

Advanced User Guide

IS580 Series Servo Drive

User Guide

A04
Data code 19010433

Preface

The IS580, an upgraded product of IS300, is a servo drive developed for high-performance vector control of permanent magnet synchronous motor (PMSM). Using the high-performance vector control technology, it optimizes the process control of injection molding machine, including the control on injection speed and pressure holding precision as well as the stability control upon working with the injection molding machine controller. It also provides monitoring software and communication buses and supports multiple encoder types, realizing flexible function combinations and stable performance.

The IS580 is mainly applied to such industries as plastic molding, pipe extrusion, shoes making, rubber production, and metal die casting. Compared with IS300, it features better hydraulic control performance, faster pressure and speed responses, lower steady-state pressure fluctuation and smaller size.



Introduction

§ Features

Compared with IS300, the IS580 series servo drive features:

1) Smaller size and higher power density

For models of the same power, the drive size reduces by at least 40% on average.

2) Wide voltage range

Rated input: three-phase 380–480 VAC

Voltage fluctuation range: -15% to +10%

3) Built-in DC reactor

A built-in DC reactor is provided for models of 30 kW or above, simplifying installation.

4) Improved built-in braking unit and braking protection functions

A built-in braking unit is configured for models of 75 kW or below (external braking unit for models of 90 kW or above). The braking circuit is equipped with various protection functions, including regenerative resistor short circuit, braking circuit overcurrent, braking transistor overload, and braking transistor short circuit.

5) Longer service life of the bus capacitor

The bus capacitor can serve for a longer time due to better configurations.

6) Fan drive circuit protection

The fan drive circuit generates a protection when the fan is unexpectedly short-circuited due to blocking or damage.

7) Better drive protection functions

The full series of servo drives are equipped with protections against output short circuit to ground and pre-charge relay (contactor) close fault.

8) Optimized EMC solution

A complete set of solution can be provided based on actual application requirements and certification requirements.

9) Matching with 23-bit absolute encoder and support for "auto-tuning free" function (intelligent identification of motor parameters, with auto-tuning not required when setting up the motor).

The IS580 can work with a 23-bit absolute encoder, achieving a resolution of up to 8 million pulses per revolution (PPR). It also supports motor parameter packing to perform the "auto-tuning free" function, simplifying the use of software.


NOTE

◆ The "auto-tuning free" function is available only to servo systems configured with ESMG/ISMGx-xxxxxxx-A3xxxx series motor with a 23-bit absolute encoder.

§ Unpacking

Upon unpacking, check the following items:

- Whether the nameplate model and ratings of the servo drive (with certificate of conformity) in the packaging box are consistent with your order.
- Whether the product is damaged during transportation. If you find anything omission or damage, contact Inovance or your supplier immediately.

§ First-time Use

Read this user guide carefully if you use this product for the first time. For any problem concerning the functions or performances, contact the technicians of Inovance for help.

§ Standards Compliance

The following table lists the certifications and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

Certification	Certification Mark	Directive		Standard
CE	CE	EMC Directive	2014/30/EU	EN 61800-3
		Low Voltage Directive	2014/35/EU	EN 61800-5-1
		RoHS Directive	2011/65/EU	EN 50581
UL	c UL us LISTED	-		UL61800-5-1 C22.2 No.14-13

Safety Information and Precautions

Before Use

This user guide describes the correct use of the IS580. Read this guide carefully and fully understand the safety instructions before using the product (installation, wiring,

running, maintenance, and inspection).

Safety Precautions

1) Before installing, using, and maintaining this equipment, read the safety information and precautions thoroughly, and comply with them during operations.
2) To ensure the safety of humans and equipment, follow the signs on the equipment and all the safety instructions in this user guide.
3) "CAUTION", "WARNING", and "DANGER" items in this user guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
4) Use this equipment according to the designated environment requirements. Damage caused by improper usage is not covered by warranty.
5) Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions

 DANGER	indicates that failure to comply with the notice will result in severe personal injuries or even death.
 WARNING	indicates that failure to comply with the notice may result in severe personal injuries or even death.
 CAUTION	indicates that failure to comply with the notice may result in minor personal injuries or damage to the equipment.

Safety Instructions

Unpacking
 CAUTION ◆ Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation. ◆ Unpack the package by following the package sequence. Do not hit the package with force. ◆ Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories. ◆ Check whether the number of packing materials is consistent with the packing list.
 WARNING ◆ Do not install the equipment if you find damage, rust, or indications of use on the equipment or accessories. ◆ Do not install the equipment if you find water seepage, component missing or damage upon unpacking. ◆ Do not install the equipment if you find the packing list does not conform to the equipment you received.
Storage and Transportation
 CAUTION ◆ Store and transport this equipment based on the storage and transportation requirements for humidity and temperature. ◆ Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration. ◆ Avoid storing this equipment for more than three months. Long-term storage requires stricter protection and necessary inspections. ◆ Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation. ◆ Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.
 WARNING ◆ Use professional loading and unloading equipment to carry large-scale or heavy equipment. ◆ When carrying this equipment with bare hands, hold the equipment casing firmly with care to prevent parts falling. Failure to comply may result in personal injuries. ◆ Handle the equipment with care during transportation and mind your step to prevent personal injuries or equipment damage. ◆ Never stand or stay below the equipment when the equipment is lifted by hoisting equipment.

Installation
 ◆ Thoroughly read the safety instructions and the user guide before installation. ◆ Do not modify this equipment. ◆ Do not rotate the equipment components or loosen retaining bolts (especially those marked in red) on equipment components. ◆ Do not install this equipment in places with strong electric or magnetic fields. ◆ When this product is mounted in a cabinet or terminal device, protection measures such as a fireproofing shell, electric protection shell, or mechanical protection shell must be provided for the cabinet or terminal device. The IP level must meet IEC standards and local laws and regulations.
 ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Installation, wiring, maintenance, inspection, or parts replacement must be performed by only experienced personnel who have been trained with necessary electrical information. ◆ Installation personnel must be familiar with equipment installation requirements and relevant technical materials. ◆ Before installing equipment with strong electromagnetic interference, such as a transformer, install an electromagnetic shielding device for this equipment to prevent malfunctions.
Wiring
 ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Never perform wiring at power-on. Failure to comply will result in an electric shock. ◆ Before wiring, cut off all equipment power supplies. Before wiring, cut off all equipment power supplies. Wait at least 10 minutes before further operations because residual voltage exists after power-off. ◆ Make sure that the equipment is well grounded. Failure to comply will result in an electric shock. ◆ During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an anti-static wrist strap. Failure to comply will result in damage to internal equipment circuits.



- Never connect the power cable to output terminals of the equipment. Failure to comply may cause equipment damage or even a fire.
- When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- After wiring, make sure that no screws are fallen and cables are exposed in the drive and other related devices.

Power-on



- Before power-on, make sure that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Before power-on, make sure that the power supply meets equipment requirements to prevent equipment damage or even a fire.
- At power-on, unexpected operations may be triggered on the equipment. Therefore, stay away from the equipment.
- After power-on, do not open the cabinet door and protective cover of the equipment. Failure to comply will result in an electric shock.
- Do not touch any wiring terminals at power-on. Failure to comply will result in an electric shock.
- Do not remove any part of the equipment at power-on. Failure to comply will result in an electric shock.

Operation



- Do not touch any wiring terminals at power-on.Failure to comply will result in an electric shock.
- Do not remove any part of the equipment during operation. Failure to comply will result in an electric shock.
- Do not touch the equipment shell, fan, or resistor for temperature detection. Failure to comply will result in heat injuries.
- Signal detection must be performed by only professionals during operation. Failure to comply will result in personal injuries or equipment damage.



- Prevent metal or other objects from falling into the device during operation. Failure to comply may result in equipment damage.
- Do not start or stop the equipment using the contactor. Failure to comply may result in equipment damage.

Maintenance
 ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Do not maintain the equipment at power-on. Failure to comply will result in an electric shock. ◆ Before maintenance, cut off all equipment power supplies and wait at least 10 minutes.
 ◆ Perform daily and periodic inspection and maintenance for the equipment according to maintenance requirements and keep a maintenance record.
Repair
 ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Do not repair the equipment at power-on. Failure to comply will result in an electric shock. ◆ Before inspection and repair, cut off all equipment power supplies and wait at least 10 minutes.
 ◆ Require repair services according to the product warranty agreement. ◆ When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record. ◆ Replace quick-wear parts of the equipment according to the replacement guide. ◆ Do not operate damaged equipment. Failure to comply may result in worse damage. ◆ After the equipment is replaced, perform wiring inspection and parameter settings again.
Disposal
 ◆ Dispose of retired equipment by following local regulations or standards. Failure to comply may result in property damage or personal injuries. ◆ Recycle retired equipment by following industry waste disposal standards to avoid environmental pollution.

Safety Signs

For safe equipment operation and maintenance, comply with the safety signs on the equipment, and do not damage or remove the safety labels. The following table describes the safety signs.

Safety Sign	Description
	◆ Read this user guide before installation and operation. Failure to comply will result in an electric shock. ◆ Do not remove the cover at power-on or within 10 minutes after power-off. ◆ Before maintenance, inspection, and wiring, cut off input and output power, and wait at least 10 minutes until the power indicator is off.

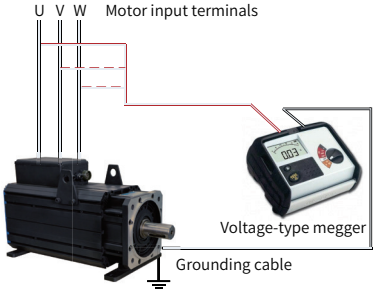
General Precautions

1) Requirements on the residual current device (RCD)

The servo drive generates high leakage current during running, which flows through the protective earthing conductor. Install a type B RCD at the primary side of the power supply. When selecting the RCD, you should consider the transient and steady-state leakage current to ground that may be generated at startup and during running of the servo drive. You can select a specialized RCD with the function of suppressing high harmonics or a general-purpose RCD with 300 mA residual current (two to four times of the protective conductor current).

2) Motor insulation test

Perform the insulation test when the motor is used for the first time, when it is reused after long-term storage, or in a regular inspection, to prevent the poor insulation of motor windings from damaging the servo drive. The motor must be disconnected from the servo drive during the insulation test. A 500 V megger is recommended for the test. Ensure that the insulation resistance is not less than 5 MΩ.



3) Thermal protection of the motor

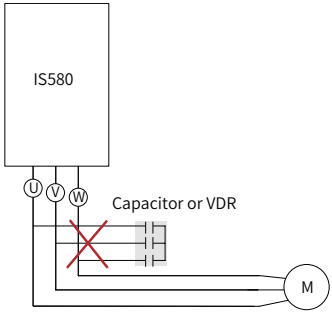
If the rated capacity of the selected motor does not match that of the servo drive, especially when the rated power of the servo drive is greater than that of the motor, adjust the motor protection parameters or install a thermal relay for the motor for protection.

4) Motor heating and noise

The output of the servo drive is pulse width modulation (PWM) wave with certain harmonic wave. Therefore, the motor temperature rise, noise, and vibration are slightly greater than those during running at the mains frequency.

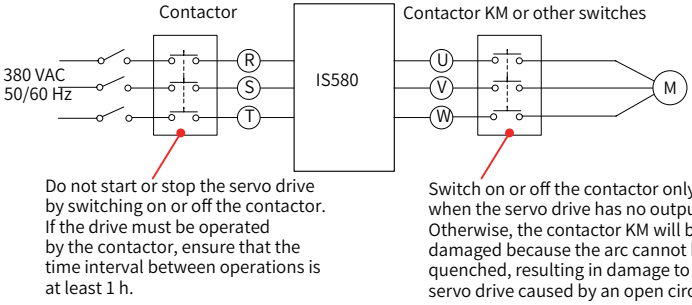
5) Voltage dependent resistor (VDR) or capacitor for improving the power factor on the output side

The output of the servo drive is PWM wave. Do not install a capacitor for the improving power factor or a lightning protection VDR on the output side of the servo drive. Otherwise, transient overcurrent or even damage to the servo drive may occur.



6) Contactors on the input and output sides of the servo drive

When a contactor is installed between the input side of the servo drive and the power supply, do not start or stop the servo drive by switching on or off the contactor. If the servo drive has to be operated by the contactor, ensure that the time interval between switching is at least 1 h because frequent charging and discharging reduce the service life of the capacitor inside the servo drive. When a contactor is installed between the output side of the servo drive and the motor, do not switch on or off the contactor when the servo drive has an output. Otherwise, modules inside the servo drive may be damaged.



7) Use outside the rated voltage

The servo drive must be used within the allowable voltage range specified in this guide. Otherwise, components inside the servo drive may be damaged. If required, use a corresponding voltage step-up or step-down device.

8) Prohibition of three-phase input changed into two-phase input

Do not change the three-phase input of the servo drive into two-phase input. Failure to comply will result in faults or damage to the servo drive.

9) Surge protection device (SPD)

The servo drive has a built-in VDR for suppressing the surge voltage generated when the inductive loads around the servo drive are switched on or off. If the inductive loads generate very high surge voltage, use an SPD for the inductive load or use an SPD together with a diode.



NOTE

◆ Do not connect the SPD to the output side of the servo drive.

10) Altitude and de-rating

In places where the altitude is above 1000 m, it is necessary to de-rate the servo drive because the cooling effect reduces due to thin air. (The servo drive must be de-rated by 1% for each 100 m higher, with the maximum altitude being 3000 m. When the ambient temperature is above 40°C, the servo drive must be de-rated by 1.5% for each 1°C higher. The maximum operating temperature is 50°C.)

For de-reating, contact Inovance for technical support.

11) Special needs

If the wiring that is not described in this user guide (such as common DC bus) needs to be used, contact Inovance for technical support.

12) Disposal

The electrolytic capacitors on the main circuit and PCB may explode when they are burnt. Poisonous gas is generated when the plastic parts are burnt. Treat them as ordinary industrial waste.

13) Compatible motor

- The standard compatible motor is PMSM. If the motor is non-PMSM, replace it with a proper synchronous motor according to the rated current of the servo drive.
- The cooling fan and rotor shaft of the non-variable-frequency motor are coaxial, which results in reduced cooling effect when the motor speed reduces. Therefore, add a more powerful cooling fan or replace the motor with a variable-frequency motor in scenarios where the motor overheats easily.

- Although the standard parameters of the compatible motor have been configured inside the servo drive, it is still necessary to perform motor auto-tuning or modify the default values based on actual conditions. Otherwise, the running effect and protection performance will be affected.
- The servo drive may alarm or even be burnt out when a short circuit exists on cables or inside the motor. Therefore, perform the insulation short circuit test when the motor and cables are newly installed or during routine maintenance. During the test, ensure that the servo drive is completely disconnected from testing parts.

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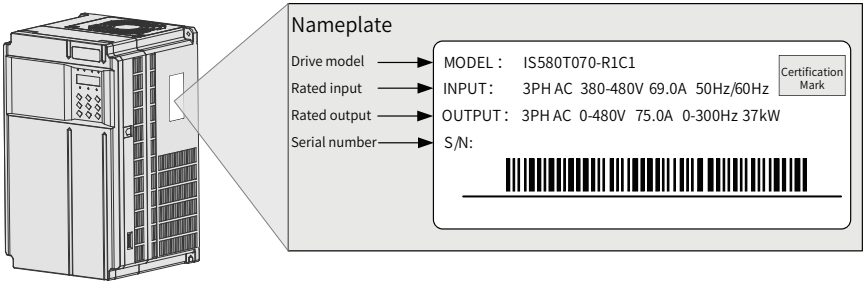
Revision History

Date	Version	Change Description
August 2016	A00	First release.
November 2016	A01	Modified model number and nameplate.
May 2019	A02	Updated logo.
July 2020	A03	Modified the covers, structure, and contents regarding motors, PG cards, troubleshooting, options and parameters, of the user guide.
November 2020	A04	Minor modifications.

1 Product Information

Safety Instruction
CAUTION ◆ Never hold the front cover or terminal cover to handle the servo drive. If only the front cover is held, the drive body will fall off, which may result in personal injury. ◆ Follow the proper ESD procedures when operating the servo drive. Failure to comply will result in damage to internal circuits of the servo drive.

1.1 Nameplate and Model Number



Model number

IS580 T 070 – R1C1 – H

IS580 series general-purpose servo drive

Code	Voltage Class
T	Three-phase 380–480 V
2T	Three-phase 220 V

Code	035	040	...	140	...
Rated output current	37	45	…	152	…

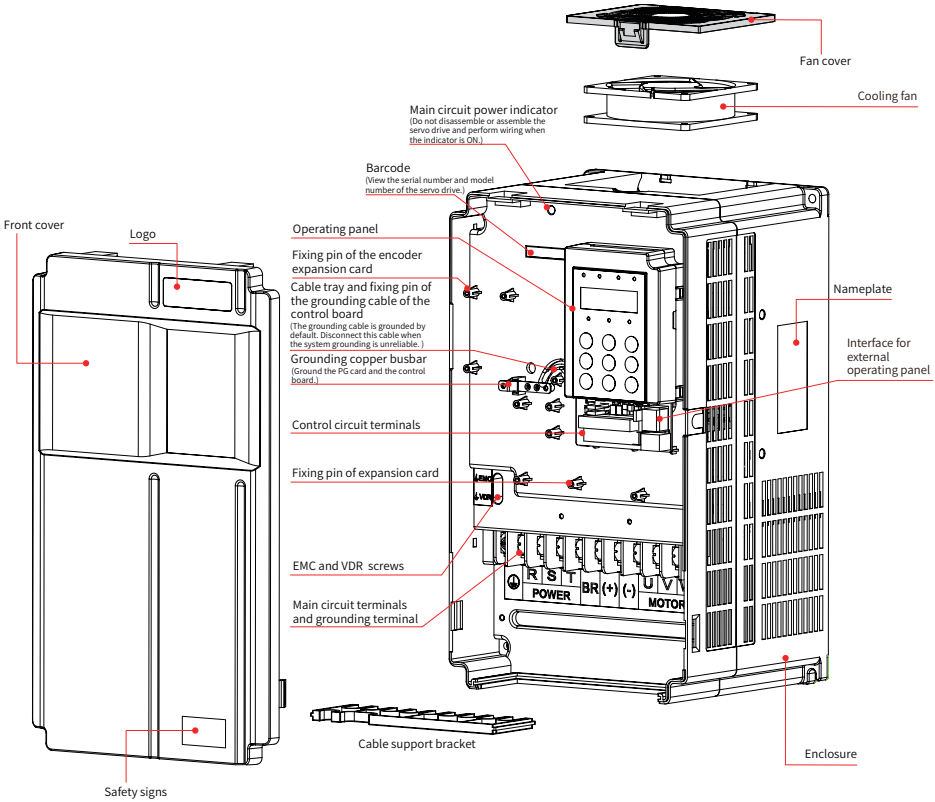
Code	Application
Blank	Default
H	Specialized for oil cooling

Code	Encoder Type
R1	Resolver
R1C1	23-bit absolute encoder

Figure 1-1 Nameplate and model number

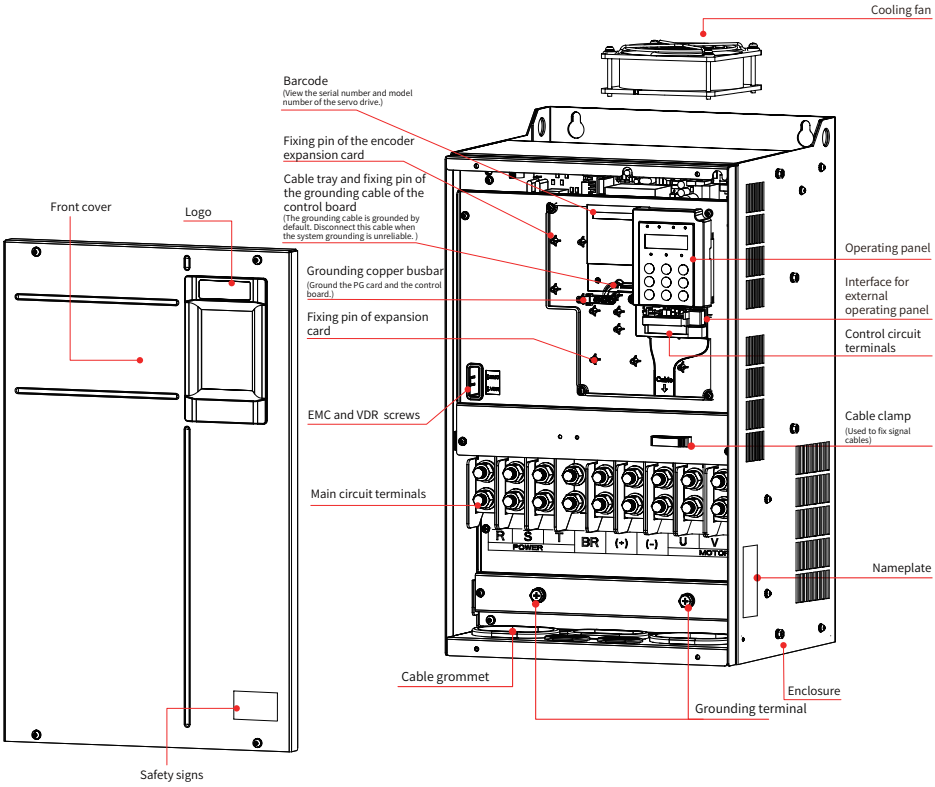
1.2 Components

Based on the voltage class and power rating, the IS580 can be divided into plastic structure and sheet metal structure, shown as follows.



Safety Sign		Description
⚠	📖	CAUTION! Read the user guide carefully before installation and operation.
⚡	10 min	DANGER! Do not remove the front cover at power-on or within 10 minutes after power-off.

Figure 1-2 Components diagram of IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, and IS580-2T020-R1 to IS580-2T070-R1



Safety Sign		Description
⚠	📖	CAUTION! Read the user guide carefully before installation and operation.
⚠	10 min	DANGER! Do not remove the front cover at power-on or within 10 minutes after power-off.

Figure 1-3 Components diagram of IS580T080-R1 to IS580T300-R1 and IS580-2T080-R1 to IS580-2T300-R1

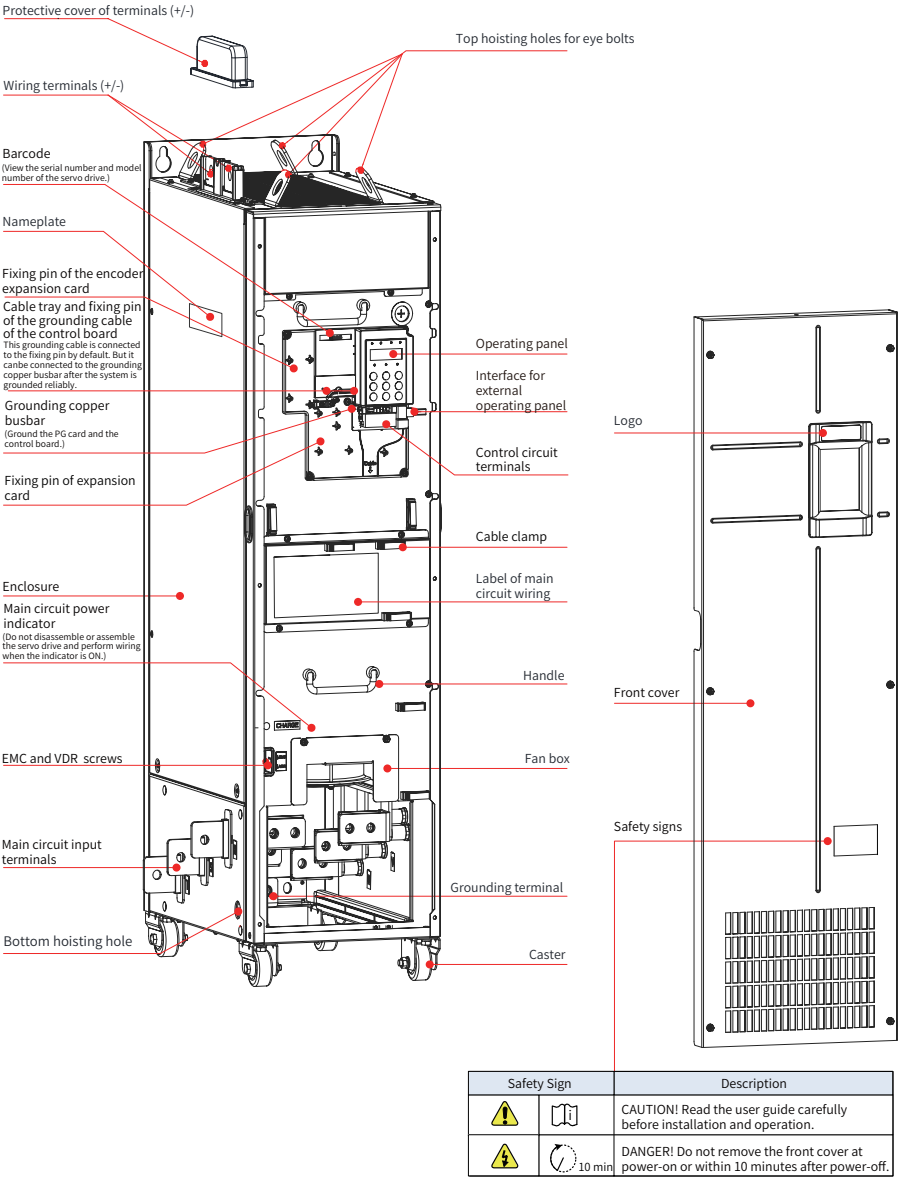


Figure 1-4 Components diagram of IS580T370-R1 to IS580T720-R1

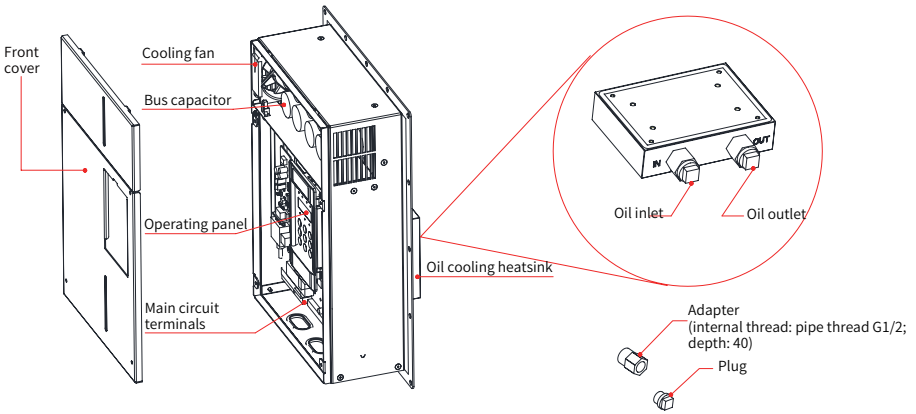


Figure 1-5 Components diagram of IS580T035-R1-H to IS580T70-R1-H

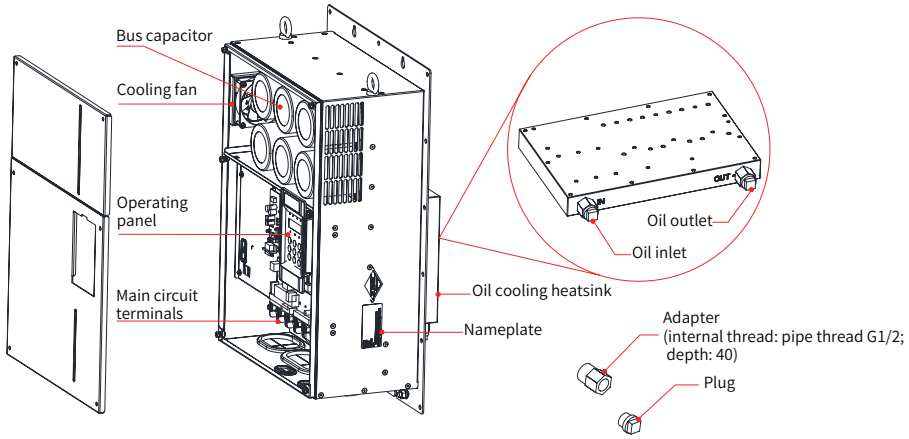


Figure 1-6 Components diagram of IS580T080-R1-H to IS580T140-R1-H

1.3 Technial Data

Table 1-1 Technial data

Item		Specification									
Model: IS580TXXX-R1, IS580TXXX-R1-H, IS580TXXX-R1-T		020	030	035	040	050	070	080	100	140	170
Applicable motor capacity (kW)		11	15	18.5	22	30	37	45	55	75	90
Input	Rated input current (A)	36.3	45.1	49.5	59	57	69	89	106	139	164
Output	Rated output current (A)	25	32	37	45	60	75	91	112	150	176
	Output voltage	Three-phase 0–480 V (≤ input voltage)									
	Max. output frequency	300 Hz (modified through parameter setting)									
	Carrier frequency	2.0–8.0 kHz (adjusted automatically based on the load features)									
	Overload capacity	150% rated current for 60s									
Power supply	Rated voltage & Rated frequency	Three-phase 380–480 VAC, 50/60 Hz; Three-phase 220 VAC, 50/60 Hz									
	Allowable voltage range	-15% to +10%; actual allowable range: 323–528 VAC									
	Allowable frequency range	±5%									
	Power capacity (kVA)	30	39	45	54	52	63	81	97	127	150
Thermal design power (kW)		0.45	0.55	0.65	0.81	1.01	1.20	1.51	1.80	1.84	2.08
Heatsink		Ambient temperature: < 45°C; Oil temperature: < 45°C; Oil speed: > 16 L/min (applicable only to oil-cooled servo drive)									

Item		Specification									
Model: IS580TXXX-R1, IS580TXXX-R1-T		210	250	300	370	420	460	520	580	650	720
Applicable motor capacity (kW)		110	132	160	200	220	250	280	315	355	400
Input	Rated input current (A)	196	240	287	365	410	441	495	565	617	687
Output	Rated output current (A)	210	253	304	377	426	465	520	585	650	725
	Output voltage	Three-phase 0–480 V (≤ input voltage)									
	Max. output frequency	300 Hz (modified through parameter setting)									
	Carrier frequency	2.0–8.0 kHz (adjusted automatically based on the load features)									
	Overload capacity	150% rated current for 60s									

Item		Specification									
Power supply	Rated voltage & Rated frequency	Three-phase 380–480 VAC, 50/60 Hz; Three-phase 220 VAC, 50/60 Hz									
	Allowable voltage range	-15% to +10%; actual allowable range: 323–528 VAC									
	Allowable frequency range	±5%									
	Power capacity (kVA)	179	220	263	334	375	404	453	517	565	629
Thermal design power (kW)		2.55	2.85	3.56	4.15	4.55	5.06	5.33	5.69	6.31	6.91

Item		Specification										
Model: IS580-2TXXX-R1		020	030	040	050	070	080	100	140	170	210	300
Applicable motor capacity (kW)		5.5	7.5	11	15	18.5	22	30	37	45	55	75
Input	Rated input current (A)	36.3	45.1	59	57	69	89	106	139	164	196	287
Output	Rated output current (A)	25	32	45	60	75	91	112	150	176	210	304
	Output voltage	Three-phase 0–220 V (≤ input voltage)										
	Max. output frequency	300 Hz (modified through parameter setting)										
	Carrier frequency	2.0–8.0 kHz (adjusted automatically based on the load features)										
	Overload capacity	150% rated current for 60s										
Power supply	Rated voltage & Rated frequency	Three-phase 220 VAC, 50/60 Hz										
	Allowable voltage range	-15% to +15%; actual allowable range: 187–242 VAC										
	Allowable frequency range	±5%										
	Power capacity (kVA)	15	20	25	26	32	41	49	64	75	90	132
Thermal design power (kW)		0.40	0.50	0.73	0.91	1.08	1.36	1.62	1.66	1.8	2.30	3.20
Heatsink		Ambient temperature: < 45°C; Oil temperature: < 45°C; Oil speed: > 16 L/min (applicable only to oil-cooled servo drive)										

Table 1-2 Technial specifications

Item		Specification	
Basic functions	Input frequency resolution	Digital setting: 0.01 Hz Analog setting: Max. frequency x 0.025%	
	Control mode	Sensorless vector control (SVC), feedback vector control (FVC), and voltage/frequency (V/f) control	
	Startup torque	SVC: 0.25 Hz/150% FVC: 0 Hz/180%	
	Speed range	1:200 (SVC)	1:1000 (FVC)
	Speed stability accuracy	±0.5% (SVC)	±0.02% (FVC)
	Torque control accuracy	FVC: ±3% SVC: ±5% above 10 Hz	
	Torque boost	Automatic torque boost Manual torque boost: 0.1% to 30.0%	
	V/f curve	Linear	
	Acceleration/ Deceleration curve	Linear or S-curve acceleration/deceleration mode Four groups of acceleration/deceleration time within the range of 0.0s to 6500.0s can be set	
	DC injection braking	Braking start frequency: 0.00 Hz to max. frequency Braking time: 0.0s to 36.0s Injection braking current: 0.0% to 100.0%	
	Built-in proportional–integral–derivative (PID)	Implements the PID function in the closed-loop control.	
	Automatic voltage regulation (AVR)	Keeps a constant output voltage automatically when the mains voltage changes.	
	Overvoltage/ Overcurrent stall control	Automatically limits the current and voltage during running to avoid frequent tripping caused by overvoltage/ overcurrent.	
Features	Fast current limit	Avoids frequent overcurrent of the servo drive.	
	Multiple field buses	Supports three field buses: Modbus RTU, CANopen and PROFIBUS-DP	
	Motor overtemperature protection	Supports KTY and PTC temperature protections.	
	Multiple encoder types	Supports the resolver and 23-bit absolute encoder	
	Powerful software tool	Supports parameter operations and provides a virtual oscilloscope that allows you to monitor the status of the servo drive.	

Item		Specification
Running	RUN command source	Supports the following command sources and allows different methods of switching between them: Operating panel Terminal I/O control Serial communication
	Frequency reference setting channel	Supports up to 10 frequency reference setting channels, including digital setting, analog voltage reference, analog current reference, pulse reference, and communication reference. Allows different methods of switching between these channels.
	Input terminals	Standard: Five digital input (DI) terminals Three analog input (AI) terminals, two of which support only 0–10 V voltage input and the other one supports 0–10 V voltage input or 0–20 mA current input.
	Output terminals	Standard: One digital output (DO) terminal Two relay output terminals Two analog output (AO) terminals that support 0–20 mA current output or 0–10 V voltage output.
Display and panel operations	LED display	Displays parameters.
	LCD display (optional)	Shows parameters in Chinese or English.
	Parameter copy	Allows quick parameter copy using the LCD operating panel (optional).
Protection functions	Phase loss protection	Input/Output phase loss protection
	Instantaneous overcurrent protection	The servo drive stops when the instantaneous current exceeds 250% of the rated output current.
	Overvoltage protection	The servo drive stops when the DC voltage of the main circuit is above 820 V.
	Undervoltage protection	The servo drive stops when the DC voltage of the main circuit is below 350 V.
	Overtemperature protection	Protection is triggered when inverter bridge overtemperature occurs.
	Overload protection	The servo drive stops after running at 150% rated current for 60s.
	Overcurrent protection	The servo drive stops when the current exceeds 2.5 times rated current.
	Braking protection	Braking unit overload protection and regenerative resistor short circuit protection
	Short circuit protection	Output interphase short circuit protection and protection against output short circuit to ground

Item		Specification
Environment	Operating location	Indoor, free from direct sunlight, dust, corrosive or combustible gases, oil mist, vapor, drip, or salt
	Altitude	1000 m or below, de-rated by 1% for each 100 m higher if the altitude exceeds 1000 m Max. altitude: 3000 m
	Ambient temperature	-10°C to +40°C, de-rated by 1.5% for each 1°C higher if the ambient temperature exceeds 40°C Max. temperature: 50°C
	Humidity	Below 95% RH, without condensation
	Vibration	< 5.9 m/s^2 (1 g)
	Storage temperature	-20°C to +60°C

1.4 Outline and Dimensions

1.4.1 IS580T020-R1 to IS580T300-R1 and IS580-2T020-R1 to IS580-2T300-R1

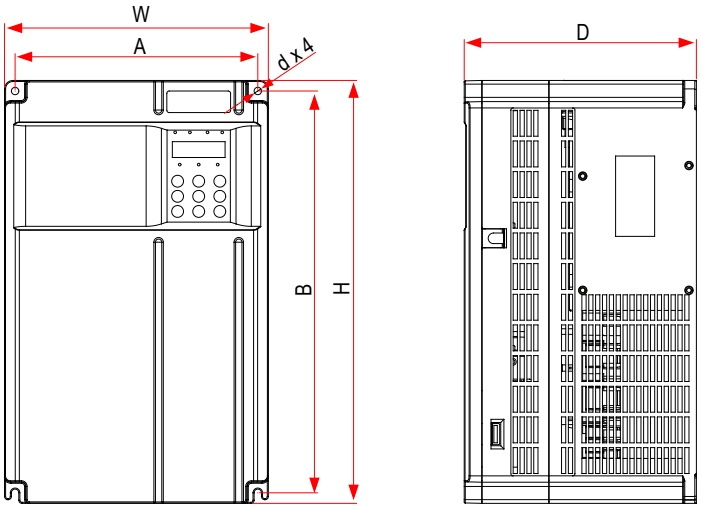


Figure 1-7 Outline and mounting dimensions of IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, and IS580-2T020-R1 to IS580-2T070-R1

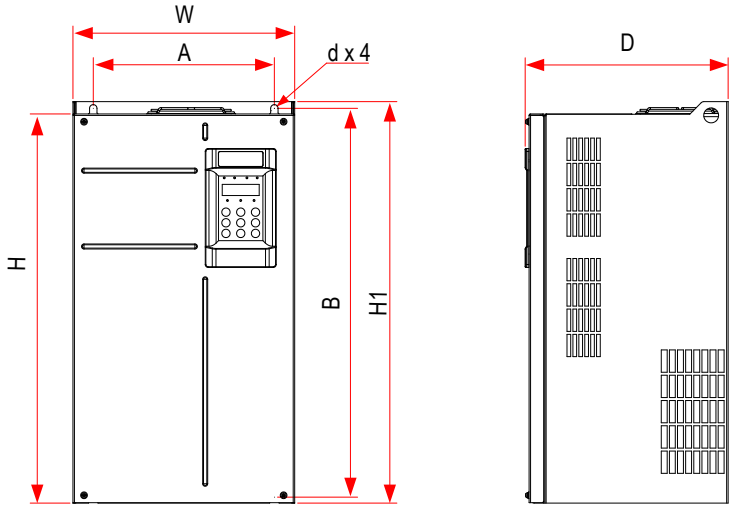


Figure 1-8 Outline and mounting dimensions of models with sheet metal structure (IS580T080-R1 to IS580T300-R1, IS580-2T080-R1 to IS580-2T300-R1)

Table 1-3 Outline and mounting hole dimensions of IS580T020-R1 to IS580T300-R1 and IS580-2T020-R1 to IS580-2T300-R1

Drive Model	Mounting Hole Dimensions (mm)		Outline Dimensions (mm)				Mounting Hole Diameter (mm)	Screw	Torque (N·m)
	A	B	H	H1	W	D			
IS580T020-R1 IS580T020-R1-T IS580-2T020-R1	195	335	350	/	210	192	Ø6	M5	2.8
IS580T030-R1 IS580T030-R1-T IS580-2T030-R1									
IS580T035-R1 IS580T035-R1-T									
IS580T040-R1 IS580T040-R1-T IS580-2T040-R1									
IS580T050-R1 IS580-2T050-R1	230	380	400	/	250	220	Ø7	M6	4.8
IS580T070-R1 IS580-2T070-R1									

Drive Model	Mounting Hole Dimensions (mm)		Outline Dimensions (mm)				Mounting Hole Diameter (mm)	Screw	Torque (N·m)
	A	B	H	H1	W	D			
IS580T080-R1 IS580-2T080-R1	245	523	525	542	300	275	Ø10	M8	13
IS580T100-R1 IS580-2T100-R1									
IS580T140-R1 IS580-2T140-R1	270	560	554	580	338	315	Ø10	M8	13
IS580T170-R1 IS580-2T170-R1									
IS580T210-R1 IS580-2T210-R1									
IS580T250-R1	320	890	874	915	400	320	Φ10	M8	13
IS580T300-R1 IS580-2T300-R1									

1.4.2 IS580T035-R1-H to IS580T140-R1-H

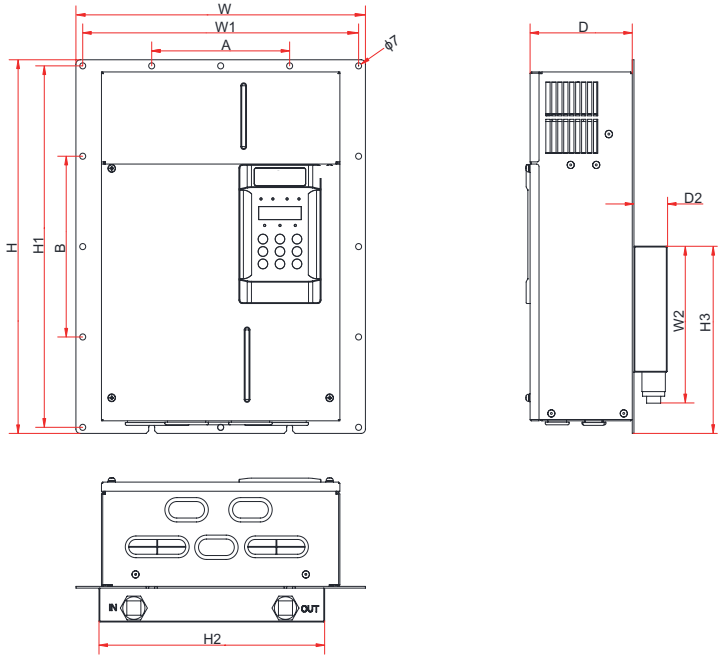


Figure 1-9 Outline and mounting dimensions of IS580T035R1-H to IS580T70-R1-H

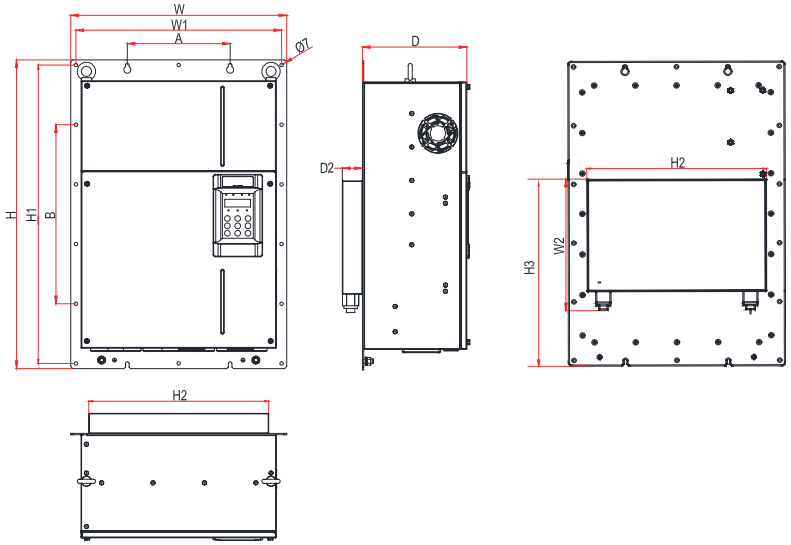


Figure 1-10 Outline and mounting dimensions of IS580T080-R1-H to IS580T140-R1-H

Table 1-4 Outline and mounting hole dimensions of IS580T035-R1-H to IS580T140-R1-H

