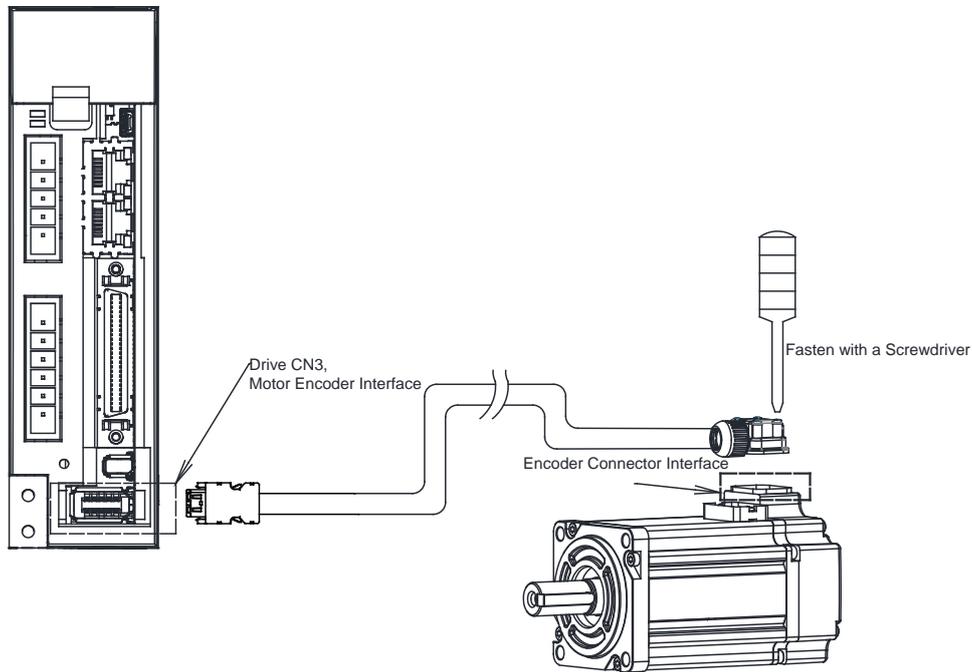
4.6.2 CN3-Encoder PIN Assignment
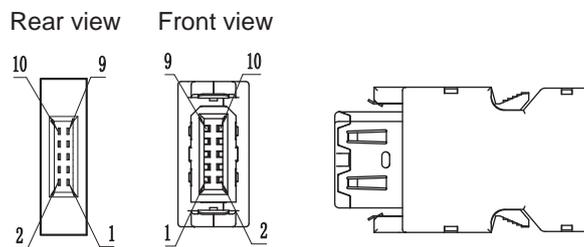
PIN.No	Symbol	Description
1	Encoder +5V	Encoder Power +5V
2	GND	Encoder Power GND
7	CLK-	CLK- Signal
8	CLC+	CLC+ Signal
9	SD-/DATA-	SD-Signal, or DATA- Signal
10	SD+/DATA+	SD+Signal, or DATA+ Signal
Shield	Shield	Shield

4.6.3 Motor Encoder Wire Connection Specification

4.6.3.1 Frame size 80mm and below Motor Encoder Connector PIN Definition

Encoder Connector

Motor Model		PIN.No	Symbol	Description
SM3L-042AT□D△ SM3L-061AT□P△ SM3L-062AT□P△ SM3L-083AT□P△ SM3L-084AT□P△ SM3H-041AT□P△ SM3H-042AT□P△ SM3H-061AT□P△ SM3H-062AT□P△ SM3H-083AT□P△	SM3L-042AX□D△ SM3L-061AX□P△ SM3L-062AX□P△ SM3L-083AX□P△ SM3L-084AX□P△ SM3H-041AX□P△ SM3H-042AX□P△ SM3H-061AX□P△ SM3H-062AX□P△ SM3H-083AX□P△	1	Shield	Shield
		2	--	--
		3	VCC	Encoder Power 5V
		4	VBAT+	Battery Power Input +
		5	SD+	Encoder Data +
		6	--	--
		7	VCC_GND	Encoder Power GND
		8	VBAT_GND	Battery Power Input -
		9	SD-	Encoder Data -

Motor Model	PIN.No	Symbol	Description
SM3L-041AB□D△ SM3L-042AB□D△ SM3L-061AB□D△ SM3L-062AB□D△ SM3L-083AB□D△ SM3L-084AB□D△ SM3M-062AB□D△ SM3M-083AB□D△	1	Shield	Shield
	2	CLK+	CLK+
	3	CLK-	CLK-
	4	DATA-	DATA-
	5	DATA+	DATA+
	6	VCC	Encoder Power 5V
	7	--	--
	8	VCC_GND	Encoder Power GND
	9	--	--

4.6.3.2 Frame Size 100mm/130mm/180mm Motor Encoder Connector PIN Definition

Motor Encoder connector   Motor Encoder connector

Motor Model			PIN.No	Symbol	Description
SM3L-102○T□U△ SM3L-103○T□U△ SM3L-104○T□U△ SM3L-105○T□U△ SM3M-132○T□U△ SM3M-133○T□U△ SM3M-134○T□U△ SM3M-135YT□M△ SM3H-132○T□U△ SM3H-133○T□U△ SM3H-134○T□U△	SM3L-102○X□U△ SM3L-103○X□U△ SM3L-104○X□U△ SM3L-105○X□U△ SM3M-132○X□U△ SM3M-133○X□U△ SM3M-134○X□U△ SM3M-135YX□M△ SM3H-132○X□U△ SM3H-133○X□U△ SM3H-134○X□U△	SM3H-182YT□U△ SM3H-183YT□U△ SM3H-184YT□U△ SM3H-185YT□U△	1	VCC	Encoder Power 5V
			2	VCC_GND	Encoder Power GND
			3	SD+	Encoder Data +
			4	SD-	Encoder Data -
			5	VBAT+	Battery Power Input +
			6	VBAT_GND	Battery Power Input -
			7,8,9	NC	---
			10	Shield	Shield

○Winding Specification   □ Brake Options   △ Oil seal Opions

Note: DO NOT connect the UN-defination PINs

4.6.4 Motor Encoder Wire Connection Definition

4.6.4.1 □80mm and below Motor Encoder Wire Connection Definition
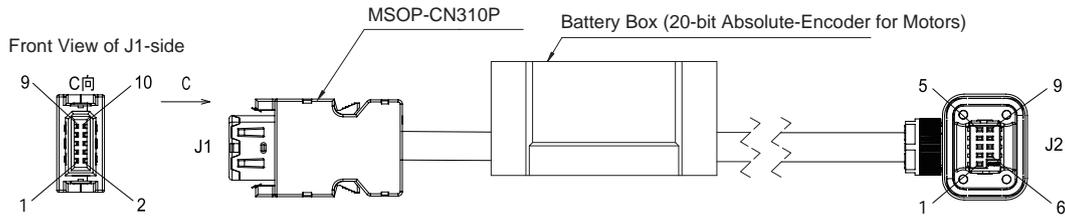
Encoder Type	Drive Side J1	Battery	Signal	Color	Motor Side J2
-T Type: 26 multi-turn absolute -X Type: 21 multi-turn absolute	1	--	VCC	Red	3
	2	--	VCC_GND	Black	7
	--	Vbat+	VBAT+	Green	4
	--	Vbat-	VBAT_GND	Orange	8
	9	--	SD-	Blue/Black	9
	10	--	SD+	Blue	5
	--	--	Shield	--	1

Encoder Type	Drive Side J1	Signal	Color	Motor Side J2
-B Type: 17 battery-less multi-turn absolute	1	VCC	Red	6
	2	VCC_GND	Black	8
	7	CLK-	Green	3
	8	CLK+	Orange	2
	9	DATA-	Blue/Black	4
	10	DATA+	Blue	5
	--	Shield	--	1

Note: DO NOT connect the UN-defination PINs

4.6.4.2 □100mm/130mm/180mm Motor Encoder Wire Connection Definitio
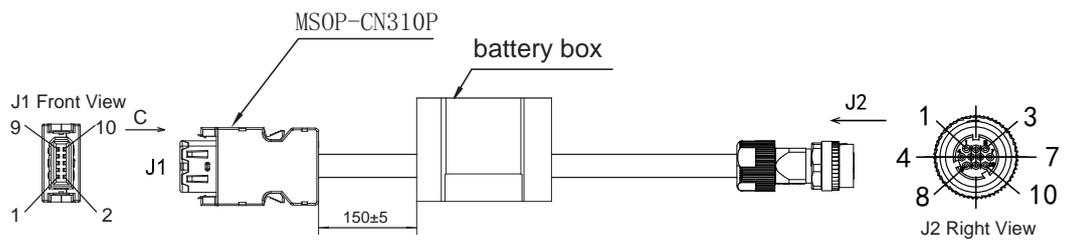
Encoder Type	Drive Side J1	Battery	Signal	Color	Motor Side J2
-T Type : 23 multi-turn absolute -X Type : 21 multi-turn absolute	1	--	VCC	Red	1
	2	--	VCC_GND	Black	2
	--	Vbat+	VBAT+	Green	5
	--	Vbat-	VBAT_GND	Orange	6
	9	--	SD-	Blue/Black	3
	10	--	SD+	Blue	4
	--	--	Shield	--	10

Note: DO NOT connect the UN-defination PINs

4.6.5 Battery of Absolute Encoder

When the SM3 series 20-bit absolute encoder motor is used in a multi-turn absolute value system, it needs to use battery power to record multi-turn data when the drive is powered off. After power-on, the drive calculates the absolute position of the mechanical load through the absolute position of the encoder. There is no need to repeat the mechanical homing operation.

When using our company's encoder cable with a battery box, the battery box has a built-in battery MSOP-BA01, which meets the UL lithium battery standard and the IEC lithium battery international safety standard. Please refer to the figure below for the battery dimensions.
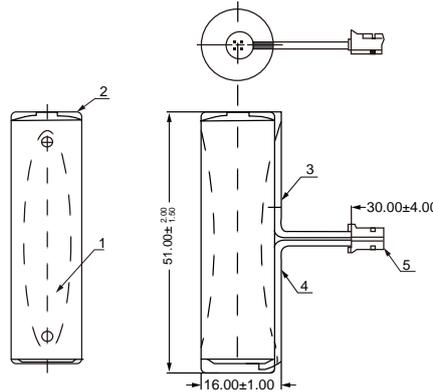
■ Battery replacement.

There is a risk of electrolyte leakage after long-term use of the battery. It is recommended to replace the battery every two years. It is recommended to replace the battery when the drive is powered on, otherwise the absolute position of the encoder will be lost due to no power supply after the battery is removed.

■ Battery selection

Please refer to the information in the table below to select a battery of appropriate specifications.

Battery Spec.	Item&Unit	Rated Value			Description
		Min.	Typical	Max.	
Output Spec. 3.6V, 2.7Ah	Battery Voltage(V)	3.3	3.6	5	Standby work
	Battery low Voltage(V)	——	2.8	——	
	Battery alarm Voltage(V)	——	3.2	——	
	Current consumption(μA)	——	2	——	During normal work
		——	10	——	During standby operation, the shaft is stationary
		——	30	——	During standby operation, the shaft rotates
	Operation Ambient(℃)	0	——	40	Same as the ambient temperature of motor
	Storage Ambient(℃)	-20	——	60	

MOONS'

■ Precautions for battery use

1. Connect the positive and negative electrodes correctly.

2. If a battery that has been used for a long time or an unusable battery is installed in the machine, liquid leakage may occur. It will not only corrode the surrounding parts, but also has the risk of short circuit. It is recommended to replace it regularly (reference period: it is recommended to replace it every two years).