Drive Model	Servo Drive							Oil Cooling Heatsink					Mounting Hole Diameter (mm)	Screw	Torque (N·m)
	Mounting Hole Dimensions (mm)				Outline Dimensions (mm)			H3	W2	H2	D2	Oil Inlet/ Outlet Adapter			
	A	W1	B	H1	W	H	D								
IS580T035-R1-H	162	324	208	416	340	430	122	215.5	180.5	170	39	Internal thread: pipe thread G 1/2, depth: 40	φ7	M6	4.8
IS580T040-R1-H															
IS580T050-R1-H									180.5	265	39				
IS580T070-R1-H															
IS580T080-R1-H	200	400	348	580	420	600	203	367	255.8	347	39		φ7	M6	4.8
IS580T100-R1-H															
IS580T140-R1-H															

1.4.3 IS580T370-R1 to IS580T720-R1

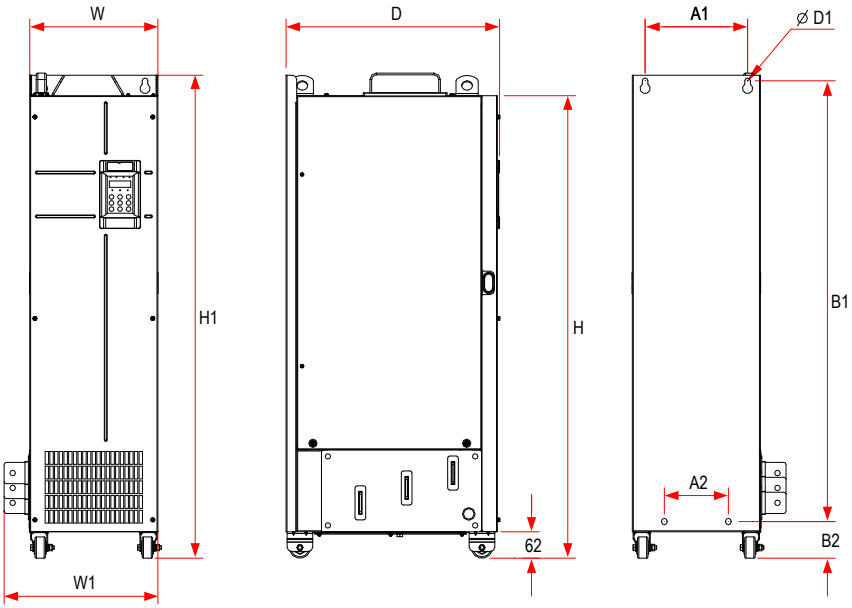


Figure 1-11 Outline and mounting dimensions of models with sheet metal structure (IS580T370-R1 to IS580T720-R1)

Table 1-5 Outline and mounting hole dimensions of IS580T370-R1 to IS580T720-R1

Drive Model	Mounting Hole Dimensions (mm)				Outline Dimensions (mm)					Mounting Hole Diameter (mm)	Screw	Torque (N·m)
	A1	A2	B1	B2	H	H1	W	W1	D	D1		
IS580T370-R1	240	150	1035	86	1086	1134	300	360	500	ϕ13	M10	20
IS580T420-R1												
IS580T460-R1	225	185	1175	97	1248	1284	330	390	545	ϕ13	M10	20
IS580T520-R1												
IS580T580-R1	240	200	1280	101	1355	1405	340	400	545	ϕ16	M12	35
IS580T650-R1												
IS580T720-R1												

1.4.4 Packaging Dimensions and Product Weight (with Packaging Material)

No.	Drive Model	Packaging Type	Outer Packaging Dimensions (L x W x H) (mm)	Net Weight (kg)	Gross Weight (kg)
1	IS580T020-R1 IS580-2T020-R1 IS580T030-R1 IS580-2T030-R1 IS580T035-R1 IS580T040-R1 IS580-2T040-R1	Carton + EPE pearl cotton	465 x 352 x 322	7.58	8.68
2	IS580T050-R1 IS580-2T050-R1 IS580T070-R1 IS580-2T070-R1	Carton + EPE pearl cotton	530 x 386 x 367	15.5	17.2
3	IS580T080-R1 IS580-2T080-R1 IS580T100-R1 IS580-2T100-R1	Carton + EPE pearl cotton +Plywood pallet	715 x 435 x 427	34.5	42
4	IS580T140-R1 IS580-2T140-R1 IS580T170-R1 IS580-2T170-R1 IS580T210-R1 IS580-2T210-R1	Carton + EPE pearl cotton +Plywood pallet	742 x 480 x 467	51	59
5	IS580T250-R1 IS580T300-R1 IS580-2T300-R1	Carton + Paper cushion + Plywood pallet	1030 x 465 x 482	85	98
6	IS580T370-R1 IS580T420-R1	Carton + Paper cushion + Plywood pallet	1220 x 495 x 680	110	128
7	IS580T460-R1 IS580T520-R1	Carton + Paper cushion + Plywood pallet	1370 x 525 x 730	155	168
8	IS580T580-R1 IS580T650-R1 IS580T720-R1	Wooden box	1540 x 550 x 740	185	220
9	IS580T035-R1-H	Carton + EPE pearl cotton	550 x 460 x 250	14	15
10	IS580T040-R1-H				
11	IS580T050-R1-H			16.5	17.5
12	IS580T070-R1-H				
13	IS580T080-R1-H	Wooden box + EPE pearl cotton	680 x 480 x 410	42	46
14	IS580T100-R1-H			43	47
15	IS580T140-R1-H			44.5	48.5
Note: There is a tolerance of ±3 mm for outer packaging.					

1.5 Options

Peripheral options include the braking unit, various expansion cards, and external operating panel, as listed in the following table. For details about their usage, see the instructions of each option. If any optional is required, specify it in your order.

Table 1-6 Options of the IS580

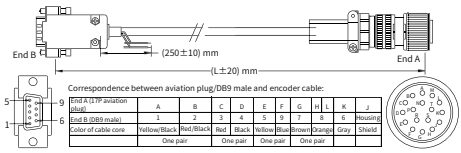
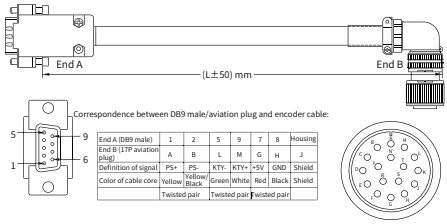
Component	Model	Function	Remarks
External braking unit	MDBUN	◆ External braking unit for models of 90 kW or above ◆ Built-in braking unit for models of 11 kW to 75 kW	Parallel connection of multiple servo drives for models of 90 kW or above
RS485 communication card	MD38TX1	Supports Modbus communication card with photocoupler isolation.	Available for all models
CANopen communication expansion card	MD38CAN1	Supports CANopen communication.	Available for all models
Multi-functional PG card	MD38PGMD	Supports differential input, collector input, push-pull input, differential output, and collector output.	Available for all models
Resolver interface card	S58-PG-B1	◆ Applicable to the resolver with an excitation frequency of 10 kHz ◆ DB9 interface equipped	Available for all models
23-bit PG card	ES510-PG-CT1	◆ Used together with 23-bit absolute encoder ◆ DB9 interface equipped	Available for all models
LED operating panel	MD32NKE1	LED display and operating panel	Available for MD series Provides RJ45 interface
External LCD operating panel	SOP-20-810	External LCD display and operating panel	Used to copy and modify parameters.
Extension cable	MDCAB	◆ Standard 8-core cable ◆ Connected to MD32NKE1, MD32KC, MDCP, or SOP-20-810	Standard length: 3 m
Through-hole mounting bracket	MD500-AZJ-A1T*	Meets the requirements of middle through-hole mounting.	Each model has corresponding mounting bracket. For details, see "3.1.6 Through-hole Mounting Brackets" on page 59.

Component	Model	Function	Remarks
Cable fixation bracket	MD500-AZJ-A2T*	Meets the requirements of secondary fixation of power cables and 360° grounding of the shield.	Each model has corresponding mounting bracket. For details, see "3.2.2 Functions of Main Circuit Terminals and Precautions" on page 65.

Table 1-7 Model list of motors, drives, cables, and PG cards

Model or Series of the Servo Motor	Frame	Drive	Resolver Cable (** Indicates Cable Length)	PG Card
ESMG1/ISMG1-XXXXXXX-R1A1FA	100	IS580TXXX-R1	S58-L-P31-**	S58-PG-B1
ESMG2/ISMG2-XXXXXXX-R1A1FA	200		S58-L-P31-**	
ESMG1/ISMG1-XXXXXXX-A3A1FA	100	IS580TXXX-R1C1	S58-P10-**	ES510-PG-CT1
ESMG2/ISMG2-XXXXXXX-A3A1FA	200		S58-P10-**	

Table 1-8 Encoder cables

Cable Name	Cable Model	Cable Length (mm)	Cable Outline
Resolver cables (with aviation plug)	S58-L-P31-3.0	3,000	
	S58-L-P31-6.0	6,000	
	S58-L-P31-8.0	8,000	
	S58-L-P31-12.0	12,000	
	S58-L-P31-15.0	15,000	
	S58-L-P31-20.0	20,000	
	S58-L-P31-25.0	25,000	
23-bit absolute encoderr cables (with aviation plug)	S58-P10-3.0	3,000	
	S58-P10-6.0	6,000	
	S58-P10-7.0	7,000	
	S58-P10-8.0	8,000	
	S58-P10-12.0	12,000	
	S58-P10-15.0	15,000	
	S58-P10-25.0	25,000	

2 System Connections

Safety Instruction
DANGER ◆ Never perform wiring at power-on. Failure to comply will result in an electric shock. Always keep the circuit breaker in OFF state.
WARNING ◆ When installing the servo drive in an enclosed cabinet or casing box, use the cooling fan or air conditioner to keep the air inlet temperature below 50°C. Failure to comply will result in overheat or even a fire.
CAUTION ◆ During installation, use a paper or cloth to cover the upper part of the servo drive to prevent metal filings, oil, and water from entering into the servo drive when drilling holes. ◆ If foreign matters enter into the servo drive, the servo drive may get faulty. ◆ After the installation is completed, remove the paper or cloth. Otherwise, the ventilation will get poor and the drive will overheat abnormally. ◆ Follow the proper ESD procedures when operating the servo drive. Failure to comply will result in damage to internal circuits of the servo drive. ◆ When operating the motor out of the speed range, contact the motor manufacturer. ◆ Confirm the load torque characteristics of the machine to be connected because the torque characteristics are different when the machine is driven by the drive and by the mains power. Pay attention to this point when selecting the capacity of the servo drive. In addition, when the distance between the motor and the servo drive exceeds 100 m, the motor torque decreases with the decrease of the voltage. In this case, use a cable thick enough to connect the motor and the drive or contact Inovance's technical personnel. ◆ Never lift the drive when the cover is removed. Failure to comply will result in damage to the PCB and the terminal block.

2.1 Connection of Peripherals

When using the IS580 to control the hydraulic system with PMSM, install peripherals on both the input and output sides of the servo drive to ensure system's safety and stability. The structure of systems with three-phase 380–480 V servo drive of 11 kW or above is as follows.

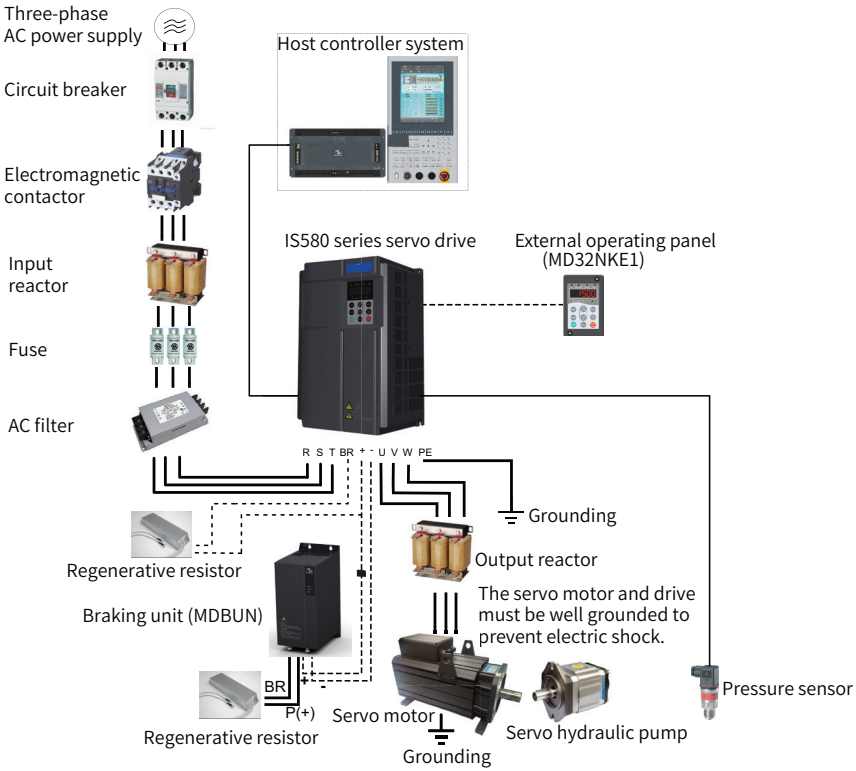


Figure 2-1 Electrical system configuration with IS580

NOTE

- The preceding figure is just a connection diagram of peripherals and cannot be used as a guide for peripheral selection. For the selection of peripherals, see *"8 Selection of Electrical Peripherals" on page 145*.

2.2 Usage of Peripherals

Table 2-1 Usage description of electrical peripherals

Name	Installation Position	Function Description
Circuit breaker	Between the power supply and the drive input side	Short circuit breaker: Cuts off the power supply when an overcurrent occurs on downstream devices to prevent accidents.
		RCD: Provides protection against potential high leakage current during running of the drive to prevent an electric shock or even a fire. Select a proper RCD according to the field situation.
(Electromagnetic) Contactor	Between the air switch and the drive input side	◆ Do not power on or power off the drive frequently by switching the contactor on and off (the time interval cannot be less than 1 h). ◆ Do not use the contactor to directly start/ stop the drive.
Input reactor	On the drive input side	◆ Improves the power factor of the input side. ◆ Eliminates high harmonics of the input side effectively to prevent other devices from being damaged due to the distortion of the voltage waveform. ◆ Eliminates the input current unbalance caused by inter-phase unbalance.
Fuse	Between the power supply and the drive input side	Prvents accidents in case of short circuit and protect downstream semiconductor components.
AC filter	On the drive input side	◆ Reduces the external conduction and radiation interference generated by the drive. ◆ Decreases the conduction interference flowing from the power supply to the drive and improves the anti-interference capacity of the drive.
Regenerative resistor	Models of 75 kW or below	For models of 75 kW or below, use a regenerative resistor to absorb regenerative energy during motor deceleration.
Braking unit	Models of 90 kW or above	For models of 90 kW or above, use the braking unit MDBUN provided by Inovance and the recommended regenerative energy to absorb regenerative energy during motor deceleration.

Name	Installation Position	Function Description
Output reactor (du/dt filter)	Between the drive output side and the motor (close to the drive side)	The output side of the servo drive usually has many high harmonics. When the distance between the motor and the drive is too long, large distributed capacitance exists in the circuit. Certain harmonics may cause resonance in the circuit, which will: ◆ degrade the motor insulation performance, causing damage to the motor in the long run. ◆ generate large leakage current, causing frequent drive protection trips. If the distance between the drive and the motor is greater than 50 m, install an AC output reactor.
Output ferrite core	On the drive output side (close to the drive side)	Reduces the bearing current.
Host controller system	Part of control signals from the host controller is connected to the drive	◆ Controls the drive. ◆ Sends various references to the drive. ◆ Exchanges information with the drive.
Servo motor	On the drive output side	Selects an appropriate motor according to the recommendation.
Servo hydraulic pump	Connected to the servo motor	Provides the hydraulic system with flow and pressure.
Pressure sensor	Installed in the oil outlet circuit, with feedback signals connected to the drive	Provides hydraulic circuits with pressure feedback analog signals.
DC reactor	Built-in DC reactor is offered for models of 30 kW or above	◆ Improves the power factor of the input side. ◆ Increases the efficiency and thermal stability of the servo drive. ◆ Eliminates the impact of high harmonics of the input side on the servo drive, reducing the external conduction and radiation interference.



NOTE

◆ Do not install the capacitor or SPD on the drive output side. Failure to comply will cause faults of the drive or damage to the capacitor and SPD.
◆ Harmonics exist in the input/output (main circuits) of the drive, which may interfere with the communication device connected to the drive. Therefore, install an AC input filter to minimize interference.

3 Installation and Wiring

3.1 Installation

3.1.1 Installation Environment

1) Ambient temperature: The ambient temperature substantially affects the service life of the servo drive. Do not operate the servo drive outside the allowable ambient temperature (-10°C to +50°C).

2) Install the servo drive on the surface of a nonflammable object. Ensure that there is sufficient space around for heat dissipation because a large amount of heat will be generated during the operation of the servo drive. Install the servo drive vertically on the support by using the screws.

3) Install the servo drive in a place without strong vibration. The vibration cannot exceed 1 g. Keep the servo drive away from devices such as punch presses.

4) Install the servo drive in a place free from direct sunlight, high humidity, and condensation.

5) Install the servo drive in a place free from corrosive, flammable, and explosive gases.

6) Install the servo drive in a place free from oil dirt and dust.

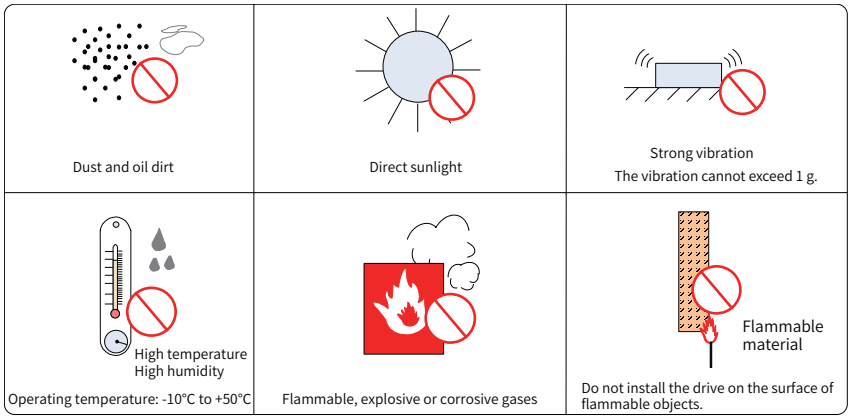


Figure 3-1 Requirements for the installation environment

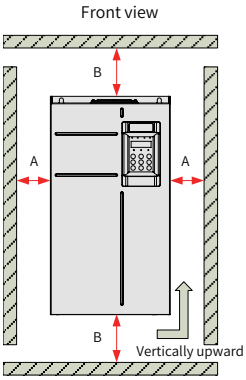
7) The servo drive must be installed in a cabinet which is used in a final system with a fireproof enclosure providing both electrical and mechanical protections. The installation must conform to local laws and regulations and related IEC requirements.

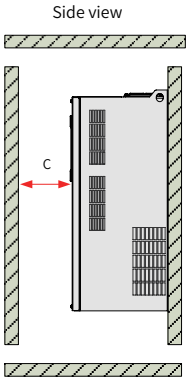
3.1.2 Mounting Clearance and Direction

1) Mounting clearance

The clearance that needs to be reserved depends on the power rating of the servo drive.

■ Mounting of a single drive

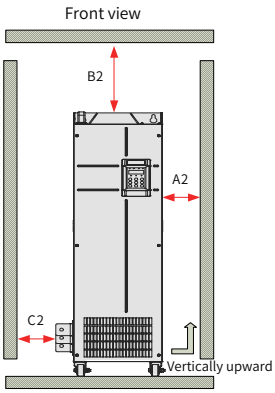


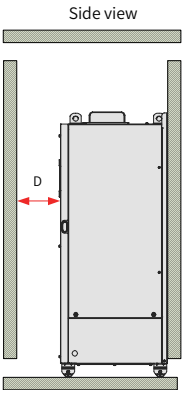


Mounting clearance requirements

Power Rating	Clearance Requirement (unit: mm)		
11–22 kW	A ≥ 10	B ≥ 200	C ≥ 40
30–37 kW	A ≥ 50	B ≥ 200	C ≥ 40
45–160 kW	A ≥ 50	B ≥ 300	C ≥ 40

Figure 3-2 Mounting clearance for a single drive (IS580T020-R1 to IS580T300-R1, IS580-2T020-R1 to IS580-2T300-R1, and IS580T035-R1-H to IS580T140-R1-H)





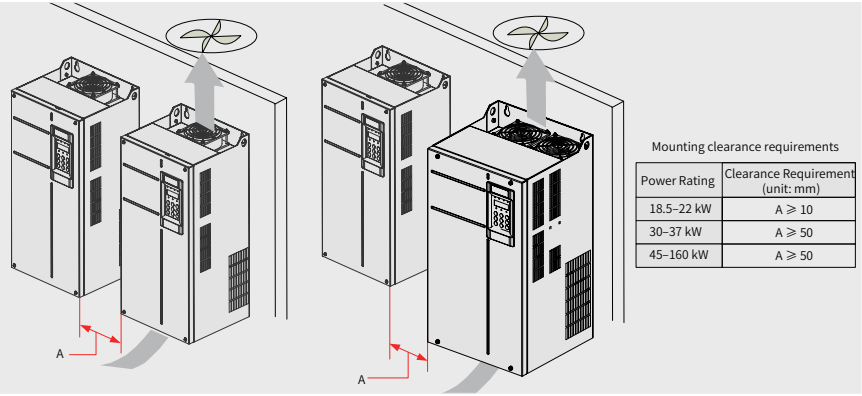
Mounting clearance requirements

Power Rating	Clearance Requirement (unit: mm)			
200–400 kW	A2 ≥ 10	B2 ≥ 250	C2 ≥ 20	D ≥ 20

Figure 3-3 Mounting clearance for a single drive (IS580T370-R1 to IS580T720-R1)

■ Multi-drive mounting

The servo drive dissipates heat from bottom to top. If multiple servo drives are connected together, install them side by side.



Mounting clearance requirements

Power Rating	Clearance Requirement (unit: mm)
18.5–22 kW	A ⩾ 10
30–37 kW	A ⩾ 50
45–160 kW	A ⩾ 50

Figure 3-4 Clearance for multi-drive mounting

For applications where a servo drive needs to be installed above another servo drive, install an air guide plate to divert the air from the lower servo drive away from the upper one. Otherwise, an overtemperature or overload fault will occur.

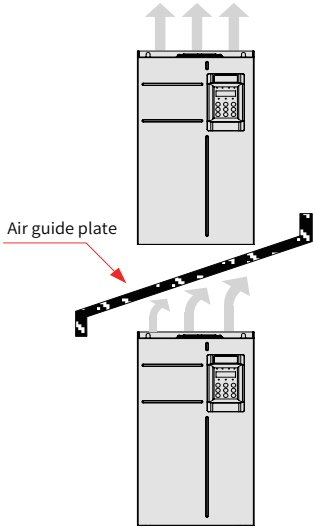


Figure 3-5 Mounting of one servo drive above another

NOTE

◆ Models IS580T370-R1 to IS580T720-R1 support only the installation of a single servo drive in the cabinet. Contact Inovance if side-by-side installation of multiple drives is required.

2) Mounting direction

Install the servo drive in an upright direction. Never install the drive in horizontal, side, upside-down or other directions.

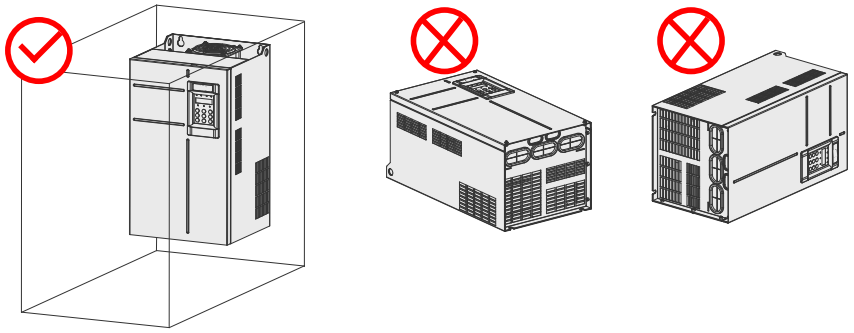


Figure 3-6 Mounting direction diagram

3.1.3 Installation of 11–160 kW Servo Drive

The installation screw and torque of the servo drive are as follows:

Drive Model		Oil Cooling Servo Drive	Screw	Torque (N·m)
Three-phase 380–480 V	Three-phase 220–240 V			
IS580T020-R1	IS580-2T020-R1	-	M5	2.8
IS580T030-R1	IS580-2T030-R1			
IS580T035-R1	-			
IS580T040-R1	IS580-2T040-R1			
IS580T050-R1	IS580-2T050-R1	IS580T035-R1-H IS580T040-R1-H IS580T050-R1-H IS580T070-R1-H IS580T080-R1-H IS580T100-R1-H IS580T140-R1-H	M6	4.8
IS580T070-R1	IS580-2T070-R1			
IS580T080-R1	IS580-2T080-R1	-	M8	13
IS580T100-R1	IS580-2T100-R1			
IS580T140-R1	IS580-2T140-R1			
IS580T170-R1	IS580-2T170-R1			
IS580T210-R1	IS580-2T210-R1			
IS580T250-R1	-			
IS580T300-R1	IS580-2T300-R1			
IS580T370-R1	-	-	M10	13
IS580T420-R1	-			
IS580T460-R1	-			
IS580T520-R1	-			

Drive Model		Oil Cooling Servo Drive	Screw	Torque (N·m)
Three-phase 380–480 V	Three-phase 220–240 V			
IS580T580-R1	-	-	M12	13
IS580T650-R1	-			
IS580T720-R1	-			

Depending on the power rating, the IS580 can be divided into plastic structure (models: IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, and IS580-2T020-R1 to IS580-2T070-R1) and sheet metal structure (models: IS580T080-R1 to IS580T300-R1 and IS580-2T080-R1 to IS580-2T300-R1). According to the applications, you can install the IS580 in the method of either backplate mounting or through-hole mounting (heatsink installed outside the cabinet).

1) Backplate mounting

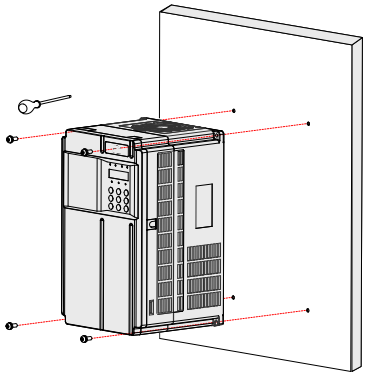


Figure 3-7 Backplate mounting of IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, and IS580-2T020-R1 to IS580-2T070-R1

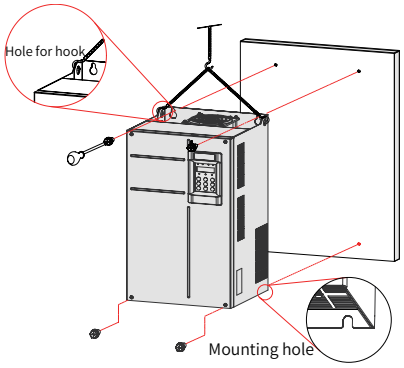


Figure 3-8 Backplate mounting of IS580T080-R1 to IS580T300-R1 and IS580-2T080-R1 to IS580-2T300-R1

NOTE

◆ It is forbidden to fasten only the top two retaining nuts of the servo drive because the servo drive may fall and be damaged due to uneven force after long-time running.

2) Through-hole mounting

■ IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, and IS580-2T020-R1 to IS580-2T070-R1

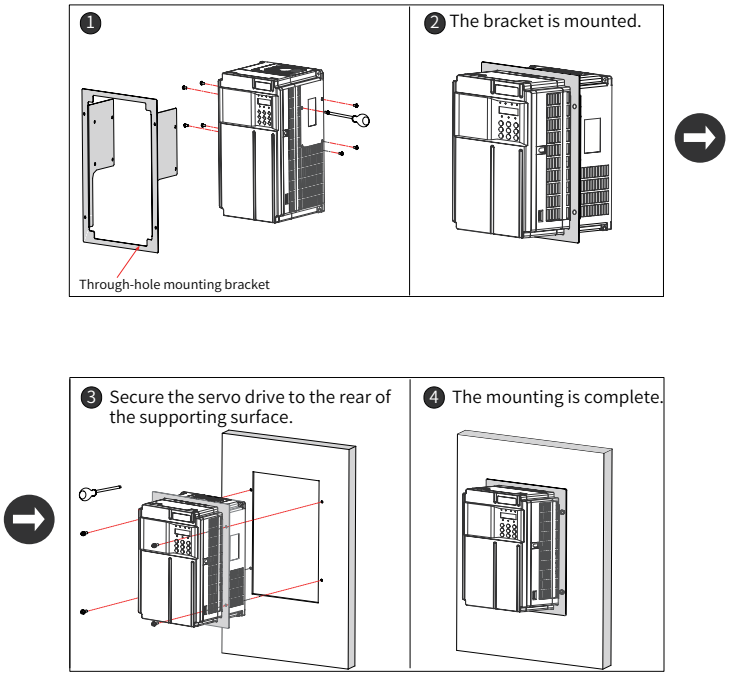


Figure 3-9 Through-hole mounting of IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, and IS580-2T020-R1 to IS580-2T070-R1

■ IS580T080-R1 to IS580T300-R1 and IS580-2T080-R1 to IS580-2T300-R1

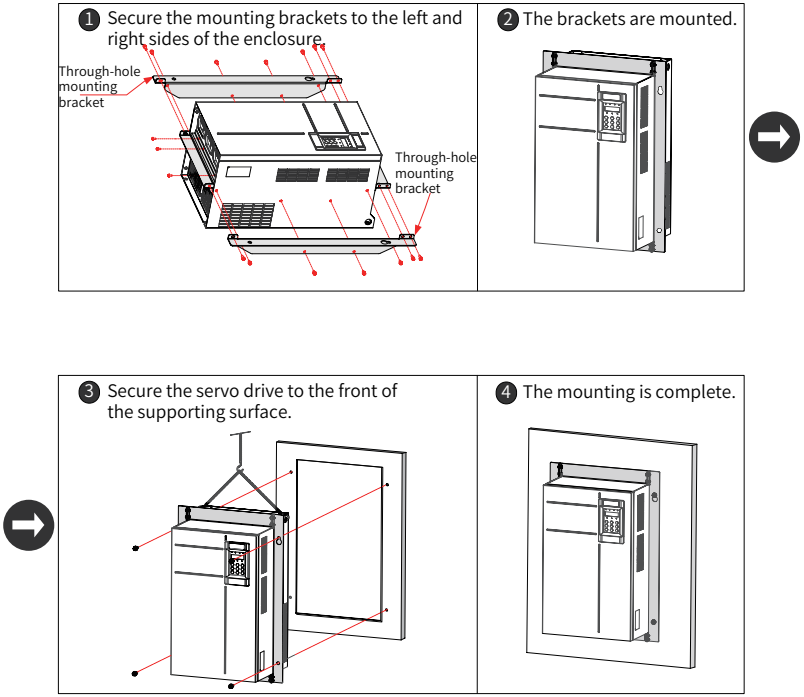


Figure 3-10 Through-hole mounting of IS580T080-R1 to IS580TIS580T300-R1 and IS580-2T080-R1 to IS580-2T300-R1

■ IS580T035-R1-H to IS580T70-R1-H and IS580T080-R1-H to IS580T140-R1-H

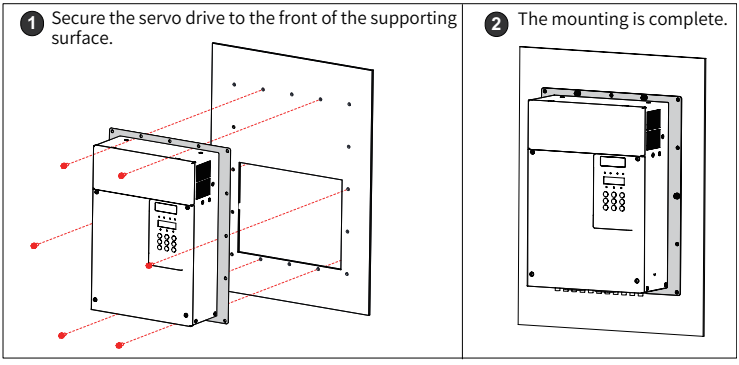


Figure 3-11 Through-hole mounting of IS580T035-R1-H to IS580T70-R1-H and IS580T080-R1-H to IS580T140-R1-H

3.1.4 Installation of 200–400 kW Servo Drive in the Cabinet

1) Ventilation

For IS580T370-R1 to IS580T720-R1, only one drive can be installed in a cabinet. Reserve enough ventilation space when installing these drives. Select a proper installation mode based on the product model and application scenarios.

■ Direct discharging cabinet (without fan on the top)

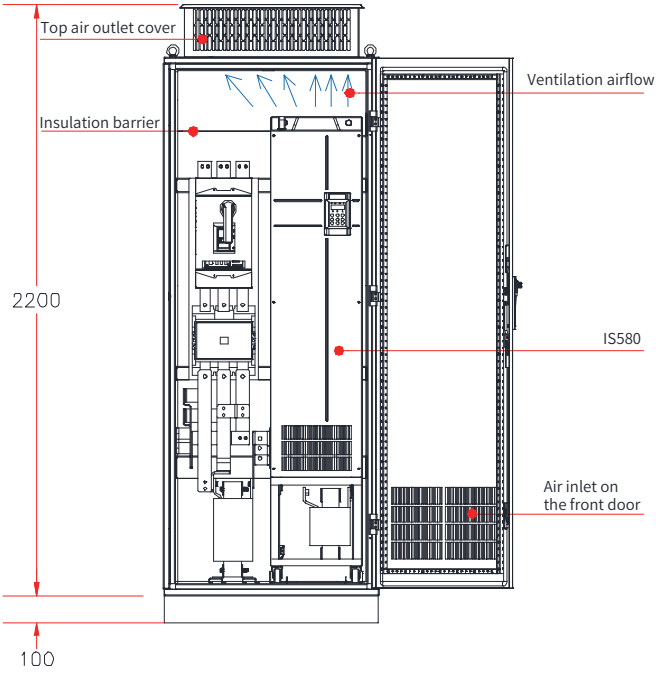


Figure 3-12 Direct discharging cabinet

Table 3-2 Ventilation parameters of direct discharging cabinet

Model	Quantity of Fan	Total Air Volume (CFM)	Effective Area of Air Inlet (mm^2)	Effective Area of Air Outlet (mm^2)
IS580T370-R1	2	586	31809	50894
IS580T420-R1	2	722	31809	50894
IS580T460-R1	3	789	47713	76341
IS580T520-R1	3	882	47713	76341
IS580T580-R1	3	644	47713	76341
IS580T650-R1	3	796	47713	76341
IS580T720-R1	3	796	47713	76341
Notes: CFM = 0.0283 m^3/min Effective area means through-hole area.				

■ Cabinet with fan on the top

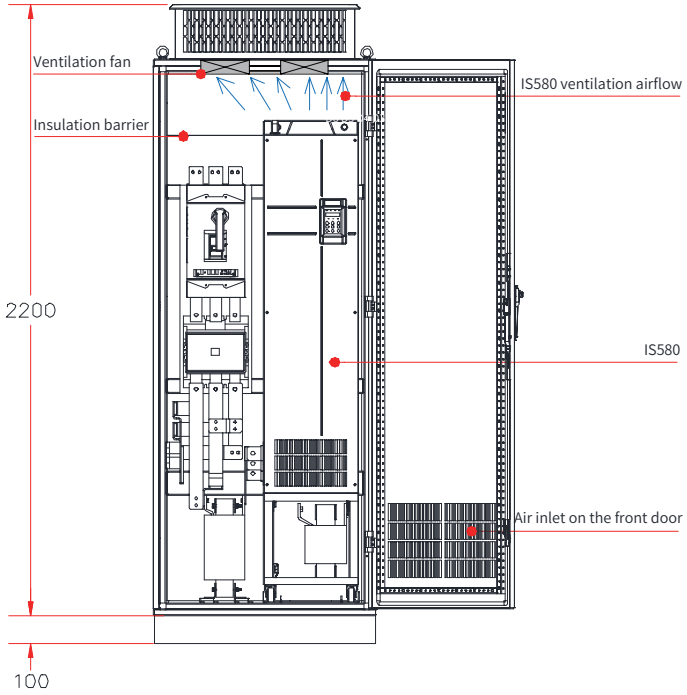


Figure 3-13 Cabinet with fan on the top

Table 3-3 Ventilation parameters of cabinet with fan on the top

Model	Quantity of Fan	Total Air Volume (CFM)	Effective Area of Air Inlet (mm^2)	Max. Air Volume Required by the Top Fan (CFM)	Effective Area of Air Outlet (mm^2)
IS580T370-R1	2	586	31809	703	S = 0.942 x N x (Dout2-DHUB2) In the preceding formula, N is the quantity of top fans, Dout is the diameter of the top fan, and DHUB is the diameter of the top fan center HUB.
IS580T420-R1	2	722	31809	866	
IS580T460-R1	3	789	47713	947	
IS580T520-R1	3	882	47713	1058	
IS580T580-R1	3	644	47713	773	
IS580T650-R1	3	796	47713	955	
IS580T720-R1	3	796	47713	955	
Notes: CFM = 0.0283 m^3/min Effective area means through-hole area.					

As shown in the following figure, an insulation barrier is required so that hot air can discharge from the top air outlet rather than circulate inside the cabinet.

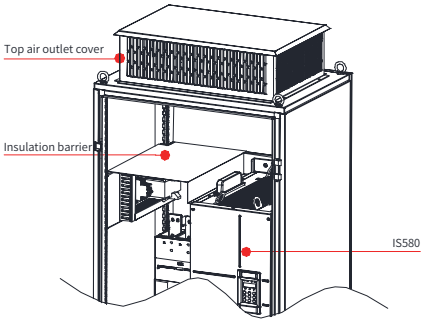


Figure 3-14 Insulation barrier in the cabinet

2) Precautions

A nine-folding AL cabinet (PS cabinet) is recommended for drive installation. Before installing the servo drive, mount the bottom mounting bracket and guide rails in the cabinet. Additionally, prepare a mounting beam with reserved holes (see *"1.4 Outline and Dimensions" on page 28* for the positions and dimensions of holes) to fix the servo drive. Enough space must be reserved inside the cabinet for connecting the copper busbar on the servo drive.

You can push the servo drive into or pull the servo drive out the cabinet through the four casters. Make sure to align the casters to the guide rails before push-in and pull-out. To ensure safety, arrange two workers to perform such operations.

Safety Instruction
CAUTION ◆ See *Figure 3-3* for mounting clearance requirements. Ensure there is sufficient ventilation space for both the servo drive and other devices in the cabinet, as shown in *Figure 3-12* and *Figure 3-13*. ◆ Use an extended rod sleeve to operate the copper busbar terminal of main circuit power cables. ◆ Make sure to align the casters to the guide rails before push-in and pull-out. To ensure safety, arrange two workers to perform push-in or pull-out, as shown in *Figure 3-21* and *Figure 3-22*. ◆ See *Figure 3-15* for cabinet layout before installing the servo drive in the cabinet. The cabinet dimensions is 2200 x 800 x 600 (unit: mm), with the top ventilation cover (height: 200 mm) included. A cabinet base with a height of 100 mm is required for installation. An insulation barrier must be installed at the top of the cabinet to avoid the circulation of ventilation airflow of IS580 in the cabinet. Additionally, air inlet openings must be provided at the bottom of the cabinet door. ◆ See *"1.4 Outline and Dimensions" on page 28* for the dimensions of the mounting bracket (delivered with the servo drive). Ensure that the guide rails have enough strength and stiffness. ◆ After push-in, remove the baffle on the air outlet of the servo drive to prevent overtemperature caused by the accumulation of ventilation air.

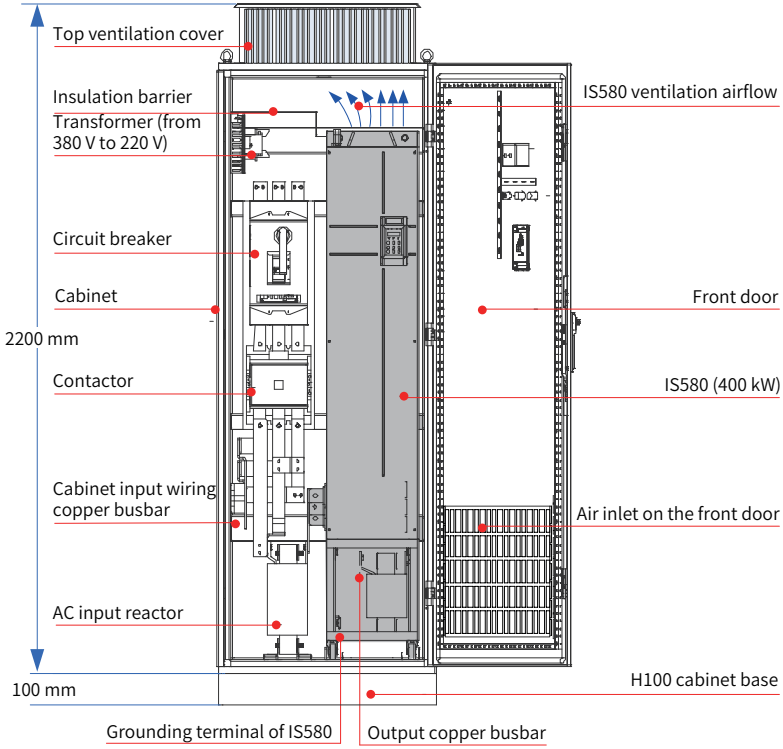


Figure 3-15 Recommended cabinet layout

3) Installation steps

Step	Operation
1	Install the beam used to fix the servo drive in the nine-folding AL cabinet, as shown in *Figure 3-16*.
2	Secure the bottom mounting bracket, as shown in *Figure 3-18*.
3	Assemble the guide rails (optional) and connect them to the cabinet.
4	Remove the drive cover (for detailed operations, see *"3.1.5 Removing and Installing the Front Cover" on page 56*) so that the handle is exposed.
5	Two operators work together to align the casters of the servo drive to guide rails and then slowly push the drive into the cabinet (see *Figure 3-21* and *Figure 3-22*). Use a soft strap during push-in and pull-out to prevent turnover.
6	Remove the soft strap. Fix the servo drive on the mounting beam in the cabinet by securing the fixed holes at the top and bottom of the back of the servo drive through screws, as shown in *Figure 3-23*.
7	Check whether the servo drive is installed securely. If yes, remove the guide rails.

■ Fixing the mounting beam and reserving mounting holes

A nine-folding AL cabinet (PS cabinet), whose cross section is shown in *Figure 3-1*, is recommended for the installation of the servo drive.

When the servo drive of IS580T370-R1 to IS580T720-R1 is installed in a nine-folding AL cabinet of 600 mm deep, the mounting beam must fold inwards (*Figure 3-1*). There is no such requirement when the drive is installed in a cabinet with a depth of 800 mm or above.

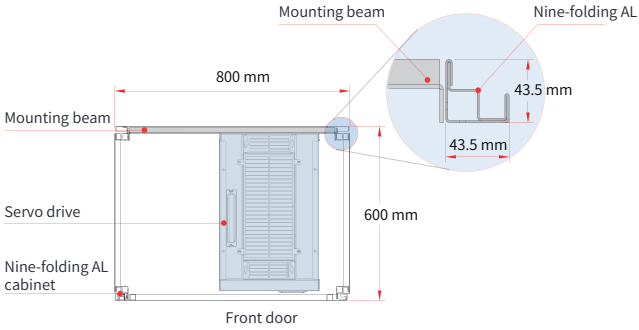


Figure 3-16 Top view of IS580T370-R1 to IS580T720-R1

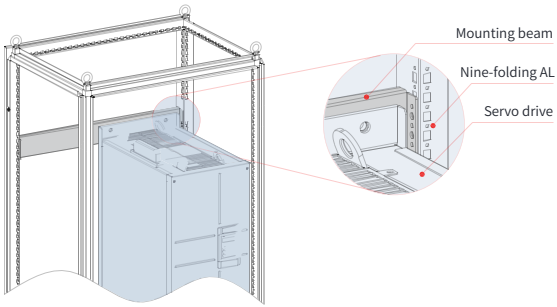


Figure 3-17 3D view of IS580T370-R1 to IS580T720-R1

NOTE

◆ If the cabinet has a front door and a rear door, the cabinet of 600 mm deep is too small to accommodate the drive of IS580T370-R1 to IS580T720-R1. In this case, the cabinet of 800 mm deep is recommended.

■ Installing the bottom mounting bracket

Fix the mounting bracket on the cabinet base using six M5 self-tapping screws, as shown in the following figure (see *"3.1.6 Through-hole Mounting Brackets" on page 59* for details).

If a non-nine-folding AL cabinet is used, on-site drilling is required for the mounting bracket.

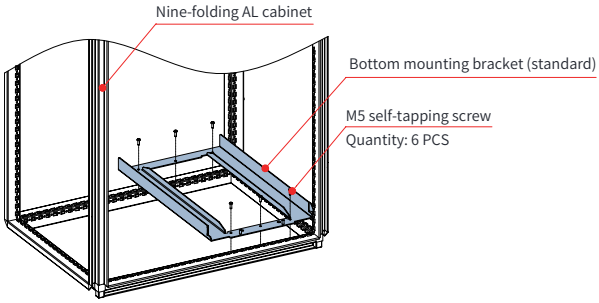
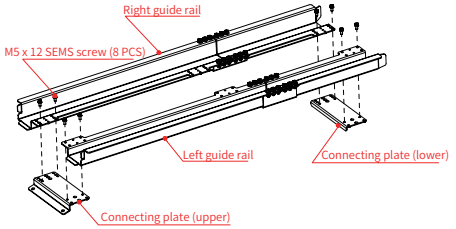


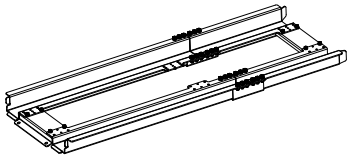
Figure 3-18 Installing the bottom mounting bracket

■ Assembling guide rails (optional; model: MD500-AZJ-A3T10)

Assemble the guide rail of correct model according to the following figure: align the two holes at the front of the guide rail with the studs of the mounting bracket, and then attach them with two M6 nuts.



Before guide rail assembly



After guide rail assembly

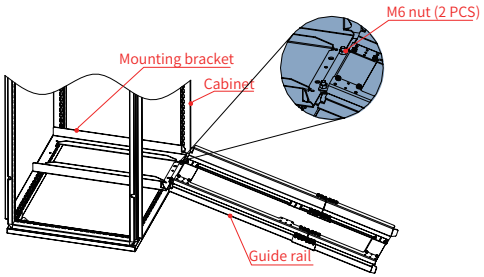


Figure 3-19 Assembling guide rails in the cabinet

■ Installing the servo drive in the cabinet

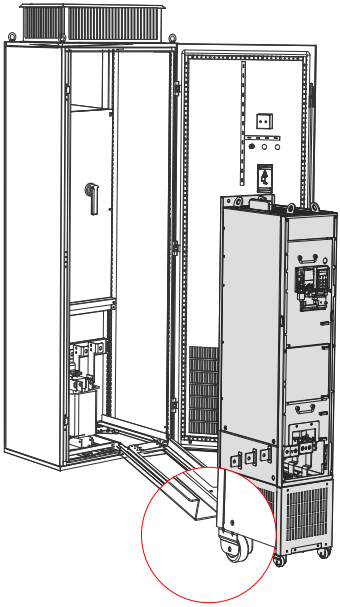


Figure 3-20 Aligning casters of the drive to guide rails

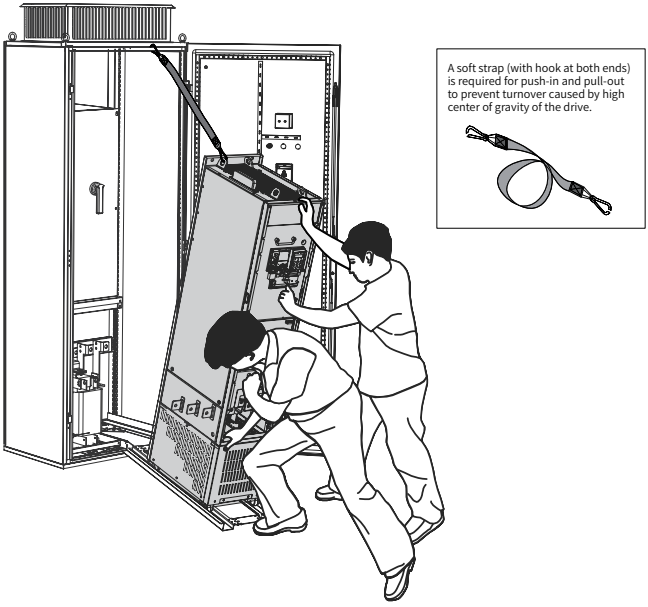


Figure 3-21 Pushing the servo drive into the cabinet

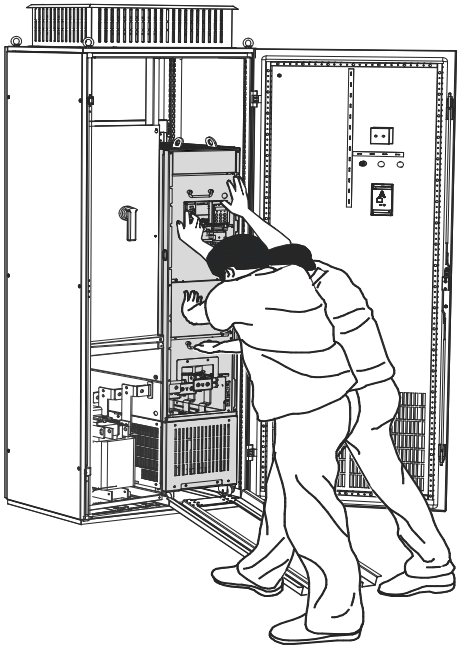


Figure 3-22 Installation completed

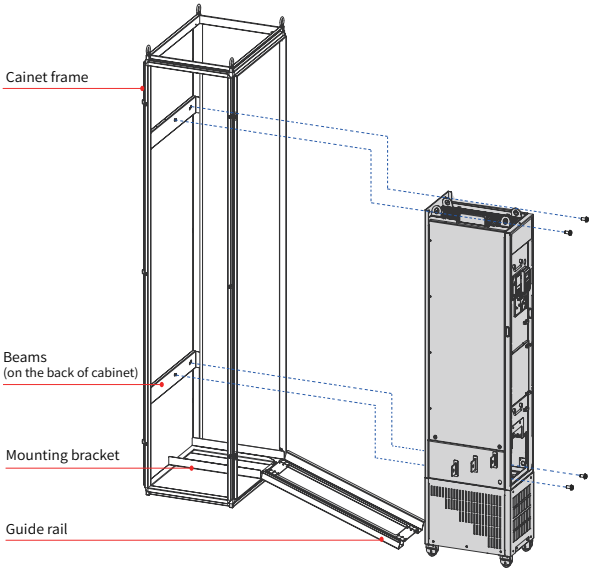


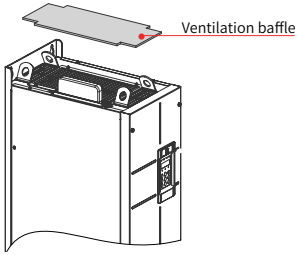
Figure 3-23 Fixing the drive to the beam through the four mounting holes on the back of the drive

Precautions:

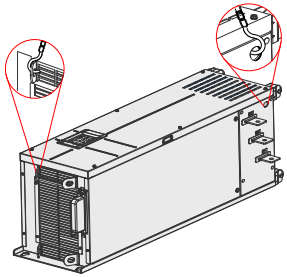
① Removal: When removing the drive from the cabinet, follow installation steps in reverse order.

② Ensure the four mounting holes on the back of the drive are connected to the mounting beam securely.

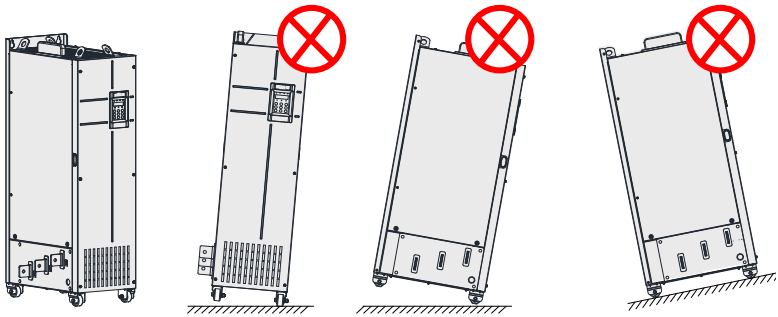
③ After installation is complete, remove the baffle on the top of the drive. The baffle is used to prevent foreign objects such as screws from falling into the ventilation openings during install.



④ Use the top hoisting rings to move or hoist the drive. If it is necessary to place the drive in a horizontal position, use the top hoisting rings and the bottom hoist hole when you hoist the drive again. Ensure the DC bus terminals are not damaged.



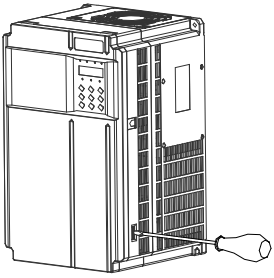
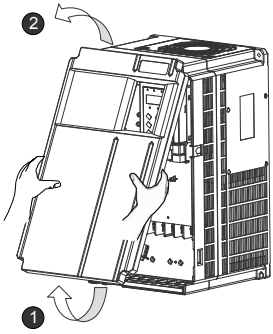
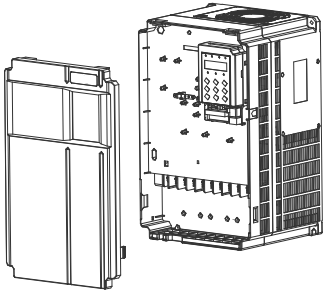
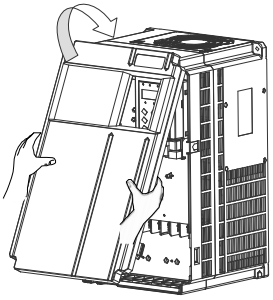
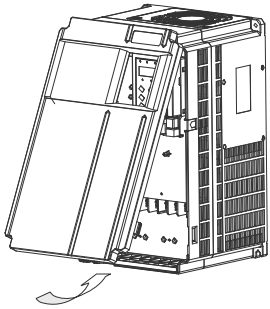
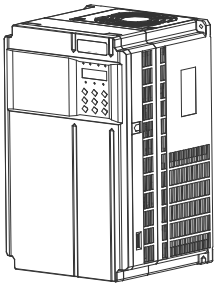
⑤ When placing the drive in an upright position, prevent stress on both sides of the drive and do not place the drive on an inclined floor. This is because the drive may turn over due to a large size and high weight (approximately 200 kg) if the inclination exceeds 5° .



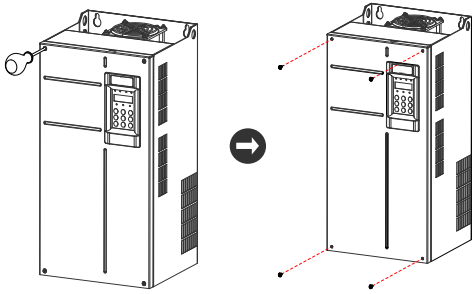
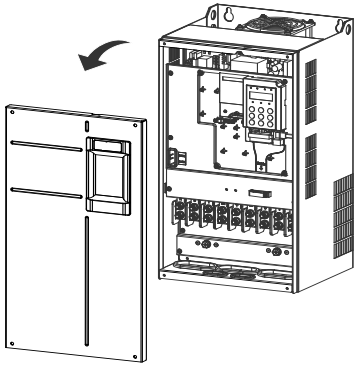
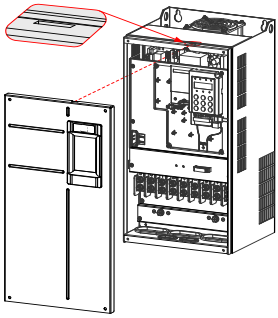
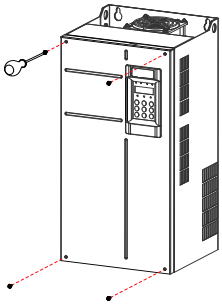
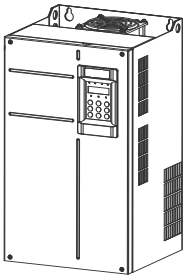
3.1.5 Removing and Installing the Front Cover

Remove the front cover before connecting the main circuit and the control circuit.

■ Removing and installing the front cover of IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, and IS580-2T020-R1 to IS580-2T070-R1

<table>
<tr><td colspan="3">Removal</td></tr>
<tr>
<td>Use a tool to push the snap-fit joints inwards on both sides of the drive to release the cover.
  </td>
<td>① Hold the lower part of the cover.
② Push the cover upwards and lift the upper part of the cover.
  </td>
<td>The cover is removed successfully.
  </td>
</tr>
<tr><td colspan="3">Installation</td></tr>
<tr>
<td>Hold the front cover and insert the snap-fit joints at the top of the front cover into the fixing holes.
  </td>
<td>Align the front cover to the drive and push it down following the arrow direction until the cover is in place.
  </td>
<td>The installation is complete.
  </td>
</tr>
</table>

■ Removing and installing the front cover of IS580T080-R1 to IS580T300-R1 and IS580-2T080-R1 to IS580-2T300-R1

<table>
<tr><th colspan="3">Removal</th></tr>
<tr><td colspan="2">Loosen the four retaining screws from the front cover with a screwdriver.
  </td><td>Hold the cover and life it following the arrow direction.
  </td></tr>
<tr><th colspan="3">Installation</th></tr>
<tr><td>Hold the front cover and align it with the top mounting hole of the servo drive, as shown in the following figure.
  </td><td>Secure the four retaining screws with a screwdriver.
  </td><td>The installation is complete.
  </td></tr>
</table>

■ Removing and installing the front cover of IS580T370-R1 to IS580T720-R1

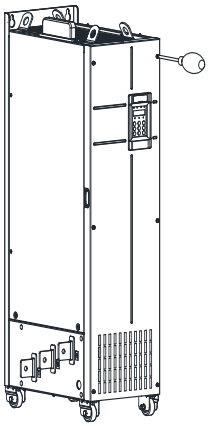
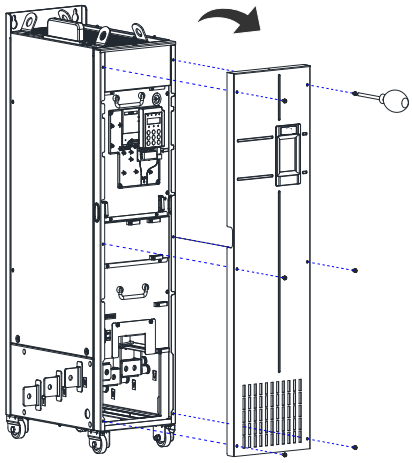
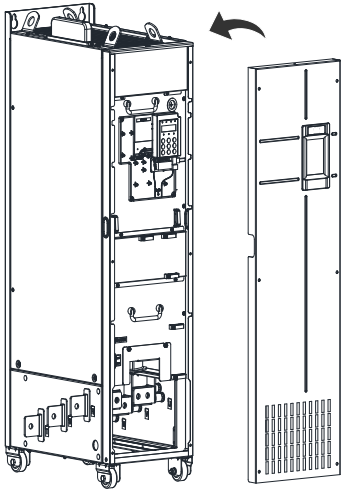
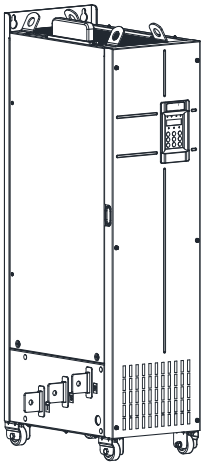
Removal	
Loosen the six retaining screws from the front cover with a screwdriver.	Hold the front cover and pull it up following the arrow direction.
	
Installation	
Hold the front cover and align it with the top mounting hole of the servo drive, as shown in the following figure. Then, align the six screw holes on the cover with the cover mounting holes on the servo drive.	Secure the six retaining screws with a screwdriver.
	

Figure 3-24 Removing and installing the front cover of IS580T370-R1 to IS580T720-R1

NOTE

- Before removing the cover, power off the servo drive and wait at least 10 minutes after the drive is powered off.
- Be careful when removing the front cover. Falling off of the cover may cause equipment damage or personal injury.

3.1.6 Through-hole Mounting Brackets

Table 3-4 Models of through-hole mounting brackets

Model	Applicable Drive		
	Three-phase 380–480 V	Three-phase 220–240 V	/
MD500-AZJ-A1T5	IS580T020-R1	IS580-2T020-R1	IS580T020-R1-T
	IS580T030-R1	IS580-2T030-R1	IS580T030-R1-T
	IS580T035-R1	-	IS580T035-R1-T
	IS580T040-R1	IS580-2T040-R1	IS580T040-R1-T
MD500-AZJ-A1T6	IS580T050-R1	IS580-2T050-R1	-
	IS580T070-R1	IS580-2T070-R1	-
MD500-AZJ-A1T7	IS580T080-R1	IS580-2T080-R1	-
	IS580T100-R1	IS580-2T100-R1	-
MD500-AZJ-A1T8	IS580T140-R1	IS580-2T140-R1	-
	IS580T170-R1	IS580-2T170-R1	-
	IS580T210-R1	IS580-2T210-R1	-
MD500-AZJ-A1T9	IS580T250-R1	-	-
	IS580T300-R1	IS580-2T300-R1	-

■ Dimensions of MD500-AZJ-A1T5

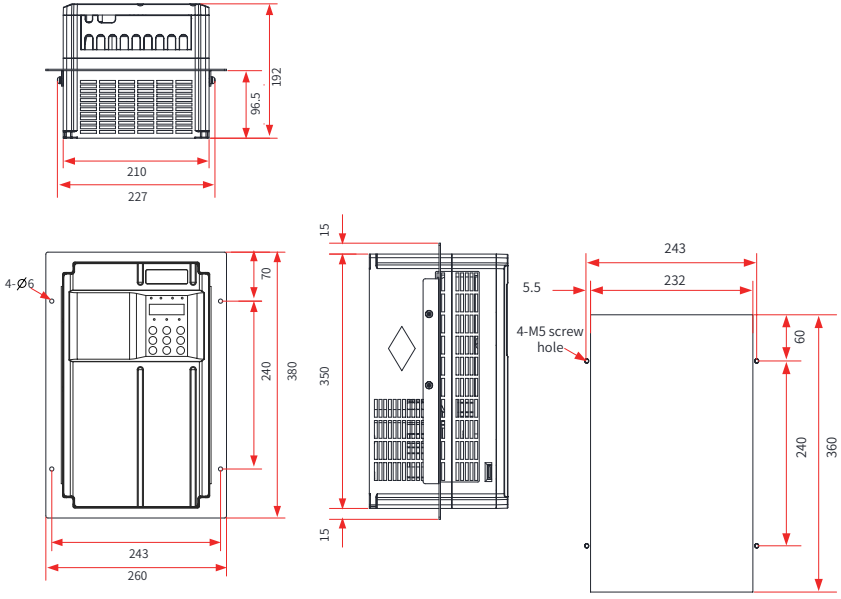


Figure 3-25 Dimensions of through-hole mounting bracket MD500-AZJ-A1T5 and mounting hole

■ Dimensions of MD500-AZJ-A1T6

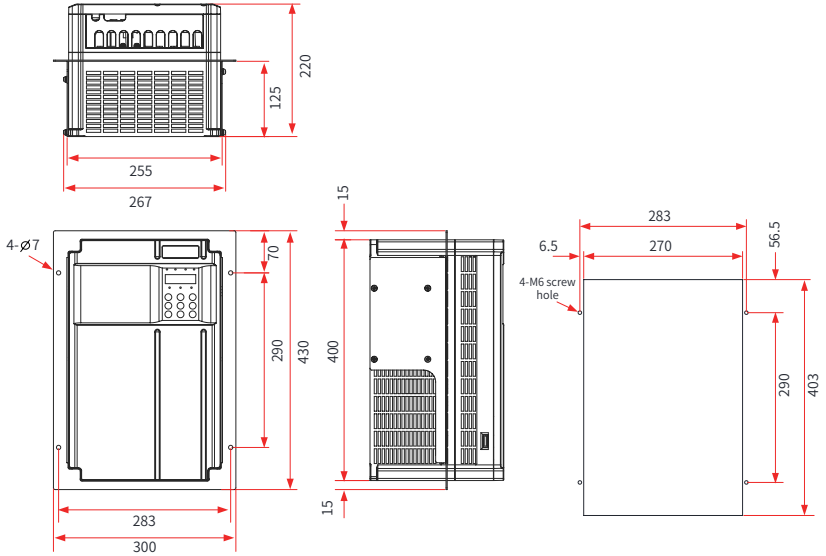


Figure 3-26 Dimensions of through-hole mounting bracket MD500-AZJ-A1T6 and mounting hole

■ Dimensions of MD500-AZJ-A1T7

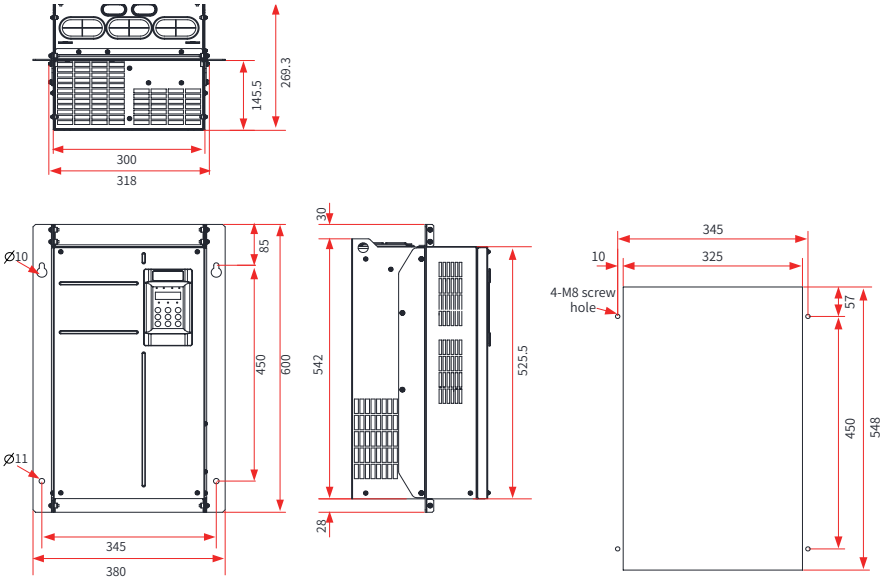


Figure 3-27 Dimensions of through-hole mounting bracket MD500-AZJ-A1T7 and mounting hole

■ Dimensions of MD500-AZJ-A1T8

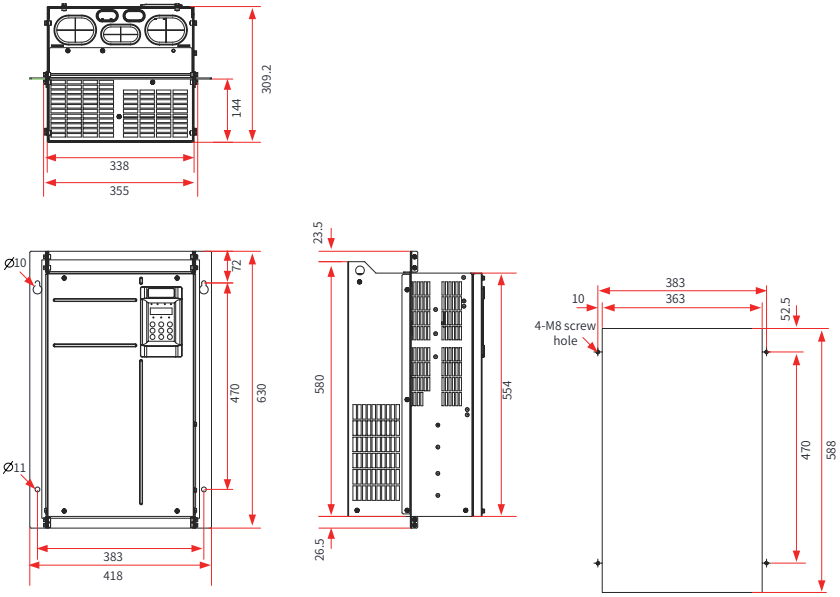


Figure 3-28 Dimensions of through-hole mounting bracket MD500-AZJ-A1T8 and mounting hole

■ Dimensions of MD500-AZJ-A1T9

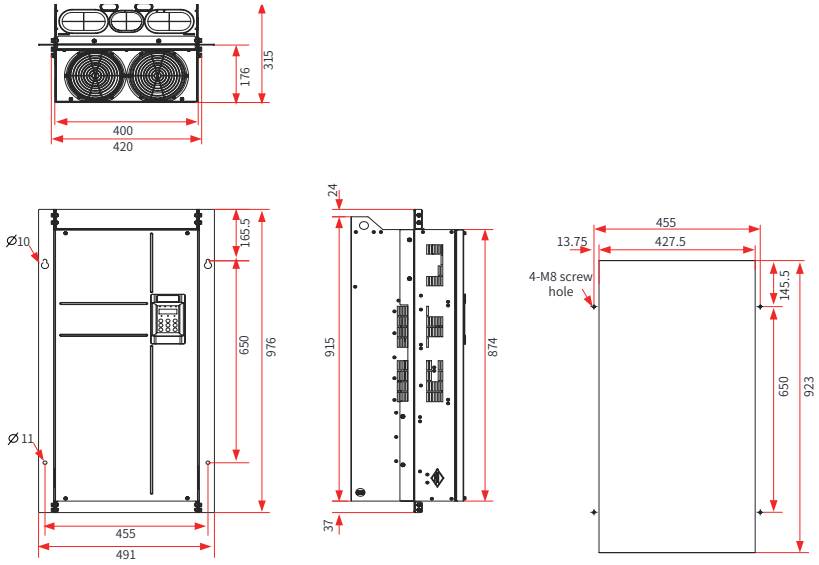


Figure 3-29 Dimensions of through-hole mounting bracket MD500-AZJ-A1T9 and mounting hole

■ Dimensions of mounting bracket for IS580T370-R1 to IS580T420-R1

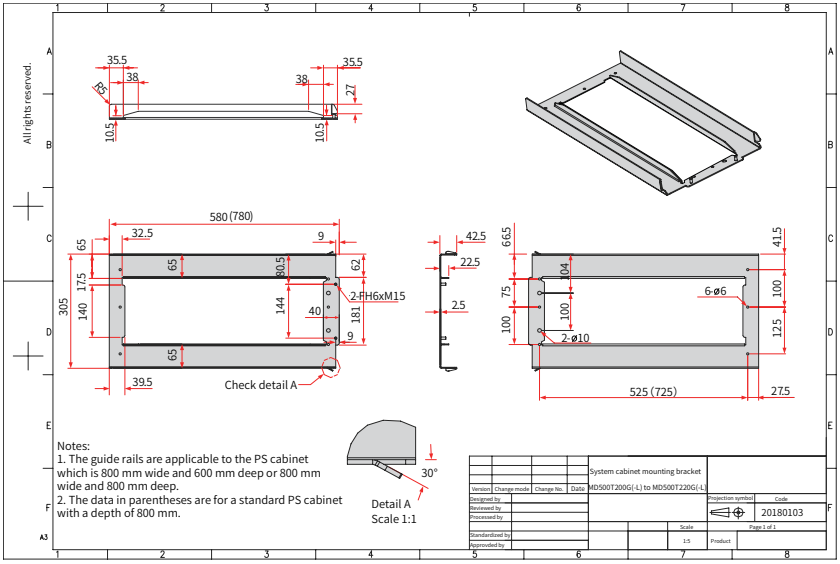


Figure 3-30 Dimensions of mounting bracket for IS580T370-R1 to IS580T420-R1 (standard configuration)

■ Dimensions of mounting bracket for IS580T460-R1 to IS580T520-R1

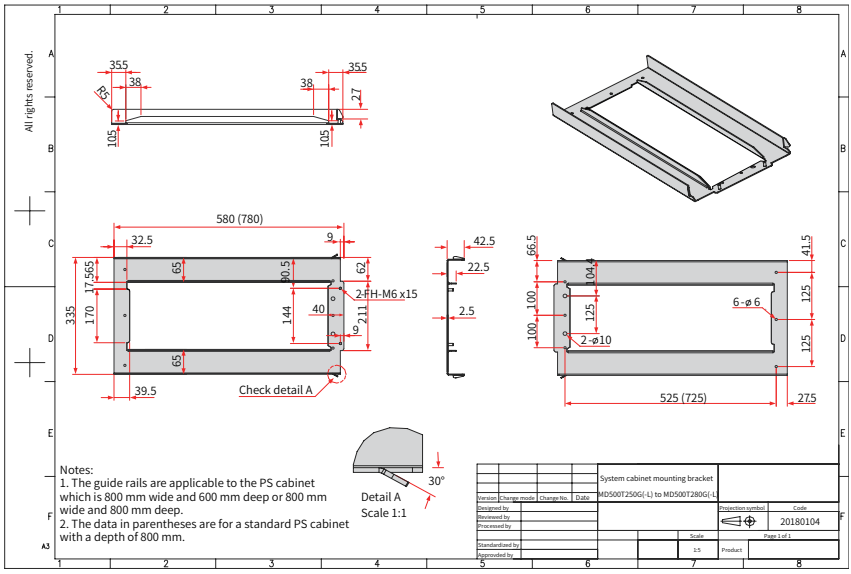


Figure 3-31 Dimensions of mounting bracket for IS580T460-R1 to IS580T520-R1 (standard configuration)

■ Dimensions of mounting bracket for IS580T580-R1 to IS580T720-R1

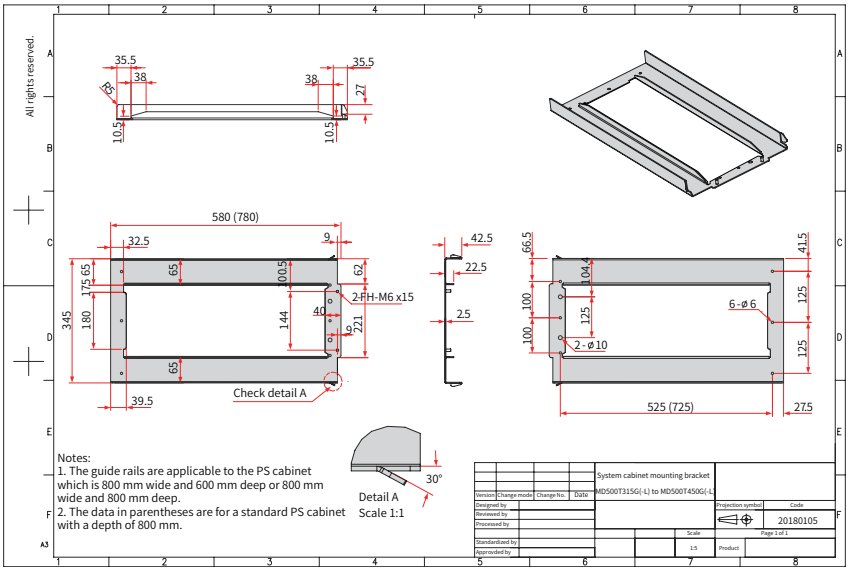


Figure 3-32 Dimensions of mounting bracket for IS580T580-R1 to IS580T720-R1 (standard configuration)

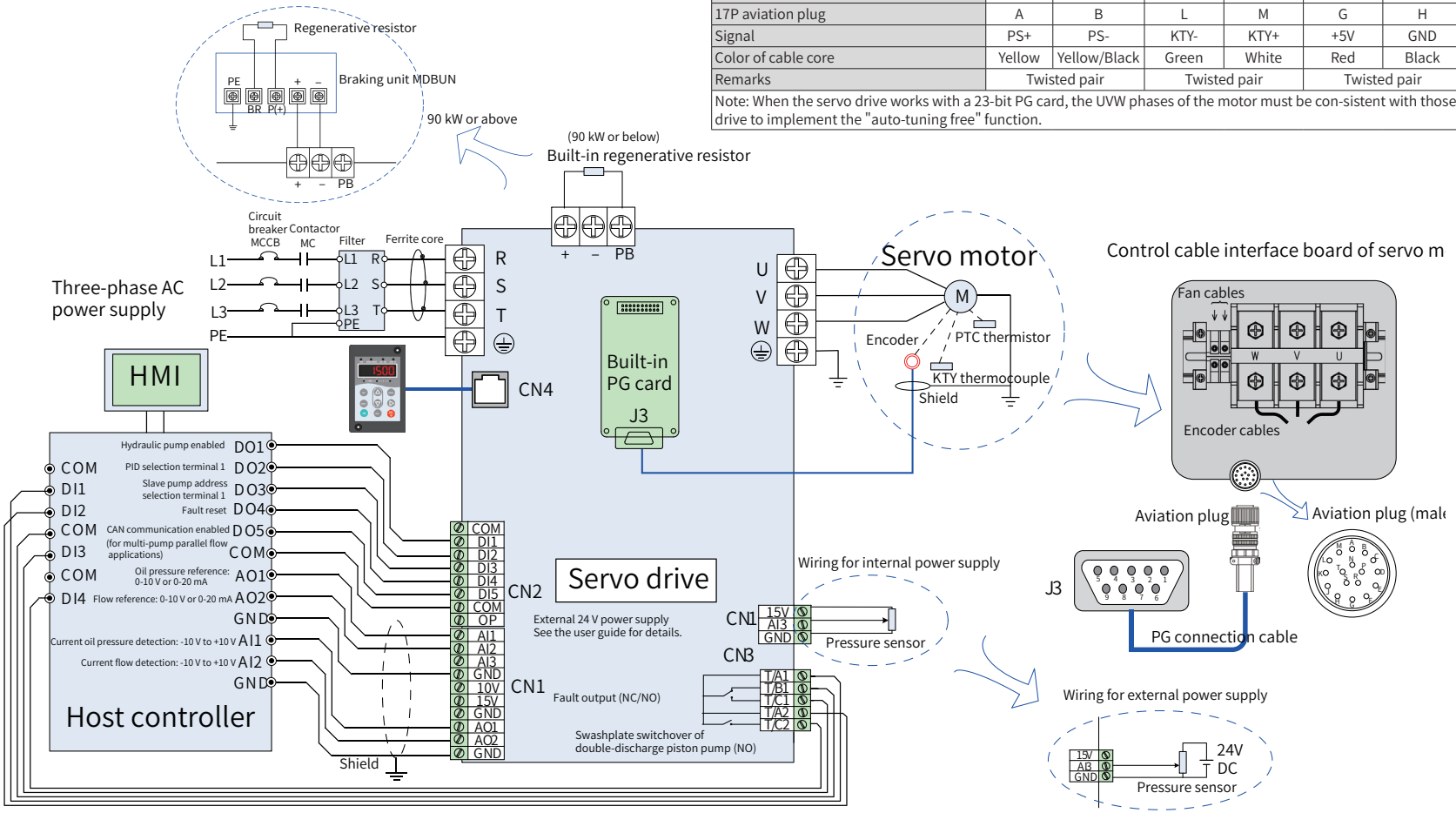
3.2 Wiring

3.2.1 Standard Wiring Diagram

The following figure shows the standard system wiring. Note that the wiring of 11–75 kW models is different from that of 90–400 kW models.

Male of DB9 connector on resolver PG card	1	2	3	4	5	9	7	8		6	Housing
17P aviation plug	A	B	C	D	E	F	G	H	L	K	J
Signal	REF-	REF+	Cos+	Cos-	Sin+	Sin-	PTC+	KTY-	PTC-	KTY+	Shield
Color of cable core	Yellow/Black	Red/Black	Red	Black	Yellow	Blue	Orange	Brown		Gray	Shield
Remarks	One pair		One pair		One pair			Common point of KTY and PTC			

Male of DB9 connector on 23-bit PG card	1	2	5	9	7	8	Housing
17P aviation plug	A	B	L	M	G	H	J
Signal	PS+	PS-	KTY-	KTY+	+5V	GND	Shield
Color of cable core	Yellow	Yellow/Black	Green	White	Red	Black	Shield
Remarks	Twisted pair		Twisted pair		Twisted pair		-
Note: When the servo drive works with a 23-bit PG card, the UVW phases of the motor must be con-sistent with those of the servo drive to implement the "auto-tuning free" function.							