3. It is forbidden to disassemble the battery to prevent the electrolyte from flying and affecting personal safety.

4. It is forbidden to throw the battery into the fire to avoid the danger of explosion.

5. It is strictly forbidden to short-circuit between the positive and negative electrodes of the battery

6. It is forbidden to charge the battery.

7. It is forbidden to solder directly on the surface of the battery, and the battery with solder feet or leads should be used.

8. Please discard the replaced battery according to local regulations.

4.7 Electromagnetic Brake

Servo motors are used in applications such as vertical axes. When the motor is disabled or powered off, to prevent the mechanical mechanism driven by the motor from falling due to gravity and other reasons, it is necessary to use a servo motor with an electromagnetic brake.

Note: The brake of the servo motor can only be used to maintain the position of the motor when the motor is not enabled or power-off. Do not use it for braking during deceleration, otherwise the motor will be damaged.

4.7.1 Wiring Diagram
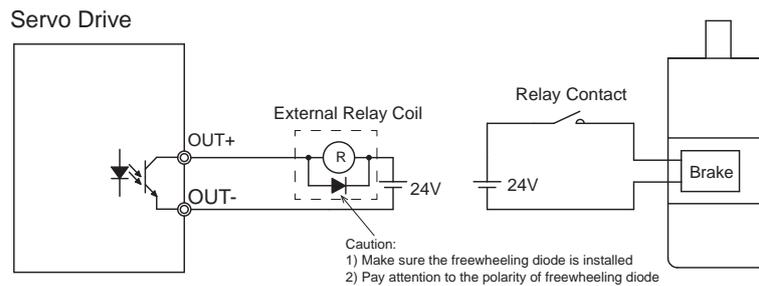
■ PIN Definition

Motor Model	PIN.No	Item	Definition	Interface Diagram
SM3L-042A◇BD△ SM3L-061A◇BP△ SM3L-062A◇BP△ SM3L-083A◇BP△ SM3L-084A◇BP△ SM3H-041A◇BP△ SM3H-042A◇BP△ SM3H-061A◇BP△ SM3H-062A◇BP△ SM3H-083A◇BP△	1	24V	Brake Power Supply +	Connector for Motor Use
	2	0V	Brake Power Supply -	
SM3L-102○◇BU△ SM3L-103○◇BU△ SM3L-104○◇BU△ SM3L-105○◇BU△ SM3M-132○◇BU△ SM3M-133○◇BU△ SM3M-134○◇BU△ SM3M-135Y◇BM△ SM3H-132○◇BU△ SM3H-133○◇BU△ SM3H-134○◇BU△	C	24V	Brake Power Supply +	Connector for Motor Use
	D	0V	Brake Power Supply -	

SM3H-182Y◇BU△ SM3H-183Y◇BU△ SM3H-184Y◇BU△ SM3H-185Y◇BU△	5	24V	Brake Power Supply +	Connector for Motor Use	W F E I B D
	6	0V	Brake Power Supply -		

○ Winding Specification，◇ Encoder Options，△ Oil Seal Options

4.7.2 Precautions for The Use of Brake

● The signal of the drive control brake can not directly drive the motor's brake. The external 24V power supply and relay must be provided. It is best to try a separate 24V power supply to prevent other equipment from causing abnormal power supply which will eventually cause the motor brake to malfunction.

● The digital output signal of the drive is an optocoupler output, the maximum is 30VDC, 100mA. When controlling inductive loads such as relays, be sure to install a freewheeling diode, otherwise the output pin circuit of the drive will be damaged and the signal will not be output normally.

● The electromagnetic brake is a normally closed type, and the motor shaft cannot rotate when the brake is not powered.

● Electromagnetic brake has no polarity requirement.

● Avoid the voltage drop as the wire is too thin.

● The brake specifications are as follows:

Motor	Power	Holding Torque (Nm)	Release Continuous Current (A)	Release Continuous Power (W@20℃)	Rated Voltage (VDC)	Release Time (ms)	Release Vlotage (VDC)	Brake Time (ms)
SM3*-04******	50W, 100W	0.32	0.26	6.3	24V±10%	40	15	20
SM3*-06******	200W, 400W	1.5	0.3	7.2		40	15	20
SM3*-08******	750W, 1000W	3.2	0.4	9.6		70		25
SM3*-10******	1kW ~ 2.5kW	8.0	0.6	14.4		120	16	
SM3*-13******	850W ~ 3kW	18.5	1.05	24.3		120		60
SM3*-18******	2.9kW ~ 7.5kW	60	2.16	52		150	19	100

4.7.3 The Timing Charts of Electromagnetic Brake

Since the brake has a delay in action, in order to avoid damage to the brake, it is necessary to pay attention to the action sequence during use. When working in CSP, CST and CSV control modes, the P5-24 parameter setting value is invalid. When designing the control program, be sure to allow enough time to ensure that the brake is opened before controlling the motor movement, otherwise the motor brake will be damaged.
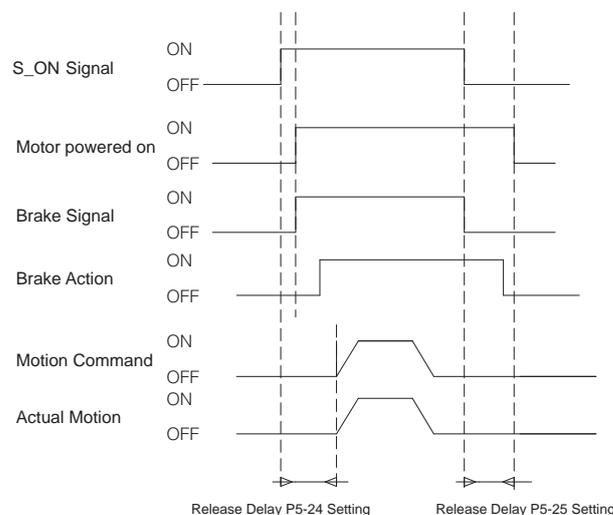
Motion waiting time and disable delay time can be set using Luna software, or by modifying parameters P5-24 and P5-25 through the panel.

4.8 Regeneration Resistor P2

When the output torque of the motor shaft is opposite to the direction of rotation, the energy is fed back from the motor load end to the drive bus capacitor, making the bus voltage value increase. When it rises to the braking voltage point, the energy can only be consumed by the regeneration resistor, otherwise it will damage the servo drive. The regeneration resistor can be built-in or externally connected by the user and the built-in and external regeneration resistors cannot be used at the same time. The related specifications of the built-in regeneration resistor in the M56S EtherCAT series servo drive are as follows:

Drive P/N	Built-in Resistor		External Resistor
	Resistor (Ω)	Power P_R(W)	Minimum Resistor (Ω)
M56S-21A8ECN	no built-in	no built-in	50
M56S-21A8ECX	200	40	50
M56S-23A0ECN	no built-in	no built-in	50
M56S-23A0ECX	200	40	50
M56S-24A5ECN	100	60	50
M56S-24A5ECX	100	60	50
M56S-26A0ECX	25	80	15
M56S-210AECX	25	80	15
M56S-213AECX	25	80	15
M56S-36A0ECX	25	80	15
M56S-313AECX	25	80	15
M56S-317AECX	35	100	35
M56S-321AECX	35	100	25
M56S-326AECX	35	100	25

4.8.1 Calculation Method of Regenerative Energy

A. Reciprocating motion

When the motor decelerates, the kinetic energy during deceleration will be converted into electrical energy and fed back to the bus capacitor.

The energy during deceleration is divided into two parts:

A) Energy generated when the motor decelerates

B) Energy generated when the external load decelerates

The following provides a simple method to simply calculate the required regenerative energy absorption resistance.

1) Calculate the energy E_M when the motor is decelerating

The following table shows the energy produced when the SM3 series servo motor decelerates from 3000 rpm to 0 rpm without external load.

Motor Series	Power (W)	Motor P/N	Rotor Inertia $J_M(10^{-4}Kg\cdot m^2)$	Energy produced by decelerating	Maximum energy absorbed by the drive capacitor $E_C(J)$
Low Inertia	100	SM3L-042A****	0.043	0.42	8.7
	200	SM3L-061A****	0.182	1.79	8.7
	400	SM3L-062A****	0.268	2.64	13
	750	SM3L-083A****	0.961	9.48	27
	1000	SM3L-084A****	1.12	11.04	27
	1000	SM3L-102A****	2.67	26.32	27
Medium Inertia	400	SM3M-062A****	0.655	3.23	8.69
	750	SM3M-083A****	1.37	6.75	13.04
	1000	SM3M-132A****	13.9	68.52	40.6
	1500	SM3M-133A****	19.4	95.64	40.6
	2000	SM3M-134A****	23.3	114.86	40.6
High Inertia	850	SM3H-132A****	13.9	68.52	40.6
	1300	SM3H-133A****	19.4	95.64	40.6
	1800	SM3H-134A****	23.3	114.86	40.6

2) Calculate the energy E_L generated by the dragged load during deceleration.
Assuming that the inertia of the load is N times the inertia of the motor, the energy generated when the dragged load is decelerated from 3000rpm to 0rpm is:

$$E_L = N \times E_M$$

If $E_M + E_L < EC$, that means during deceleration, the energy generated by the motor and the dragged load during deceleration is less than the energy that the drive capacitor can absorb, so there is no need to worry about regenerative energy absorption.

3) Calculate the average power P_{AV} of the required regenerative energy absorption resistance

$$P_{AV} = \frac{E_M + E_L - E_C}{t_{dec}}$$

t_{dec} is the deceleration time + the interval time between two deceleration's

4) Judgement

If $P_{AV} < PR$，The total power generated during deceleration is less than the power of the built-in regenerative energy absorption resistance of the drive, so no external resistance is needed.

If $P_{AV} > PR$，The total power generated during deceleration is greater than the power of the built-in regenerative resistance of the drive, and an external resistance is required. In order to reasonably control the temperature rise of the external absorption resistance, the minimum resistance power is P_{AV} / 0.5.

For example：

Use 400W motor SM3L-062A****，The load inertia is 15 times the motor inertia. Assuming tdec (deceleration time + interval between two deceleration's) is 0.5s, and each movement is decelerated from 3000rpm to 0rpm, the required power of the regeneration resistance is calculated as:：

E_M = 1.2J, E_C = 13.04J
E_L = N x E_M = 15 x 1.2 = 18J
P_{AV}=(1.2+18-13.04) / 0.5 = 12.32Watt

Since the 400W drive has a built-in absorption resistor power of 40W, there is no need to connect an external resistor.

B. The external load torque drives the motor, and most of the continuous negative power output of the motor is doing positive work, that is, the torque output direction of the motor as same as the direction of rotation. In some special applications, the torque output direction of the motor just opposite to the speed direction, and the external energy will be fed back into the drive at this time. The servo system will output the opposite force to overcome the gravity of the external load in order to meet the requirements of position and speed. Such as the vertical downward movement of a large load, when running for a long time, the bus capacitance is full and it cannot continue to absorb the regenerative energy. At this time, the regenerative resistor is required to absorb the energy. The power calculation formula is as follows:

$$P_T = 2\pi T_M N_M$$

Where:

M is the output torque，Unit: Nm

M is the speed，Unit: rps

For example ：

The torque output direction of the motor is opposite to the direction of rotation. When the motor output torque is 0.6Nm and the speed is 2400rpm, the power at this time is:

P_T=2 x 3.14 x 0.6 x 2400 / 60= 150.72

At this time, an external absorption resistor is required, and the minimum power is 150.72W. In order to reasonably control the temperature rise of the external absorption resistor, the minimum power is 300W.