3.2.2 Functions of Main Circuit Terminals and Precautions

1) Main circuit terminals of IS580

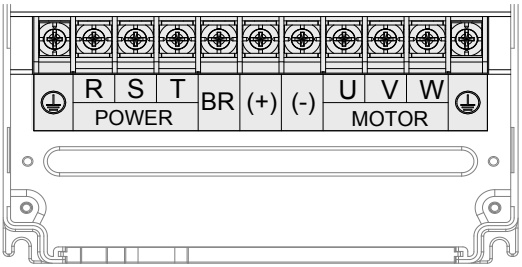
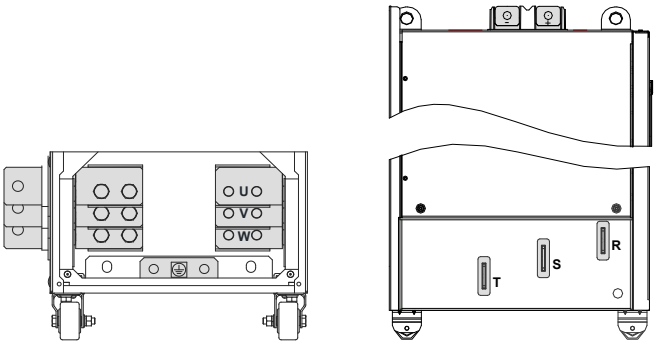


Figure 3-33 Main circuit terminal layout in IS580T020-R1 to IS580T300-R1 and IS580-2T020-R1 to IS580-2T300-R1



Front view Side view

Figure 3-34 Main circuit terminal layout in IS580T370-R1 to IS580T720-R1

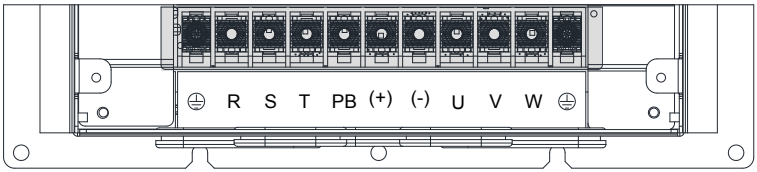


Figure 3-35 Main circuit terminal layout in IS580T035-R1-H to IS580T040-R1-H

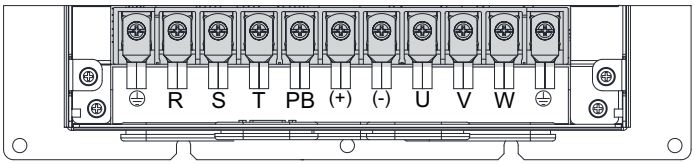


Figure 3-36 Main circuit terminal layout in IS580T050-R1-H to IS580T070-R1-H

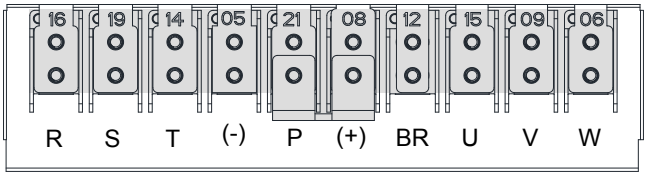


Figure 3-37 Main circuit terminal layout in IS580T080-R1-H to IS580T140-R1-H

Table 3-5 Description of main circuit terminals in IS580T080-R1-H to IS580T140-R1-H

Terminal	Name	Function Description
R, S, T	Three-phase power input terminals	Connected to three-phase AC input power supply
(+), (-)	Positive and negative terminals of the DC bus	Common DC bus input
(+), P	DC reactor connection terminals	Connected to the external DC reactor for oil cooling models of 45–75k W
(+), BR	Regenerative resistor connection terminals	Connected to the regenerative resistor
U, V, W	Servo drive output terminals	Connected to the three-phase motor
⏚	Grounding (PE) terminal	Connected to the ground

NOTE

◆ When the servo drive is configured with a 23-bit PG card, the UVW phases of the motor must be consistent with those of the servo drive.

2) Selection of main circuit cables

Symmetrical shielded cables are recommended for main circuit input/output cables. Compared with 4-core cables, the symmetrical shielded cables can reduce the electromagnetic radiation of the entire conductive system.

■ Recommended power cables: symmetrical shielded cables

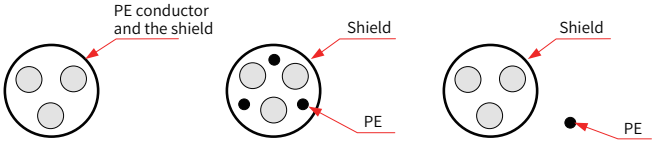


Figure 3-38 Recommended power cables

- Non-recommended power cables:

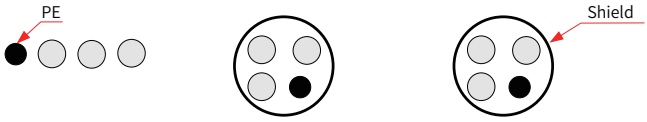


Figure 3-39 Non-recommended power cables

3) Power input terminals R, S, T

- The input wiring of the servo drive has no phase sequence requirement.
- The specifications and installation methods of external power cables must comply with local laws and regulations and related IEC standards.
- Select copper conductors of proper size as power cables according to the recommended values in *"3.2.3 Layout and Dimensions of Main Circuit Terminals" on page 71*.
- Install the filter in a place close to the input terminals of the servo drive, and the cable between them must be shorter than 30 cm. Ensure that the grounding terminal of the filter and that of the servo drive are connected together and that both the filter and the servo drive are installed on the same conductive surface that is connected to the main grounding terminal of the cabinet.

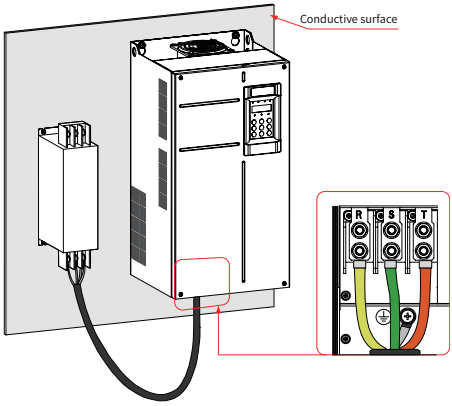


Figure 3-40 Installation diagram of the filter

4) DC bus terminals (+), (-)

- DC bus terminals (+) and (-) carry a residual voltage after power failure. Wait at least 10 minutes and ensure that the CHARGE indicator goes off before performing wiring. Failure to comply will result in an electric shock.
- When an external braking component is used in a drive of 90 kW or above, ensure the correct polarity (+/-)connection of DC bus terminals. Failure to comply will result in damage to the servo drive and the braking component or even a fire.

- Use a cable shorter than 10 m to connect DC bus terminals to braking units. Use parallel twisted pair or close pair cables for this connection.
- Do not connect the regenerative resistor directly to the DC bus. Failure to comply may result in damage to the servo drive or even a fire.

5) Regenerative resistor connection terminals (+) and BR

- Select a regenerative resistor recommended in this user guide, and ensure that the cable between the regenerative resistor and connection terminals is shorter than 5 m. Failure to comply will result in damage to the servo drive.
- Do not place any combustible object around the regenerative resistor to avoid burning of surrounding components caused by overtemperature of the regenerative resistor.
- For models of 75 kW and below with built-in braking unit, set F9-08 (Braking transistor action voltage) to a proper value based on the actual load after the regenerative resistor is connected.

6) Servo drive output terminals U, V, W

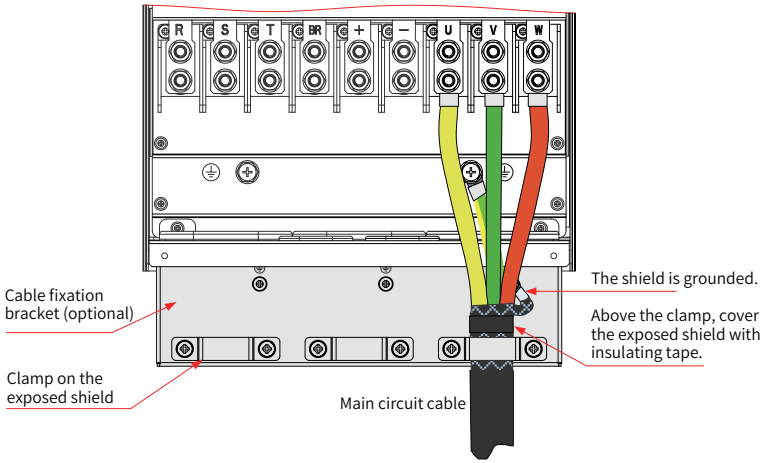


Figure 3-41 Wiring of the shield

The cable fixation bracket (optional) in the preceding figure needs to be ordered separately. It is in-stalled as follows:

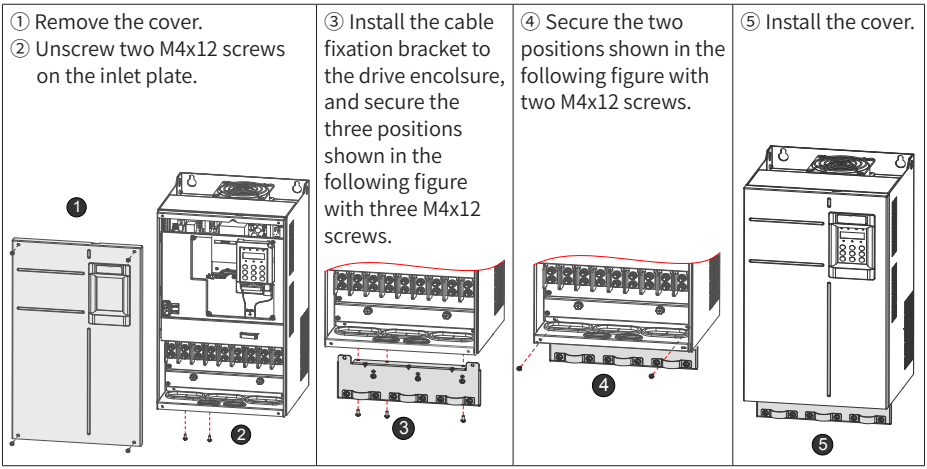


Figure 3-42 Installation of cable fixation bracket

Table 3-6 Models of cable fixation bracket

Model of Bracket	Applicable Servo Drive Model		
MD500-AZJ-A2T5	IS580T020-R1	IS580-2T020-R1	IS580T020-R1-T
	IS580T030-R1	IS580-2T030-R1	IS580T030-R1-T
	IS580T035-R1	-	IS580T035-R1-T
	IS580T040-R1	IS580-2T040-R1	IS580T040-R1-T
MD500-AZJ-A2T6	IS580T050-R1	IS580-2T050-R1	-
	IS580T070-R1	IS580-2T070-R1	-
MD500-AZJ-A2T7	IS580T080-R1	IS580-2T080-R1	-
	IS580T100-R1	IS580-2T100-R1	-
MD500-AZJ-A2T8	IS580T140-R1	IS580-2T140-R1	-
	IS580T170-R1	IS580-2T170-R1	-
	IS580T210-R1	IS580-2T210-R1	-
MD500-AZJ-A2T9	IS580T250-R1	-	-
	IS580T300-R1	IS580-2T300-R1	-

- The specification and installation method of external power cables must comply with the local laws and regulations and related IEC standards.
- Select copper conductors of proper size as power cables according to the recommended values in *"8.1 Cables, Circuit Breaker and Contactor" on page 145*.
- Do not connect a capacitor or an SPD to the output side of the servo drive. Failure to comply will result in frequent drive protection or even damage to the drive.
- If the motor cable is too long, electrical resonance will be generated due to the

impact of distributed capacitance. This will damage the motor insulation or generate high leakage current, causing the overcurrent protection of the servo drive. Therefore, install an AC output reactor close to the servo drive if the motor cable is longer than 100 m.

- Shielded cables are recommended for motor output cables. Use the fixing support of power cables to ground the shield 360 degrees, and connect the drain wire of the shield to the PE terminal.
- Ensure that the drain wire of the motor cable shield is as short as possible, and the width is not less than 1/5 of its length.

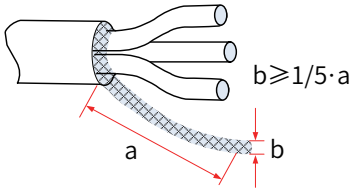


Figure 3-43 Drain wire of the motor cable shield

7) Grounding (PE) terminal

- The grounding terminal must be grounded reliably. The resistance of the grounding cable must be smaller than 10 Ω. Otherwise, the servo drive will be abnormal or damaged.
- Do not connect the grounding terminal of the drive to the neutral conductor of the power supply.
- Select the protective grounding conductor of a proper size according to the recommended values in *"8.1 Cables, Circuit Breaker and Contactor" on page 145*.
- Use yellow-green cables for the protective grounding conductor.
- It is recommended to install the servo drive on the conductive metal surface. Ensure that the entire conductive bottom of the drive is in good contact with the surface.
- Install the filter and the servo drive on the same surface to ensure the filtering effect of the filter.

8) Requirements on the upstream protection device

- Install proper protection devices on the power input side to provide protections on overcurrent, short circuit, and electrical isolation.
- When selecting the protection devices, consider the current capacity of the power cable, system overload capacity, and short circuit capacity of upstream power distribution. Generally, make a selection according to the recommended values in *"8.1 Cables, Circuit Breaker and Contactor" on page 145*.

9) Requirements on the grid system

- The IS580 is applicable to the grid system with the neutral point grounded. If the drive is used in an IT power system (a system with the neutral ungrounded or high resistance grounding), remove the VDR screw (screw 1 in the following figure). Failure to comply may result in personal injury or damage to the servo drive.
- In applications where an RCD is used, if the RCD trips at startup, remove the EMC screw (screw 2 in the following figure).

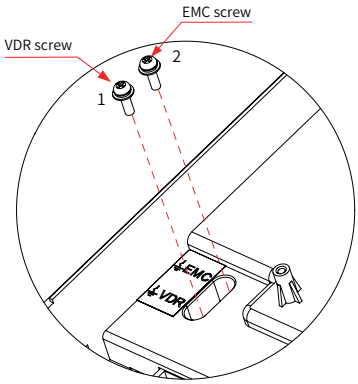


Figure 3-44 VDR and EMC screws

3.2.3 Layout and Dimensions of Main Circuit Terminals

The following figures show the layout and dimensions of main circuit terminals in different servo drive models. For the cable selection, see *"8.1 Cables, Circuit Breaker and Contactor" on page 145*.

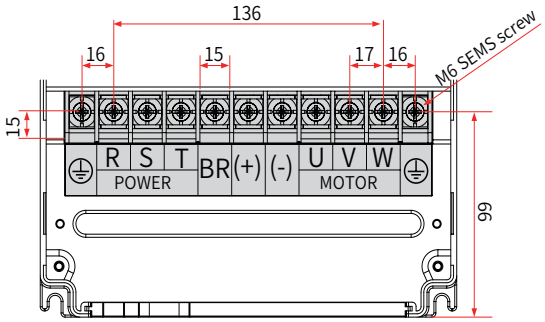


Figure 3-45 Dimensions of main circuit terminals in IS580T020-R1, IS580T040-R1, IS580T020-R1-T, IS580T040-R1-T, IS580-2T020-R1, and IS580-2T040-R1

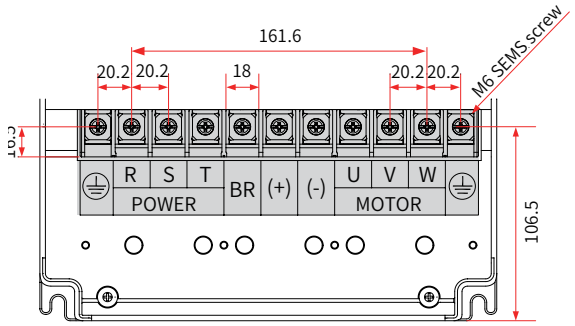


Figure 3-46 Dimensions of main circuit terminals in IS580T050-R1, IS580T070-R1, IS580-2T050-R1, and IS580-2T070-R1

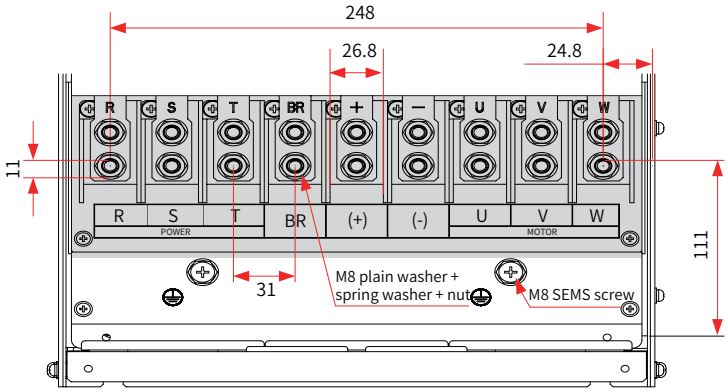


Figure 3-47 Dimensions of main circuit terminals in IS580T080-R1, IS580T100-R1, IS580-2T080-R1, and IS580-2T100-R1

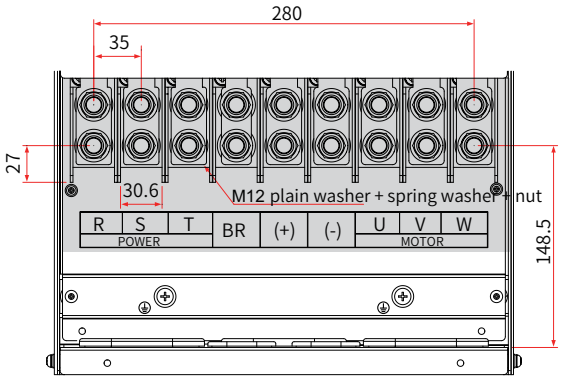


Figure 3-48 Dimensions of main circuit terminals in IS580T140-R1, IS580T170-R1, IS580T210-R1, IS580-2T140-R1, IS580-2T170-R1, and IS580-2T210-R1

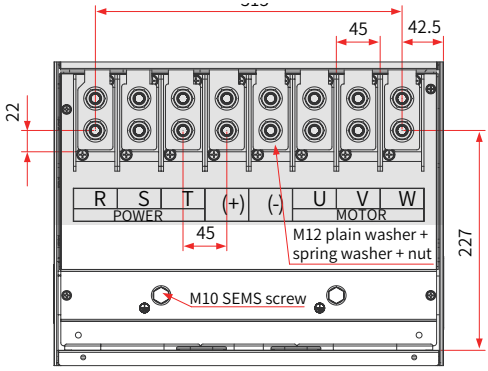


Figure 3-49 Dimensions of main circuit terminals in IS580T250-R1, IS580T300-R1, and IS580-2T300-R1

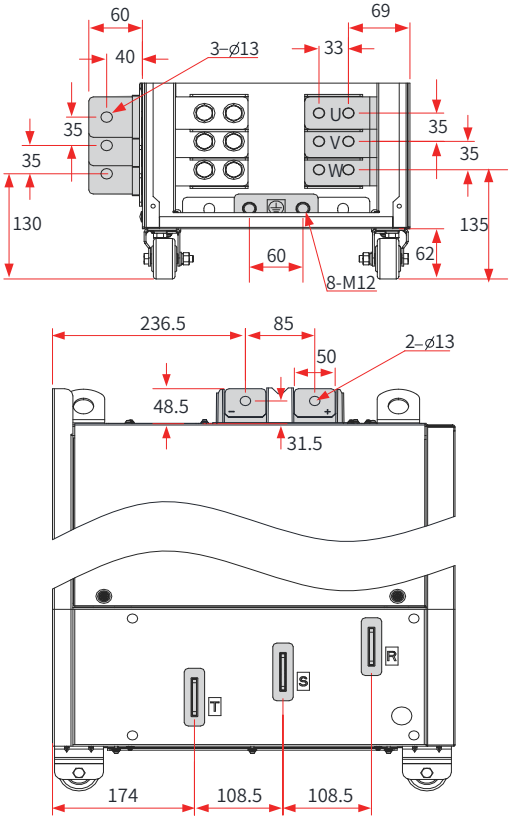


Figure 3-50 Dimensions of main circuit terminals in IS580T370-R1 and IS580T420-R1

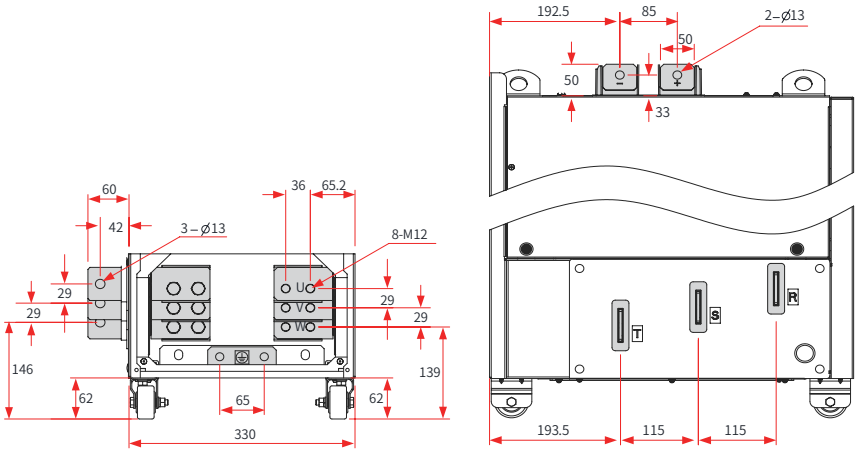


Figure 3-51 Dimensions of main circuit terminals in IS580T460-R1 and IS580T520-R1

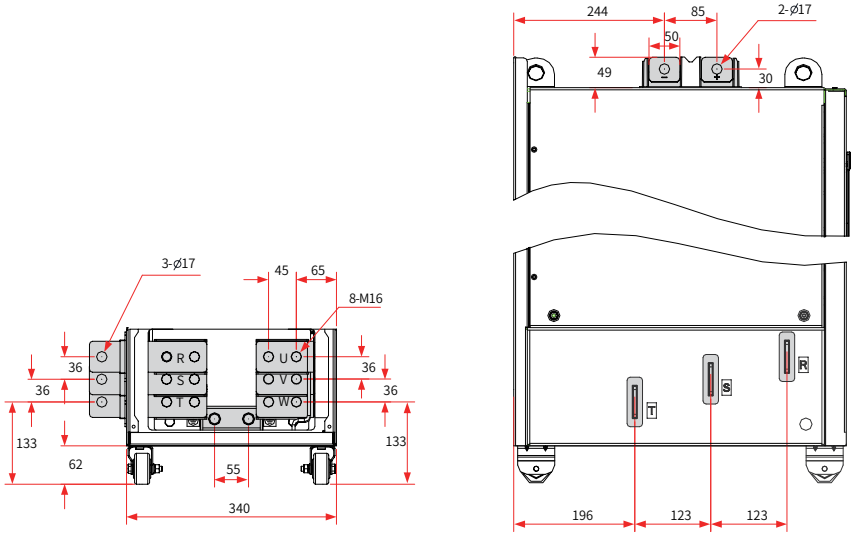


Figure 3-52 Dimensions of main circuit terminals in IS580T580-R1 and IS580T720-R1

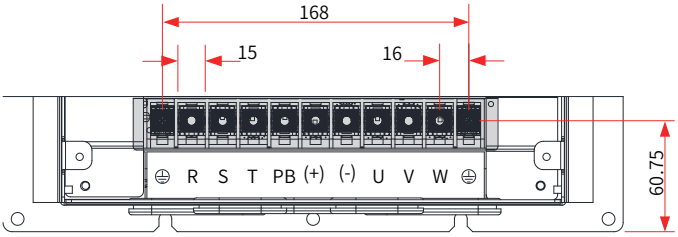


Figure 3-53 Dimensions of main circuit terminals in IS580T035-R1-H to IS580T040-R1-H

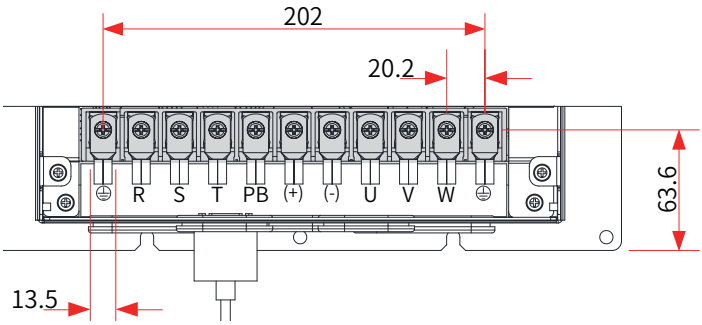


Figure 3-54 Dimensions of main circuit terminals in IS580T050-R1-H to IS580T070-R1-H

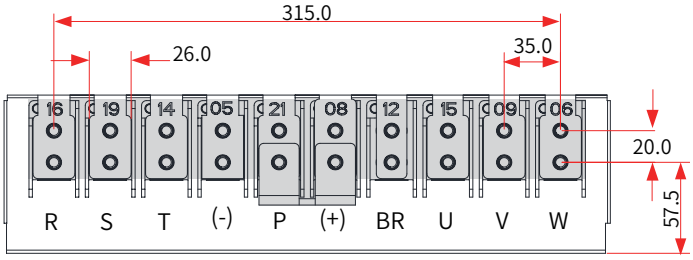


Figure 3-55 Dimensions of main circuit terminals in IS580T080-R1-H to IS580T140-R1-H

3.2.4 Layout of the Control Board

During the control circuit wiring, remove the front cover of the servo drive (For detailed operations, see "3.1.5 Removing and Installing the Front Cover" on page 56) before jumper operations, PG card connections, and function expansion card connections. The following figure shows the position of the control board, jumpers, and various expansion cards (For the installation of optional cards, see "10 Optional Cards" on page 211).

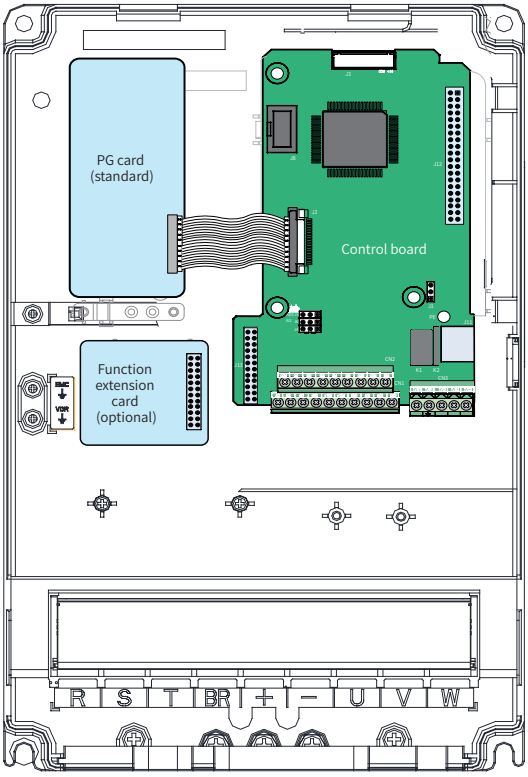


Figure 3-56 Control board of the IS580

3.2.5 Layout and Functions of Control Board Terminals

■ Layout of the control board terminals

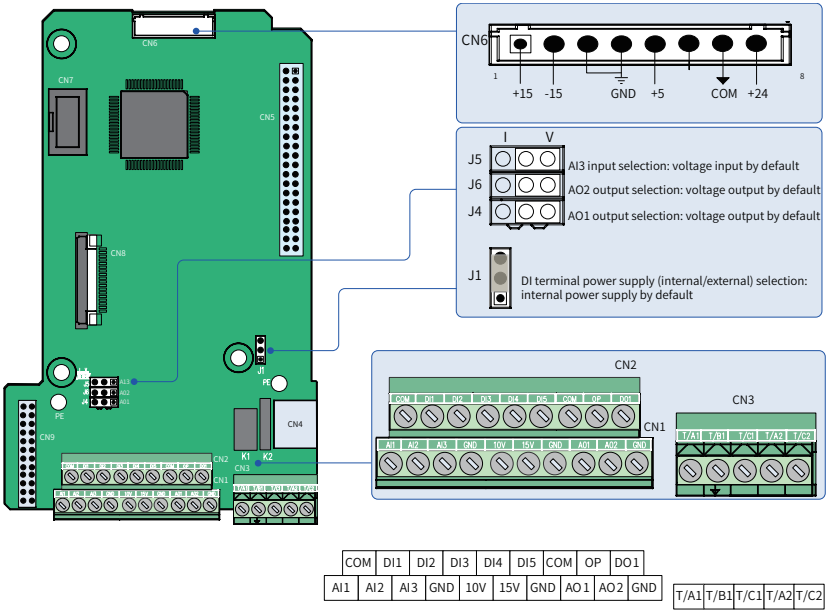


Figure 3-57 Layout of control board terminals

Table 3-7 Function description of control board terminals

Type	Terminal	Name	Function Description
Power supplies	10V-GND	External 10 V power supply	◆ Provides 10 V power supply, generally for an external potentiometer (resistance range: 1–5 kΩ) ◆ Maximum output current: 10 mA
	15V-GND	External 15 V power supply	◆ Provides 15 V power supply, generally for an external pressure sensor ◆ Maximum output current: 10 mA
Analog inputs (AIs)	AI1-GND	AI terminal 1	◆ Input voltage: 0–10 VDC ◆ Input impedance: 22 kΩ
	AI2-GND	AI terminal 2	◆ Input voltage: 0–10 VDC ◆ Input impedance: 22 kΩ
	AI3-GND	AI terminal 3	◆ Input range: 0–10 VDC/0–20 mA, determined by jumper J5 on the control board ◆ Input impedance: 22 kΩ (voltage input) or 500 Ω (current input)

Type	Terminal	Name	Function Description
Digital inputs (DIs)	DI1-COM	DI terminal 1	◆ Photocoupler isolation input, with the input frequency less than 100 Hz; Either an internal or an external power supply, determined by jumper J1 on the control board. ◆ Input impedance: 1.39 kΩ ◆ Voltage range upon active level input: 9–30 V
	DI2-COM	DI terminal 2	
	DI3-COM	DI terminal 3	
	DI4-COM	DI terminal 4	
	DI5-COM	DI terminal 5	
	OP	External 24 V power supply for DI	Select an external 24 V power supply to power the DI circuit using the jumper cap.
Analog outputs (AOs)	AO1-GND	AO terminal 1	◆ Either a voltage or a current output, determined by jumper J4 on the control board, with the load resistance less than 500 Ω. ◆ Output voltage: 0–10 V ◆ Output current: 0–20 mA
	AO2-GND	AO terminal 2	◆ Either a voltage or a current output, determined by jumper J6 on the control board, with the load resistance less than 500 Ω. ◆ Output voltage: 0–10 V ◆ Output current: 0–20 mA
Digital output (DOs)	DO1-COM	DO terminal 1	◆ Photocoupler isolation and bipolar open collector output ◆ Output voltage: 0–24 V ◆ Output current: 0–50 mA **Note:** DO1 only supports the external power supply. When the external power supply is used, check whether the power ground can be connected to the COM terminal.
Relay outputs	T/A1-T/B1	Normally closed (NC) terminal	Contact driving capacity: 250 VAC, 3 A, COSØ = 0.4 30 VDC, 1 A
	T/A1-T/C1	Normally open (NO) terminal	
	T/A2-T/C2	NO terminal	
Auxiliary interfaces	CN9	Functionn expansion card interface	28-core terminal, used for connection with various optional cards, such as bus cards
	CN8	PG card interface	Supports the resolver and 23-bit absolute encoderr
	CN4	External operating panel interface	Connected to the external operating panel.

Type	Terminal	Name	Function Description
Jumpers[1]	J1	DI signal drive selection terminal	Used to select the power supply (internal/external) to drive DI signals, internal 24 V power supply by default
	J4	AO1 output selection terminal	Used to select voltage/current output, voltage output by default
	J6	AO2 output selection terminal	Used to select voltage/current output, voltage output by default
	J5	AI3 input selection terminal	Used to select voltage/current input, voltage input by default

[1] For the position of jumpers J1, J4, J5, and J6 on the control board, see *"Figure 3-57 Layout of control board terminals" on page 77*.

3.2.6 Wiring of Control Board Terminals

1) Selection of control circuit cables

All control cables must be shielded cables.

Use a separate shielded cable for each analog signal, and do not use a common return cable for these signal cables.

Shielded twisted pairs (STPs) are recommended for digital signal cables.

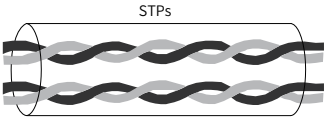


Figure 3-58 STPs diagram

2) Wiring requirements for the control circuit

- The motor cables must be laid far away from all control cables.
- It is recommended that the motor cables, input power cables, and control circuit cables be laid in different cable trays. To avoid electromagnetic interference caused by coupling, avoid long parallel runs of motor cables with control circuit cables.
- If control circuit cables must run across drive cables, make sure the angle between them is close to 90 degrees.

The recommended wiring is as follows:

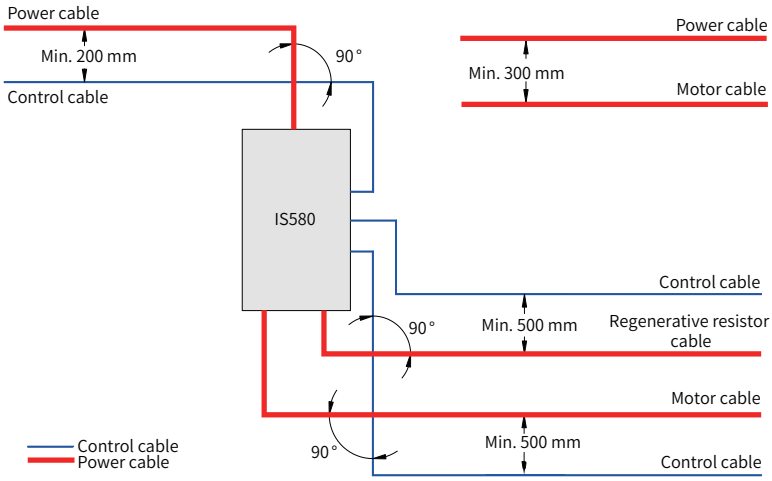


Figure 3-59 Wiring diagram

3) Analog input terminals AI1 and AI2

Weak analog voltage signals are easy to suffer external interference. Therefore, shielded cables are required and the cable length must be less than 20 m, as shown in the following figure. In applications where analog signals suffer severe interference, install a filter capacitor or ferrite core on the analog signal source side, as shown in *"Figure 3-62 Wiring of the AI3 terminal" on page 81*.

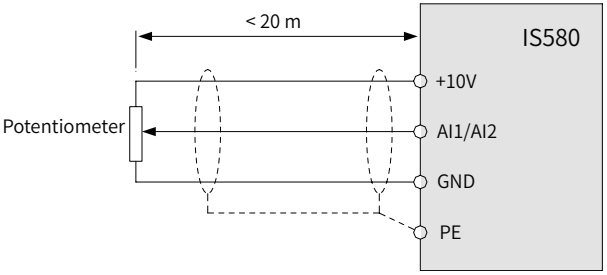


Figure 3-60 Wiring of AI terminals

Connect the shield drain wire of AI terminals to the PE terminal on the servo drive side.

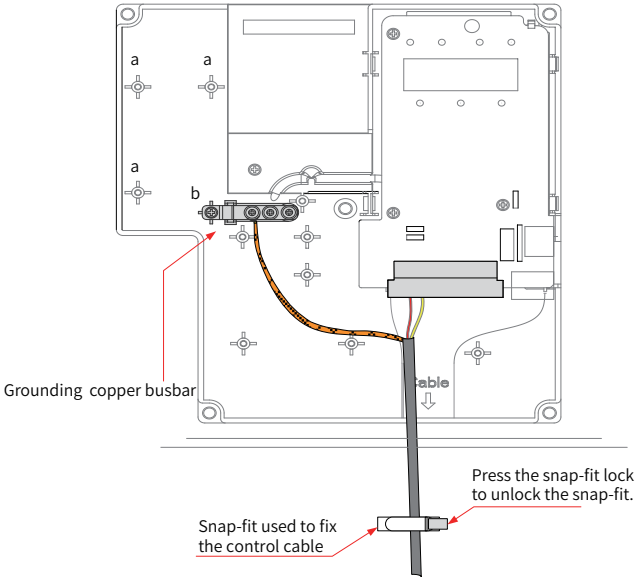


Figure 3-61 Grounding of the shield of AI terminals

4) Analog input terminal AI3

When the voltage signal input is used, terminal AI3 is connected in the same method as terminal AI1.

When the current signal input is used, terminal AI3 is used for current input, terminal GND is used for current output, and the "I" side of jumper J5 jumps is shorted.

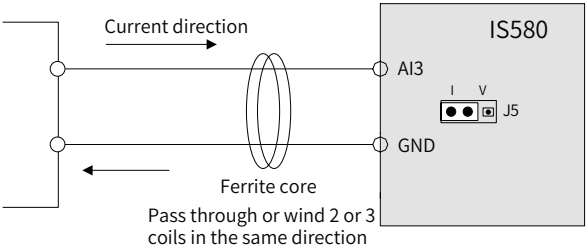


Figure 3-62 Wiring of the AI3 terminal

5) Digital input terminals DI1 to DI5

■ Sink wiring

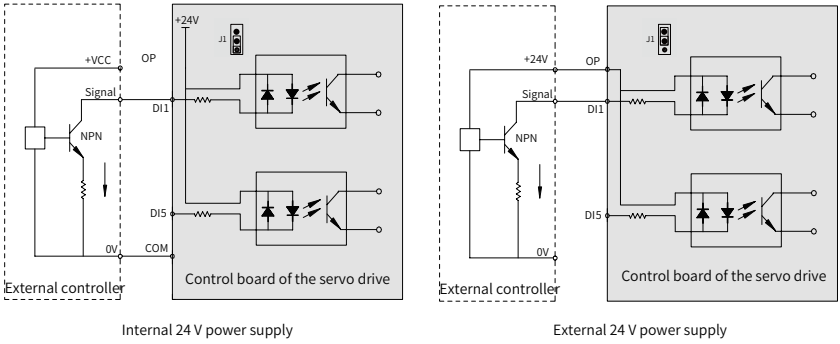


Figure 3-63 Sink wiring

The internal 24 V power supply is mostly used for wiring. When the internal power supply is used, short pins 1 and 2 of jumper J1 on the control board, as shown in the preceding figure, and connect the COM terminal of the servo drive to the 0V of the external controller.

If an external 24 V power supply is used, short pins 2 and 3 of jumper J1 on the control board (shown in the preceding figure), connect +24V of the power supply to the OP terminal of the servo drive, and connect 0V of the power supply to the corresponding DI terminal through the controller contact.

NOTE

◆ In sink mode, the DI terminals of different servo drives cannot be connected in parallel. Otherwise, DI malfunction may occur. If parallel connection of DI terminals (between different servo drives) is required, connect a diode in series on the DI terminal side (the anode is connected to the DI terminal), as shown in the following figure. The diode needs to meet the following requirements: IF > 40 mA, VR > 40 V.

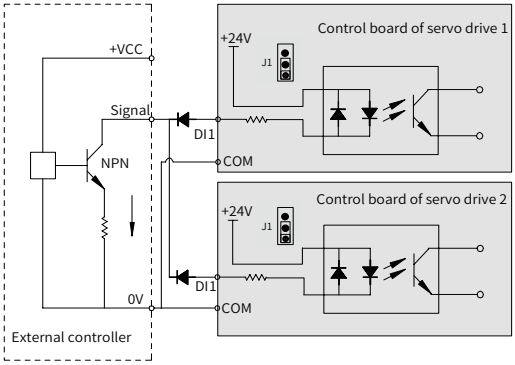


Figure 3-64 Parallel sink wiring of DI terminals between multiple servo drives

■ Source wiring

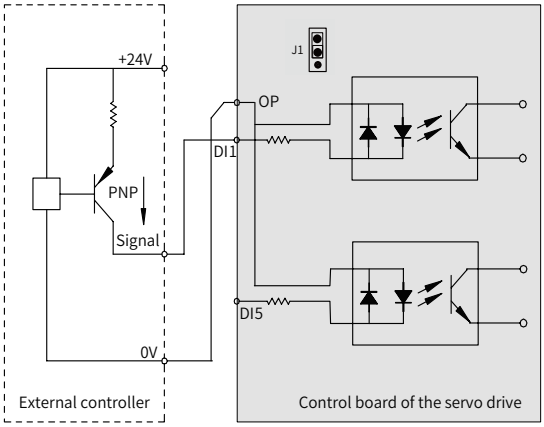


Figure 3-65 Source wiring for external 24 V power supply

In source mode, an external 24 V power supply is required. Short pins 2 and 3 of jumper J1 on the control board, and connect 0V of the external controller to the OP terminal of the servo drive.

6) Digital output terminal

When the DO terminal is used to drive the relay, install a snubber diode on both sides of the relay coil. Otherwise, the 24 VDC power supply may be damaged. The driving capacity does not exceed 50 mA.

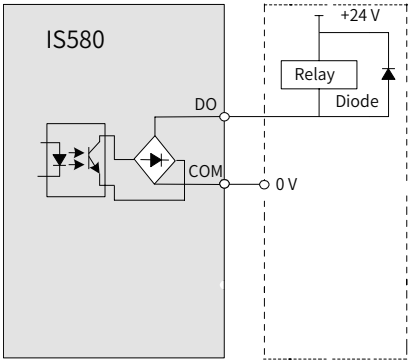


Figure 3-66 Wiring of the DO terminal

NOTE

- Install the polarity of the snubber diode correctly. Otherwise, the 24 VDC power supply will be damaged immediately once there is a digital output.
- The DO terminal can be driven only by an external 24 V power supply. When DO1 is driven by an external power supply, check whether the external 24 V power ground can be connected to the grounding terminal of the control board.

7) Relay output terminals

Inductive loads, such as the relay, contactor, and motor, can cause voltage spike when the current is cut off. Use a VDR for protection at the relay contact, and install a snubber circuit (VDR, RC snubber circuit, or diode) on the inductive load to minimize the interference when cutting off the current.

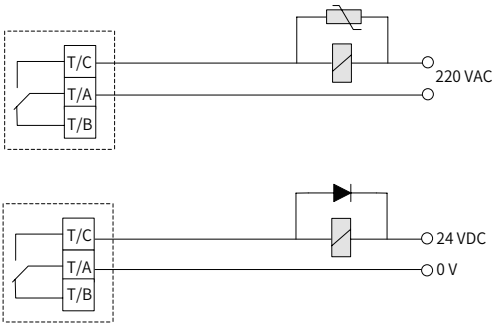


Figure 3-67 Anti-interference processing of relay output terminals

3.2.7 Description of PG Cards

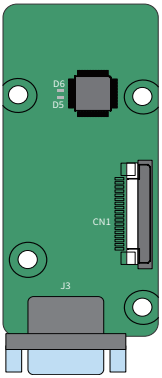
The IS580 is equipped with a built-in PG card, with the resolver PG card for IS580TXXX-R1 and 23-bit PG card for IS580TXXX-R1C1.