4.8.2 Regeneration Resistor Connection

In some applications, when the internal resistor cannot meet the absorption of the regenerative electromotive force, in order to prevent the drive from causing an over voltage alarm, an external resistor with a larger power is required; the wiring method of the resistor is as follows:

Using built-in resister	Using external resistor
Please short-circuit the B2 and B3 of the P2 connector. Note: The short-circuit has been installed at the factory	Please connect the resistor to B1+ and B2, and keep B2 and B3 disconnected
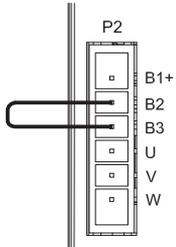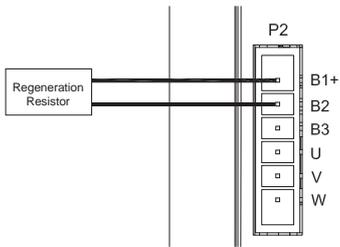
4.8.3 Drive Parameter Setting

The parameters are as follows：

Parameter	Item	Unit	Description
P1-19	Resistor Value	Ohm	Set the value of the regeneration resistor
P1-20	Resistor Power	Watt	Set the power of the regeneration resistor
P1-21	Regeneration absorption time constant	ms	Set the sustainable absorption time of the regeneration resistor

Note:

Please set the resistor value, power and absorption time of the absorption resistor correctly, otherwise it will affect the use of this function and cause the drive to give alarms such as over voltage and failure of regenerative energy absorption.

When connecting an external resistor, make sure that the total resistance value cannot be less than the minimum allowable resistance value of the drive. If multiple resistor series and parallel connections are used, please calculate the total resistance and total power correctly.

Specifications	Parameter Setting
External：100Ω，200W	Parameter set: P1-19 = 100 P1-20 = 200
External：2*50Ω200W, in serial	Parameter set: P1-19 = 100 P1-20 = 400
External：2*100Ω200W, in parallel	Parameter set: P1-19 = 50 P1-20 = 400

4.9 Connect to Host Computer CN1

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

Pin No.	Symbol	Function
1	+5V	USB Power 5V
2	D-	USB Data-
3	D+	USB Data+
4	--	——
5	GND	USB GND

Note: Please use USB Mini-B for the drive side connector

4.10 Input and Output Signal Interface Connector CN2

4.10.1 Input and Output Interface Specifications and Diagram

The CN2 port of M56S EtherCAT series AC servo drive is used to connect input and output signals. The pin definition is as follows:

Function Type：X type、N type
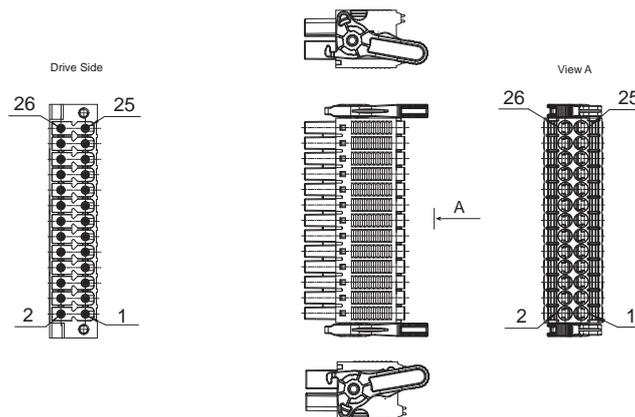
Input and output specification:

I/O	Digital Signal	Inputs	8 Configurable Optically isolate general Inputs, 24VDC, 20mA
		Outputs	4 Configurable Optically isolate general Outputs, max 30VDC, 100mA
	Analog Signal	Inputs	2 analog inputs, -10V~+10V, resolution 12bit (X-type only)
		Outputs	2 analog outputs, -10V~+10V, maximum 10mA (X-type only)

■ I/O Diagram
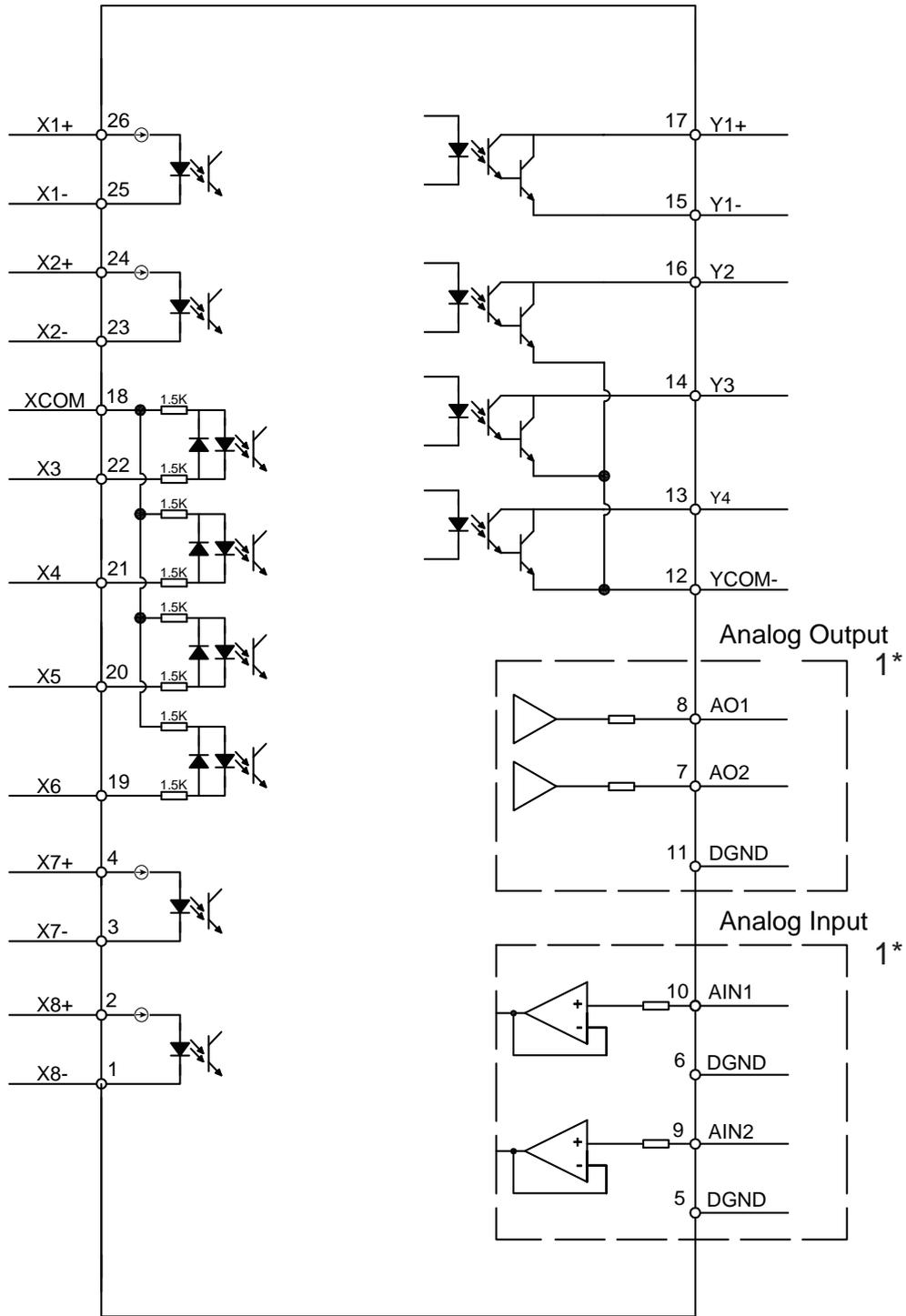
1*: The curve box is only applicable to X-type drives

Note: Do not make any connections to undefined pins

4.10.2 Input and Output Pin Definition

PIN No.	Symbol	Description	PIN No.	Symbol	Description
25	X1-	Digital Input 1-	26	X1+	Digital Input 1+
23	X2-	Digital Input 2-	24	X2+	Digital Input 2+
21	X4	Digital Input 4	22	X3	Digital Input 3
19	X6	Digital Input 6	20	X5	Digital Input 5
17	Y1+	Digital Output 1+	18	XCOM	Digital Input Common
15	Y1-	Digital Output 1-	16	Y2	Digital Output 2
13	Y4	Digital Output 4	14	Y3	Digital Output 3
11	DGND	Digital GND	12	YCOM-	Digital Output Common
9	AIN2	Analog Input 2	10	AIN1	Analog Input 1
7	AO2	Analog Output 2	8	AO1	Analog Output 1
5	DGND	Digital GND	6	DGND	Digital GND
3	X7-	Digital Input 7-	4	X7+	Digital Input 7+
1	X8-	Digital Input 8-	2	X8+	Digital Input 8+

Note: Grey-marked partial pin definitions are supported only by X type drives.

4.10.3 Digital Input Signal

M56S EtherCATseries AC servo drive has 8 digital input signals, and each input signal can be configured to a specific function through parameters as well as the logic of the input level. In the M56S EtherCAT series AC servo, each pin has the following functions:

◆ **Specific function signals,** such as alarm reset, limitation switch, Touch Probe signal input, etc.
◆ **General input signal,** as a general input signal, no specific function

■ List of assignable function inputs

Function	Symbol	Function Code	
		Closed	Open
General Input	GPIN	0	
Alarm Reset	A-CLR	3	4
CW Limit	CW-LMT	5	6
CCW Limit	CCW-LMT	7	8
Gain Select	GAIN-SEL	11	12
Emergency Stop	E-STOP	13	14
Torque Limit Input	TQ-LMT	19	20
Zero speed Clamp	ZCLAMP	21	22
Velocity Limit Input	V-LMT	37	38
Homing Sensor Switch	HOM-SW	39	40
Virtual-CW-LMT	Virtual-CW-LMT	41	42
Virtual-CCW-LMT	Virtual-CCW-LMT	43	44

Signal	Symbol	CN2-PIN No.	Default	
			Function	Input Logic*1
X1	X1+	26	Virtual-CCW-LMT	Closed
	X1-	25		
X2	X2+	24	Virtual-CW-LMT	Closed
	X2-	23		
X3	X3	22	Alarm Reset	Closed
X4	X4	21	General purpose Input	Closed
X5	X5	20	Emergency Stop	Closed
X6	X6	19	Torque Limit Input	Closed
XCOM	XCOM	18		——
X7	X7+	4	Touch Probe 1	Closed
	X7-	3		
X8	X8+	2	Homing Switch	Closed
	X8-	1		

Note: The level logic of the pin input is as follows:

Closed: The drive's digital input circuit forms a loop, and current flows in or out of the input pin

Open: The drive's digital input circuit does not form a loop, and there is no current flowing in or out of the input pin

4.10.4 Digital Output Signal

M56S EtherCAT series AC servo drive has 4 digital output signals. Each output signal can be configured to a specific function through parameters as well as the logic of the output level.

■ List of assignable function outputs

Function	Symbol	Function Code	
		Closed	Open
General purpose Output	GPOUT	0	
Alarm Output	ALM	1	2
Warning Output	WARN	3	4
Brake Release Output	BRK	5	6
Servo on Status	SON-ST	7	8
Positioning Complete	COIN	9	10
Dynamic Pos. Output	DYM-LMT	11	12
Torque Reach Output	TQ-REACH	13	14
Torque Limit Output	T-LMT	15	16
Velocity Coincidence Output	V-COIN	17	18
Velocity Reach Output	AT-SPD	19	20
Velocity Limit Output	V-LMT	21	22
Servo Ready	S-RDY	23	24
Homing Finished	HOMED	25	26
Soft Limit CW	SLCW	27	28
Soft Limit CCW	SLCCW	29	30
Near Target Position Output	IN-POS	31	32
Zero speed detected Output	Z-SPD	33	34
Torque Coincidence Output	T-COIN	35	36

Signal	Symbol	CN2-PIN No.	Default	
			Function	Input Logic*[1]
Y1	Y1+	17	General purpose Output	Open
	Y1-	15		
Y2	Y2	16	Servo Ready	Closed
Y3	Y3	14	Alarm Output	Open
Y4	Y4	13	Positioning Complete	Closed
YCOM-	YCOM-	12	Y2~Y4 Output Common	——

Note: The level logic of the pin input is as follows:

Closed: The drive's digital input circuit forms a loop, and current flows in or out of the input pin

Open: The drive's digital input circuit does not form a loop, and there is no current flowing in or out of the input pin

4.10.5 Input Signal Wiring

■ **Input X1、X2、X7、X8**

M56S EtherCAT series AC servo drive has 4 optically isolated differential, 24VDC, maximum current 20mA digital input ports; X1 and X2 are ordinary input ports, X7 and X8 are high-speed input ports, and the high-speed input frequency can reach 2MHz. It can be used as a general input to connect sensor signals, Touch Probe 1 (X7) signals, Touch Probe 2 (X8) signals, PLC and other output signals of other controllers.

■ **X1、X2、X7、X8** Circuits are as follows:

X1+	26
X1-	25
X2+	24
X2-	23
X7+	4
X7-	3
X8+	2
X8-	1
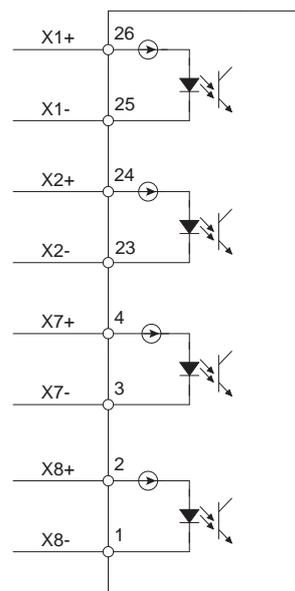
Function Type：X-Type、N-Type

■ X1、X2、X7、X8 Input connection Diagram

A. Host SINK Mode	B. Host SOURCING Mode
Controller · 5-24VDC · Servo Drive · X1/2/7/8+ · X1/2/7/8- · 0VDC	Controller · 5-24VDC · Servo Drive · X1/2/7/8+ · X1/2/7/8- · 0VDC
C. PNP Sensor Connection	**D. NPN Sensor Connection**
5-24VDC · PNP Sensor · Output X1/2/7/8+ · X1/2/7/8- · 0VDC	5-24VDC · X1/2/7/8+ · NPN Sensor · Output X1/2/7/8- · 0VDC
E. Sensor and Switch Connection	
+5-24VDC Power Supply · X1/2/7/8+ · 0V · X1/2/7/8- · Relay or switch	
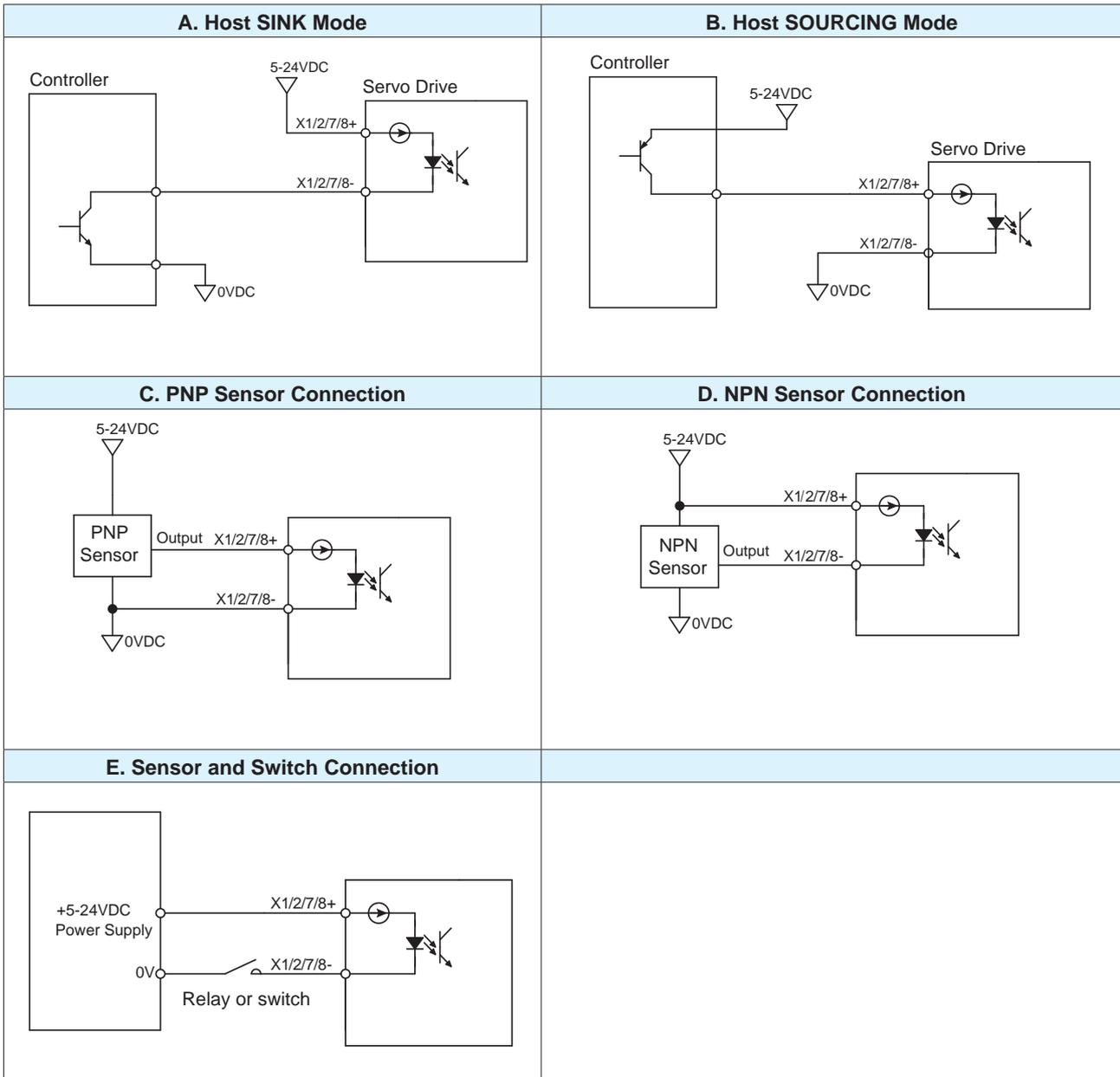
■ Input **X3**、**X4**、**X5**、**X6**

The M56S EtherCAT series AC servo also has 4 optocoupler isolated single-ended input ports with a common COM point. Because these input circuits are optically isolated, they require a power supply. If it is connected to a PLC, you can use the power supply of the PLC; if it is connected to a relay or a mechanical switch, a 24VDC power supply is required.

■ What's COM?

"Common" represents a common terminal of equal potential. If you are using a source current (PNP) signal, you should connect COM to the ground (negative power supply); if you are using a current sink (NPN) signal, then COM should be connected to the positive power supply.

■ **X3**、**X4**、**X5**、**X6** Circuits are as follows:
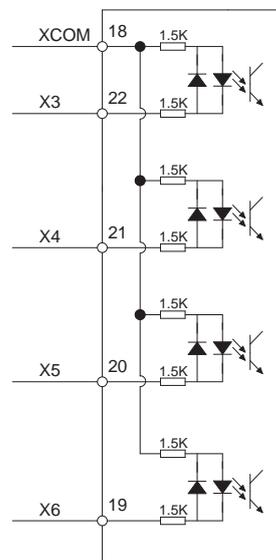
Function Type：X-Type、N-Type

■ **X3、X4、X5、X6** Input Connection Diagram

A. Host SINK Mode	B. Host Sourcing Mode

C. PNP Sensor Connection	D. NPN Sensor Connection

E. Sensor and Switch Connection(XCOM to Power supply)	F. Sensor and Switch Connection(XCOM to GND)
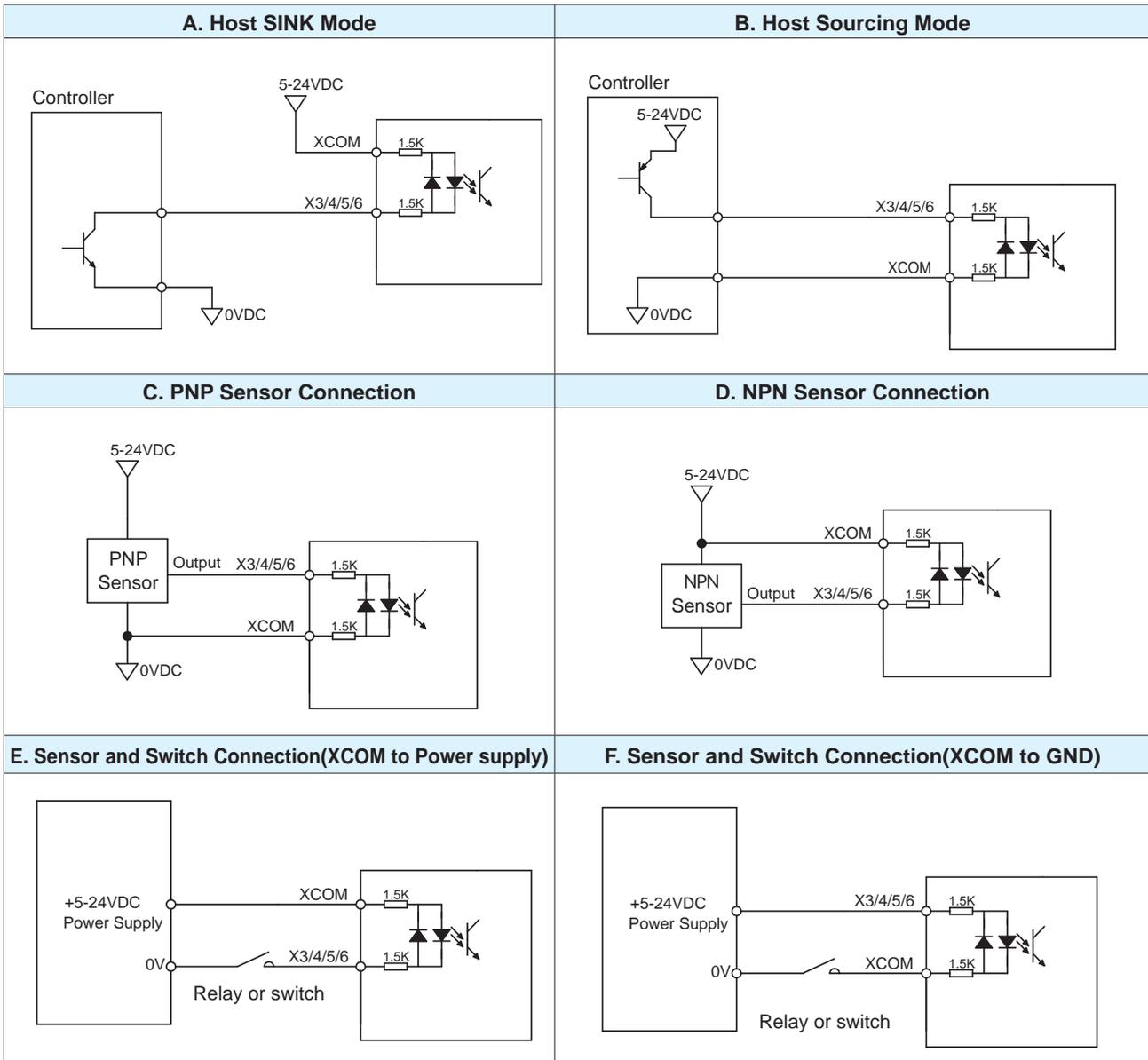
4.10.6 Analog Signal Input

M56S EtherCAT AC servo drives, the X-type drives have 2 single-ended analog inputs. The voltage range is -10V~+10V and the speed and torque range can be set by parameters.