Table 3-9 Configurations of the motor, servo drive, cable, and PG card

Motor Type	Servo Drive	Cable Type	Cable[2]	PG Card
ESMGX/ ISMGXXXXXXXX-R1A1FA	IS580TXXX-R1	Resolver PG card with the aviation plug	S58-L-P31-XX (XX can be 3.0, 6.0, 8.0, 12.0, 15.0, 20.0, and 25.0)	S58-PG-B1
ESMGX/ ISMGXXXXXXXX-A3A1FA	IS580TXXX-R1C1	23-bit PG card with the aviation plug	S58-L-P10-XX (XX can be 3.0, 6.0, 7.0, 8.0, 12.0, 15.0, and 25.0)	ES510-PG-CT1
Third-party or Inovance motors without the aviation plug	IS580TXXX-R1	Resolver PG card without the aviation plug	S58-L-P30-XX (XX can be 3.0, 6.0, and 15.0)	S58-PG-B1

[2] XX is the cable length (unit: m).

1) Resolver PG card (S58-PG-B1)



Specifications of the S58-PG-B1	
User interface	DB9 female
Cable specification	> 22AWG
Resolution	12-bit
Excitation frequency	10 kHz
VRMS	7 V
VP-P	3.15 ± 27%
Range of frequency-division	Without frequency-division function
Load capacity	175 mA
Input impedance	0.5 transformation ratio: 5.9 kΩ 0.286 transformation ratio: 9.4 kΩ

Table 3-10 Function description of S58-PG-B1 terminals

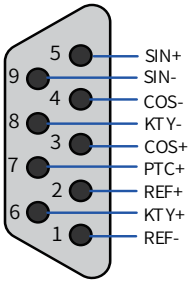
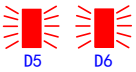
Terminal	Pin No.	Pin Definition	Function Description	Terminal Layout
J3	1	REF-	Resolver excitation negative	
	2	REF+	Resolver excitation positive	
	3	COS+	Resolver feedback COS positive	
	4	COS-	Resolver feedback COS negative	
	5	SIN+	Resolver feedback SIN positive	
	6	KTY+	KTY resistance positive	
	7	PTC+	PTC resistance positive	
	8	KTY-	KTY/PTC resistance negative	
	9	SIN-	Resolver feedback SIN negative	
CN1	18-pin flexible flat cable (FFC) interface, connected to jumper J2 on the control board of the servo drive			

Table 3-11 Status description of S58-PG-B1 indicators

Fault Indicator	Status	Possible Cause and Solution
	Normal	No
	Phase-locked loop (PPL) loss of lock	The phase lag of the resolver is too large.
	The signal SIN/COS amplitude exceeds the upper limit	Possible cause: There is an interference. Solution: Ground the motor well and connect the grounding terminal on the PG card to the PE terminal of the servo drive.

Fault Indicator	Status	Possible Cause and Solution
	The signal SIN/COS amplitude is too small.	Possible cause: The DB9 connector is not connected or incorrectly connected, or the cable is disconnected. Solution: If the preceding situation does not occur, check whether the resolver matches the S58-PG-B1.
◆ Note: For some PG cards, D3 is the same as D5 and D2 is the same as D6.		



- ◆ The resolver must meet the parameter requirements of the S58-PG-B1, and the excitation input DC resistance must be larger than 17 Ω (measured by a multimeter). Otherwise, the S58-PG-B1 cannot work properly.
- ◆ Do not select a resolver with more than four pole-pairs. Otherwise, the S58-PG-B1 will be overloaded.

2) 23-bit PG card (ES510-PG-CT1)

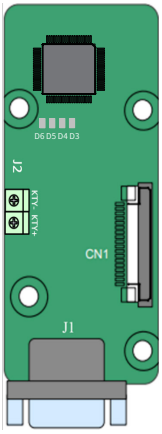
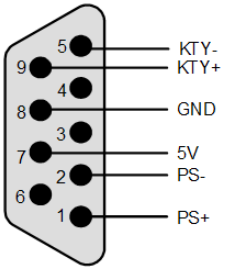


Figure 3-68 Terminal layout on the 23-bit PG card

Table 3-12 Function description of ES510-PG-CT1 terminals

Terminal	Pin No.	Pin Definition	Function Description	Terminal Layout
J1	1	PS+	485+	
	2	PS-	485-	
	3	NC	Not connected	
	4	NC	Not connected	
	5	KTY-	KTY thermistor negative	
	6	NC	Not connected	
	7	5 V	5 V power supply for the encoder	
	8	GND	Reference ground of 5 V power supply	
	9	KTY+	KTY thermistor positive	

Terminal	Pin No.	Pin Definition	Function Description	Terminal Layout	
J2	1	KTY-	KTY thermistor negative		Reserved for the motor
	2	KTY+	KTY thermistor positive		
CN1	18-pin FFC interface, connected to jumper J2 on the control board of the servo drive				

Table 3-13 Status description of IS580-PG-RT1 indicators

Indicator	Mark	Normal State	Fault State	Fault Cause	Solution
D3 (red)	I-NOSIE	Steady OFF	Flashing or steady ON	The communication between the PG card and A3 serie high-performance encoder suffers an interference, or the communication cable between them is disconnected.	Ground the motor well and connect the grounding terminal on the PG card to the PE terminal of the servo drive.
D4 (red)	O-NIOSE	Steady OFF	Flashing or steady ON	The communication between the PG card and the control board suffers an interference, or the communication cable between them is disconnected.	Ground the motor well and connect the grounding terminal on the PG card to the PE terminal of the servo drive.
D5 (green)	LATCH	◆ Slow flashing: Reading motor angle ◆ Rapid flashing: Reading motor parameter	Steady OFF	The communication between the PG card and the control board suffers an interference, or the communication cable between them is disconnected.	Check whether the FFC between the PG card and the control board is connected properly.
D6 (green)	DL	Steady OFF	Steady ON	The DB9 connector is disconnected or connected incorrectly, or the cable is disconnected.	Check whether the DB9 connector of the encoder cable is connected properly.

3.2.8 Wiring of PG Cards

■ Wiring method

1) With aviation plug (applicable to the ESMG/ISMG/ISMQ series motor)

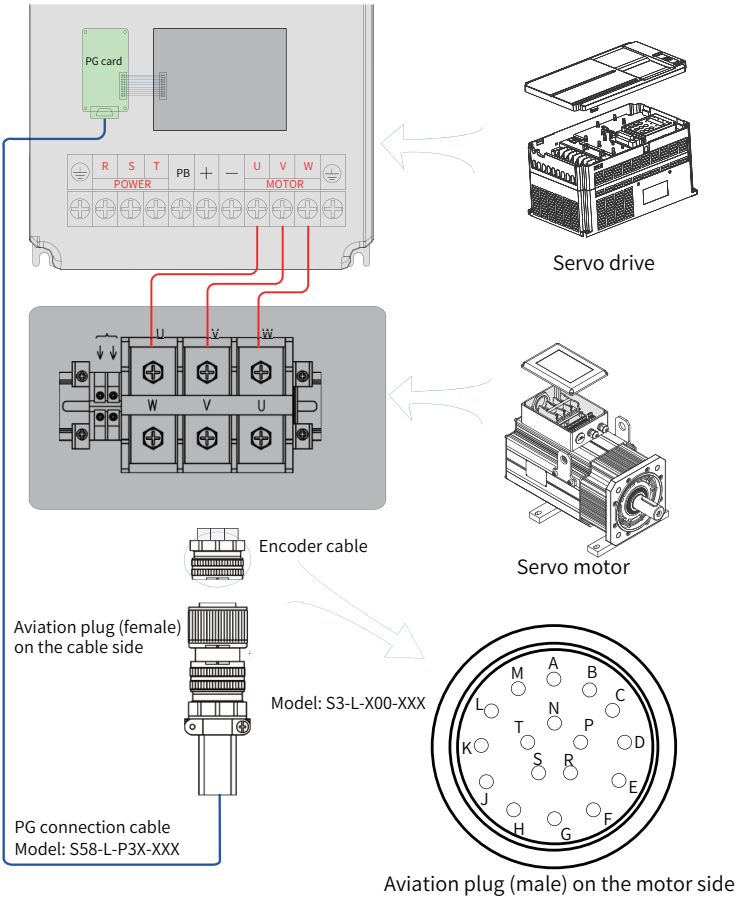


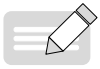
Figure 3-69 Wiring between the PG card and the motor (applicable to the ESMG/ISMG/ISMQ series motor)

The following table shows the color of cable cores for the resolver PG card with aviation plug (applicable to the ESMG/ISMG/ISMQ series motor).

17P Aviation Plug	A	B	C	D	E	F	G	H	L	K	J
Resolver PG Card (DB9 Male)	1	2	3	4	5	9	7	8		6	Housing
Definition of Signal	REF-	REF+	Cos+	Cos-	Sin+	Sin-	PTC+	KTY-	PTC-	KTY+	Shield
Color of Cable Core	Yellow/ Black	Red/ Black	Red	Black	Yellow	Blue	Orange	Brown		Gray	Shield
Remarks	One pair		One pair		One pair		/	Common point of KTY and PTC		/	/

The following table shows the color of cable cores for the 23-bit PG card with aviation plug (applicable to the ESMG/ISMG/ISMQ series motor).

17P Aviation Plug	A	B	L	M	G	H	J
23-bit PG Card (DB9 Male)	1	2	5	9	7	8	Housing
Definition of Signal	PS+	PS-	KTY-	KTY+	+5V	GND	Shield
Color of Cable Core	Yellow	Yellow/Black	Green	White	Red	Black	Shield
Remarks	Twisted pair		Twisted pair		Twisted pair		/



NOTE

- When the drive is configured with a 23-bit PG card, the UVW phases of the motor must be consistent with those of the servo drive so that the intelligent identification of motor parameters can be implemented.

2) Without aviation plug (applicable to the ESMG/ISMG-****-F series motor)

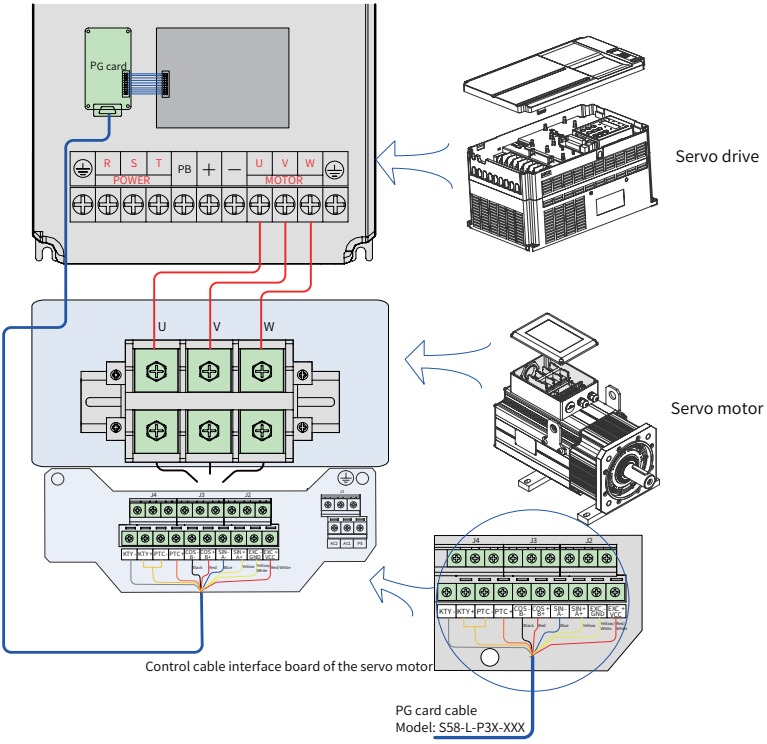


Figure 3-70 Wiring between the resolver PG card and the motor (applicable to the third-party or Inovance motors without the aviation plug)

The following table shows the color of cable cores for the resolver PG card without aviation plug (applicable to the third-party or Inovance motors without the aviation plug).

Resolver PG Card (DB9 Male)	1	2	3	4	5	9	7	8	6
Color of Cable Core	REF-	REF+	Cos+	Cos-	Sin+	Sin-	PTC+	KTY-/ PTC-	KTY+
Definition of Signal	Yellow/ Black	Red/ Black	Red	Black	Yellow	Blue	Orange	Brown	Gray
Remarks	One pair		One pair		One pair		/	Common point of KTY and PTC	/

■ Shield grounding of the PG card

When the parameters of the servo drive are set properly, the PG card suffers an electromagnetic interference if the feedback speed or position of the PG card is instable. To solve this problem, ground the shield of the encoder signal cable.

A grounding PE terminal is provided for the IS580. After the PG card is installed, connect the shield of the encoder signal cable to the PE terminal of the PG card to achieve the connection between the signal cable shield and the PE terminal of the servo drive, completing the grounding of the signal cable shield.

Installation of the PG card: Before installation, remove the screws in the amplified position in the following figure, align the mounting holes of the PG card to the three fixing pins (on the upper left of the amplified position), and fix the PG card with M3x8 screws.

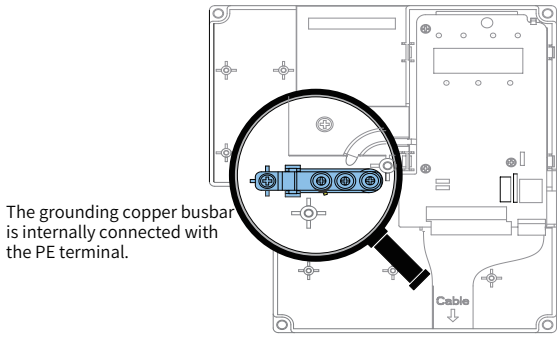


Figure 3-71 PE terminal design for the servo drive (grounding copper busbar)

■ EMC guidelines

For details, see *"10.2.7 EMC Guidance" on page 225*.

3.2.9 Control Circuit Terminal Tightening Torque and Cable Selection

■ Tubular terminals

Use the tubular terminals with an insulation sleeve.

When the single cable or twisted pair cable is used, the cable core must be exposed by not greater than 6 mm.

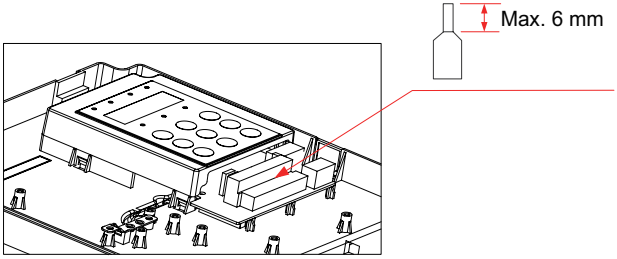


Figure 3-72 Requirement for the tubular terminals of control cables

Table 3-14 Specifications of control cables

Control Circuit Terminal Block	Single Cable (mm^2, AWG)	Twisted Pair Cable (mm^2, AWG)	Tightening Torque (N·m)
	0.2–0.75 (18AWG to 24AWG)		0.565

3.2.10 Wiring Checklist

Table 3-15 Wiring checklist

No.	Item	Remarks
1	Check whether the drive model is consistent with your order.	
2	Check whether peripherals (regenerative resistor, braking unit, AC reactor, filter, and circuit breaker) meet the design requirements.	
3	Check whether the optional card models are consistent with your order.	
4	Check whether the installation method and position of the servo drive meet the requirements.	
5	Check whether the input voltage of the servo drive is within 323–528 V.	
6	Check whether the rated motor voltage is consistent with the output specification of the servo drive.	
7	Check whether power input cables are connected to R, S, T terminals of the servo drive correctly.	
8	Check whether motor cables are connected to U, V, W terminals of the servo drive correctly.	
9	Check whether the diameter of the main circuit cables meets the requirements.	
10	Check whether the motor output cable exceeds 50 m. If so, reduce the carrier frequency (F0-15).	
11	Check whether the grounding cable is connected properly.	
12	Check whether the servo drive output terminals and control signal terminals are connected securely.	
13	Check whether the regenerative resistor and braking unit are connected correctly and whether their resistances are proper.	
14	Check whether the control circuit signal cables of the servo drive are STPs.	
15	Check whether the optional cards are connected correctly.	
16	Check whether the control circuit cables are laid separately from the main circuit power cables.	

4 Panel Operations

4.1 Description of the Operating Panel

You can set or modify the parameters, monitor the servo drive status, and start or stop the servo drive by operating the operating panel. The following figure shows the appearance and keys of the operating panel.

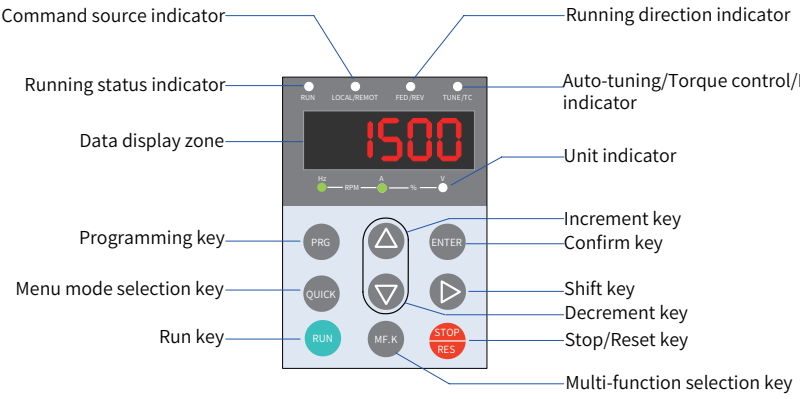
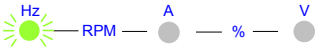
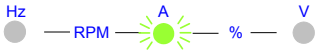
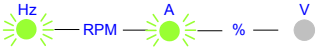


Figure 4-1 Operating panel

1) Indicators on the operating panel

Table 4-1 Description of indicators on the operating panel

Indicator Status		Status Description
RUN Running status indicator	RUN	OFF: Stop status
	RUN	ON: Running status
LOCAL/REMOT Command source indicator	LOCAL/ REMOT	OFF: Operating panel control
	LOCAL/ REMOT	ON: Terminal control
	LOCAL/ REMOT	Flashing: Communication control
FWD/REV Running direction indicator	FED/REV	OFF: Forward running
	FED/REV	ON: Reverse running

Indicator Status		Status Description
TUNE/TC Auto-tuning/ Torque control/ Fault indicator		OFF: Normal running
		ON: Torque control mode
		Slow flashing: Auto-tuning state (once per second)
		Quick flashing: Fault state (four times per second)
		Hz: unit of frequency
		A: unit of current
		V: unit of voltage
		RPM: unit of rotational speed
		%: percentage

2) LED displays

The 5-digit LEDs on the operating panel are able to display the set frequency, output frequency, various monitoring data, and fault codes.

Table 4-2 LED displays and actual data

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
	0		6		C		N
	1		7		c		P
	2		8		D		R
	3		9		E		T
	4		A		F		U
	5, S		B		L		u

3) Keys on the operating panel

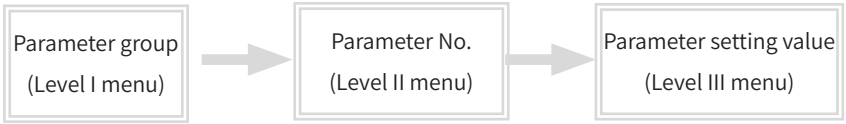
Table 4-3 Function of keys on the operating panel

Key	Key Name	Function
PRG	Programming	Enter or exit Level I menu.
ENTER	Confirm	Enter the menu interfaces level by level, and confirm parameter settings.
△	Increment	Increase the data or parameter.
▽	Decrement	Decrease the data or parameter.
▷	Shift	◆ Select the displayed parameter in the stop or running state. ◆ Select the digit to be modified when modifying a parameter value.
RUN	Run	Start the servo drive in the operating panel control mode.
STOP RES	Stop/Reset	Stop the servo drive when the drive is in the running state and perform a reset operation when the drive is in the fault state. The functions of this key can be restricted by F7-02 (STOP function).
MF.K	Multi-function selection	Perform function switchover according to the setting of F7-01 (MF.K function selection). For details, see "3) Operations of the multi-function selection key" on page 98.
QUICK	Menu mode selection	Perform switchover between different menu modes.

4.2 Viewing and Modifying Parameters

1) Operation instructions

The operating panel adopts a three-level menu to perform operations such as parameter settings. It consists of:



After entering each level of menu, if the LED flashes, you can press , or to modify the flashing value. Figure 4-2 shows the operation procedure.

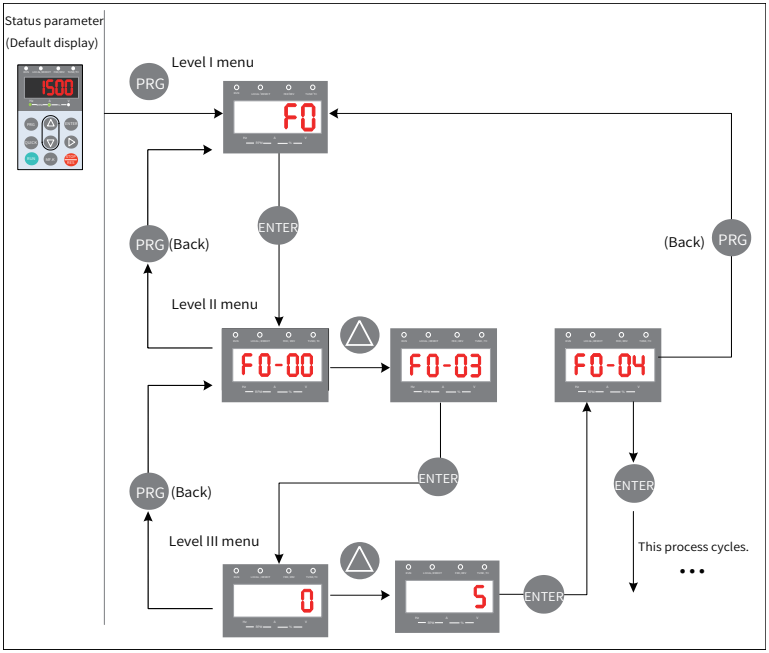


Figure 4-2 Operation procedure of the three-level menu

The following example shows how to modify F3-02 (Cut-off frequency of torque boost) from 10.00 Hz to 15.00 Hz.

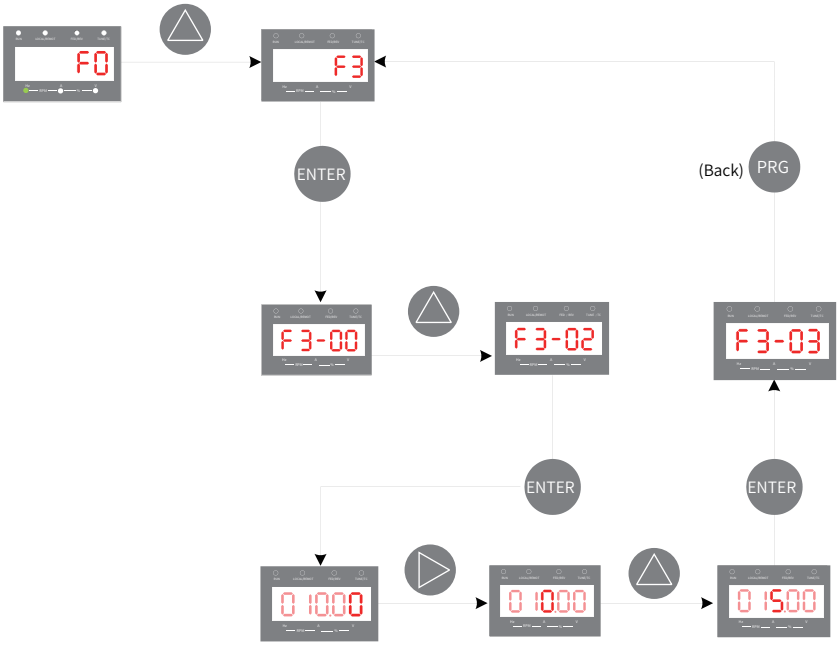


Figure 4-3 Parameter value modification procedure

NOTE

- You can return to Level II menu from Level III menu by pressing PRG or ENTER. The difference between them is as follows:

  After you press ENTER, the system saves the parameter setting, goes back to Level II menu, and automatically shifts to the next parameter.

  After you press PRG, the system does not save the parameter setting, but directly goes back to Level II menu and remains at the current parameter.

- In Level III menu, if a parameter has no blinking digit, it means that the parameter cannot be modified. This may be because:

1) Such a parameter is read-only, such as drive type, detected parameters, and running record parameters.
2) Such a parameter cannot be modified when the servo drive is in the running state. It can be modified only when the drive is in the stop state.

2) Parameter groups

Table 4-4 Parameter groups

Parameter Group	Function Description	Remarks
Group F0 to Group FP	Basic parameters	Including running reference parameters, frequency reference parameters, motor parameters, control mode parameters, AI/AO characteristic correction parameters, and optimized control parameters.
Group A0 to Group AF		
Groups U0 and U1	Monitoring parameters	Display of basic monitoring parameters

3) Operations of the multi-function selection key

The function of multi-function selection key MF.K can be set in F7-01 (MF.K function selection) . You can use this key to switch the command source or rotational direction of the servo drive or perform forward/reverse jog in either stop or running state.

Parameter No.	Parameter Name	Default	Setting Range	Parameter Description
F7-01	MF.K function selection	0	0: MF.K inactive	The key has no function.
			1: Switchover between operating panel control mode and terminal/ communication control mode	When F0-02 (Command source) is set to 0 (Operating panel control mode), the command source remains unchanged after you press MF.K . When F0-02 (Command source) is set to 1 (Terminal control mode), the command source switches from operating panel control to terminal control after you press MF.K . When F0-02 (Command source) is set to 2 (Communication control mode), the command source switches from operating panel control to communication control after you press MF.K .
			2: Switchover between forward running and reverse running	You can use MF.K to change the direction of frequency reference. This function is valid only when the command source is operating panel.
			3: Forward jog	Use MF.K to implement forward jog.

5 Basic Operations and Trial Run

This chapter describes the basic commissioning steps of the servo drive, including the frequency reference setting, startup control, and stop control. By following the instructions, you can perform the motor trial run under the control of the servo drive.

5.1 General Commissioning Flowchart of the Servo Drive

5.1.1 Setting the Command Source

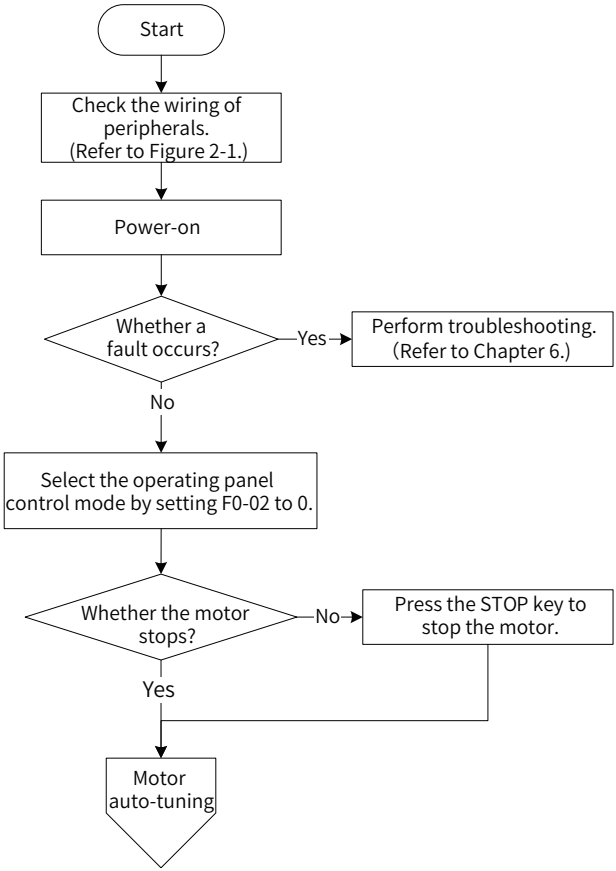


Figure 5-1 Setting the operating panel control mode

5.1.2 Motor Auto-Tuning

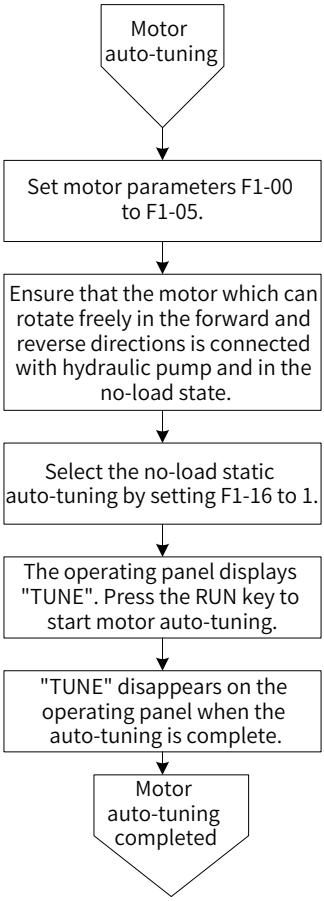


Figure 5-2 Motor auto-tuning

5.1.3 Trial Run

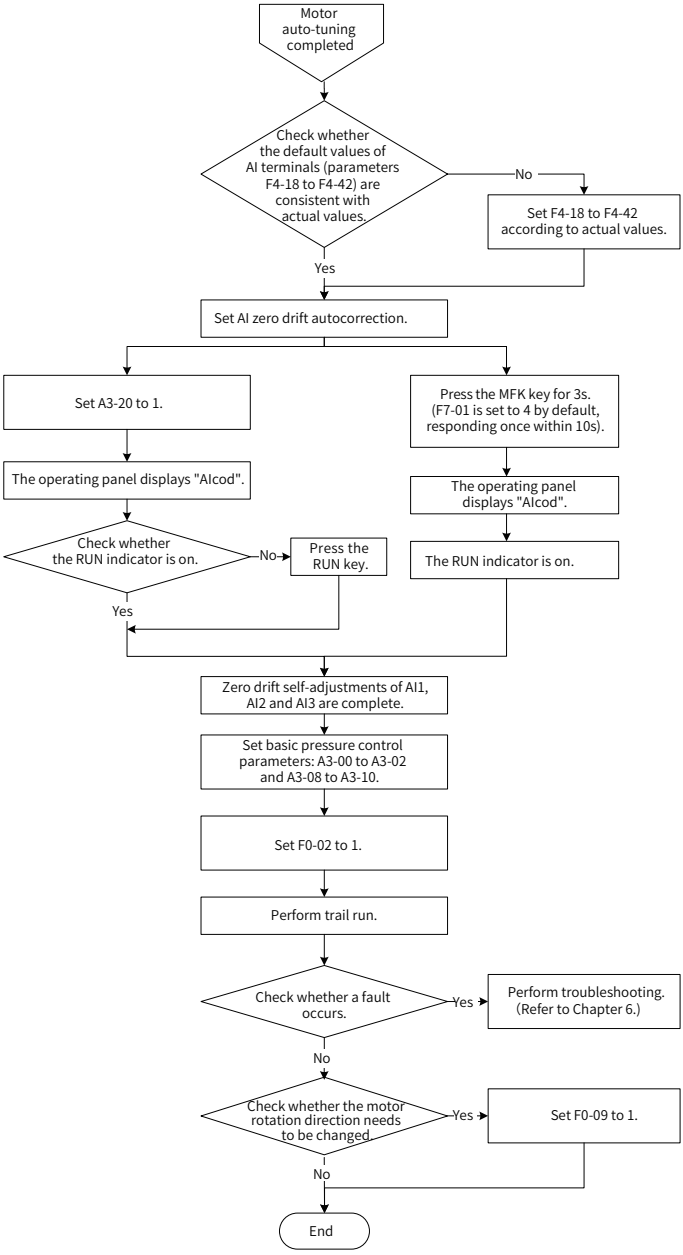


Figure 5-3 Trial run

5.2 Inspection Before Power-on

Before power-on, check the following items:

Item	Description
Power voltage	Check whether the power voltage is 380–480 VAC, 50/60 Hz.
	Check whether the power input terminals (R, S, T) are connected reliably.
	Check whether the servo drive and the motor are properly grounded.
Connection between servo drive output terminals and motor terminals	Check whether the connection between servo drive output terminals (U, V, W) and motor terminals is secure.
Connection between servo drive control circuit terminals and other control devices	Check whether the connection between servo drive control circuit terminals and other control devices is secure.
State of servo drive control circuit terminals	Check whether all servo drive control circuit terminals are OFF (the servo drive is not in the running state).
Motor load	Check whether the motor is in the no-load state and not connected with the mechanical system.

5.3 Panel Display After Power-on

After the servo drive is powered on, the display on the operating panel is as follows:

State	Display	Description
Normal state		Digital setting "1500" is displayed by default.
Fault state		When a fault occurs, the servo drive stops. The fault type is displayed.

5.4 Parameter Settings

5.4.1 Parameter Initialization

You can initialize the servo drive. After initialization, FP-01 (Parameter initialization) automatically restores to 0.

Parameter No.	Parameter Name	Setting Range	Default
FP-01	Parameter initialization	0: No operation 1: Restore factory parameters, excluding motor parameters 2: Clear fault records 3: Restore user backup parameters 4: Restore factory system parameters, excluding A2-01 5: Restore all parameters excluding groups FF, FP, and FA. Remember to back up parameters.	0

1: Restore factory parameters, excluding motor parameters

After FP-01 (Parameter initialization) is set to 1, most parameters of the servo drive are restored to default settings. But motor parameters, fault records, timed business running time (group FA), AI/AO correction parameters (F4-43 to F4-54), and heatsink temperature (F7-07) cannot be restored.

2: Clear fault records

Clear the fault records and accumulative running time (F7-09).

3: Restore user backup parameters

Restore the user parameters that are backed up by setting FP-05 (User parameter storage) to 1.

4: Restore factory system parameters, excluding A2-01

After FP-01 (Parameter initialization) is set to 4, most parameters of the servo drive are restored to default settings. But CAN ommunication address (A2-01), motor parameters, fault records, timed business running time (group FA), AI/AO correction parameters (F4-43 to F4-54), and heatsink temperature (F7-07) cannot be restored.

5: Restore all parameters, excluding groups FF, FP, and FA

After FP-01 (Parameter initialization) is set to 5, most parameters of the servo drive are restored to default settings. But timed business running time (group FA), accumulative running time (F7-09), and factory parameters (group FF) cannot be restored.

5.4.2 Startup and Stop Commands

Parameter No.	Parameter Name	Setting Range	Default
F0-02	Command source	0: Operating panel control (LOCAL/REMOT indicator OFF) 1: Terminal control (LOCAL/REMOT indicator ON) 2: Communication control (LOCAL/REMOT indicator flashing)	0

It is used to select the input channel of servo drive control commands, such as startup, stop, forward running, reverse running, and jog.

0: Operating panel control (LOCAL/REMOT indicator OFF)

Commands are given by pressing 

and 

on the operating panel.

1: Terminal control (LOCAL/REMOT indicator ON)

Commands are given by multi-functional input terminals such as FWD, REV, JOGF, and JOGR.

2: Communication control (LOCAL/REMOT indicator flashing)

5.4.3 Motor Control Mode Selection

Parameter No.	Parameter Name	Setting Range	Application
F0-01	Motor control mode	0: Sensorless vector control (SVC)	Refers to open-loop vector control.
		1: Feedback vector control (FVC)	Refers to closed-loop vector control. The motor must be configured with an encoder and the PG card (optional) of the servo drive must match the encoder type.
		2: Variable/Frequency (V/f) control (speed open-loop control)	Applicable to applications with low load requirements or applications where one servo drive drives multiple motors, such as fans and pumps.

5.5 Auto-Tuning: Motor Type Selection

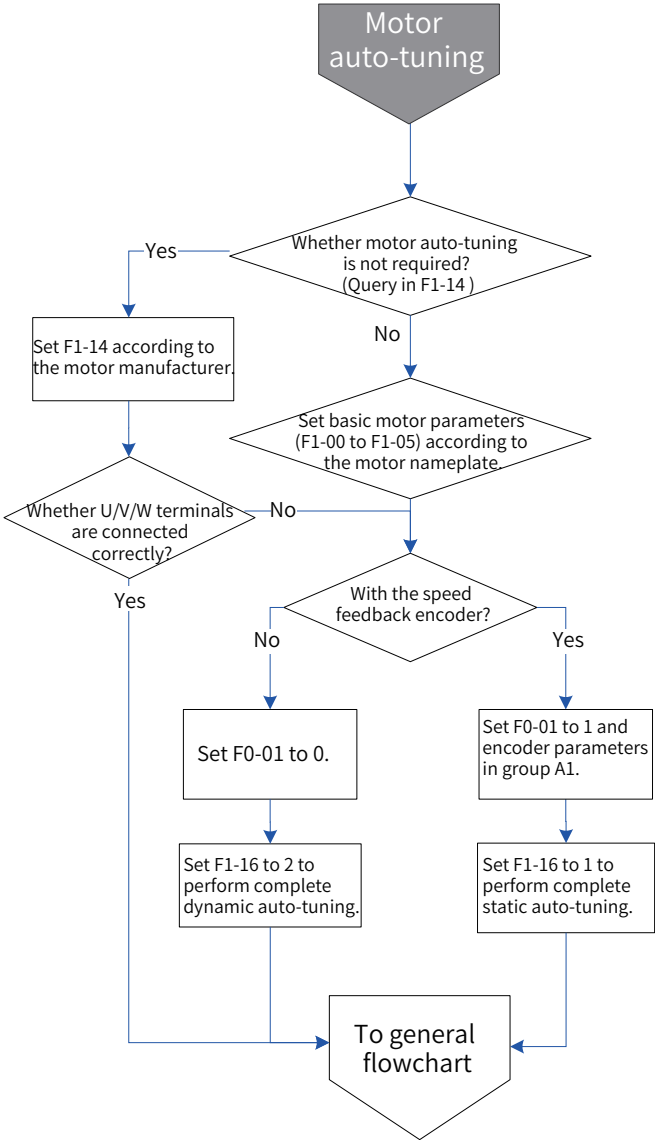


Figure 5-4 Motor auto-tuning procedure (vector control)


NOTE

- The IS580 is compatible with 23-bit absolute encoderr, with a resolution of up to 8 million PPR. It also supports motor parameter packing, realizing intelligent identification of motor parameters and improving the simplicity of servo drive. The intelligent identification of motor parameters is only applicable to servo systems equipped with ESMG/ISMGx-xxxxxxx-A3xxxx series motor with 23-bit absolute encoderr.

Motor type selection:

Parameter No.	Parameter Name	Setting Range
F1-00	Motor type selection	0: Asynchronous motor
		1: Variable frequency asynchronous motor
		2: Synchronous motor

The servo drive can obtain the internal electrical parameters of the controlled motor through static auto-tuning 1, no-load dynamic auto-tuning, static auto-tuning 2, and manual input of motor parameters.

If an Inovance motor is used, you can run the motor directly after inputting the motor code in FP-02 (Motor model).

Auto-Tuning Mode	Applicable Scenario	Auto-Tuning Effect
Static auto-tuning 1 (F1-16 = 1)	Applied to scenarios where the motor back EMF is known. The motor runs at a low speed during auto-tuning. You can perform auto-tuning without turning on the overflow valve.	Best
No-load dynamic auto-tuning (F1-16 = 2)	Applied to scenarios where the motor back EMF is unknown. The motor runs at a high speed during auto-tuning; therefore, the overflow valve must be turned on. With-load auto-tuning will affect the precision of motor auto-tuning and the control effect of the servo system.	Ordinary
Static auto-tuning 2 (F1-16 = 3)	Applied to scenarios where the motor back EMF is known and where there is a heavy load. The motor runs at a low speed during auto-tuning. You can perform auto-tuning without turning on the overflow valve. **Note:** When the encoder and motor are connected correctly, adopt this mode if E43.02 is reported during static auto-tuning 1 or dynamic auto-tuning.	Good
Manual input of motor parameters	Applied to scenarios where the motor can be hardly disconnected from the application system. Input the parameters of the motor of the same model that have implemented auto-tuning successfully into F1-00 to F1-06 and F1-11 to F1-15.	Good

The motor auto-tuning procedure is as follows:

Step 1: If the motor can be completely disconnected from the load, disconnect the motor from the load after power-off so that the motor can rotate without load.

Step 2: After power-on, set F0-02 (Command source) to 0 (Operating panel control).

Step 3: Input the parameters (such as F1-00 to F1-05) on the motor nameplate correctly.

If there is an encoder, input the encoder parameters (A1-00 and A1-04)

Step 4: Set F1-16 (Auto-tuning mode) to 1 (Static auto-tuning 1), and press ENTER on the operating panel to confirm. Then, "TUNE" is displayed on the operating panel, as shown in the following figure.



Press RUN on the operating panel, and the servo drive will drive the motor to accelerate/decelerate and run in the forward/reverse direction. The RUN indicator becomes ON (

) and the auto-tuning lasts for approximately 2 minimum When 

disappears and the operating panel returns to the normal parameter display, motor auto-tuning is complete.

The servo drive automatically computes the following motor parameters after a complete auto-tuning.

Parameter No.	Parameter Name
F1-11	D-axis inductance (synchronous motor)
F1-12	Q-axis inductance (synchronous motor)
F1-13	Synchronous motor stator resistance

If the motor cannot be completely disconnected from the load, set F1-16 (Auto-tuning mode) to 3 (Static auto-tuning 2) and press RUN on the operating panel to start motor auto-tuning.

5.6 Observation of Running Status

1) After the auto-tuning has been completed, set F0-08 (Preset frequency) to 5.00 to perform a low-speed trial run and observe whether the servo drive runs stably with a small running current.

2) If the running current is too large, check whether motor parameters (Group F1) and the number of rotary encoder poles (A1-04) are set correctly. If the parameters need to be modified, perform auto-tuning again, perform a low-speed trial run,

and observe whether the running current is normal.

3) When motor auto-tuning becomes normal, check whether the servo drive runs in the correct direction. If not, exchange any two phases of motor UVW cables and perform motor auto-tuning again.

4) If an oscillation or a low sound occurs during motor running, reduce the speed loop properly by decreasing the value of F2-00 (Speed loop proportional gain 1) and F2-03 (Speed loop proportional gain 2) or increasing the value of F2-01 (Speed loop integral time 1) and F2-04 (Speed loop integral time 2).

5) If the motor speed is unstable during running, enhance the speed loop properly by increasing the value of F2-00 (Speed loop proportional gain 1) and F2-03 (Speed loop proportional gain 2) or decreasing the value of F2-01 (Speed loop integral time 1) and F2-04 (Speed loop integral time 2).



NOTE

- The overflow valve must be turned on to ensure that there is no load during trial run.
- The speed/current loop parameters are set in group F2.
- The speed/current loop response will affect pressure stability. If conditions permit, set a strong speed/current loop response as possible as can.

5.7 Commissioning of the Servo Hydraulic Pump

5.7.1 Oil Pressure Control Mode Selection

Parameter No.	Parameter Name	Setting Range	Application
A3-00	Oil pressure control mode	0: Speed mode	Non-oil pressure control mode
		2: References given by AI terminals	During the oil pressure control by the servo drive, AI1 gives the oil pressure reference, AI2 gives the flow reference, and AI3 gives the oil pressure feedback reference.
A3-00	Oil pressure control mode	5: References given by EST host controller through CAN communication	During the oil pressure control by the servo drive, the EST host controller gives the oil pressure and flow references through CAN communication, and AI3 gives the oil pressure feedback reference.
		6: References given by CANopen communication	During the oil pressure control by the servo drive, CANopen communication gives the oil pressure and flow references, and AI3 gives the oil pressure feedback reference.

When the servo drive switches from the non-oil pressure control mode (A3-00 = 0) to oil pressure control modes (A3-00 ≠ 0), the parameters listed in the following table will be set automatically.

Parameter No.	Parameter Name	Setting Range
F0-01	Control mode	1: Vector control
F0-02	Command source	1: Terminal control
F0-17	Acceleration time	0.0s
F0-18	Deceleration time	0.0s
F1-00	Motor type	2: Synchronous motor

If you modify these parameters in oil pressure control modes, the parameters will be restored to the automatically set values when the servo drive is powered on again after power failure. When the servo drive switches from oil pressure control modes to the non-oil pressure control mode, these parameters will be restored to the values set before switching to oil pressure control modes.

5.7.2 AI Zero Drift Autocorrection

Step	Parameter Setting	Description
Command source setting	F0-02 = 0	Operating panel control mode LOCAL/REMOT indicator on the operating panel is OFF.
AI zero drift autocorrection	A3-20 = 1	AI zero drift autocorrection When AI cod is displayed, press RUN on the operating panel and AI zero drift will be autocorrected.

NOTE

- Manual AI zero drift correction: When the servo drive is disabled, view the values of U1-04, U1-05, and U1-06. The maximum values of the three parameters plus 10 mV is written to F4-18, F4-23, and F4-28, respectively.
- After AI zero drift autocorrection is complete, A3-20 will be automatically restored to 0.

5.7.3 Oil Pressure Parameter Settings

1) Parameters related to system pressure and flow

■ System flow and pressure parameters

Parameter No.	Parameter Name	Setting Range
A3-01	Maximum motor speed	It is used to set maximum motor speed (motor speed corresponding to 100% of the flow reference)
A3-02	System pressure	It is used to set maximum system pressure. Range: 0 to A3-03 (Maximum oil pressure).
A3-03	Maximum oil pressure	It is used to set the measuring range of the output type pressure sensor with a voltage of 0–10 VDC.

■ AI1 oil pressure reference parameters

Parameter No.	Parameter Name	Setting Range
F4-18	AI1 minimum input	Minimum voltage input of oil pressure reference, corresponding to AI1 zero drift
F4-19	Corresponding value of AI1 minimum input	Minimum oil pressure reference Default: 0.0% (zero pressure)
F4-20	AI1 maximum input	Maximum voltage input of oil pressure reference Maximum value: 10 V
F4-21	Corresponding value of AI1 maximum input	Maximum oil pressure reference, 100% corresponding to system pressure (A3-02)

These parameters are used to set the AI1 oil pressure reference (0–10 V or other measuring range) corresponding to different oil pressures (0 kg/cm^2 to A3-02).

■ AI2 flow reference parameters

Parameter No.	Parameter Name	Setting Range
F4-23	AI2 minimum input	Minimum voltage input of flow reference, corresponding to AI2 zero drift
F4-24	Corresponding value of AI2 minimum input	Minimum flow reference Default: 0.0% (zero flow)
F4-25	AI2 maximum input	Maximum voltage input of flow reference Maximum value: 10 V
F4-26	Corresponding value of AI2 maximum input	Maximum flow reference, 100% corresponding to maximum motor speed (A3-01) by default

These parameters are used to set the AI2 flow reference (0–10 V or other measuring range) corresponding to different motor speeds (0 rpm to A3-01).

■ AI3 oil pressure feedback parameters

Parameter No.	Parameter Name	Setting Range
F4-28	AI3 minimum input	Minimum voltage input of oil pressure feedback, corresponding to AI3 zero drift
F4-29	Corresponding value of AI3 minimum input	Minimum oil pressure feedback Default: 0.0% (zero pressure)
F4-30	AI3 maximum input	Maximum voltage input of oil pressure feedback Maximum value: 10 V
F4-31	Corresponding value of AI3 maximum input	Maximum oil pressure feedback, 100% corresponding to maximum oil pressure (A3-03) by default

These parameters are used to set the AI3 oil pressure feedback (0–10 V or other measuring range) corresponding to different pressure sensor measuring ranges (0 kg/cm^2 to A3-03).

2) Pressure relief parameter

Parameter No.	Parameter Name	Setting Range
A3-08	Maximum reverse motor speed	It is used to set the maximum reverse motor speed during pressure relief, corresponding to the percentage of maximum motor speed (A3-01). A larger value indicates a faster pressure relief, and a smaller value indicates a slower pressure relief. Noise will occur during reverse running of the hydraulic pump if the value of A3-08 is too large.

3) Base flow and base pressure

Due to the existence of internal leakage in the hydraulic pump, the hydraulic oil in the oil circuit will flow back to the oil tank when there are no flow and pressure references, causing the entry of air into the oil circuit. This will result in system running noise and instability. Therefore, certain base flow and pressure must be provided.

Parameter No.	Parameter Name	Setting Range
A3-09	Base flow	0.0% to 50.0%, corresponding to the percentage of maximum motor speed (A3-01)
A3-10	Base pressure	0.0–50.0 kg/cm^2

4) Filter time of oil pressure and flow references

■ Oil pressure reference filter time

Parameter No.	Parameter Name	Setting Range
F4-22	AI1 input filter time	0.000s to 10.000s
A3-04	Rising time of 1st group of oil pressure references	0.000s to 2.000s
A4-02	Falling time of 1st group of oil pressure references	0.000s to 2.000s
A3-25	Rising S-curve filter time of 1st group of oil pressure references	0.000s to 1.000s
A3-26	Falling S-curve filter time of 1st group of oil pressure references	0.000s to 1.000s
A4-10	Rising S-curve filter time of 2nd group of oil pressure references	0.001s to 1.000s
A4-11	Falling S-curve filter time of 2nd group of oil pressure references	0.001s to 1.000s
A4-14	Rising time of 2nd group of oil pressure references	0s to 2.000s
A4-15	Falling time of 2nd group of oil pressure references	0s to 2.000s

A smaller filter time generates quicker oil pressure response and larger overshoot. Conversely, a larger filter time generates slower oil pressure response and smaller overshoot.

■ Flow reference filter time

Parameter No.	Parameter Name	Setting Range
F4-27	AI2 input sampling filter	0.000s to 10.000s
A4-03	Rising time of 1st group of flow references	0s to 1.000s
A4-04	Falling time of 1st group of flow references	0s to 1.000s
A4-12	Rising time of 2nd group of flow references	0.001s to 5.000s
A4-13	Falling time of 2nd group of flow references	0.001s to 5.000s

A smaller filter time generates quicker oil pressure response and larger running impact. Conversely, a larger filter time generates slower oil pressure response and smoother running.

5.7.4 Adjustment of Oil Pressure PID

1) Oil pressure PID modes

■ Oil pressure PID mode 1: PID groups selected by DI terminals

The servo drive has four groups of PID parameters which can be selected using different combinations of terminals DI2 allocated with function 48 and DI3 allocated with function 49. They are:

DI3 (Function 49)	DI2 (Function 48)	PID Group
0	0	Group 1: A3-05, A3-06, A3-07
0	1	Group 2: A3-11, A3-12, A3-13
1	0	Group 3: A3-14, A3-15, A3-16
1	1	Group 4: A3-17, A3-18, A3-19

A larger proportional gain (Kp) and differential time (Kd) but smaller integral time (Ki) generate a faster response. An overshoot will occur if the response is too fast, causing the system oscillation and instability.

A smaller proportional gain (Kp) and differential time (Kd) but larger integral time (Ki) generate a slower response. If the response is too slow, the efficiency will decrease and the product manufacturing will become unstable.

■ Oil pressure PID proportional gain (parameters: A3-05, A3-11, A3-14, and A3-17)

The larger the proportional gain is, the quicker the pressure response will be. However, a system oscillation will occur if the proportional gain is too large.
The smaller the proportional gain is, the slower the pressure response will be. The following figure shows the details.

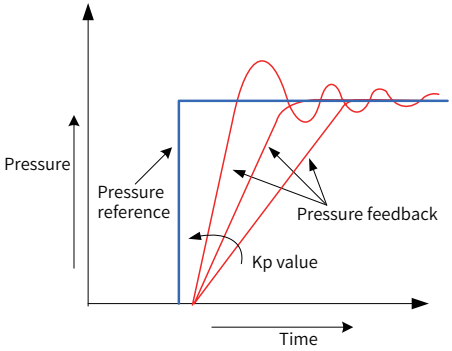


Figure 5-5 Oil pressure PID proportional gain

■ Oil pressure PID integral time (parameters: A3-06, A3-12, A3-15, and A3-18)

The smaller the integral time is, the quicker the pressure response will be. However, an overshoot or even a system oscillation will occur if the response is too quick.
The larger the integral time is, the slower the pressure response will be. However, the pressure will become unstable if the response is too slow. The following figure shows the details.

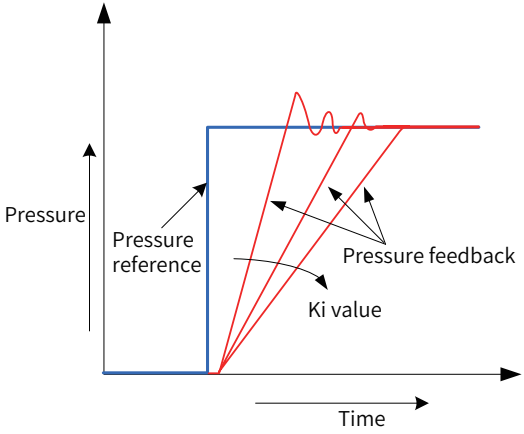


Figure 5-6 Oil pressure PID integral time

2) Oil pressure loop PID response gain (parameter: A3-29)

A3-29 (Oil pressure loop gain) is used to adjust the response of the entire oil pressure loop control circuit. The larger the oil pressure loop gain is, the quicker the response will be. However, a system oscillation will occur if the response is too quick.

The smaller the oil pressure loop gain is, the slower the response will be.

In applications where the oil pressure system has a very large inertia or where the oil tube is long and thin, reduce the oil pressure loop gain.

5.7.5 Adjustment of Pressure Holding Stability

If the pressure fluctuation of pressure holding is too large during commissioning, increase the low-speed speed loop response to enhance the pressure stability. That is, increase the value of F2-00 (Speed loop proportional gain 1) and decrease the value of F2-01 (Speed loop integral time 1) properly. The motor will have an oscillation if the adjustments are improper.

6 Troubleshooting

6.1 Safety Instructions

Safety Instruction
 DANGER ◆ Before wiring, turn all the circuit breakers off. Failure to comply will result in an electric shock.
 WARNING ◆ Ensure that the servo drive is grounded according to local laws and regulations. Failure to comply will result in an electric shock or even a fire. ◆ Do not remove the enclosure or touch the internal circuit of the servo drive when the power is on. Failure to comply will result in an electric shock. ◆ Inspection, maintenance, and repair can be performed only by qualified personnel. Failure to comply will result in an electric shock or even a fire. ◆ When installing the servo drive in an enclosed cabinet or a casing box, use the cooling fan or air conditioner to keep the air inlet temperature below 50°C. Failure to comply will result in overheat or even a fire. ◆ Tighten all screws based on the specified torque. Failure to comply may result in an electric shock or even a fire. ◆ Ensure that the input voltage of the servo drive is within the range specified on the nameplate. Failure to comply will result in an electric shock or even a fire. ◆ Never place flammable and explosive objects around the drive.
 CAUTION ◆ During installation, use a paper or cloth to cover the upper part of the servo drive to prevent metal filings, oil, and water from entering into the servo drive when drilling holes. If foreign matters enter into the servo drive, the servo drive may get faulty. ◆ After the installation is completed, remove the paper or cloth. Otherwise, the ventilation will get poor, causing abnormal overheat of the drive. ◆ Follow proper ESD procedures when operating the servo drive. Failure to comply will result in damage to internal circuits of the servo drive.

6.2 Alarms and Fault Display

When a fault occurs, the servo drive stops output immediately, the fault indicator 

flashes, and the contact of the fault relay acts. The operating panel will display the fault code, such as 

. See "Table 6-2 Fault list" on page 118 to find corresponding fault type and solutions. The solutions listed in Table 6-2 are for reference only. Do not repair or modify the drive by yourself. If the fault cannot be eliminated, contact the technical personnel of Inovance.

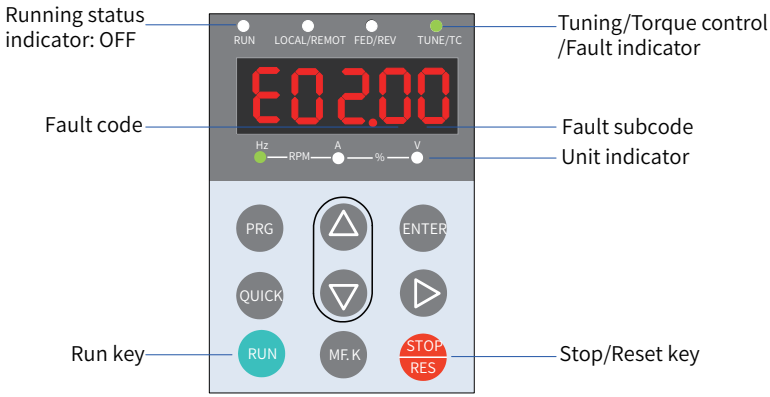
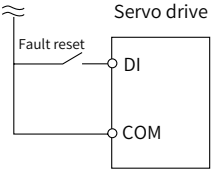
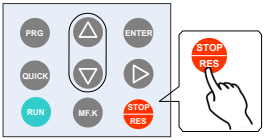
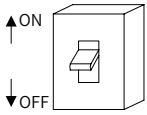
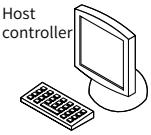


Figure 6-1 Fault display on the operating panel

6.3 Restart After Fault

Table 6-1 Methods of restarting the servo drive after fault

Stage	Solution	Remarks
In the fault state	View the detailed information of recent three faults using the operating panel, including fault time, fault type, and frequency/current/bus voltage/input or output status/power-on time/running time at the occurrence of the fault.	View the fault information in parameters F9-18 to F9-44. 
Before fault reset	Find the fault cause according to the fault type displayed on the operating panel and eliminate the fault. Then, reset the servo drive.	Troubleshoot the fault according to "6.4 Fault Alarms and Solutions" on page 118.
Methods of resetting the fault	1) Allocate a DI terminal with function 9 (Fault reset) by setting any one of F4-00 (DI1 terminal function selection) to F4-04 (DI5 function selection) to 9.	
	2) Set F7-02 (STOP/RESET key function) to 2 (default value), indicating that STOP RES key can be used to reset the fault in all operation modes.	Press STOP RES key on the operating panel. 
	3) The fault can be reset automatically after the servo drive is powered on again. Cut off the main circuit power supply, and re-power on the main circuit after the display on the operating panel disappears.	
	4) Reset the fault through the communication. Write "7" (Fault reset) into the communication address 2000H using the host controller so that the servo drive can be reset after the fault is eliminated.	

6.4 Fault Alarms and Solutions

The following faults may occur during the use of the servo drive. Perform simple fault analyses according to the following solutions. (You need not pay attention to the fault subcode if it is not provided.)

Table 6-2 Fault list

Fault	Panel Display	Possible Cause	Solution
Detection circuit fault	E0 1.00	The current detection circuit is damaged, causing too large current zero-drift at stop.	Check the current detection circuit.
Overcurrent during acceleration	E02.00	The drive output circuit is grounded or short-circuited.	Eliminate external faults.
		The braking transistor is short-circuited.	Power off the servo drive, remove the regenerative resistor, and power on the servo drive again. ◆ If no fault is reported, it indicates that the braking circuit is abnormal. The cause may be that the resistance between the regenerative resistor cable and the enclosure of the servo drive is too small (short circuit). In this case, replace the regenerative resistor. ◆ If the fault persists, it indicates that the braking transistor circuit is normal but the motor control loop is abnormal. Check whether the overcurrent is caused by other reasons.
		The control mode is SVC or FVC, and motor auto-tuning is not performed.	Set motor parameters according to the nameplate and perform motor auto-tuning.
		The acceleration time is too short.	Increase the acceleration time.
		The rotating motor is started.	Select the motor speed tracking restart or start the motor after it stops.
		The servo drive suffers external interference.	View historical fault records. If the current is significantly smaller than the overcurreth threshold when the fault occurs, find the interference source. If no external interference exists, the drive board, Hall sensor, Hall cables or the control board may be faulty.

Fault	Panel Display	Possible Cause	Solution
Overcurrent during deceleration	E03.00	The drive output circuit is grounded or short-circuited.	Eliminate external faults. Check whether short circuite or open circuit exists in the motor.
		The braking transistor is short-circuited.	Power off the servo drive, remove the regenerative resistor, and power on the servo drive again. ◆ If no fault is reported, it indicates that the braking circuit is abnormal. The cause may be that the resistance between the regenerative resistor cable and the enclosure of the servo drive is too small (short circuit). In this case, replace the regenerative resistor. ◆ If the fault persists, it indicates that the braking transistor circuit is normal but the motor control loop is abnormal. Check whether the overcurrent is caused by other reasons.
		The control mode is SVC or FVC, and motor auto-tuning is not performed.	Set motor parameters according to the nameplate and perform motor auto-tuning.
		The deceleration time is too short.	Increase the deceleration time.
		The servo drive suffers external interference.	View historical fault records. If the current is significantly smaller than the overcurreth threshold when the fault occurs, find the interference source. If no external interference exists, the drive board, Hall sensor, Hall cables or the control board may be faulty.

Fault	Panel Display	Possible Cause	Solution
Overcurrent at constant speed	E04.00	The drive output circuit is grounded or short-circuited.	Eliminate external faults. Check whether short circuite or open circuit exists in the motor.
		The braking transistor is short-circuited.	Power off the servo drive, remove the regenerative resistor, and power on the servo drive again. ◆ If no fault is reported, it indicates that the braking circuit is abnormal. The cause may be that the resistance between the regenerative resistor cable and the enclosure of the servo drive is too small (short circuit). In this case, replace the regenerative resistor. ◆ If the fault persists, it indicates that the braking transistor circuit is normal but the motor control loop is abnormal. Check whether the overcurrent is caused by other reasons.
		The control mode is SVC or FVC, but motor auto-tuning is not performed.	Set motor parameters according to the nameplate and perform motor auto-tuning.
		The deceleration time is too short.	If the running current exceeds the rated motor current or the rated output current of the servo drive during stable running, select a drive of larger power class.
		The servo drive suffers external interference.	View historical fault records. If the current is significantly smaller than the overcurreth threshold when the fault occurs, find the interference source. If no external interference exists, the drive board, Hall sensor, Hall cables or the control board may be faulty.
Overvoltage during acceleration	E05.00	The input voltage is too high.	Adjust the input voltage to the normal range.
		An external force drives the motor during acceleration.	Cancel the external force or install a regenerative resistor.
		The braking unit and regenerative resistor are not installed.	Install a braking unit and regenerative resistor.
		The acceleration time is too short.	Increase the acceleration time.

Fault	Panel Display	Possible Cause	Solution
Overvoltage during deceleration	E06.00	The input voltage is too high.	Adjust the input voltage to the normal range.
		An external force drives the motor during deceleration.	Cancel the external force or install a regenerative resistor.
		The deceleration time is too short.	Increase the deceleration time.
		The braking unit and regenerative resistor are not installed.	Install a braking unit and regenerative resistor.
		The motor is short-circuited to ground.	The short circuit to ground causes a booster circuit, which may result in overvoltage. Check whether short circuit to ground exists in the drive output cables or the motor.
Overvoltage at constant speed	E07.00	The input voltage is too high.	Adjust the input voltage to the normal range.
		An external force drives the motor during running at a constant speed.	Cancel the external force or install a regenerative resistor.
Pre-charge resistor fault	E08.00	The pre-charge resistor is frequently off and on in a short period.	Power off the servo drive and consult the technical personnel of Inovance.
Undervoltage	E09.01	The input voltage of the servo drive exceed the specified range.	Adjust the voltage to the normal range.
		The bus voltage is abnormal.	Consult the technical personnel of Inovance.
		The rectifier bridge, pre-charge resistor, drive board or control board is abnormal.	Consult the technical personnel of Inovance.
	E09.09	The program cannot run long time after power-on.	Check the input voltage and bus voltage, or consult the technical personnel of Inovance.
Drive overload	E10.00	The load is too heavy or locked-rotor occurs on the motor.	Reduce the load and check the motor and mechanical conditions.
		The power class of the servo drive is too small.	Select a drive of larger power class.
	E10.01	The encoder is faulty.	Set A1-05 (Detection time of PG card disconnection protection) to a proper value (2s) to enable the encoder check.

Fault	Panel Display	Possible Cause	Solution
Input phase loss	E12.00	Three-phase power input phase loss exists.	Check and eliminate external faults.
		The drive board, lightning protection board, main control board (MCB) or rectifier bridge is abnormal.	Consult the technical personnel of Inovance.
Output phase loss	E13.00	The motor is faulty.	Check whether an open circuit exists in the motor.
		The cable connecting the drive and the motor is abnormal.	Eliminate external faults.
		The three-phase output of the servo drive is unbalanced during motor running.	Check whether the motor three-phase winding is anormal. If yes, eliminate the fault.
		The drive board or IGBT module is abnormal.	Consult the technical personnel of Inovance.
IGBT overheat	E14.00	The ambient temperature is too high	Reduce the ambient temperature.
		The air filter is blocked.	Clean the air filter.
		The fan is damaged.	Replace the damaged fan.
		The thermistor is damaged.	Replace the damaged thermistor.
		The IGBT is damaged.	Replace the damaged IGBT.
External input fault	E15.00	Input the external fault signal using the DI terminal.	Eliminate external faults and confirm whether restart is allowed (view F8-18). Reset and run the servo drive.
		The STOP key is pressed in the terminal/ communication control mode or in a stall state.	Reset and run the servo drive.
Communication fault	E16.03	The host controller does not work properly.	Check the wiring of the host controller.
		The communication cable is abnormal.	Check the connection of communication cables.
		The communication expansion card type (F0-28) is set incorrectly.	Set the communication expansion card type correctly.
		The communication parameters in group FD are set incorrectly.	Set the communication parameters correctly.
		If the fault still persists after all the preceding solutions have been done, restore the default settings.	

Fault	Panel Display	Possible Cause	Solution
Contactor fault	E17.00	The drive board or power board is abnormal.	Replace the drive board or power board.
		The contactor is faulty.	Replace the contactor.
		The lightning protection board is abnormal.	Replace the lightning protection board.
		An external interference.	Eliminate the external interference.
Current detection fault	E18.00	The zero drift or temperature drift of the UVW current detection circuit is too large.	Consult the technical personnel of Inovance. (The Hall sensor, Hall cables, the drive board, the wiring between the drive board and the control board, or the control board is abnormal.)
Motor auto-tuning fault	E19.02	The initial pole position angle auto-tuning of the synchronous motor is abnormal.	Check whether the motor inductance is too large, or the motor is disconnected.
	E19.23	The pole position auto-tuning of the synchronous motor is abnormal.	Check the current detection circuit or the motor winding.
Encoder fault	E20.03	The encoder direction detection is incorrect.	Check the pulse signal and motor parameter settings.
	E20.08	The encoder angle verification is incorrect.	Check the encoder PPR and motor parameters settings.
EEPROM reading/writing fault	E21.01	Parameter writing error	◆ Decrease the parameter modification frequency if the EEPROM reading/writing is too frequent. ◆ Replace the PCB if the board is damaged.
	E21.02	Parameter reading error	
	E21.03	Parameter writing/reading delay error	
	E21.04	The quantity of parameters to be stored exceeds range.	
	E21.05	Parameter writing error occurs at power-on.	
	E21.06	Parameter reading error occurs at power-on.	
	E21.07	At power-on, the quantity of parameters to be stored exceeds range.	

Fault	Panel Display	Possible Cause	Solution
Motor short circuit to ground	E23.00	The motor is short-circuited to ground.	Check whether the motor is short-circuited to ground. If yes, replace motor cables or the motor. If the fault still persists after replacement, consult the technical personnel of Inovance.
	E23.09	Before the servo drive is powered on, the motor is rotating under the drive of an external force.	Power on the servo drive after the motor stops.
Output inter-phase short circuit	E24.00	There is an output inter-phase short circuit.	Check whether the UVW three-phase output of the servo drive is short-circuited.
EEPROM address error	E25.00	The EEPROM address exceeds the specified range, or identical physical addresses occur.	Power off the servo drive and consult the technical personnel of Inovance.
Running time reached	E26.00	The running time reaches the set value.	◆ Set F8-17 (Set running time) to a non-zero value. ◆ Set F7-09 (Accumulative running time) to a value larger than F8-17 (Set running time). ◆ Set F8-23 (Action selection when accumulative running time is reached) to 1. (For the selection of stop mode when the running time is reached, see "Figure 6-3 Running time reached (E26.00)" on page 131.)
Business running time reached	E27.00	The business running time is reached.	Check if FA-08 [Accumulative business running time (hour)] is equal to or larger than any of FA-01 (Timed 1st running time), FA-03 (Timed 2nd running time), FA-05 (Timed 3rd running time), and FA-07 (Timed 4th running time). If yes, ask for the running time protection passwords (FA-00, FA-02, FA-04, FA-06) from the manufacturer, and increase the value of FA-01 (Timed 1st running time), FA-03 (Timed 2nd running time), FA-05 (Timed 3rd running time), and FA-07 (Timed 4th running time).

Fault	Panel Display	Possible Cause	Solution
Output load loss	E30.00	There is an output load loss.	Check the working condition of the load.
Pulse-by-pulse current limit fault		The drive output circuit is grounded or short-circuited.	Eliminate external faults.
	E40.00	The load is too heavy or locked-rotor occurs on the motor.	Reduce the load, and check the motor and mechanical conditions.
		The power class of the servo drive is too small.	Select a drive of larger power class.
CAN communication fault	E42.01	The communication cable is disconnected.	◆ Check whether the communication cable is in good contact. ◆ Check whether the cable shield is connected properly and whether the communication cable is too long. ◆ Check the load rate of the CAN bus.
	E42.02	The communication suffers severe interference (receiving error)	
	E42.03	The communication is never online after power-on.	◆ Check whether CANH and CANL are connected incorrectly. ◆ Check whether parameters (A2-00 and A2-01) are set incorrectly and whether the communication cable is faulty. Eliminate these problems one by one.
	E42.04	There is an expansion card fault (extension protocol card not supported temporarily).	Power off the servo drive, consult the technical personnel of Inovance, and replace the expansion card.
	E42.07	CANopen protocol abnormal	Power off the servo drive and consult the technical personnel of Inovance.
	E42.11	CANopen communication timeout	Power off the servo drive and consult the technical personnel of Inovance.
	E42.12	PDO length does not match the mapping.	Power off the servo drive and consult the technical personnel of Inovance.

Fault	Panel Display	Possible Cause	Solution
Encoder fault during motor auto-tuning	E43.00	The encoder parameters are set improperly.	Set the encoder parameters properly.
		The motor auto-tuning is not performed.	Perform motor auto-tuning.
		Motor overspeed detection parameters (F9-67 and F9-68) are set improperly.	Set F9-67 and F9-68 properly according to actual conditions.
Excessive speed deviation	E44.00	The speed deviation is too large.	Check whether the installation and wiring of the encoder and the motor power cable are loose. Check whether the servo drive works normally after the PG card is replaced.
	E44.01	The drive parameters are set incorrectly.	Increase the value of F2-10 (Torque upper limit).
	E44.02	The encoder is faulty.	◆ Power off the servo drive and replace the PG card. ◆ Consult the technical personnel of Inovance.
	E44.03	The drive parameters are set incorrectly or the encoder is faulty.	◆ Power off the servo drive and replace the PG card. ◆ Increase the value of F2-10 (Torque upper limit). ◆ Consult the technical personnel of Inovance.

Fault	Panel Display	Possible Cause	Solution
Motor overtemperature		The PTC protection is enabled when the motor overheats.	Handle this problem according to "Figure 6-2 Motor overtemperature (E45.00)" on page 131.
		The temperature sensor cable is disconnected or not connected.	Check whether the motor temperature sensor cable is disconnected.
		The PTC thermistor is short-circuited or connected reversely.	◆ Check whether short circuit occurs on the motor temperature sensor. ◆ Check whether terminals PTCP and PTCN are connected reversely.
		The KTY protection is enabled when the motor overheats.	Handle this problem according to "Figure 6-2 Motor overtemperature (E45.00)" on page 131.
		The PTC cable is disconnected.	Set F9-16 (Motor overtemperature protection) to 2 and enable both PTC and KTY protections. Check whether the PTC cable is disconnected.
		The KTY cable is disconnected.	Set F9-16 (Motor overtemperature protection) to 2 and and enable both PTC and KTY protections. Check whether the KTY cable is disconnected.

Fault	Panel Display	Possible Cause	Solution
Pressure sensor fault		The pressure sensor is faulty.	Check whether the connection of the pressure sensor is loose and the power supply and the output are normal.
		The load is too heavy (the motor or hydraulic pump is stuck).	◆ Stop the servo drive and rotate the motor manually to check whether the motor can rotate. ◆ Check whether F2-10 (Torque upper limit) is set to a proper value. ◆ Check whether dynamic motor auto-tuning is normal.
		The zero drift of the pressure sensor is faulty.	◆ Ensure that the pressure measured by the pressure sensor is zero. ◆ Ensure that the pressure sensor is connected correctly (whether the values of AI3 and U0-32 measured by the multimeter are consistent). ◆ Ensure that parameters F4-28 (AI3 minimum input) to F4-31 (Corresponding value of AI3 maximum input) are set correctly.
		The measuring range of the pressure sensor exceeds the upper and lower limits.	Check whether the measuring range of the pressure sensor is smaller than A3-55 (Lower pressure deviation limit during pressure relief when the valve is closing) or larger than A3-56 (Upper torque limit in zero torque mode).
Slave pump fault in multi-pump confluence mode		The slave pump is faulty in the multi-pump confluence mode.	See *"Appendix C Multi-Pump Mode of the Injection Molding Machine" on page 236*.
Station number conflict		There is a conflict between station numbers.	See *"Appendix C Multi-Pump Mode of the Injection Molding Machine" on page 236*.

Fault	Panel Display	Possible Cause	Solution
Encoder fault	E49.01	◆ The encoder cable is disconnected or not connected. ◆ The encoder type is set incorrectly.	◆ Check whether the PG card connector becomes loose. ◆ Check whether the PG card cable is connected correctly. ◆ Check the PG card and encoder types and whether A1-00 (PG card type) is set properly.
	E49.02	Encoder interference exists.	Use the shielded cable as the encoder cable, and separate the encoder cable from the power cable. Ground the PG card and connect and disconnect it for several times.
Multi-master fault in multi-pump mode	E52.00	Multiple masters are used together in the multi-pump mode.	See "Appendix C Multi-Pump Mode of the Injection Molding Machine" on page 236.
Parameter restoring fault	E58.00	Parameters are not stored before restoring.	Set the parameters correctly, and then store them. (Input the password set in FP-04 and set FP-05 to 1 to store parameters.)
Back EMF fault during auto-tuning	E59.00	The motor back EMF is too low during dynamic auto-tuning.	Check whether parameters in group F1 are set correctly, and replace the motor with a new one of the same type to test whether the motor is demagnetized.
Overtime working of braking transistor	E61.00	The braking transistor works overtime.	Check whether the bus voltage is higher than the braking voltage for a long time and whether the braking protection time set previously is too short.
	E61.01	The regenerative resistor is not connected or disconnected.	Check whether the regenerative resistor is in good connection and enable the regenerative resistor detection by setting F8-26.
Reverse running time reached	E63.00	In the oil pressure mode, the reverse running time exceeds the value set in A4-09 (Protection time for long-time pressure relief during reverse rotation).	Check whether the flow falling time and oil cooling reference falling time set previously are too short.
The pressure sensor voltage exceeds the allowable range.	E65.00	The AI3 voltage is larger than A3-57 or smaller than A3-58.	Check whether Ai3 is connected correctly.
Regenerative resistor fault	E66.01	The regenerative resistor is not connected or disconnected.	◆ Check the wiring of the regenerative resistor. ◆ If no regenerative resistor is required, set F8-26 to 0.
	E66.02	The resistance of the regenerative resistor is too small.	Select a regenerative resistor with proper resistance.

Fault	Panel Display	Possible Cause	Solution
Parameter initialization abnormal	E67.00	Parameter initialization is abnormal at power-on.	Power off the servo drive and consult the technical personnel of Inovance.
Motor rotor locked	E69.00	The UVW phases are incorrect.	◆ After power-off, adjust the motor cables to ensure that UVW cables of the servo drive are connected to those of the motor in correct sequence. ◆ Set A1-09 ("Auto-tuning free" function) to 0 to disable the "auto-tuning free" function and perform auto-tuning again.
"Auto-tuning free" fault	E70.00	Parameters related to "auto-tuning free" function are set incorrectly.	Check the following items: ◆ whether A1-09 ("Auto-tuning free" function) is set correctly. ◆ whether the motor is a synchronous motor. ◆ whether the encoder is a 23-bit absolute encoder. ◆ whether the control mode is FVC.
	E70.01	SPI communication cable used for "auto-tuning free" function is disconnected.	Check whether the communication cable of the PG card is connected incompletely or disconnected.
	E70.02	RS485 communication cable used for "auto-tuning free" function is disconnected.	Check whether the cable between the PG card and the encoder is connected incompletely or discon-nected.
	E70.03	Motor parameters are set incorrectly.	Set A1-09 ("Auto-tuning free" function) to 0 to disable the "auto-tuning free" function and perform auto-tuning again. If the fault still exists, consult the technical personnel of Inovance.
	E70.05	The "auto-tuning free" function is disabled.	Set A1-09 ("Auto-tuning free" function) to 1 to enable the "auto-tuning free" function. Then, set A1-10 to a proper value.
Feedback speed abnormal	E71.00	There is an alarm when the frequency deviation exceeds the rated motor frequency.	The solutions are the same as those of E69.00.
Encoder direction abnormal in the "auto-tuning free" mode	E73.00	In the "auto-tuning free" mode, the UVW wiring is abnormal, or the encoder direction is manually modified to the reverse direction (A1-03 is set to 1).	Connect the UVW cables correctly or prohibit the modification of the encoder direction in the "au-to-tuning free" mode.

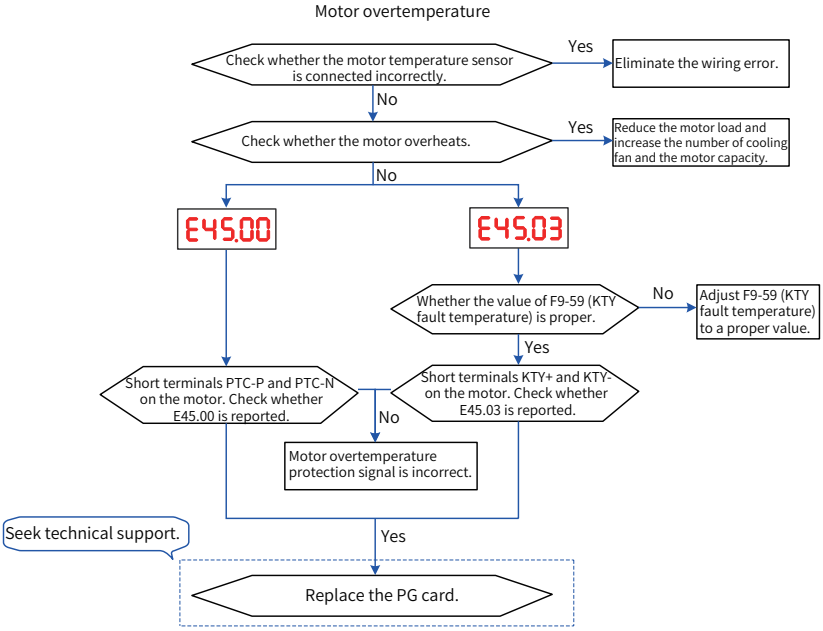


Figure 6-2 Motor overtemperature (E45.00)

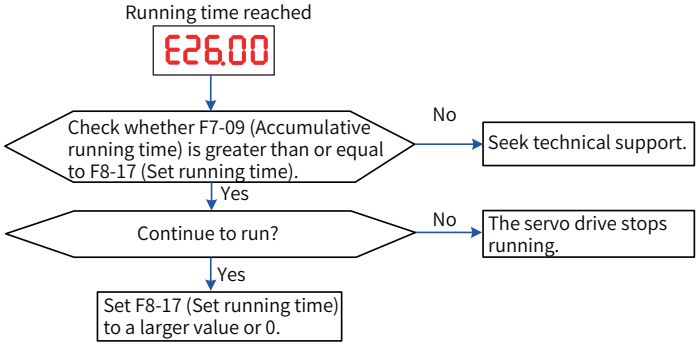
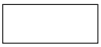


Figure 6-3 Running time reached (E26.00)

6.5 Common Faults and Solutions

No.	Fault Symptom	Possible Cause	Solution
1	There is no display at power-on. 	There is no mains voltage or the mains voltage is too low.	◆ Check the power supply.
		The switched-mode power supply on the drive board is faulty.	◆ Check the bus voltage.
		The cable between the control board and the drive board and that between the control board and the operating panel is broken.	◆ Re-connect the 8-core and 40-core cables.
		The pre-charge resistor of the servo drive is damaged.	◆ Consult the technical personnel of Inovance.
		The control board or operating panel is faulty.	
		The rectifier bridge is damaged.	
2	"HC" is displayed at power-on. 	The cable between the drive board and the control board is in poor contact.	◆ Re-connect the 8-core and 40-core cables.
		Components on the control board are damaged.	◆ Consult the technical personnel of Inovance.
		The motor or motor cable is short-circuited to the ground.	
		The Hall sensor is damaged.	
		The mains voltage is too low.	
3	The display is normal at power-on. But after the running starts, "HC" is displayed and the drive stops running immediately. 	The cooling fan is damaged or blocked.	◆ Replace the fan.
		A short circuit exists in the wiring of external control terminals.	◆ Eliminate the external short circuit fault.

No.	Fault Symptom	Possible Cause	Solution
4	The motor does not rotate after the servo drive starts running.	The motor wiring is abnormal.	◆ Check whether the wiring between the servo drive and the motor is normal.
		The motor parameters are set incorrectly.	◆ Restore the factory parameters and reset parameter groups properly. ◆ Check whether the encoder parameters and rated motor parameters (such as rate motor frequency and rated motor speed) are set correctly. ◆ Check whether F0-01 (Control mode) and F0-02 (Command source) are set correctly. ◆ In the V/f control mode, modify F3-01 (Torque boost) under heavy-load start.
		The cable connecting the drive board and the control board is in poor contact.	◆ Re-connect the cable connecting the drive board and the control board and ensure a secure connection.
		The drive board is faulty.	◆ Consult the technical personnel of Inovance.
5	DI terminals are disabled.	The parameters are set incorrectly.	◆ Check and reset parameters in group F4.
		The external signal is incorrect.	◆ Re-connect the external signal cable.
		Jumper J1 is connected incorrectly.	◆ Check whether jumper J1 is connected correctly according to the wiring diagram.
		The control board is faulty.	◆ Consult the technical personnel of Inovance.
6	The motor speed cannot rise in the FVC mode.	The encoder is faulty.	◆ Replace the encoder and check the wiring.
		The encoder is connected incorrectly or in poor contact.	◆ Replace the PG card.
		The PG card is faulty.	◆ Consult the technical personnel of Inovance.
		The drive board is faulty.	

No.	Fault Symptom	Possible Cause	Solution
7	The servo drive reports overcurrent and overvoltage frequently.	The motor parameters are set improperly.	◆ Reset the motor parameters or perform motor auto-tuning again.
		The acceleration/deceleration time is improper.	◆ Set a proper acceleration/deceleration time.
		The load fluctuates.	◆ Consult the technical personnel of Inovance.
8	The motor coasts to stop or the motor brake is inactive during deceleration or deceleration to stop.	The encoder cable is disconnected, or the overvoltage stall protection is enabled.	◆ Check the encoder wiring in the FVC mode (F0-01 = 1). ◆ If a regenerative resistor is configured, disable the overvoltage stall protection function by setting F3-23 (V/f voltage limit enabled) to 0.
9	The pre-charge resistor is damaged.	◆ The drain wire of the regenerative resistor is connected to the metal enclosure (that is, short-circuited to the ground). ◆ The braking transistor is damaged. ◆ The short circuit occurs due to the damage of the bus capacitor. ◆ The negative bus (Bus-) is short-circuited to the ground.	◆ Increase the insulation of the drain wire of the regenerative resistor by taking such measures as winding the electric tape cloth. ◆ Replace the braking transistor. ◆ Replace the bus capacitor. ◆ Eliminate the short circuit fault.