Signal		CN2-Pin No.	Description
		X Type	
AIN1	Analog Input Signal	10	In the analog speed mode, the analog speed command can be configured to change the setting range.
AIN2		9	In the analog torque mode, the analog torque command can be configured to change the set range 100% corresponds to 1 times the rated torque output of the motor.
DGND		5，6	Reference ground for analog input signal

■ Analog Input connection Diagram
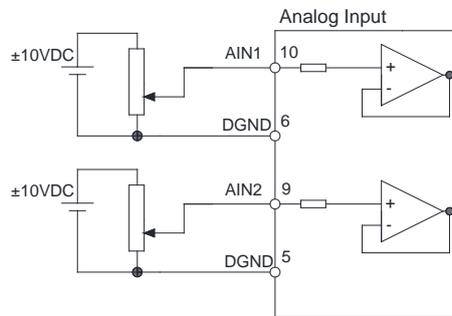
Function Type：X-Type

4.10.7 Output Signal Wiring

M56S EtherCAT series AC servo drives, the X-type and N-type have 1 optocoupler isolated differential output and 3 optocoupler isolated outputs with COM. The functions can be configured through software while the connection of SINK and SOURCING is supported.

■ Output Signal Diagram
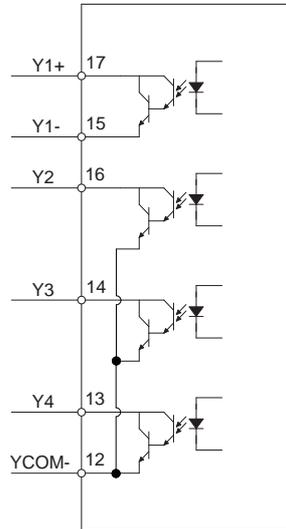
Function Type：X-Type、N-Type

■ Output Connection Diagram

A. Optocoupler Circuity	B. Connect to External Load
C.Connect to Relay Circuity	
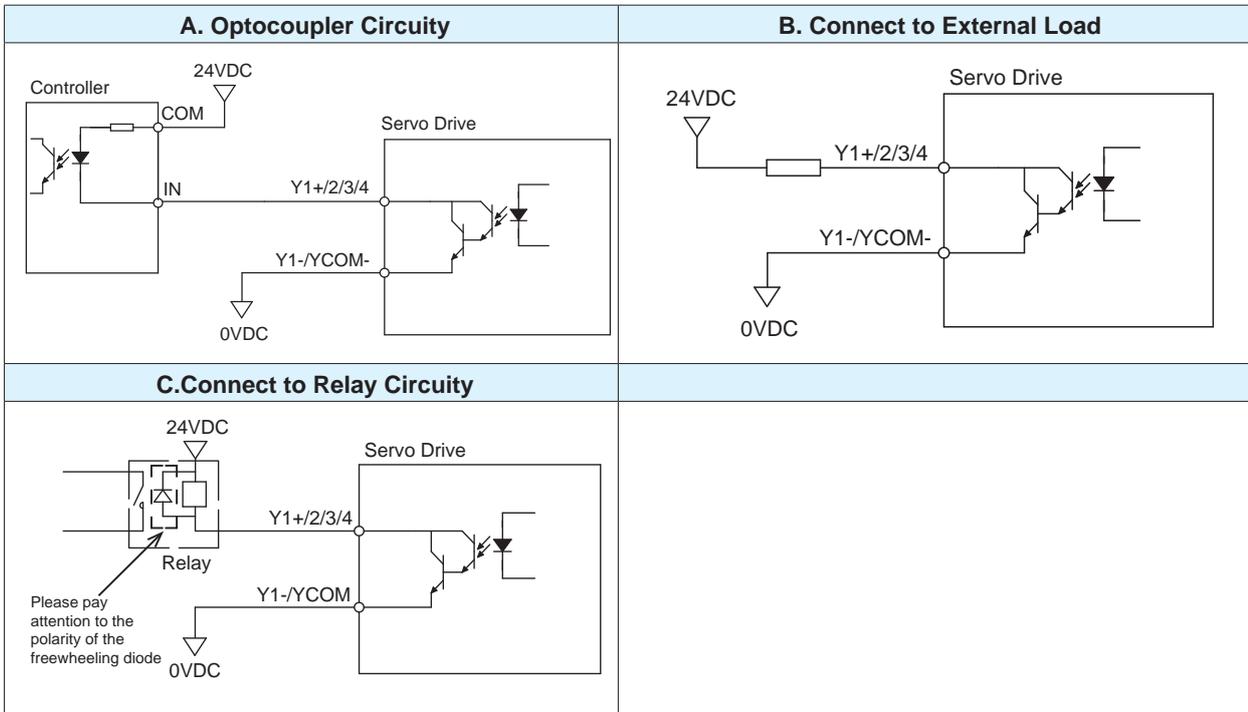
Note: Maximum output current is 30VDC 100mA.

4.10.8 Analog Output Signal

M56S EtherCAT AC servo drives, the X-type drives have 2 single-ended analog outputs to monitor the current percentage of motor current, percentage of command current, actual motor speed, motor command speed, position error and other data.

The output voltage range is -10V~+10V while the maximum output current is 10mA, and the output impedance is 10Ω. Please pay attention to the input impedance of the external analog input circuit.

Signal		CN2-Pin No.	Description
		X Type	
AO1	Analog Signal Output	8	Use the analog output signal to monitor the operating parameters of the motor: actual current, command current, actual speed, command speed, position error
AO2		7	The data corresponding to the two outputs can be set through configuration
DGND		11	DGND of analog output

■ Analog Output Signal Connection Diagram

Motor Type: X Type
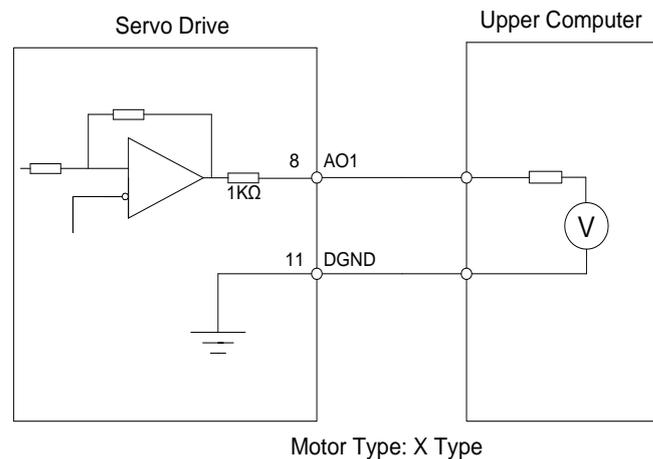
4.11 Full Closed-loop Feedback Signal CN4

The CN4 connector is used to connect the A, B, Z differential signals of an encoder or grating ruler installed externally on the machine, for the servo drive to do full closed loop control.
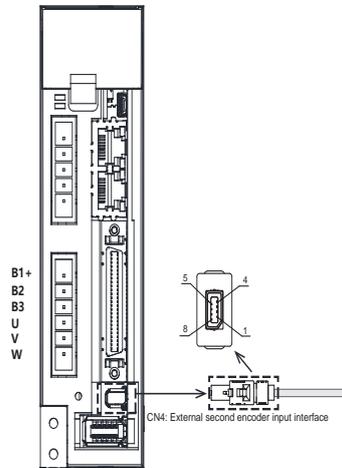
■   Connector Definition

Signal	CN4- PIN	Item	Description
	X Type		
5V	1	Power Supply	Power supply for the second feedback signal
GND	2		
Z-	3	Encoder Signal Input	Pulse type: differential Maximum frequency: 1Mpps Minimum pulse width: 0.5 μ s
Z+	4		
B-	5		
B+	6		
A-	7		
A+	8		

■ Signal Connection Diagram
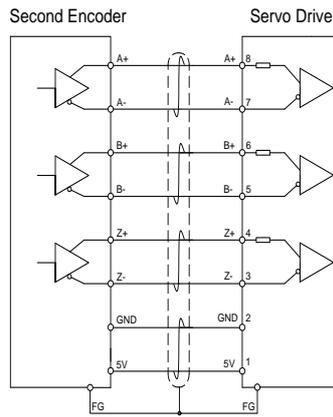
Precautions:

● Please use a twisted-pair shielded cable for the external second encoder signal wire, with a wire diameter of 0.18mm^2(AWG22) or more.

● The total length of the cable is recommended to be within 10 meters. When the wiring is long, to prevent 5V voltage drop and signal attenuation, please increase the wire diameter.

● To prevent interference, the digital ground of the external encoder must be connected to the one of the drive, and the cable shielding layer while the drive must be well grounded.

● The maximum 5V output current of the drive is 5V±5% 200mA Max. If the current consumption of the external encoder exceeds this specification, please use an external power supply.

● When using an external power supply, do not connect the external 5V to the 5V power output of CN4. However, the 0V of the external power supply must be connected to the 0V pin of CN4 of the drive to form an equipotential.

4.12 Safe Torque OFF(STO) CN5

In M56s EtherCAT AC servo series, the X-type drives support the safe torque off(STO) function.

The STO (Safe Torque Off) function is connected via port CN5. The STO function shuts off the motor current which will turn off output torque by forcibly turning off the signal of the servo drive power transistor. This is done internally through the STO Input/ Output signal circuit.

After the STO function is triggered, the drive will have a fault alarm status(Alarm code: `r20to`), and the motor will be disabled.

4.12.1 Safety Precautions

● If do not use the STO function, 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, 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.

4.12.2 STO Input/Output Signals

■ Internal Circuit Diagram
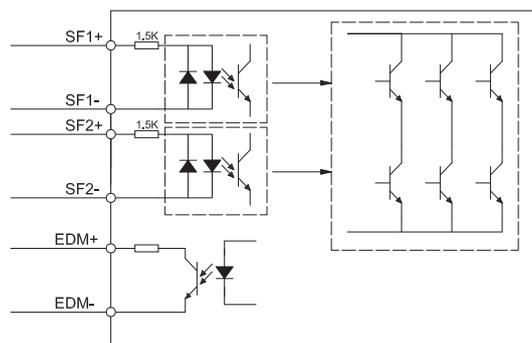
■ Input/Output Pin No.
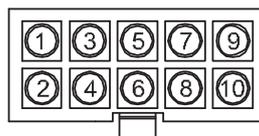
The connector and terminal models are as follows:

Name	P/N	Manufacturer
Plastic	43025-1000	MOLEX
Contact pin	43030-0005	MOLEX

■ 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 mode
	SF1-	5		
Safety Input SF2	SF2+	3	When SF2 has no input signal, 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	+12VDC power ground, 750W and abelow type +24VDC power ground, 1000W and above type	
Power	VCC	9,10	+12VDC power ground, 750W and abelow type +24VDC power ground, 1000W and above type	

Note: When any of the safety inputs SF1 and SF2 are OFF, the STO function will start to work.