7 Maintenance

7.1 Daily Inspection

Safety Instruction
DANGER ◆ Never perform wiring at power-on. Failure to comply will result in an electric shock. ◆ Before inspection, cut off the power supply of all devices. After the servo drive is powered off, wait for several minutes before the next operation until the power indicator is OFF because there is residual voltage in the DC capacitor of the servo drive. Before next power-on, wait for an interval specified by the drive. ◆ Do not modify the wiring, disconnect the cables, remove the optional cards and replace the cooling fan(s) during running. Failure to comply will result in an electric shock. ◆ The motor grounding terminal must be grounded. Otherwise, an electric shock will occur when contacting the motor housing. ◆ Installation, wiring, commissioning, maintenance, repair, inspection, and component replacement must be performed only by qualified electrical personnel.
WARNING ◆ Do not run the servo drive with the front cover removed. ◆ For illustration purpose, the drawings in this user guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified before using the product, and perform operations in accordance with the instructions. ◆ Tighten all screw terminals based on the specified tightening torque. This is to prevent a fire caused by overheat of the loose cable connection. ◆ Ensure that the input voltage of the main circuit is within the allowable range. Incorrect input voltage will result in abnormal running of the servo drive. ◆ Keep flammable materials far away from the servo drive and do not install the servo drive on flammable surfaces such as metal.
CAUTION ◆ Replace the cooling fan according to the instructions in this user guide. Ensure correct air outlet direction of the fan. Incorrect air direction will weaken the cooling effect. ◆ Do not install or remove the motor when the servo driver is running. Failure to comply will result in an electric shock and damage to the servo drive. ◆ Use shielded cables for control circuit wiring. ◆ Prevent the drive malfunction and ground the shield at one end reliably. ◆ Do not modify the drive circuits. Failure to comply will result in damage to the servo drive. ◆ Connect the output circuit terminals of the servo drive and the motor terminals correctly. ◆ If it is necessary to change the motor running direction, exchange any two of output terminals of the servo drive. ◆ Do not operate the damaged servo drive to prevent other devices from being damaged.

Daily inspection items

The influence of the ambient temperature, humidity, dust, and vibration will cause the aging of the components in the servo drive, which may result in potential faults or reduce the service life of the servo drive. Therefore, it is necessary to carry out daily and periodic maintenance for the servo drive. More frequent periodic inspection is required if the servo drive is used in the following situations:

- High ambient temperature
- Frequent start and stop
- Fluctuations in the AC power supply or load
- Strong vibration or impact
- Dust and hydrochloric acid

Check the following items daily to avoid performance deterioration and product damage. Copy this checklist and sign the "Checked" column after each inspection.

Item	Inspection	Solution	Checked
Motor	Whether abnormal sound or vibration exists	◆ Check whether the mechanical connection of the motor is abnormal. ◆ Check whether there is motor phase loss. ◆ Check whether the retaining screws of the motor are secure.	
Fan	Whether the cooling fans of the servo drive and motor work abnormally	◆ Check whether the cooling fan of the servo drive is running. ◆ Check whether the cooling fan of the motor is abnormal. ◆ Check whether the air filter is clogged. ◆ Check whether the ambient temperature is within the allowable range.	
Installation environment	Whether the power cabinet and cable trays are abnormal	◆ Check whether the insulation of input and output cables of the servo drive is damaged. ◆ Check whether the mounting brackets vibrate. ◆ Check whether the copper busbar and cable terminals become loose or get corroded.	
Load	Whether the running current of the drive exceeds the rated current of the drive and motor	◆ Check whether the motor parameters are set properly. ◆ Check whether the motor is overloaded. ◆ Check whether the mechanical vibration is too large (less than 1 g on normal condition).	

Item	Inspection	Solution	Checked
Input voltage	Whether the power voltage between the main circuit and the control circuit is within the allowable range	◆ Check whether the input voltage is within the allowable range. ◆ Check whether the start of heavy load exists around the servo drive.	

7.2 Periodic Inspection

7.2.1 Periodic Inspection Items

Periodically inspect the components that can be hardly checked during running. Keep the servo drive clean all the time. Remove the dust on the surface of the servo drive, especially the metal dust, to prevent it from entering into the drive. Clear the oil stain from the cooling fan of the servo drive.

Safety Instruction
DANGER ◆ Do not perform inspection at power-on. Failure to comply will result in an electric shock. ◆ Cut off all power supplies before inspection, and wait for at least 10 minutes before further operations to avoid risks caused by the residual voltage in the capacitor of the drive.

Item	Inspection	Solution	Checked
Servo drive	Whether there are wastes, dirt, and dust on the surface of the servo drive	◆ Check whether the servo drive cabinet is powered off. ◆ Use a vacuum cleaner to clean wastes and dust to prevent direct contact with components. ◆ Wipe the surface dirt that is difficult to clean with ethyl alcohol and wait until the surface becomes dry.	
Cables	◆ Whether the power cables and connections discolor ◆ Whether the insulation layer is aged or cracked	◆ Replace the cracked cables. ◆ Replace the damaged terminals.	
Peripheral devices, such as the electromagnetic contactor	◆ Whether the contactor cannot be closed completely or has an abnormal sound when it acts ◆ Whether a short circuit, water stain, expansion or cracking occurs on any peripheral device	◆ Replace the abnormal peripheral devices.	

Item	Inspection	Solution	Checked
Air vent	◆ Whether the air filter and heatsink are clogged ◆ Whether the fan is damaged	◆ Clean the are filter. ◆ Replace the fan.	
Control circuit	◆ Whether any control component is in poor contact ◆ Whether terminal screws are loose ◆ Whether the insulation layer of control cables is cracked	◆ Clear away foreign matters on the surface of control cables and terminals. ◆ Replace the damaged or corroded control cables.	

7.2.2 Insulation Test on the Main Circuit

NOTE

◆ Before measuring the insulation resistance with a megger (500 VDC megger recommended), disconnect the main circuit from the servo drive. Do not use the insulation resistance meter to test the insulation of the main circuit (see *"Figure 7-1 Insulation test on the main circuit"*). The high voltage test (> 500 V) does not need to be performed again because it has been done before delivery.

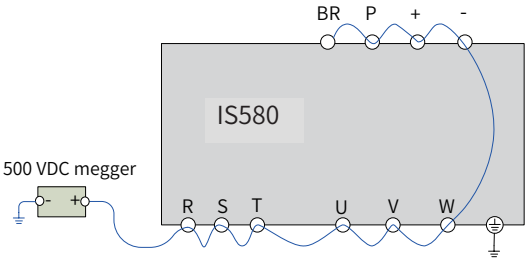


Figure 7-1 Insulation test on the main circuit

The measured insulation resistance must be greater than 5 MΩ. Before the test, remove the VDR screws and disconnect the VDR.

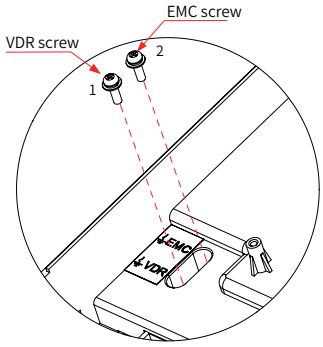


Figure 7-2 Positions of VDR and EMC grounding jumpers

7.3 Replacement of Quick-Wear Parts

7.3.1 Service Life of Quick-Wear Parts

The quick-wear parts of the servo drive include the cooling fan and the filter electrolytic capacitor. Their service life is closely related to the operating environment and maintenance. The standard service life of the two components is listed in the following table.

Component	Service Life
Cooling fan	≥ 5 years
Electrolytic capacitor	≥ 5 years



NOTE

The standard service life indicates the time when the components are used under the following conditions. You can determine when to replace these components according to the actual running time.

- Ambient temperature: 40°C
- Load rate: 80%
- Operating rate: 24 hours per day

7.3.2 Quantity of the Cooling Fan

Model				Quantity
IS580T020-R1	IS580T035-R1-H	IS580-2T020-R1	IS580T020-R1-T	1
IS580T030-R1	IS580T040-R1-H	IS580-2T030-R1	IS580T030-R1-T	1
IS580T035-R1	IS580T050-R1-H	-	IS580T035-R1-T	1
IS580T040-R1	IS580T070-R1-H	IS580-2T040-R1	IS580T040-R1-T	1
IS580T050-R1	IS580T080-R1-H	IS580-2T050-R1	-	1
IS580T070-R1	IS580T100-R1-H	IS580-2T070-R1	-	1
IS580T080-R1	IS580T140-R1-H	IS580-2T080-R1	-	1
IS580T100-R1	-	IS580-2T100-R1	-	1
IS580T140-R1	-	IS580-2T140-R1	-	2
IS580T170-R1	-	IS580-2T170-R1	-	2
IS580T210-R1	-	IS580-2T210-R1	-	2
IS580T250-R1	-	-	-	2
IS580T300-R1	-	IS580-2T300-R1	-	2
IS580T370-R1	-	-	-	2
IS580T420-R1	-	-	-	2
IS580T460-R1	-	-	-	3
IS580T520-R1	-	-	-	3
IS580T580-R1	-	-	-	3

Model				Quantity
IS580T650-R1	-	-	-	3
IS580T720-R1	-	-	-	3

7.3.3 Replacing the Cooling Fan

- Possible damage causes: bearing worn and blade aging
- Judging criteria:

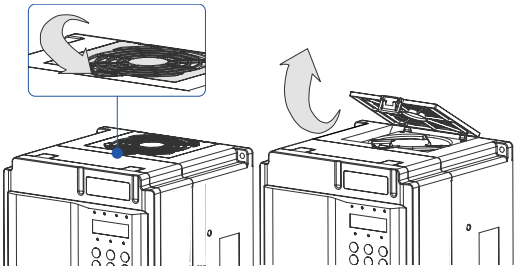
1) Whether there is crack on the blades
2) Whether there is abnormal vibration noise at startup
3) Whether the blade running is abnormal

- How to replace the cooling fan:

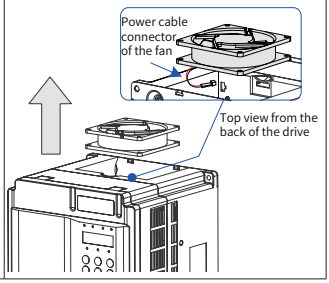
1) Press the snap-fit joint on the protective cover and pull the cover out.
2) After the replacement is complete, check the airflow direction. Ensure the airflow is upward.

Removing the Cooling Fan (IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, IS580-2T020-R1 to IS580-2T070-R1)

Press the snap-fit joint on the protective cover slightly and remove the fan cover.



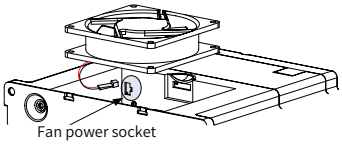
Pull the fan upwards and disconnect the power cable connector from the socket.



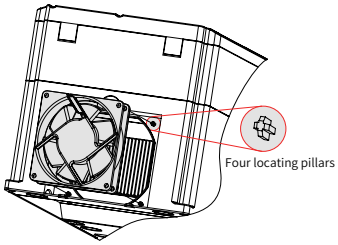
Installing the Cooling Fan (IS580T020-R1-T to IS580T040-R1-T, IS580T020-R1 to IS580T070-R1, IS580-2T020-R1 to IS580-2T070-R1)

① Install the fan in a procedure reverse to removal. Pay attention to the direction of the fan.

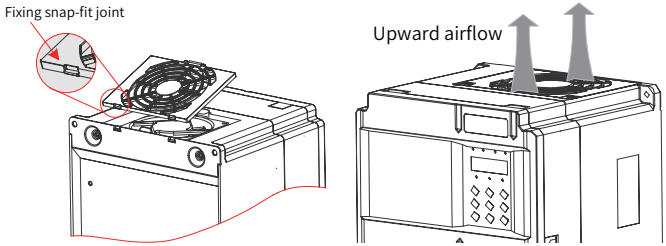
② Insert the power cable connector of the fan into the power socket in the drive, as shown in the following figure.



③ Push the fan into the location to be installed and ensure that the four fixing holes on the bottom of the fan are aligned with the four locating pillars in the servo drive.

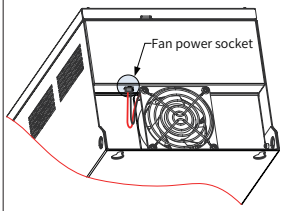


④ Insert the two fixing snap-fit joints on the fan into the grooves and then push down the snap-fit joint on the other side of the fan slightly.

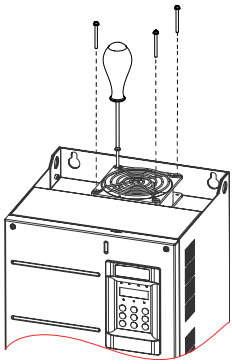


Removing the Cooling Fan (IS580T080-R1 to IS580T300-R1, IS580-2T080-R1 to IS580-2T300-R1)

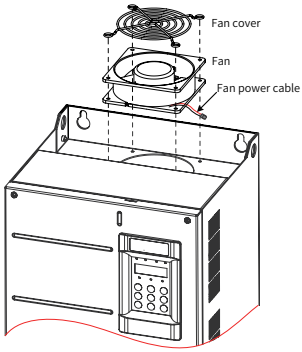
① Disconnect the fan cable connector from the socket (top view).



② Remove the four screws on the fan cover with a screwdriver.



③ Remove the fan and fan cover from the servo drive.

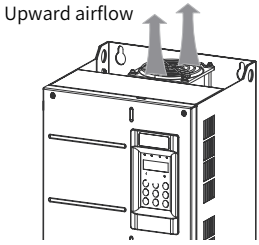


Installing the Cooling Fan (IS580T080-R1 to IS580T300-R1, IS580-2T080-R1 to IS580-2T300-R1)

① Install the fan by following the steps reverse to removal. Ensure the correct direction of the fan.

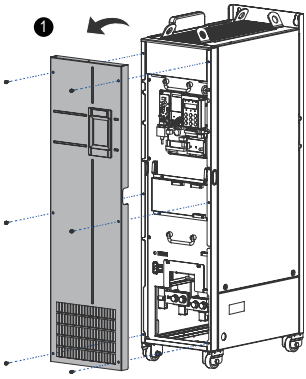
② Install the fan cover and fan into the drive and ensure that the four mounting holes are aligned, as shown by imaginary lines in preceding Step 3.

③ Keep the airflow direction upward.



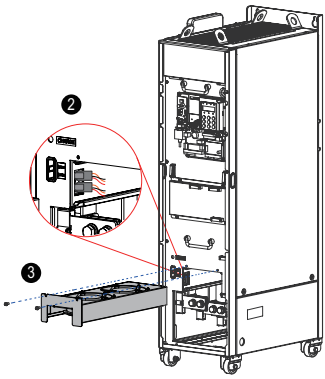
Removing the Cooling Fan (IS580T370-R1 to IS580T720-R1)

① Loosen the six screws on the front cover and move the cover along the arrow direction to remove it.

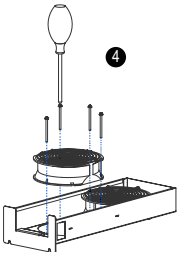


② As shown in the following figure, unplug the fan power cable connector (one for each fan).

③ Remove the screws on the fan box and pull the fan box out along the arrow direction.



④ Remove the screws from each fan cover.

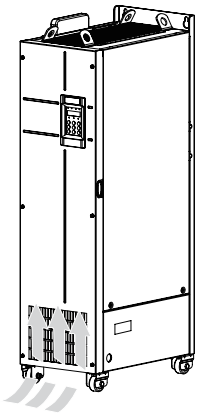


Installing the Cooling Fan (IS580T370-R1 to IS580T720-R1)

① Install the fan by following the steps reverse to removal. Ensure the correct direction of the fan.

② Align the fan box to the rail and push it into the drive.

③ Connect the fan power cable connectors and fix the fan cover. After the fan replacement is complete, check the airflow direction to ensure that it is upward.



7.3.4 Filter Electrolytic Capacitor

- Possible damage causes: input power supply in poor quality, high ambient temperature, frequent load jumping, and electrolytic aging.
- Judging criteria: whether there is liquid leakage, whether the safety valve has projected, the electrostatic capacitance, and the insulation resistance.
- Replacement of the filter electrolytic capacitor: Do not replace the electrolytic capacitor yourself because the electrolytic capacitor will influence the internal components of the servo drive. Contact Inovance if there is a requirement for replacement.

7.4 Storage

For temporary and long-term storage of the servo drive, pay attention to the following aspects:

1) Pack the servo drive with the original packing box provided by Inovance.
2) Do not expose the servo drive in the environment with high humidity or temperature, or in an outdoor place with strong sunlight for a long time.
3) Long-term storage degrades the electrolytic capacitor. Thus, the servo drive must be energized once every six months, and each time lasts at least five hours. The input voltage must be increased slowly to the rated value with the regulator, or consult a professional servo drive personnel for technical support.

8 Selection of Electrical Peripherals

8.1 Cables, Circuit Breaker and Contactor

Table 8-1 Selection of electrical peripherals

Model	Recommended Input IEC Cable (mm^2) [1]	Recommended IEC Ground Cable (mm^2))	Recommended Output IEC Cable (mm^2)	Terminal Width (mm)	Screw Specification	Recommended Bussmann Fuse (Passed UL Certification)		Recommended Contactor Specification	Recommended Circuit Breaker Specification
						Rated Current (A)	Model	Rated Current (A)	Rated Current (A)
IS580T020-R1 IS580T020-R1-T IS580-2T020-R1	3 x 6	6	3 x 6	15.0	M6	60	FWH-60B	40	50
IS580T030-R1 IS580T030-R1-T IS580-2T030-R1	3 x 10	10	3 x 10	15.0	M6	70	FWH-70B	50	63
IS580T035-R1 IS580T035-R1-H IS580T035-R1-T	3 x 10	10	3 x 10	15.0	M6	80	FWH-80B	65	80
IS580T040-R1 IS580T040-R1-H IS580T040-R1-T IS580-2T040-R1	3 x 16	16	3 x 16	15.0	M6	100	FWH-100B	65	80
IS580T050-R1 IS580T050-R1-H IS580-2T050-H IS580-2T050-R1	3 x 16	16	3 x 16	18.0	M6	100	FWH-100B	65	80
IS580T070-R1 IS580T070-R1-H IS580-2T070-R1	3 x 25	16	3 x 25	18.0	M6	125	FWH-125B	80	100
IS580T080-R1 IS580T080-R1-H IS580-2T080-R1	3 x 35	16	3 x35	26.8	M8	150	FWH-150B	95	160
IS580T100-R1 IS580T100-R1-H IS580-2T100-R1	3 x 50	25	3 x 50	26.8	M8	200	FWH-200B	115	160
IS580T140-R1 IS580T140-R1-H IS580-2T140-R1	3 x 70	35	3 x 70	30.6	M12	250	FWH-250A	150	250
IS580T170-R1 IS580-2T170-R1	3 x 95	50	3 x 95	30.6	M12	275	FWH-275A	170	250
IS580T210-R1 IS580-2T210-R1	3 x 120	70	3 x 120	30.6	M12	325	FWH-325A	205	400
IS580T250-R1	3 x 150	95	3 x 150	45	M12	400	FWH-400A	245	400
IS580T300-R1 IS580-2T300-R1	3 x 185	95	3 x 185	45	M12	500	FWH-500A	300	400
IS580T370-R1	2 x (3 x 95)	95	2 x (3 x 95)	*	M12	600	FWH-600A	410	500
IS580T420-R1	2 x (3 x 120)	120	2 x (3 x 120)	*	M12	700	FWH-700A	410	630

Model	Recommended Input IEC Cable (mm^2) [1]	Recommended IEC Ground Cable (mm^2))	Recommended Output IEC Cable (mm^2)	Terminal Width (mm)	Screw Specification	Recommended Bussmann Fuse (Passed UL Certification)		Recommended Contactor Specification	Recommended Circuit Breaker Specification
						Rated Current (A)	Model	Rated Current (A)	Rated Current (A)
IS580T460-R1	2 x (3 x 120)	120	2 x (3 x 120)	*	M12	800	FWH-800A	475	630
IS580T520-R1	2 x (3 x 150)	150	2 x (3 x 150)	*	M12	800	FWH-800A	620	700
IS580T580-R1	2 x (3 x 185)	185	2 x (3 x 185)	*	M16	1000	FWH-1000A	620	800
IS580T650-R1	2 x (3 x 185)	185	2 x (3 x 185)	*	M16	1000	FWH-1000A	620	800
IS580T720-R1	2 x (3 x 240)	240	2 x (3 x 240)	*	M16	1200	FWH-1200A	800	1000



NOTE

[1] Compliant with Chinese standard. "3 x 10" indicates a 3-core cable, and "2 x (3 x 95)" indicates two 3-core cables.

Table 8-2 Selection of main circuit cables

Model	Recommended Input/Output Power Cable (mm^2)	Recommended Cable Lug Model	Recommended Grounding Cable (mm^2)	Recommended Cable Lug Model for Grounding Cable	Tightening Torque (N·m)
Three-phase 200–240 V					
IS580T020	3 x 6	TNR5.5-5	6	TNR5.5-5	2.8
IS580T030	3 x 10	TNR8-5	10	TNR8-5	2.8
IS580T035	3 x 10	GTNR10-6	10	GTNR10-6	4
IS580T040	3 x 16	GTNR16-6	16	GTNR16-6	4
IS580T050	3 x 16	GTNR16-6	16	GTNR16-6	4
IS580T070	3 x 25	GTNR25-6	16	GTNR16-6	4
IS580T080	3 x 35	GTNR35-8	16	GTNR16-8	10.5
IS580T100	3 x 50	GTNR50-8	25	GTNR25-8	10.5
IS580T140	3 x 70	GTNR70-12	35	GTNR35-12	35
IS580T170	3 x 95	GTNR95-12	50	GTNR50-12	35
IS580T210	3 x 120	GTNR120-12	70	GTNR70-12	35
IS580T250	3 x 150	BC150-12	95	BC95-12	35
IS580T300	3 x 185	BC185-12	95	BC95-12	35
IS580T370	2 x (3 x 95)	BC95-12	95	BC95-12	35
IS580T420	2 x (3 x 120)	BC120-12	120	BC120-12	35
IS580T460	2 x (3 x 120)	BC120-12	120	BC120-12	35
IS580T520	2 x (3 x 150)	BC150-12	150	BC150-12	35
IS580T580	2 x (3 x 185)	BC185-16	185	BC185-16	85
IS580T650	2 x (3 x 185)	BC185-16	185	BC185-16	85

Model	Recommended Input/Output Power Cable (mm^2)	Recommended Cable Lug Model	Recommended Grounding Cable (mm^2)	Recommended Cable Lug Model for Grounding Cable	Tightening Torque (N·m)
IS580T720	2 x (3 x 240)	BC240-16	240	BC240-16	85
Three-phase 200–240 V					
IS580-2T020-R1	3 x 6	TNR5.5-5	6	TNR5.5-5	2.8
IS580-2T030-R1	3 x 10	TNR8-5	10	TNR8-5	2.8
IS580-2T040-R1	3 x 16	GTNR16-6	16	GTNR16-6	4
IS580-2T050-R1	3 x 16	GTNR16-6	16	GTNR16-6	4
IS580-2T070-R1	3 x 25	GTNR25-6	16	GTNR16-6	4
IS580-2T080-R1	3 x 35	GTNR35-8	16	GTNR16-8	10.5
IS580-2T100-R1	3 x 50	GTNR50-8	25	GTNR25-8	10.5
IS580-2T140-R1	3 x 70	GTNR70-12	35	GTNR35-12	35
IS580-2T170-R1	3 x 95	GTNR95-12	50	GTNR50-12	35
IS580-2T210-R1	3 x 120	GTNR120-12	70	GTNR70-12	35
IS580-2T300-R1	3 x 185	BC185-12	95	BC95-12	35

■ Recommended cable lugs (Suzhou Yuanli Metal Enterprise Co., Ltd)



GTNR series　　TNR series　　BC series

Figure 8-1 Cable lugs

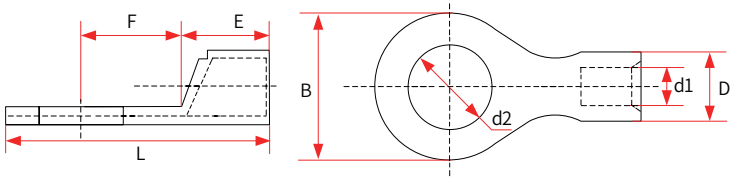


Figure 8-2 Dimensions of the TNR series cable lug

Table 8-3 Model and dimensions of the TNR series cable lug (unit: mm)

Model	Cable Size		D	d1	E	F	B	d2	L	Current (A)	Crimping Tool
	AWG/MCM	mm^2									
TNR0.75-4	22-16	0.25-1.0	2.8	1.3	4.5	6.6	8.0	4.3	15.0	10	RYO-8 AK-1M
TNR1.25-4	22-16	0.25-1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	19	

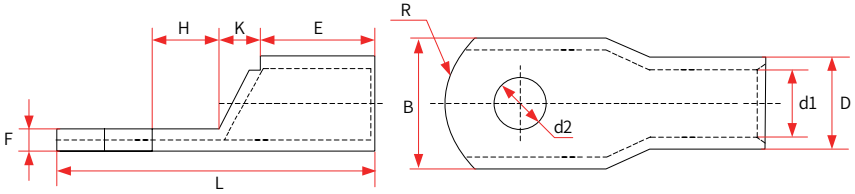


Figure 8-3 Dimensions of the GTNR series cable lug

Table 8-4 Model and dimensions of the GTNR series cable lug (unit: mm)

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR1.5-5	4.0	2.2	5.0	5.0	2.0	8.0	5.3	1.0	16.0	5	RYO-8 YYT-8 RYO-14
GTNR2.5-4	4.5	2.9	7.0	5.0	2.0	8.0	4.3	1.0	18.0		
GTNR2.5-5				6.0			5.3		20.0	7	
GTNR2.5-6						10.2	6.4	0.8			
GTNR4-5	5.2	3.6	7.0	6.0	2.0	10.0	5.3	1.0	20.0		
GTNR4-6							6.4				
GTNR6-5	6.0	4.2	9.0	6.0	3.0	10.0	5.3	1.2	23.0		
GTNR6-6				7.5			6.4		26.0		
GTNR6-8						12.0	8.4	1.0			
GTNR10-6	7.0	5.0	9.0	8.0	3.5	12.4	6.4	1.3	26.5		
GTNR10-8							8.4		27.5		
GTNR16-6	7.8	5.8	12.0	8.0	4.0	12.4	6.4	1.3	31.0		CT-38 CT-100
GTNR16-8							8.4				
GTNR25-6	9.5	7.5	12.0	8.0	4.5	14.0	6.4	2.0	32.0	10	CT-38 CT-100
GTNR25-8				9.0		15.5	8.4	1.6	34.0		
GTNR25-10				10.5		17.5	10.5	1.4	37.0		
GTNR35-6	11.4	8.6	15.0	9.0	5.0	15.5	6.4	2.8	38.0		
GTNR35-8							8.4				
GTNR35-10				10.5		17.5	10.5	2.5	40.5		
GTNR50-8	12.6	9.6	16.0	11.0	6.0	18.0	8.4	2.8	43.5		CT-100
GTNR50-10							10.5				
GTNR70-8	15.0	12.0	18.0	13.0	7.0	21.0	8.4	2.8	50.0	14	
GTNR70-10							10.5				
GTNR70-12							13.0				
GTNR95-10	17.4	13.5	20.0	13.0	9.0	25.0	10.5	3.9	55.0		
GTNR95-12							13.0				

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR120-12	19.8	15.0	22.0	14.0	10.0	28.0	13.0	4.7	60.0	16	RYC-150
GTNR120-16				16.0			17.0		64.0		
GTNR150-12	21.2	16.5	26.0	16.0	11.0	30.0	13.0	4.7	69.0	24	
GTNR150-16							17.0				
GTNR185-16	23.5	18.5	32.0	17.0	12.0	34.0	17.0	5.0	78.0		
GTNR240-16	26.5	21.5	38.0	20.0	14.0	38.0	17.0	5.5	92.0		
GTNR240-20							21.0				

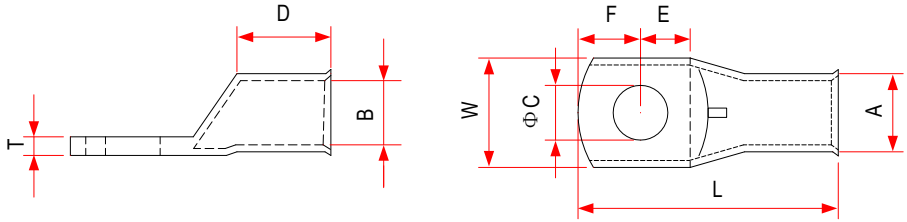


Figure 8-4 Dimensions of the BC series cable lug

Table 8-5 Model and dimensions of the BC series cable lug (unit: mm)

Model	A	B	W	E	D	L	T	C	F
120-8	19.0	15.0	27.2	16.5	27.0	73.0	4.0	8.5	16.5
120-10								10.5	
120-12								12.8	
120-14								14.7	
120-16								16.7	
120-20				18.8				20.7	14.3
150-8	21.0	16.5	30.0	16.5	27.0	78.0	4.5	8.5	16.5
150-10								10.5	
150-12								12.8	
150-14								14.7	
150-16								16.7	
150-20				18.8				20.7	14.3
185-10	23	18.5	33.5	16.5	30	82	4.5	10.5	16.5
185-12								12.8	
185-14								14.7	
185-16								16.7	
185-20				18.8				20.7	14.3

Model	A	B	W	E	D	L	T	C	F
240-10	26	21	37.7	18.0	32.0	88.0	5.0	10.5	17.0
240-12								12.8	
240-14								14.7	
240-16								16.7	
240-20								20.7	
300-10	28.0	23.0	41.0	18.0	37.0	97.0	5.0	10.5	17.0
300-12								12.8	
300-14								14.7	
300-16								16.7	
300-20								20.7	

■ RCD selection

1) The earth leakage current of the servo drive is greater than 3.5 mA. Therefore, the servo drive must be grounded.
2) Use a type B RCD (time-delayed) to suppress the DC leakage current generated by the servo drive inside the protective conductor.
3) Use a time-delay RCD to reduce the carrier frequency of the servo drive.
4) Replace the RCD with one with higher rated operating current if the RCD malfunctions.
5) Shorten the length of the motor drive cable.
6) Take more leakage current suppression measures.
7) Recommended RCD manufacturers are CHINT and Schneider.

8.2 AC Input Reactor

The AC input reactor is an external option used to suppress the harmonics in the input current. In applications where strong suppression of harmonics is required, install an external AC input reactor. The following table lists the recommended manufacturer and models of the AC input reactor.

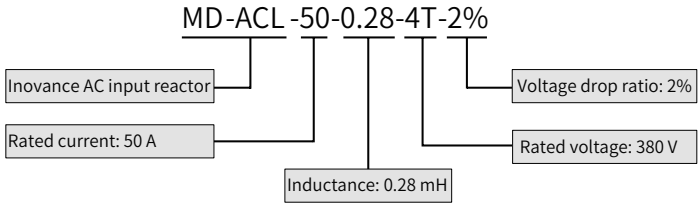
1) Recommended AC input reactor models

Table 8-6 Recommended AC input reactor models

Drive Model	AC Input Reactor Model (Inovance)
IS580T020-R1, IS580T020-R1-T, IS580-2T020-R1	MD-ACL-50-0.28-4T-2%
IS580T030-R1, IS580T030-R1-T, IS580-2T030-R1	MD-ACL-50-0.28-4T-2%
IS580T035-R1, IS580T035-R1-H, IS580T035-R1-T	MD-ACL-50-0.28-4T-2%
IS580T040-R1, IS580T040-R1-H, IS580T040-R1-T, IS580-2T040-R1	MD-ACL-60-0.24-4T-2%

Drive Model	AC Input Reactor Model (Inovance)
IS580T050-R1, IS580T050-R1-H, IS580-2T050-R1	MD-ACL-80-0.17-4T-2%
IS580T070-R1, IS580T070-R1-H, IS580-2T070-R1	MD-ACL-90-0.16-4T-2%
IS580T080-R1, IS580T080-R1-H, IS580-2T080-R1	MD-ACL-120-0.12-4T-2%
IS580T100-R1, IS580T100-R1-H, IS580-2T100-R1	MD-ACL-150-0.095-4T-2%
IS580T140-R1, IS580T140-R1-H, IS580-2T140-R1	MD-ACL-200-0.07-4T-2%
IS580T170-R1, IS580-2T170-R1	MD-ACL-250-0.056-4T-2%
IS580T210-R1, IS580-2T210-R1	MD-ACL-250-0.056-4T-2%
IS580T250-R1	MD-ACL-330-0.042-4T-2%
IS580T300-R1, IS580-2T300-R1	MD-ACL-330-0.042-4T-2%
IS580T370-R1	MD-ACL-490-0.028-4T-2%
IS580T420-R1	MD-ACL-490-0.028-4T-2%
IS580T460-R1	MD-ACL-490-0.028-4T-2%
IS580T520-R1	MD-ACL-660-0.021-4T-2%
IS580T580-R1	MD-ACL-660-0.021-4T-2%
IS580T650-R1	MD-ACL-800-0.017-4T-2%
IS580T720-R1	MD-ACL-800-0.017-4T-2%

2) Model number of the AC input reactor



3) Outline dimensions of the AC input reactor

■ 50–60 A

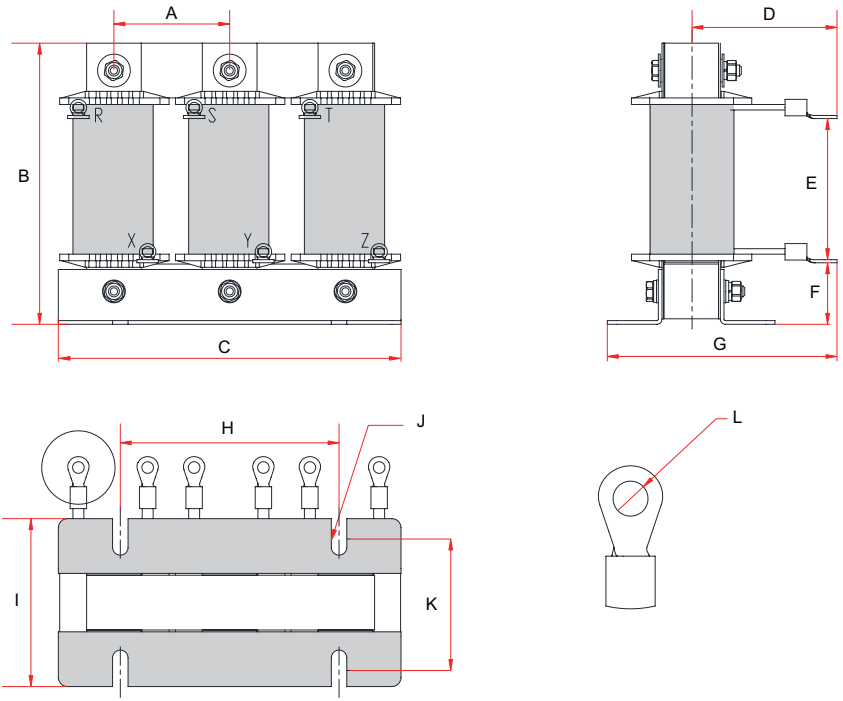


Figure 8-5 Dimension diagram of 50–60 A AC input reactor

Table 8-7 Dimensions of 50–60 A AC input reactor (unit: mm)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L
50	64	160	195	80±10	75±5	35±5	135	120±1	92±2	Φ8.5*20	72±2	Φ6.4
60	64	160	195	80±10	75±5	35±5	135	120±1	92±2	Φ8.5*20	72±2	Φ6.4

■ 90–120 A

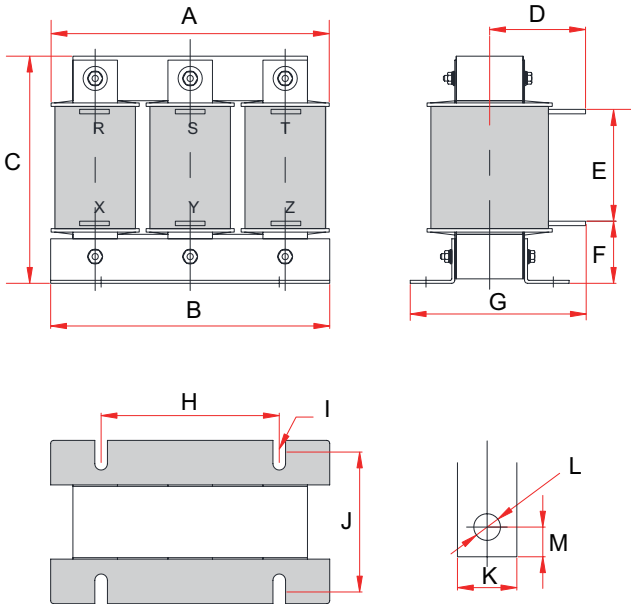


Figure 8-6 Dimension diagram of 90–120 A AC input reactor

Table 8-8 Dimensions of 90–120 A AC input reactor (unit: mm)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L	M
90	195	188±1	160	-	-	-	150	120±1	Φ8.5*20	72±2	-	-	-
120	195	188±1	160	78±10	79±5	40±5	135	120±1	Φ8.5*20	92±2	20	Φ9	10

■ 150–330 A

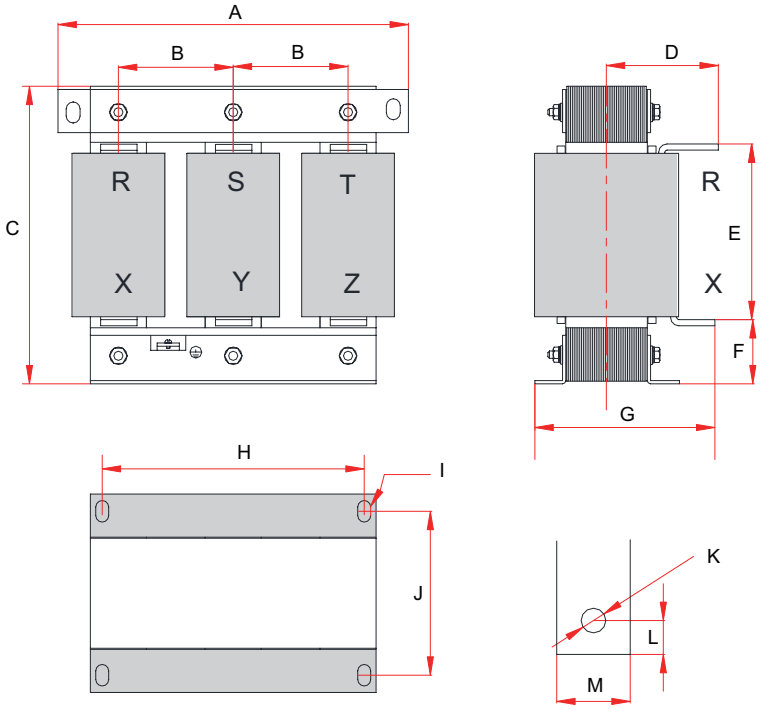


Figure 8-7 Dimension diagram of 150–330 A AC input reactor

Table 8-9 Dimensions of 150–330 A AC input reactor (unit: mm)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L	M
150	250	81±5	230	92±10	145±5	38±5	155	182±1	Φ11*18	76±2	Φ11	13	25
200	250	81±5	230	102±10	145±5	40±5	175	182±1	Φ11*18	96±2	Φ11	13	25
250	250	81±5	260	102±10	160±5	50±5	175	182±1	Φ11*18	96±2	Φ11	13	25
330	290	95±5	275	107±10	160±5	60±5	180	214±1	Φ11*18	100±2	Φ12	15	30

NOTE

◆ The dimensions of the AC input reactor provided here are for reference only. The actual dimensions are subject to the real product.

8.3 EMC Filter

8.3.1 Standard EMC Filter

The following filters meet the emission requirements of category C2 specified in the standard EN 61800-3. The filter must be grounded securely and the cable between the filter and the servo drive must be less than 30 cm. For the cable selection, see *"8.1 Cables, Circuit Breaker and Contactor" on page 145*.

1) Appearance



Schaffner FN3258 series filter



Schaffner FN3359 series filter



Jianli EBK5 series filter

Figure 8-8 Appearance of standard EMC filters

NOTE

- The cable between the filter and the servo drive must be as short as possible (within 30 cm). Connect the filter and the servo drive to the same grounding reference surface to ensure reliable grounding of the filter. Otherwise, the expected filtering effect will not be achieved.

2) Recommended EMC filter models

Schaffner and Jianli filters are recommended, as listed in the following table.