■ STO Connection Diagrams

● Connection to safety switch
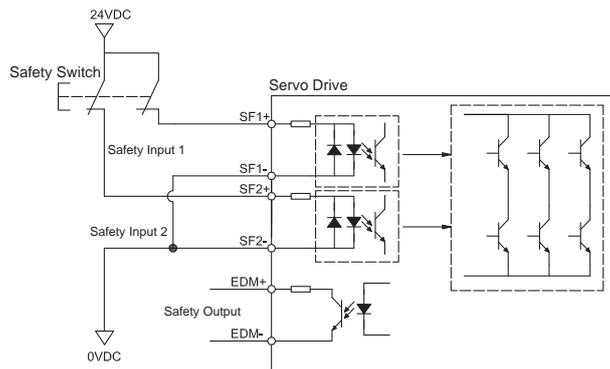
● Safety light curtain connection

5 Display and Operation

5.1 Description of Control Panel

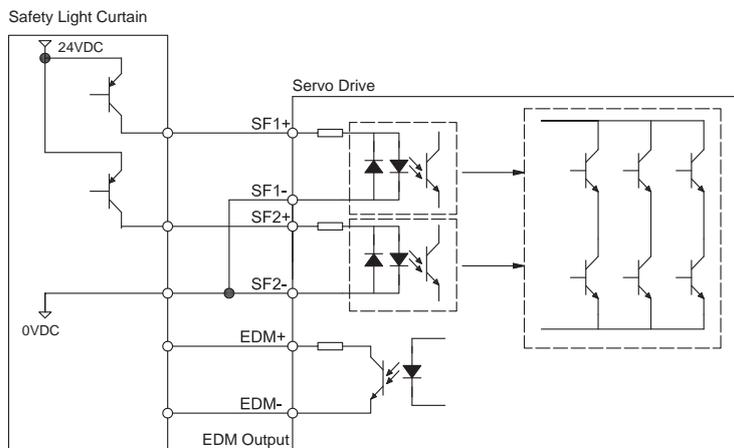| Symbol	Name	Details
-	LED Display	The LCD display (5 digits, 7 segments) show the drive's operating condition and warning codes, parameters and settings values.
(M)	MODE Key	Press and hold on mode button to switch LED display mode a). Monitoring selection mode b). Function selection mode c). Parameter 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.
(S)	SET Key	Press to entering mode Press and hold to save parameters/settings

5.2 Mode Switch Control

- Pressing the MODE button and the SET button changes between status monitoring, function control, parameters setting and other modes.
- If no warnings or faults occur, the drive will not go into warning and fault display mode.
- If any warnings are detected by the drive, the LED display will switch into warning or fault display mode immediately. Pressing Mode/Set button will switch back to the previous display mode. Pressing UP/DOWN button will switch other warning or fault display.
- If no button(s) on the control panel is pressed for 20 seconds, the display will switch back to the previous status monitoring display mode.
- In monitoring selection mode, function selection mode and parameter setting mode, to edit the values, press MODE to move the cursor to the left, then change parameters by using the UP/DOWN buttons.
- In status monitoring mode, press and hold the SET button to lock the control panel. To unlock the panel, press and hold the SET button again.

Control mode switch flowchart:
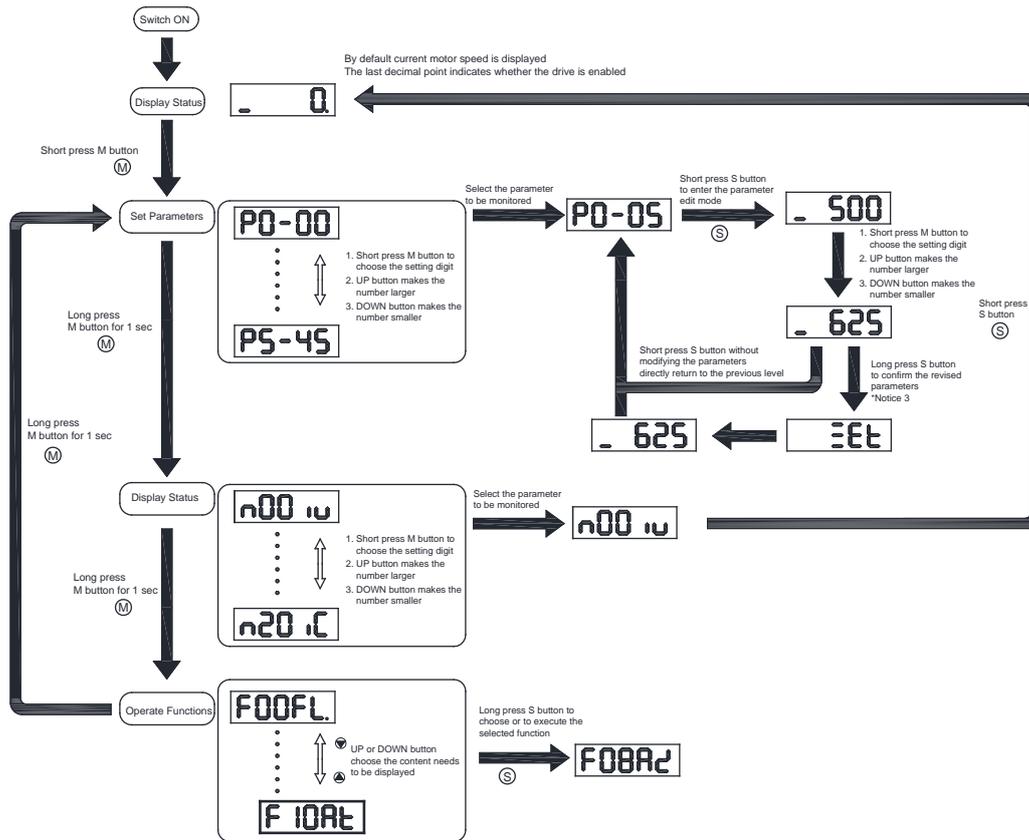
NOTE:

(1) After power on, the status selected by the customer will be displayed. By default, the current motor speed is displayed.

(2) In the parameter setting mode, short press SET button will exit the parameter edit mode and return to parameter setting selection interface without saving any settings.

(3) In parameter setting mode, long press SET button will confirm the modification of the parameter, which will take effect immediately without saving in drive flash. If it is needed to save the parameter after power failure, it is recommended to choose parameter saving function in the function operation interface which long press SET button will take effect.

(4) Do not save parameters when the motor is running.

5.3 LED Display Description

5.3.1 Decimal Point And Negative Sign Description

LED display	Description
 Identification digit for enable Identification digit for negative High-digit identification data (>4)	◆ Enable Identification Digit: The decimal point at the lower corner of the LED panel is the identification digit to judge whether the drive is enabled. If it is on, it means the drive is enabled and the motor is powered on. If it is off, it means the drive is not enabled and the motor is not powered on. ◆ Negative identification digit: It represents whether the number shown is positive or not. ON: negative OFF: positive ◆ High-digit data (>4): when the displayed data is greater than 4 digits, it will be displayed in pages and the identification digit will mark the number of digits at this time. For details, please refer to 5.3.2 "display with more than 4 digits"

5.3.2 Data Display

■ Positive Display (≤4 digits)

LED display	Description
 High-digit identification (≥4 digits) Normally open Identification digit for negative	◆ The first digit from the left is the identification digit of more than 4. When it is at the bottom of 7-terminal LED, it means the display is low 4-digit data. Always on: it means the displayed data is the lower 4-digit data and there is no higher data. Flashing: It represents the displayed data is the lower 4-digit data and there exists numbers greater than 4 digits. ◆ When the decimal point of negative identification digit is off, it means the displayed data is positive. **As shown in the figure, the displayed number is 2345.**

■ Negative Display(≤4 digits)

LED display	Description
 High-digit identification (≥4 digits) Normally open Identification digit for negative	◆ The first digit from the left is the identification digit of more than 4. When it is at the bottom of 7-terminal LED, it means the display is low 4-digit data. Always on: it means the displayed data is the lower 4-digit data and there is no higher data. Flashing: It represents the displayed data is the lower 4-digit data and there exists numbers greater than 4 digits. ◆ When the decimal point of negative identification digit is on, it means the displayed data is negative. **As shown in the figure, the displayed number is -2345.**

■ Number display (≥5 digits)

Since M56S series AC Servo LED display panel has only 5 digits, when it is necessary to display data greater than 5 bits, the following method is adopted.

e.g. If we want to display -1234567890

	LED display	Description
Display "7890" in the lower 4 bits	 The high-level identification digits of data more than 4 flashing Identification digit for negative	◆ The first digit from the left is the identification digit of data more than 4. When it is at the bottom of the 7-terminal LED, it represents the display the lower 4 digits of data have been shown. Flashing: it means that the displayed data is lower 4 digits and there are more than 4 digits. ◆ When the decimal point of negative number identification digit is always on, it means the displayed data is negative.

Display "3456" in the middle 4 digits	ⅲ.3456 The high-level identification digits of data more than 4 flashing — Identification digit for negative	◆ The first digit from left lights up in the middle of the 7-terminal LED, indicating that the data in the middle 4 digits is displayed. Always on: it represents the middle 4-digit data as displayed one and there is no higher data. Flashing: it represents the middle 4-digit data as displayed one and there are higher digits.
Display "12" as the highest digits	‾. 12 The high-level identification digits of data more than 4 flashing — Identification digit for negative	◆ The first digit from the left lights up on the upper part of the 7-terminal led, which means the highest 4 digits of data are displayed. Always on: it means the displayed data is the highest 4-digit data and there is no higher data.

When the high-level identification digit flashes, it represents there are numbers in high-digits and short press on "△"/"▽" can switch the number of pages displayed.

5.3.3 Other LED Display

LED display	Description
SEt	It means " SET". When modifying the parameter, long press "S" button for 1s. When the parameter is modified successfully, it takes effect immediately. It will not be saved when power failure happens.
SAuEd	In parameter setting mode, pressing and holding the "S" button will save the change. 'Saved' will also be displayed on the LED.
buSY	In parameter setting mode when the motor is rotating and the is pressed and held, the LED display will read "busy" meaning that the current parameter change cannot be saved. Stop the current motor motion and save the parameter again.

5.3.4 Point To Point Motion Mode

LED display	Description
P--CW.	When the LED display reads "P-CW" it means the motor is rotating in a CW direction in the point-to-point mode.
P-CCW.	When the LED display reads "P-CCW" it means the motor is rotating in a CCW direction in the point-to-point mode.

5.3.5 Jog Mode

LED display	Description
J--CW.	When the LED display reads "J-CW" it means the motor is rotating in a CW direction in JOG mode.
J-CCW.	When the LED display reads "J-CCW" it means the motor is rotating in a CCW direction in JOG mode.

5.3.6 Control Panel Lock

LED display	Description
LCК	This means the key panel is locked. Press and hold 'S" for 1 second while in status monitoring mode to lock.
unLCК	When the control panel is locked, press and hold "S" for 1 second to unlock it.

5.4 Status Monitoring Selection Mode

To change the status monitoring type, please press "M" to enter monitoring selection mode, and thenuse ⬆⬇ to make selections, and press "S" to confirm. Steps are shown as follows:
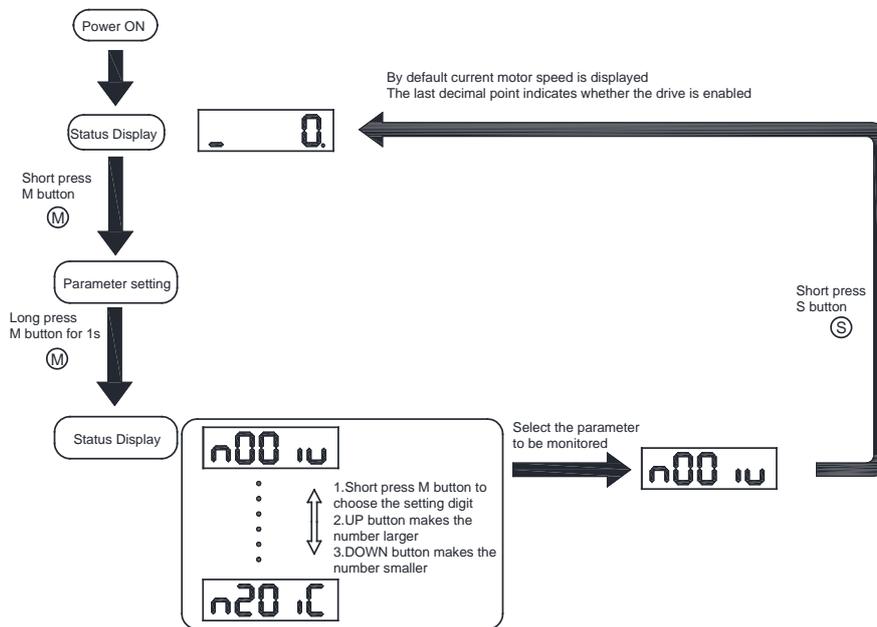
n-Status Display Choose Mode Setting Value	Display Symbols	Explanation	Unit	Display Example
n-00	**n00 ıu**	Actual motor speed	RPM Rotation per Minute	◆ Display when "3000" rpm **_3000.** ◆ Display when "-3000" rpm **_.3000.**
n-01	**n01 ıֵ**	Real time position error of motor	Pulses	◆ Display -1234567890 **.7890** Short press "down" button / Short press "UP" button
n-02	**n02L⁼**	Command pulse input count	Pulses	**.3456** Short press "down" button / Short press "UP" button
n-03	**n03 ıE**	Motor encoder location	Pulses	**_ 12**
n-04	**n04 ıP**	Command location	Pulses	
n-05	**n05 ıt**	Drive PCB temperature	0.1℃	◆ Display "62.5" ℃ **_ 625**

n-06	**n06.U**	DC Bus Voltage	0.1V	◆ Display "315.7" VDC **_3157**
n-07	**n07dA**	EtherCAT Communication Node Address		◆ Display address is "1" **_1001**
n-08	**n08AH**	Alarm history 0		◆ Display "r07" as alarm code **_ 7**
n-09	**n09AH**	Alarm history 1		◆ Display "r07" as alarm code **_ 7**
n-10	**n10AH**	Fault History 2		◆ Display "r07" as alarming code **_ 7**
n-11	**n11AH**	Fault History 3		◆ Display "r07" as alarming code **_ 7**
n-12	**n12AH**	Fault History 4		◆ Display "r07" as alarming code **_ 7**
n-13	**n13AH**	Fault History 5		◆ Display "r07" as alarming code **_ 7**
n-14	**n14AH**	Fault History 6		◆ Display "r07" as alarming code **_ 7**
n-15	**n15AH**	Fault History 7		◆ Display "r07" as alarming code **_ 7**
n-16	**n16.A**	Analog Input 1 sample voltage	mV	◆ Display "8.211" V **_8211**
n-17	**n17.A**	Analog Input 2 sample voltage	mV	◆ Display "8.707" V **_8707**
n-18	**n18 in**	Digital input status		◆ Each 7-segment number represents the state of a digital input 1: Closed Status 0: Open **1011** Input the Status of X4 — Input the Status of X1 Input the Status of X3 — Input the Status of X2 Short press "Down" button / Short press "UP" button **-0110** Input the Status of X8 — Input the Status of X5 Input the Status of X7 — Input the Status of X6
n-19	**n19oU**	Digital Output status		◆ Each 7-segment number represents the state of a digital output 1: Closed Status 0: Open **_1011** Output Status of Y4 — Output Status of Y1 Output Status of Y3 — Output Status of Y2
n-20	**n20.C**	Command current percentage	0.1%	◆ Display current command - 72.5% **_ 725**
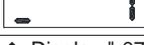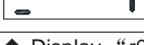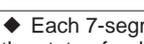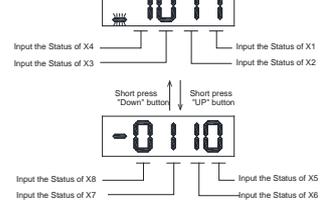
Note:
Closed**:** The digital input/ output circuit of the drive forms a loop and the current flows in or out from the input/ output pin. The drive has an input/ output signal.
Open**:** The drive digital input/ output circuit does not form a loop. No current flows in or out of the input/ output pin and the drive has no input/ output signal.

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)**
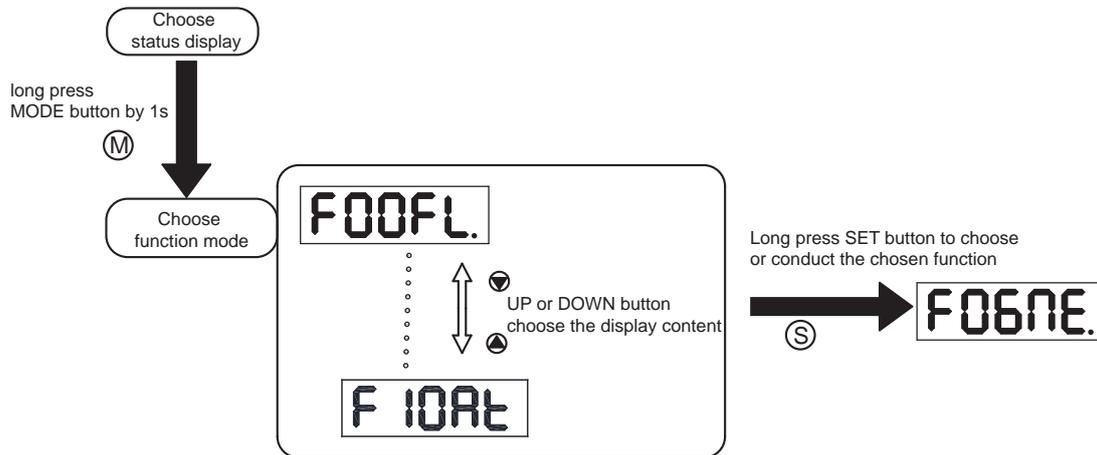
5.5.1 Function Mode Description

Function mode details are as follows:

Function mode number	LED display	Description
F00	FOOFL	point to point position mode: rotating speed is1rps; travel distance is 1rev
F01	FO1CJ	JOG mode:JOG speed 1rps
F02	FO2Ar	(F02AR) ---- Clear drive's current alarm
F03	FO3SA	(F03SA) ---- Save parameter changes for P
F04	FO4Md	(F04MD) ---- Drive disable
F05	FO5ME	(F05ME) ---- Drive enable
F06	FO6AZ	(F06AZ) ---- Analog auto tunning
F07	FO7SK	(F07SK) ---- Motion Stop/Q Stop
F08	FO8rF	(F08ERF) ---- Restore drive parameter to default setting value
F09	FO9EM	(F09EM) ---- Reset absolute encoder
F10	F10At	(F10AT) ---- Start automatic setting

5.5.2 Operation Flow Chart

Choose status display

long press M button for 1s (M)

Choose function mode

F-00 point-to-point positioning mode

FOOFL.

Short press SET button (S)

Short press (M)

Enter point-to-point positioning

P-P.

Note: in point-to-point positioning mode
1) The operating speed is 1rps
2) Each positioning distance is 1 turn

Short press (▲) motor rotates forward for one turn and displays → P--CЯ.

Short press (▼) motor reverses one turn and displays → P-CCЯ.

Short press (S) motor stops point-to-point movement

Short press (M) return to the upper option

UP or DOWN button choose the display content

F-01 Jogging mode

FO 1CJ.

Short press SET button (S)

Short press (M)

Enter JOG mode

JoG.

Caution:
Under jogging mode,
1) Velocity is 1rps

Short press (▲) motor rotates forward and displays → J--CЯ.

Short press (▼) motor rotates reverse and displays → J-CCЯ.

Short press (S) motor stops JOG movement

Short press (M) return to upper options

UP or DOWN button choose the display content

F-02 Clear the alarming

FO2Яr

Short press SET button (S)

Clear the current alarming by the drive

FO2Яr

UP or DOWN button choose the display content

F-03 Save parameters

FO3ΞЯ

Short press SET button (S)

Display after 1s

Save changes to group P parameters

ΞЯuEd   Saved means Saved successfully

UP or DOWN button choose the display content

F-04 Servo disabled

FO4Пd

Short press SET button (S)

Make the drive in disable status

FO4Пd

UP or DOWN button choose the display content

F-05 Servo enabled

FO5ПE

Short press SET button (S)

Enable the drive immediately when the drive does not alarm

FO5ПE.

UP or DOWN button choose the display content

F-06 Analog input to automatic adjustment

FO6Яↄ

Short press SET button (S)

Display after 1s

Automatically set analog input offset

ΞEt

UP or DOWN button choose the display content

F-07 Movement stop/ Q program stop

FO7ΞЯ.

Short press SET button (S)

Stop the current command movement and stop the Q program

FO7ΞЯ.

UP or DOWN button choose the display content

F-08 Restore by default

FO8rF

Short press SET button (S)

Display after 1s

Restore the current parameters of the drive to the factory settings

ΞEt

UP or DOWN button choose the display content

F-09 Reset Absolute Encoder

FO9EП

Short press SET button (S)

Display after 1s

When the absolute location of an absolute encoder was lost or in multi-turn error, reset the absolute encoder operation.
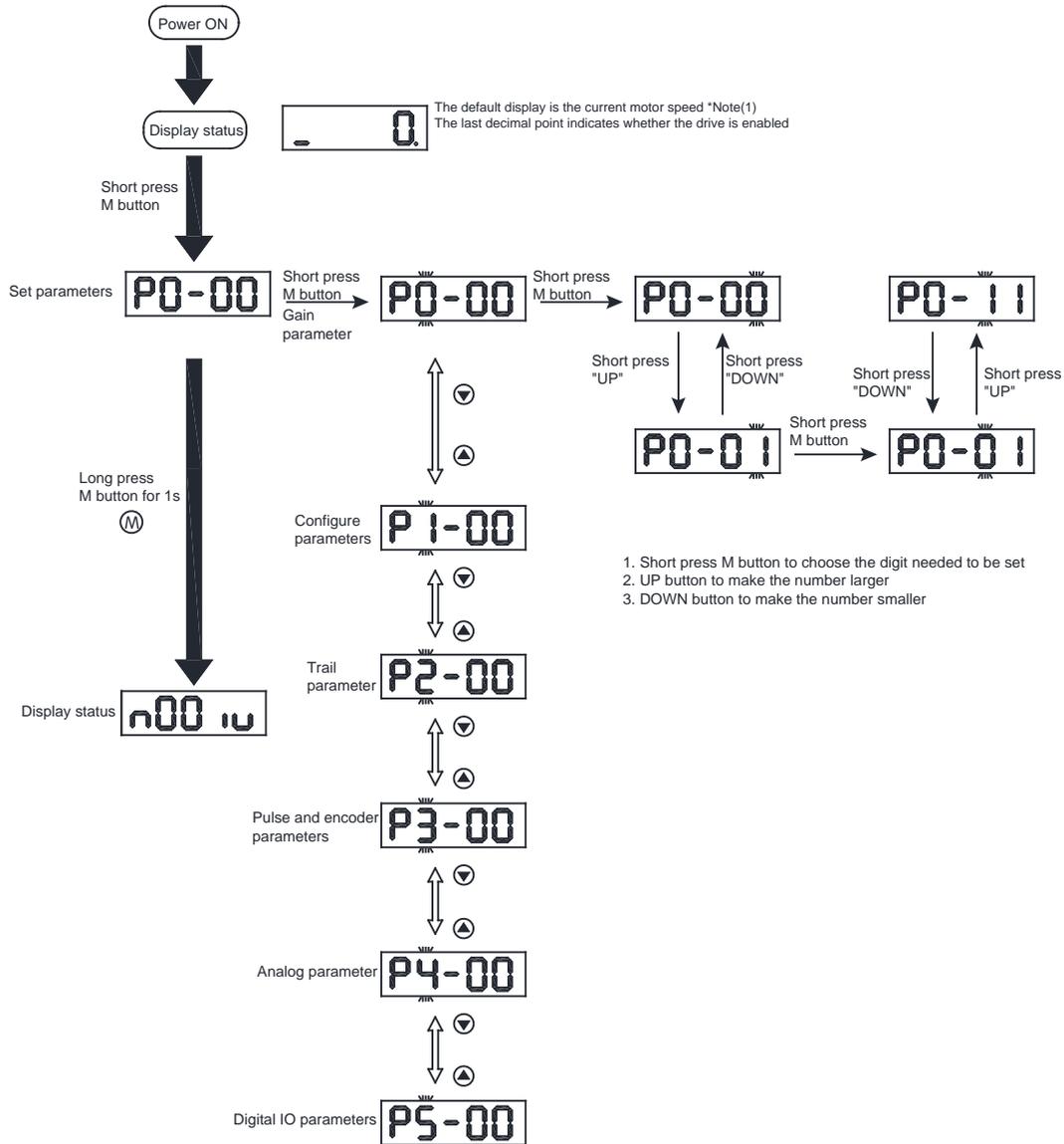
ΞEt

5.6 Parameter Setting Mode

5.6.1 Parameter Setting Method

In this mode, users can modify the parameters to be set and display them with P+ parameter number.

1) Short press M button to choose the digit needed to be set
2) Short press "UP" to make the number larger
3) Short press "DOWN" to make the number smaller

## 5.6.2 Revision and Saving Parameters

A. Revise parameters:

1) Short press "M" button to make move to higher-digit and choose the digit needed to be set

2) Long press "M" button to make move to lower-digit and choose the digit needed to be set

3) Short press "UP" button to make the number bigger

4) Short press "DOWN" button to make the number smaller

5) Long press "S" button to confirm modify the parameters

Set example: modify the content parameter P0-05 to "15531"
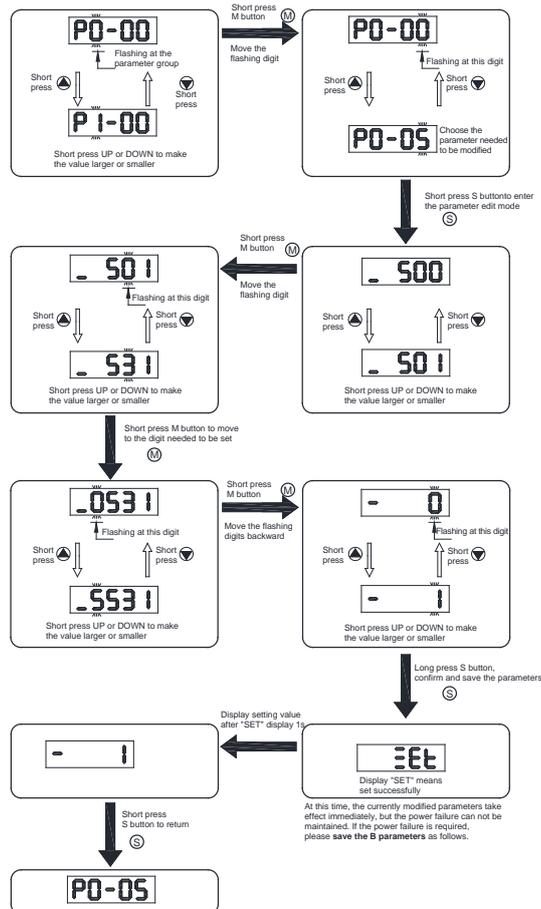
B Save parameters

After the parameters have been modified successfully, it takes immediate effect (except for some parameters that need to be powered off to take effect). However, it will not be powered off, that is, after the next power on, it will restore to previously saved values. To maintain power-off, please do the following.
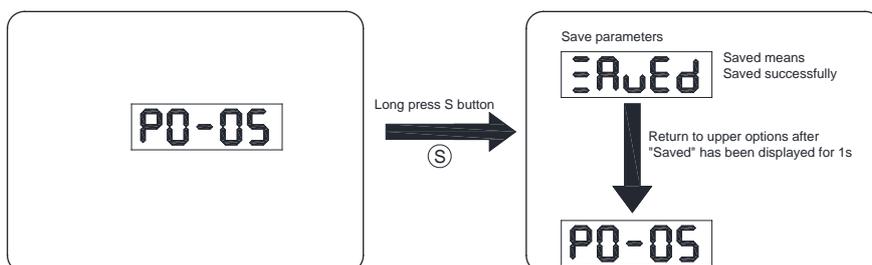
5.7 Control Panel Lock

In order to prevent misoperation by personnel unfamiliar with the drive, M56S Ether CAT series AC servo drive provides key lock function. When the button has been locked, man can not operate or modify parameters.
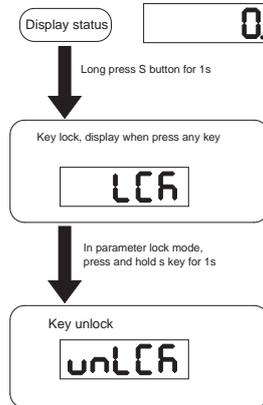
5.8 Warning And Fault Display

In any case, once the drive generates the following alarms, it will enter the abnormal alarm display mode. If multiple abnormal alarms are generated at the same time, you can press ▲▼ page turning to view. Short press Ⓜ to Ⓢ return to the mode before the abnormal alarm.
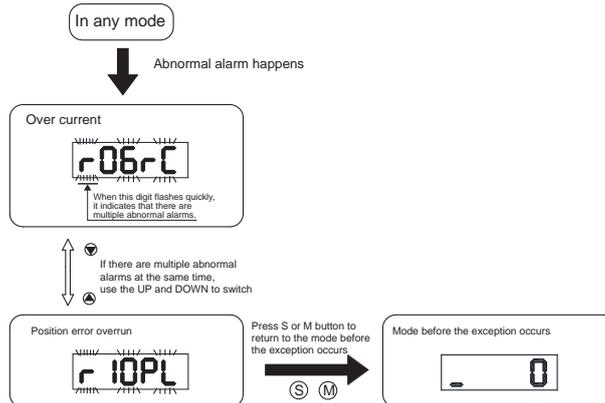
Alarm display codes are as follows

LED Display	Description	Alarm Type	Drive Status after Alarm Occurs
r0 lot	Drive over temperature	Fault	Servo off
r02ur	Internal voltage fault	Fault	Servo off
r03uH	Over voltage	Fault	Servo off
r04HC		Fault	Servo off
r05LC	Over current	Fault	Servo off
r06rC		Fault	Servo off
r07Fb	FPGA Error	Fault	Servo off
r09Eb	Motor encoder not connected	Fault	Servo off
r 10PL	Position error	Fault	Servo off

LED Display	Description	Alarm Type	Drive Status after Alarm Occurs
r11Lu	Low voltage	Fault	Servo off
r12ou	Velocity limited	Fault	Servo off
r13Lt	CW limit or CCW limit activated	Warning	No change to drive's status
r14cL	CW limit is activated	Warning	The motor cannot continue to reverse without changing the current state
r15JL	CCW limit is activated	Warning	The motor cannot continue to rotate forward without changing the current state
r16CL	Drive overload	Warning	No change to drive's status
r17CE	USB Communication error	Warning	No change to drive's status
r18EF	Parameter save failed	Fault	Servo off
r19LP	Drive main circuit power input phase loss	Warning	No change to drive's status
r20to	STO is activated	Fault	Servo off
r21rF	Regeneration failed	Warning	Servo off
r22uU	Low voltage	Warning	No change to drive's status
r23qE	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
r25ur	Drive internal voltage error	Fault	Servo off
r26ur		Fault	Servo off
r27EE	Emergency stop	Fault	The status is determined by the setting value of 0x2038
r28FP	Full closed-loop position error overrun	Fault	Servo off
r29FE	Second encoder signal error	Fault	Servo off
r30nE	Storage error	Fault	Servo off
r31bt	Absolute encoder battery low voltage	Warning	No change to drive's status
r32AP	Missing absolute position	Warning	No change to drive's status
r33oP	Absolute position overflow	Warning	No change to drive's status
r34nt	Over temperature	Fault	Servo off
r35Ct	Drive processor over temperature	Fault	Servo off
r36nr	Absolute encoder battery low voltage	Fault	Servo off
r37Et	Motor stall	Fault	Servo off
r38CE	EtherCAT Communication error	Fault	Servo off
r39Hr	Origin regression parameter configuration error	Warning	No change to drive's status
r40H1	Motor collision alarm	Fault	Servo off
r41Er	Motor encoder communication abnormality	Fault	Servo off
r42io	I/O signal function multiplexing	Warning	No change to drive's status

6 Trial Run

6.1 Inspection Before Trial Run

In order to ensure the safety of the servo drive and mechanical structure, it is strongly recommended to check the following items before powering on the drive.

1) Wiring inspection

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
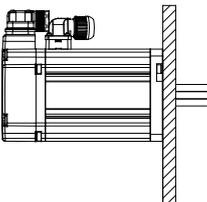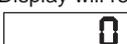
2) Power supply voltage check

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) Make sure the motor is installed securely

4) Make sure the motor shaft is not loaded

6.2 Trail Run Procedure

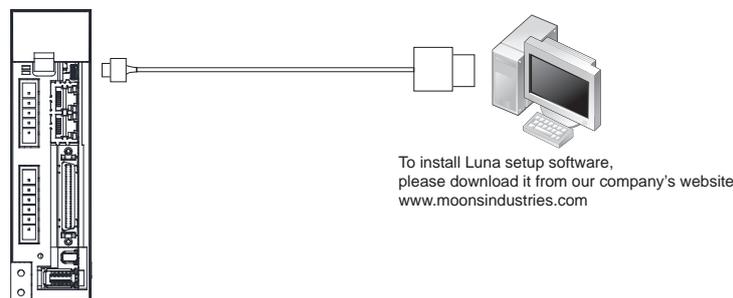| Step	Details	Description
1	Install the motor securely. 	- The motor can be installed on the machine. - Ensure no load is installed on the servo motor.
2	Make sure the wiring between the drive and motor is correct.	- The terminals on connector P2 must be connected in the order of U - Red, V - Yellow, U - Blue, FG - Yellow/Green. If the terminals are not connected to the specified wire, the drive will not be able to control the motor. - Ensure the encoder cable is connected to CN3 correctly.
3	Confirm that the drive power circuit is connected correctly	Refer to 4.3 external main circuit wiring selection to confirm whether the power input circuit is correct
4	Before using the motor with electromagnetic brake, electromagnetic braking control circuit shall be set	Refer to 4.7 connection method of motor with electromagnetic brake
5	Supply power	Do not apply more than 380VAC power supply to the servo system.

6	If there are no alarms the LED Display will read:
	`0`
	If an alarm occurs, it will display:
	`r09Eb`
		- When the power is on, the normal display should be shown without any alarm codes and the drive is disabled.
		- If the display shows alarm codes such as r-09 the encoder feedback connection is incorrect. Check the encoder wiring to the servo motor to see if it is loose or incorrect.
		- See Section 5.8 for a list of alarm codes.

7	JOG Trial Run without load	The system is ready to run JOG trial if all the above steps are completed.

6.3 Jog Operation

Step	LED display	Description
1	FOOFL	Press (M) into the Function Parameters mode at the Monitor Status mode
2	F05NE	Press the (▲) and (▼) key to select F05ME
3	F05NE.	Press the (S) key, The last decimal digit lights up, indicating that the servo is enabled
4	FO1CJ	Use (▲)、(▼) key, Select F01CJ Jog function
5	JoG.	Short press (S) key, Enter JOG mode
6	J--CH.	Short press (▲) key, The motor rotates forward at 1 revolution per second
7	or J-CCH.	or Short press (▼) key, The motor reverses at 1 revolution per second
8	JoG.	Short press (S) key, The motor will be stop
9	FO1CJ.	Short press (M) key, Return to function operation mode
10	FO4Nd	Select F04MD, Press (S) key 1S, The motor will be disabled

6.4 Configuration by Personal Computer

In order to ensure servo drive and motor meet your operation requirements, we strongly recommend customers to use "Luna Software" for following configuration setups:

1. Configure encoder usage mode

2. Define drive's input/output mode

3. Apply auto tuning function on PID parameters for optimized motor performance

Connection method

To install Luna setup software,
please download it from our company's website
www.moonsindustries.com

Luna's detail, please refer to the software manual.

7 Appendix 1: LED Character Reference

1	2	3	4	5	6	7	8	9	10
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z				

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