Table 8-10 Recommended manufacturers and models of the EMC input filter

Drive Model	Filter Model (Schaffner)	Filter Model (Jianli)
IS580T020-R1, IS580T020-R1-T, IS580-2T020-R1	FN 3258-42-33	DL-50EBK5
IS580T030-R1, IS580T030-R1-T, IS580-2T030-R1	FN 3258-55-34	DL-50EBK5
IS580T035-R1, IS580T035-R1-H, IS580T035-R1-T	FN 3258-55-34	DL-50EBK5
IS580T040-R1, IS580T040-R1-H, IS580T040-R1-T, IS580-2T040-R1	FN 3258-75-34	DL-65EBK5
IS580T050-R1, IS580T050-R1-H, IS580-2T050-R1	FN 3258-75-34	DL-65EBK5
IS580T070-R1, IS580T070-R1-H, IS580-2T070-R1	FN 3258-100-35	DL-80EBK5
IS580T080-R1, IS580T080-R1-H, IS580-2T080-R1	FN 3258-100-35	DL-100EBK5
IS580T100-R1, IS580T100-R1-H, IS580-2T100-R1	FN 3258-130-35	DL-130EBK5
IS580T140-R1, IS580T140-R1-H, IS580-2T140-R1	FN 3258-180-40	DL-160EBK5
IS580T170-R1, IS580-2T170-R1	FN 3258-180-40	DL-200EBK5
IS580T210-R1, IS580-2T210-R1	FN 3359-250-28	DL-250EBK5
IS580T250-R1	FN 3359-250-28	DL-300EBK3
IS580T300-R1, IS580-2T300-R1	FN 3359-320-99	DL-400EBK3
IS580T370-R1	FN 3359-400-99	DL-400EBK3
IS580T420-R1	FN 3359-600-99	DL-600EBK3
IS580T460-R1	FN 3359-600-99	DL-600EBK3
IS580T520-R1	FN 3359-600-99	DL-600EBK3
IS580T580-R1	FN 3359-600-99	DL-600EBK3
IS580T650-R1	FN 3359-800-99	DL-700EBK3
IS580T720-R1	FN 3359-800-99	DL-800EBK3

3) Mounting dimensions

■ Schaffner FN3258 series filter (50-180 A)

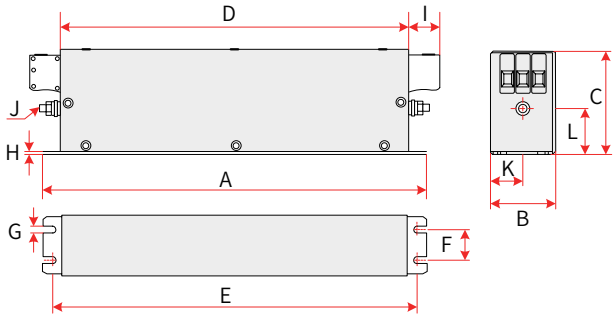


Figure 8-9 Dimension diagram of Schaffner FN3258 series filter (50-180 A)

Table 8-11 Dimensions of Schaffner FN3258 series filter (50-180 A) (unit: mm)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L
7	190	40	70	160	180	20	4.5	1	22	M5	20	29.5
16	250	45	70	220	235	25	5.4	1	22	M5	22.5	29.5
30	270	50	85	240	255	30	5.4	1	25	M5	25	39.5
42	310	50	85	280	295	30	5.4	1	25	M6	25	37.5
55	250	85	90	220	235	60	5.4	1	39	M6	42.5	26.5
75	270	80	135	240	255	60	6.5	1.5	39	M6	40	70.5
100	270	90	150	240	255	65	6.5	1.5	45	M10	45	64
130	270	90	150	240	255	65	6.5	1.5	45	M10	45	64
180	380	120	170	350	365	102	6.5	1.5	51	M10	60	47

■ Schaffner FN3359 series filter (150-250 A)

150–250 A

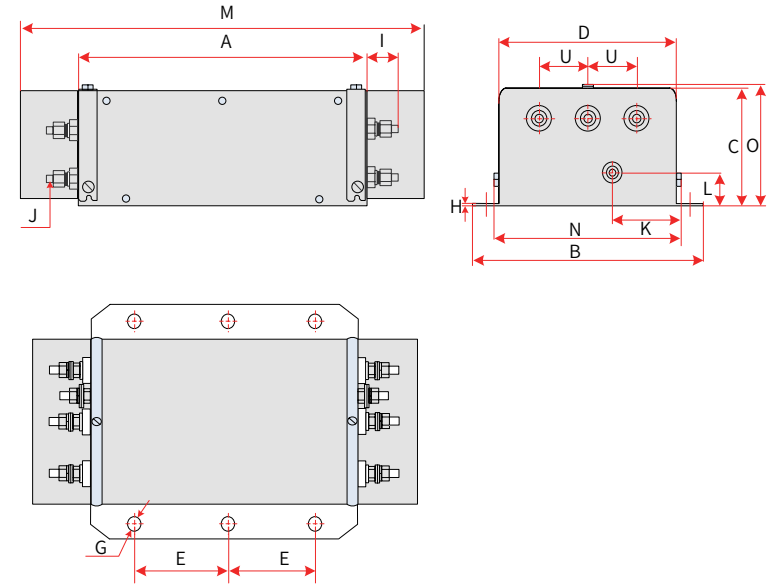


Figure 8-10 Dimension diagram of Schaffner FN 3359 series filter (150-250 A)

Table 8-12 Dimensions of Schaffner FN 3359 series filter (150-250 A) (unit: mm)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K
150	300	200	86	240	275	165	ϕ11	2	40	M10	92
200	300	200	86	240	275	165	ϕ11	2	40	M10	92
250	300	200	86	240	275	165	ϕ11	2	40	M10	92
Rated Current (A)	L	M	N	O	P	U	V	W	X	Y	Z
150	37	380	211	93	26.5	60	20	3	10	37	ϕ9
200	37	380	211	93	26.5	60	20	3	10	37	ϕ9
250	37	380	211	93	26.5	60	20	3	10	37	ϕ9

■ Jianli filters (50-180 A)

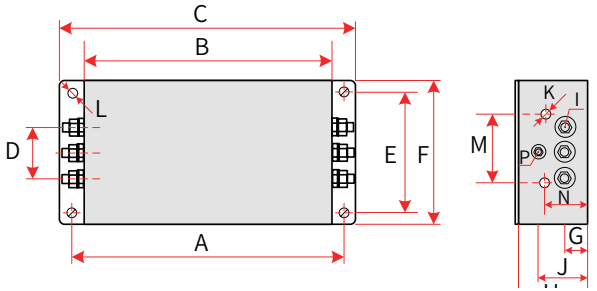


Figure 8-11 Dimension diagram of Jianli filters (50-180 A)

Table 8-13 Dimensions of Jianli filters (50-180 A) (unit: mm)

Model	A	B	C	D	E	F	G	H	I	J	K	M	N	P	L
DL-25EBK5	243	224	265	58	70	102	25	92	M6	58	M4	74	49	M6	6.4x 9.4
DL-35EBK5															
DL-50EBK5															
DL-65EBK5															
DL-80EBK5	354	323	388	66	155	188	30	92	M8	62	M4	86	56	M8	6.4x 9.4
DL-100EBK5															
DL-130EBK5															
DL-160EBK5															
DL-200EBK5															

■ Jianli filter (250 A)

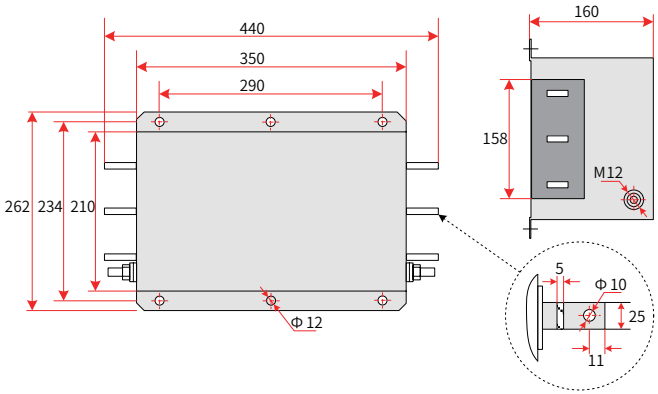


Figure 8-12 Dimension diagram of Jianli 250 A filter (unit: mm)

8.3.2 Simple EMC Input Filter

The simple EMC input filter can efficiently suppress the field interference and the interference generated by the servo drive during running.

Ground the simple EMC input filter securely and ensure that the cable between the filter and the servo drive is less than 30 cm.

Table 8-14 Recommended models for simple EMC input filter

Drive Model	Filter Model
IS580T020-R1, IS580T020-R1-T, IS580-2T020-R1	DL65EB1/10
IS580T030-R1, IS580T030-R1-T, IS580-2T030-R1	DL65EB1/10
IS580T035-R1, IS580T035-R1-H, IS580T035-R1-T	DL65EB1/10
IS580T040-R1, IS580T040-R1-H, IS580T040-R1-T, IS580-2T040-R1	DL65EB1/10
IS580T050-R1, IS580T050-R1-H, IS580-2T050-R1	DL65EB1/10
IS580T070-R1, IS580T070-R1-H, IS580-2T070-R1	DL-120EB1/10
IS580T080-R1, IS580T080-R1-H, IS580-2T080-R1	DL-120EB1/10
IS580T100-R1, IS580T100-R1-H, IS580-2T100-R1	DL-180EB1/10
IS580T140-R1, IS580T140-R1-H, IS580-2T140-R1	DL-180EB1/10
IS580T170-R1, IS580-2T170-R1	Not provided
IS580T210-R1, IS580-2T210-R1	Not provided
IS580T250-R1	Not provided
IS580T300-R1, IS580-2T300-R1	Not provided
IS580T370-R1~IS580T720-R1	Not provided

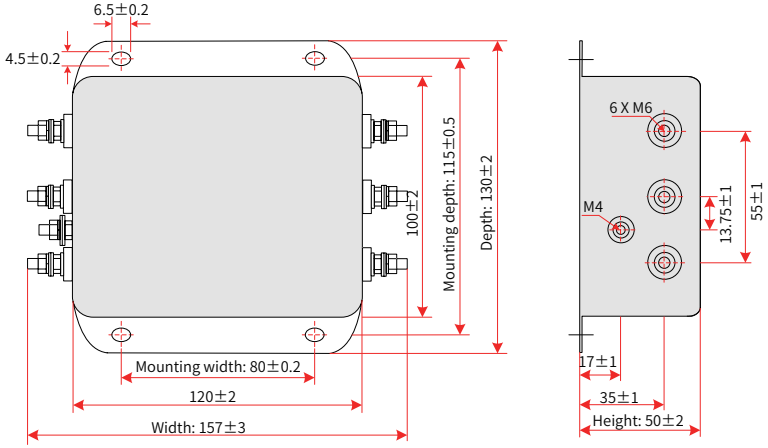


Figure 8-13 Mounting dimensions of the simple EMC filter

Table 8-15 Outline and mounting dimensions of the simple EMC filter (unit: mm)

Filter Model	Outline Dimensions (Width x Depth x Height)	Mounting Dimensions (Width x Depth)
DL-15EB1/10	157 x 130 x 50	80 x 115
DL-35EB1/10	218 x 140 x 80	184 x 112
DL-65EB1/10	218 x 140 x 80	184 x 112
DL-120EB1/10	334 x 185 x 90	304 x 155
DL-180EB1/10	388 x 220 x 100	354 x 190

8.4 Braking Components

When an external braking unit is used, the cable between the servo drive and the braking unit cannot be too long (recommended length: less than 3 m) because an over-long cable will cause large stray inductance and therefore voltage spike. Additionally, fix the cable with a cable tie to ensure parallel cabling.

8.4.1 Recommended Braking Components

Table 8-16 Recommended braking components (three-phase 380–480 VAC, 50/60 Hz)

Drive Model	Drive Power (kW)	Braking Unit		Recommended Power for Regenerative Resistor (kW)	Recommended Resistance for Regenerative Resistor (Ω)	Minimum Resistance of Regenerative Resistor (Ω)	Remarks
		Model	Quantity				
IS580T020-R1	11	Built-in		1.5	≥ 32	22	
IS580T030-R1	15			1.5	≥ 32	22	
IS580T035-R1 IS580T035-R1-H	18.5			2.5	≥ 22	18	
IS580T040-R1 IS580T040-R1-H	22			2.5	≥ 22	18	
IS580T050-R1 IS580T050-R1-H	30			3	≥ 16	12	
IS580T070-R1 IS580T070-R1-H	37			4	≥ 16	12	
IS580T080-R1 IS580T080-R1-H	45			5	≥ 16	12	
IS580T100-R1 IS580T100-R1-H	55			6	≥ 16	9	
IS580T140-R1 IS580T140-R1-H	75			8	≥ 12	7	
IS580T170-R1	90	MDBUN-90-T	1	10	≥ 8	6.2	Input voltage ≤ 440 VAC
	90	MDBUN-90-5T	1	11	≥ 8	7.0	Input voltage > 440 VAC

Drive Model	Drive Power (kW)	Braking Unit		Recommended Power for Regenerative Resistor (kW)	Recommended Resistance for Regenerative Resistor (Ω)	Minimum Resistance of Regenerative Resistor (Ω)	Remarks
		Model	Quantity				
IS580T210-R1	110	MDBUN-60-T	2	5.5 x 2	≥ 12 x 2	9.3 x 2	Input voltage ≤ 440 VAC
	110	MDBUN-60-5T	2	6 x 2	≥ 12 x 2	10.5 x 2	Input voltage > 440 VAC
IS580T250-R1	132	MDBUN-90-T	2	6.5 x 2	≥ 8 x 2	6.2 x 2	Input voltage ≤ 440 VAC
	132	MDBUN-90-5T	2	7 x 2	≥ 8 x 2	7.0 x 2	Input voltage > 440 VAC
IS580T300-R1	160	MDBUN-90-T	2	8 x 2	≥ 8 x 2	6.2 x 2	Input voltage ≤ 440 VAC
	160	MDBUN-90-5T	2	8.5 x 2	≥ 8 x 2	7.0 x 2	Input voltage > 440 VAC
IS580T370-R1	200	MDBU-200-B	2	19 x 2	4.5 x 2	2.5 x 2	Input voltage ≤ 440 VAC
	200	MDBU-200-C	2	19 x 2	5.8 x 2	3.0 x 2	Input voltage > 440 VAC
IS580T420-R1	220	MDBU-200-B	2	21 x 2	4.1 x 2	2.5 x 2	Input voltage > 440 VAC
	220	MDBU-200-C	2	21 x 2	5.3 x 2	3.0 x 2	Input voltage ≤ 440 VAC
IS580T460-R1	250	MDBU-200-B	2	24 x 2	3.6 x 2	2.5 x 2	Input voltage > 440 VAC
	250	MDBU-200-C	2	24 x 2	4.6 x 2	3.0 X 2	Input voltage ≤ 440 VAC
IS580T520-R1	280	MDBU-200-B	2	27 x 2	3.2 x 2	2.5 x 2	Input voltage > 440 VAC
	280	MDBU-200-C	2	27 x 2	4.1 x 2	3.0 x 2	Input voltage ≤ 440 VAC

Drive Model	Drive Power (kW)	Braking Unit		Recommended Power for Regenerative Resistor (kW)	Recommended Resistance for Regenerative Resistor (Ω)	Minimum Resistance of Regenerative Resistor (Ω)	Remarks
		Model	Quantity				
IS580T580-R1	315	MDBU-200-B	3	20 x 3	4.3 x 3	2.5 x 3	Input voltage > 440 VAC
	315	MDBU-200-C	3	20 x 3	5.5 x 3	3.0 x 3	Input voltage ≤ 440 VAC
IS580T650-R1	355	MDBU-200-B	3	23 x 3	3.8 x 3	2.5 x 3	Input voltage > 440 VAC
	355	MDBU-200-C	3	23 x 3	4.9 x 3	3.0 x 3	Input voltage ≤ 440 VAC
IS580T720-R1	400	MDBU-200-B	3	26 x 3	3.4 x 3	2.5 x 3	Input voltage > 440 VAC
	400	MDBU-200-C	3	26 x 3	4.3 x 3	3.0 x 3	Input voltage ≤ 440 VAC

Table 8-17 Recommended braking components (three-phase 220 VAC, 50/60 Hz)

Drive Model	Braking Unit		Recommended Power for Regenerative Resistor (kW)	Recommended Resistance for Regenerative Resistor (Ω)	Minimum Resistance of Regenerative Resistor (Ω)
	Model	Quantity			
IS580-2T020-R1	Built-in		1.5	≥ 16	11
IS580-2T030-R1			1.5	≥ 16	11
IS580-2T040-R1			2.5	≥ 12	9
IS580-2T050-R1			3	≥ 8	6
IS580-2T070-R1			4	≥ 8	6
IS580-2T080-R1			5	≥ 8	6
IS580-2T100-R1			6	≥ 6	4.5
IS580-2T140-R1			8	≥ 6	3.5
IS580-2T170-R1	MDBUN-90-2T	1	10	≥ 4	2.8
IS580-2T210-R1	MDBUN-90-2T	1	11	≥ 3	2.8
IS580-2T300-R1	MDBUN-60-2T	2	16	≥ 5 x 2	1.8

NOTE

- "x2" indicate that two braking units are connected in parallel, with each having one regenerative resistor.
- The braking voltage of the built-in braking unit is 760 V (F9-08) by default, which is suitable for a 380 V grid. If the drive is used in a 480 V grid and the regenerative resistor overheats severely, increase the braking voltage in F9-08 (recommended: 760–780 V) to avoid early working of the braking transistor.
- The braking voltage of external braking units MDBUN-60-T and MDBUN-60-5T were set to 670 V and 760 V at delivery, respectively. Adjust the braking voltage to a value greater than 760 V for a 480 V system.
- The data in preceding figures is for reference only. You can select proper resistance and power of the regenerative resistor as required. It must be noted that the resistance cannot be lower than the recommended minimum value, but the power can exceed the recommended value. The regenerative resistor model depends on the generation power of the motor in the actual system and is also related to system inertia, deceleration time, and potential energy load. Select a proper regenerative resistor as required. A larger system inertia requires shorter deceleration time and more frequent braking. In this case, you need to select a regenerative resistor with larger power and smaller resistance.

8.4.2 Outline and Mounting Dimensions of Braking Units

1) MDBUN series braking unit

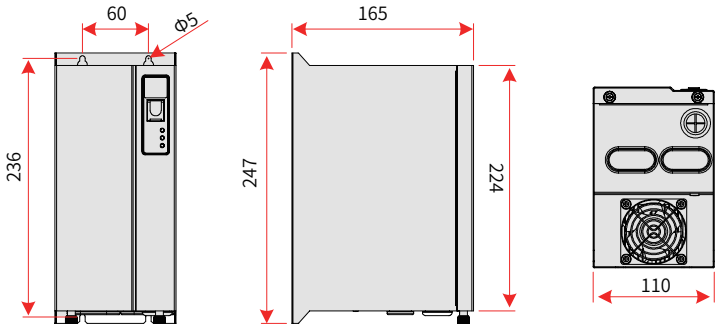


Figure 8-14 Outline dimensions of MDBUN series braking unit (unit: mm)

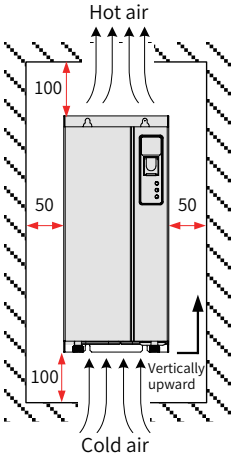


Figure 8-15 Mounting dimensions of of MDBUN series braking unit (unit: mm)

2) MDBU series braking unit

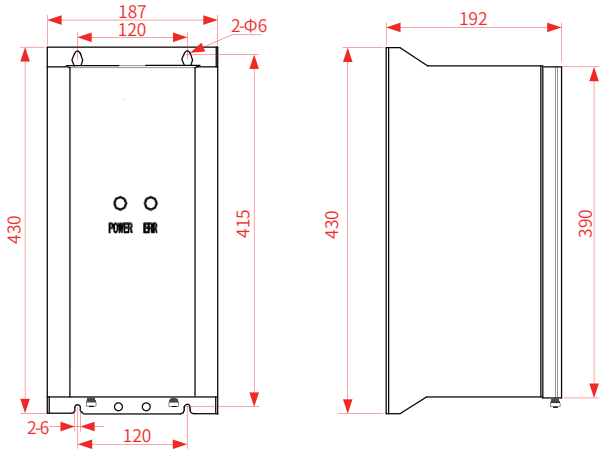


Figure 8-16 Outline dimensions of MDBU series braking unit (unit: mm)

8.5 AC Output Reactor (du/dt Filter)

Whether to install an AC output reactor (du/dt filter) on the servo drive output side depends on the actual situation. The cables between the servo drive and the motor cannot be too long because an over-long cable will cause large distributed capacitance and therefore harmonic current.

Install an AC output reactor (du/dt filter) on the servo drive output side when the output cables are equal to or greater than the values given in Table 8-18.

8.5.1 Recommended Models (Inovance)

Table 8-18 Minimum cable length when an AC output reactor (du/dt filter) is recommended

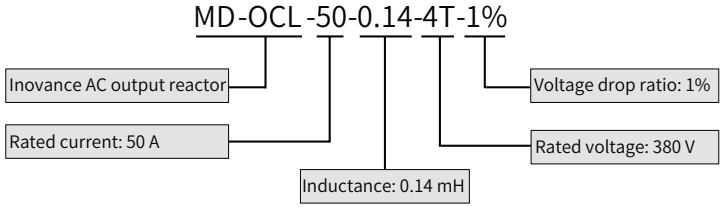
Drive Model	Rated Voltage (V)	Minimum Cable Length when an AC Output Reactor is Recommended (Unit: m)
IS580T020-R1, IS580T020-R1-T, IS580-2T020-R1	200–500	110
IS580T030-R1, IS580T030-R1-T, IS580-2T030-R1	200–500	125
IS580T035-R1, IS580T035-R1-H, IS580T035-R1-T	200–500	135
IS580T040-R1, IS580T040-R1-H, IS580T040-R1-T, IS580-2T040-R1	200–500	150
≥ IS580T050-R1(-H)	280–690	150

1) Recommended AC output reactor (du/dt filter) models

Table 8-19 Recommended manufacturer and models of the AC output reactor (du/dt filter)

Drive Model	Reactor Model (Inovance)
IS580T020-R1, IS580T020-R1-T, IS580-2T020-R1	MD-OCL-50-0.14-4T-1%
IS580T030-R1, IS580T030-R1-T, IS580-2T030-R1	MD-OCL-50-0.14-4T-1%
IS580T035-R1, IS580T035-R1-H, IS580T035-R1-T	MD-OCL-50-0.14-4T-1%
IS580T040-R1, IS580T040-R1-H, IS580T040-R1-T, IS580-2T040-R1	MD-OCL-60-0.12-4T-1%
IS580T050-R1, IS580T050-R1-H, IS580-2T050-R1	MD-OCL-80-0.087-4T-1%
IS580T070-R1, IS580T070-R1-H, IS580-2T070-R1	MD-OCL-90-0.078-4T-1%
IS580T080-R1, IS580T080-R1-H, IS580-2T080-R1	MD-OCL-120-0.058-4T-1%
IS580T100-R1, IS580T100-R1-H, IS580-2T100-R1	MD-OCL-150-0.047-4T-1%
IS580T140-R1, IS580T140-R1-H, IS580-2T140-R1	MD-OCL-200-0.035-4T-1%
IS580T170-R1, IS580-2T170-R1	MD-OCL-250-0.028-4T-1%
IS580T210-R1, IS580-2T210-R1	MD-OCL-250-0.028-4T-1%
IS580T250-R1	MD-OCL-330-0.021-4T-1%
IS580T300-R1, IS580-2T300-R1	MD-OCL-330-0.021-4T-1%

2) Model number of the AC output reactor (du/dt filter)



3) Dimensions of the AC output reactor (du/dt filter)

■ 50–120 A AC output reactor (du/dt filter)

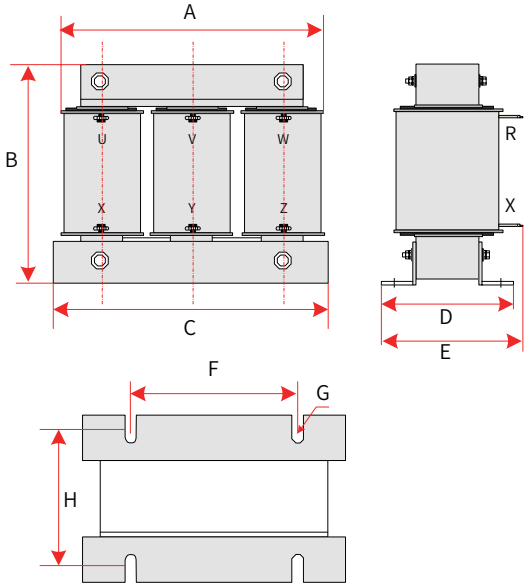


Figure 8-17 Dimension diagram of 50–120 A AC output reactor (du/dt filter)

Table 8-20 Dimensions of 50–120 A AC output reactor (du/dt filter)

Rated Current (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)
50	155	130	148	95	135	95	6 x 15	80
60	195	165	188	92	130	120	8.5 x 20	72
80	195	165	188	92	130	120	8.5 x 20	72
90	195	165	188	92	130	120	8.5 x 20	72
120	195	165	188	112	135	120	8.5 x 20	72

■ 150–250 A AC output reactor (du/dt filter)

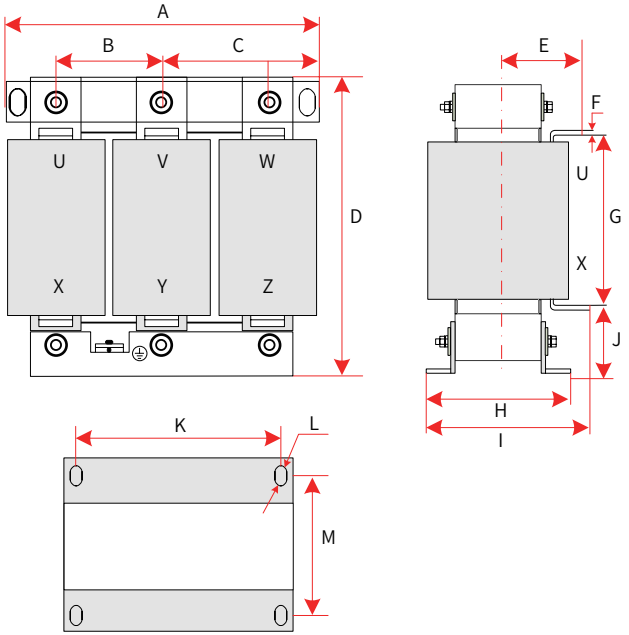


Figure 8-18 Dimension diagram of 150–250 A AC output reactor (du/dt filter)

Table 8-21 Dimensions of 150–250 A AC output reactor (du/dt filter)

Rated Current (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	I (mm)	J (mm)	K (mm)	L (mm)	M (mm)
150	250	81	81	230	97	5	140	113	170	42	182	11 x 18	87
200	250	81	81	230	102	5	140	123	175	42	182	11 x 18	97
250	250	81	81	230	102	5	140	123	175	42	214	11 x 18	106

■ 330 A AC output reactor (du/dt filter)

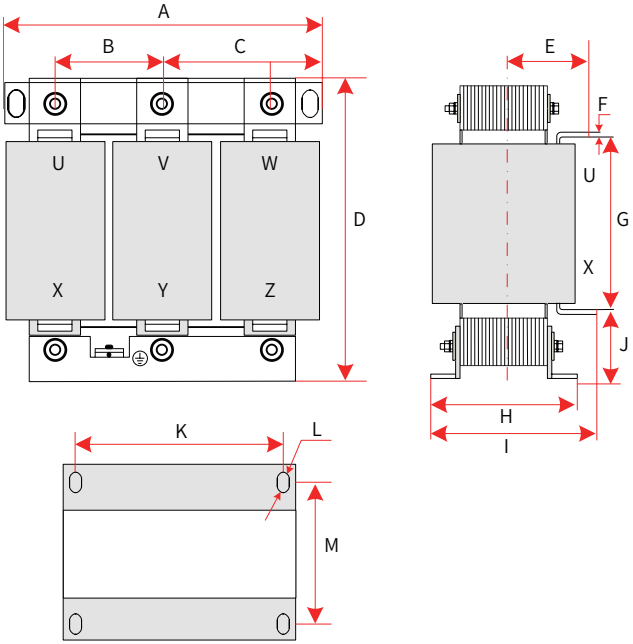


Figure 8-19 Dimension diagram of 330 A AC output reactor (du/dt filter)

Table 8-22 Dimensions of 330 A AC output reactor (du/dt filter)

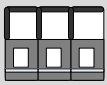
Rated Current (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	I (mm)	J (mm)	K (mm)	L (mm)	M (mm)
330	290	95	95	250	110	5	155	132	190	45	214	11 x 18	106

NOTE

◆ The dimensions of the reactor provided here are for reference only. The actual dimensions are subject to the real product.

8.5.2 Recommended Models (Schaffner)

Table 8-23 Recommended Schaffner models for the AC output reactor (du/dt filter)

Reactor	Rated Current at 40°C (A)	Rated Power of Standard Motor (kW)	Rated Inductance (mH))	Power Loss (W)	I/O Terminal			Total Weight (kg)
								
RWK 305-24-KL	24	11	0.245	45	KL	-	-	2.5
RWK 305-32-KL	32	15	0.184	55	KL	-	-	3.9
RWK 305-45-KL	45	22	0.131	60	KL	-	-	6.1
RWK 305-60-KL	60	30	0.098	65	KL	-	-	6.1
RWK 305-72-KL	72	37	0.082	70	KL	-	-	6.1
RWK 305-90-KL	90	45	0.065	75	KL	-	-	7.4
RWK 305-110-KL	110	55	0.053	90	KL	-	-	8.2
RWK 305-124-KS	124	55	0.047	110	-	KS	-	8.2
RWK 305-143-KS	143	75	0.041	115	-	KS	-	10.7
RWK 305-156-KS	156	75	0.038	120	-	KS	-	10.7
RWK 305-170-KS	170	90	0.035	130	-	KS	-	10.7
RWK 305-182-KS	182	90	0.032	140	-	KS	-	16
RWK 305-230-KS	230	132	0.026	180	-	KS	-	22
RWK 305-280-KS	280	160	0.021	220	-	KS	-	29
RWK 305-330-KS	330	160	0.018	240	-	KS	-	32
RWK 305-400-S	400	200	0.015	330	-	-	S	34
RWK 305-500-S	500	220	0.012	340	-	-	S	35
RWK 305-500-S	500	250	0.012	340	-	-	S	35
RWK 305-600-S	600	280	0.01	380	-	-	S	37
RWK 305-600-S	600	315	0.01	380	-	-	S	37
RWK 305-680-S	680	355	0.009	410	-	-	S	38
RWK 305-790-S	790	400	0.007	590	-	-	S	43

The outline and mounting dimensions of the AC output reactor (du/dt filter)

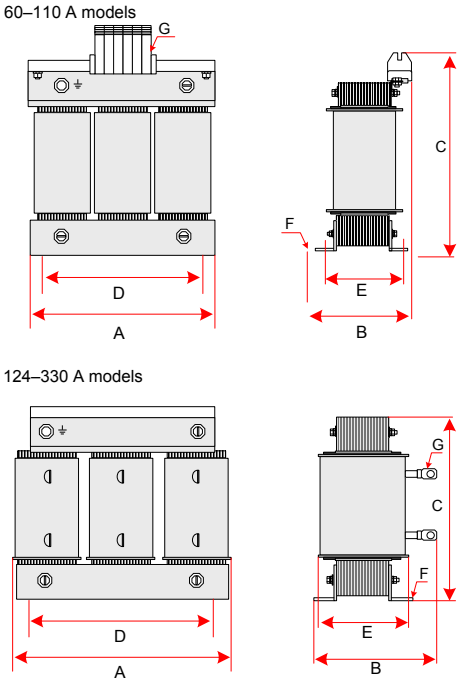


Figure 8-20 Dimension diagram of the AC output reactor

Table 8-25 Mounting dimensions of the AC output reactor

Series	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)
24 A	125	max.75	max.135	100	55	5 x 8	4 mm^2
32 A	155	max.95	max.170	130	56	8 x 12	10 mm^2
45 A	155	max.110	max.190	130	72	8 x 12	10 mm^2
60 A, 72 A	155	max.125	max.190	130	70	8 x 12	16 mm^2
90 A	190	max.115	max.225	170	57	8 x 12	35 mm^2
110 A	190	max.130	max.220	170	67	8 x 12	35 mm^2
124 A	190	max.180	max.160	170	67	8 x 12	8
143 A	190	max.180	max.160	170	77	8 x 12	8
156 A, 170 A	190	max.180	max.160	170	77	8 x 12	10
182 A	210	max.180	max.185	175	97	8 x 12	10
230 A	240	220	-	190	119	11 x 15	12
280 A	240	235	-	190	133	11 x 15	12
330 A	240	240	-	190	135	11 x 15	12

8.6 Output Ferrite Core

The output ferrite core can reduce the bearing current and the interferences on surrounding devices. Install an output ferrite core on the servo drive output side (close to the servo drive), as shown in the following figure.

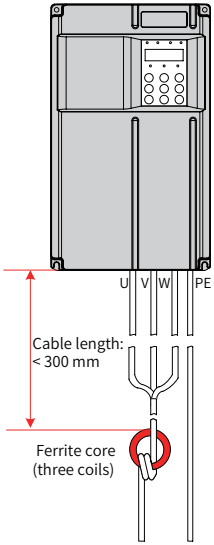


Figure 8-21 Installation of the output ferrite core



Figure 8-22 Appearance of the output ferrite core

Table 8-26 Models of the output ferrite core

Model	Product Code	Dimensions (Outer Diameter x Inner Diameter x Thickness) (unit: mm)
DY644020H	11013031	64 x 40 x 20
DY805020H	11013032	80 x 50 x 20
DY1207030H	11013033	120 x 70 x 30

8.7 Applicable Motors

Table 8-27 Selection of applicable motors

Drive Model	Power Capacity (kVA)	Input Current (A)	Output Current (A)	Applicable Motor		Thermal Power (kW)
				(kW)	(HP)	
Three-phase 380–480 VAC, 50/60 Hz						
IS580T020-R1, IS580T020-R1-T	30	36.3	25	11	15	0.445
IS580T030-R1, IS580T030-R1-T	39	45.1	32	15	20	0.553
IS580T035-R1, IS580T035-R1-H, IS580T035-R1-T	45	49.5	37	18.5	25	0.651
IS580T040-R1, IS580T040-R1-H, IS580T040-R1-T	54	59	45	22	30	0.807
IS580T050-R1, IS580T050-R1-H	52	57	60	30	40	1.01
IS580T070-R1, IS580T070-R1-H	63	69	75	37	50	1.20
IS580T080-R1, IS580T080-R1-H	81	89	91	45	60	1.51
IS580T100-R1, IS580T100-R1-H	97	106	112	55	75	1.80
IS580T140-R1, IS580T140-R1-H	127	139	150	75	100	1.84
IS580T170-R1	150	164	176	90	125	2.08
IS580T210-R1	179	196	210	110	150	2.55
IS580T250-R1	220	240	253	132	180	2.85
IS580T300-R1	263	287	304	160	220	3.56
IS580T370-R1	334	365	377	200	275	4.15
IS580T420-R1	375	410	426	220	300	4.55
IS580T460-R1	404	441	465	250	340	5.06
IS580T520-R1	453	495	520	280	380	5.33
IS580T580-R1	517	565	585	315	430	5.69
IS580T650-R1	565	617	650	355	485	6.31
IS580T720-R1	629	687	725	400	545	6.91
Three-phase 220 VAC, 50/60 Hz						
IS580-2T020-R1	30	36.3	25	5.5	7.50	0.4005
IS580-2T030-R1	39	45.1	32	7.5	11	0.4977
IS580-2T040-R1	54	59	45	11	15	0.7263
IS580-2T050-R1	52	57	60	15	18.5	0.909
IS580-2T070-R1	63	69	75	18.5	22	1.08
IS580-2T080-R1	81	89	91	22	30	1.359
IS580-2T100-R1	97	106	112	30	37	1.62
IS580-2T140-R1	127	139	150	37	45	1.656
IS580-2T170-R1	150	164	176	45	55	1.872
IS580-2T210-R1	179	196	210	55	75	2.295
IS580-2T300-R1	263	287	304	75	90	3.204

8.8 Operating Panels

1) LED operating panel

MD32NKE1 is an external LED operating panel used for commissioning. It is operated in the same way as the operating panel on the servo drive. The outline and mounting dimensions of MD32NKE1 are as follows.

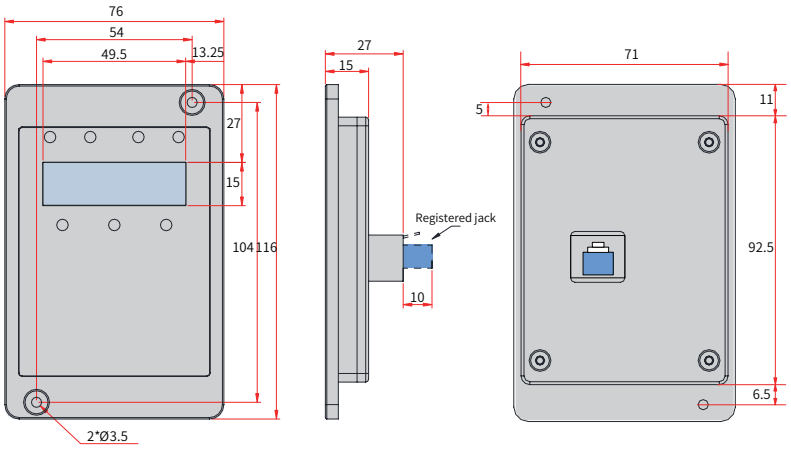


Figure 8-23 Dimensions of the external operating panel MD32NKE1

2) External LCD operating panel

SOP-20-810 is an external LCD operating panel used for parameter copy, parameter modification, and programming. The appearance and dimensions of SOP-20-810 are as follows.



Figure 8-24 Outline dimensions of SOP-20-810 (unit: mm)

9 Selection and Use of Servo Motors

9.1 Model Number

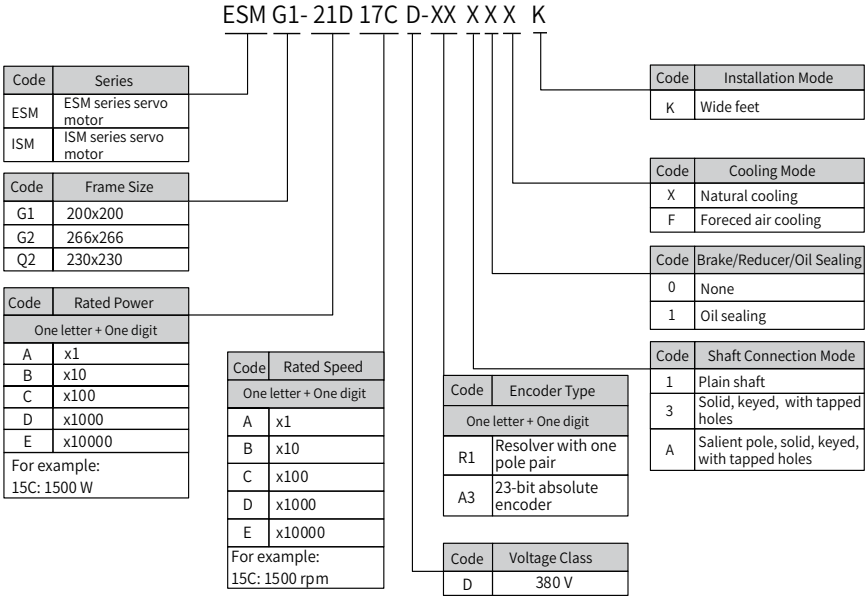


Figure 9-1 Model number of the servo motor

NOTE

- Motor duty describes the load supported by the motor. It specifies the duration time and sequence of the following periods: starting, electric braking, no-load, and rest.
- S1 duty (IEC 60034-1) is continuous duty, in which the motor runs at a constant load for sufficient time to enable the motor to reach thermal equilibrium.
- S4 duty (IEC 60034-1) is intermittent periodic duty with starting, in which the motor runs in a series of identical duty cycles, with each cycle including a significant starting time, a constant load period, and a rest period.

9.2 Selection of the ESMG1 Series Servo Motor

■ Technical specifications

Model: ESMG1-XXXXXXX-XXA1F-K			89C17CD	13D17CD	17D17CD	21D17CD	27D17CD
Rated speed	n_N	rpm	1700				
Rated frequency	f_N	Hz	113.33				
Voltage class	U_N	V	380				
Rated power	P_N	kW	8.9	13.4	16.4	20.5	26.7
Rated torque	T_N	N·m	50	75	92	115	150
Rated current	I_N	A	15.3	24.1	29.5	35.1	48.2
Rated efficiency	η	%	94.2%	94.8%	95.2%	95.4%	95.7%
Peak torque at rated speed	T_{max}	N·m	123	170	225	263	373
Peak current at rated speed	I_{max}	A	43.30	58.30	80.50	88.60	124.10
Angular acceleration at peak torque	a_{pk}	rad/s^2	16400	18889	21429	21917	24867
Max. speed	n_{max}	rpm	2500				
Peak torque at max. speed	T_{max}	N·m	80	110	145	172	212
Peak current at max. speed	I_{max}	A	36.2	49.4	66	76.4	90.4
Standstill torque	$T_N = 0$	N·m	63	94	115	144	188
Standstill current	$I_N = 0$	N·m	19	30	37	44	60
Number of motor poles	2p	-	8				
D-axis inductance	L_d	mH	16.55	7.48	5.99	5.5	3.74
Q-axis inductance	L_q	mH	32.4	14.63	11.7	10.75	7.31
Phase resistance at 20°C	R_{phi}	mΩ	826.7	282.8	200.35	171.9	108.1
Torque constant at 20°C	K_T	N·m/A	3.60	3.43	3.43	3.60	3.43
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09				
Rotor inertia	J_m	mkg·m^2	7.5	9	10.5	12	15
Insulation class	-	-	Class F				
Cooling mode	-	-	IC 416				
IP rating	-	-	IP54				
Installation mode	-	-	IM B35				
Max. impact acceleration	S	m/s^2	200				
Max. vibration in radial direction	V_r	m/s^2	200				
Max. vibration in axial direction	V_a	m/s^2	45	40	35	30	20
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ				
Withstand peak voltage	-	-	1800 VAC				
Net weight	N.W.	kg	45.2	51.9	59	66	79.8

Model: ESMG1-XXXXXXX-XXA1F-K			89C17CD	13D17CD	17D17CD	21D17CD	27D17CD
Fan type	-	-	Single-phase capacitor-run centrifugal fan				
Fan power	-	W	41				
Fan voltage	-	VAC	220/230				
Fan frequency	-	-	50/60				
Threshold of built-in PTC	PTCt	°C	130				
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652				
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)				
Operating ambient humidity	-	-	20%–90% RH (no condensation)				
Storage temperature	-	°C	-20°C to +60°C (no freezing)				
Storage humidity	-	-	20%–90% RH (no condensation)				
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)				
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	0.947	0.887	0.824	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	45°C	50°C	55°C	60°C
	-	-	1	0.952	0.901	0.855	0.781

Model: ESMG1-XXXXXXX-XXA1F-K			11D20CD	15D20CD	19D20CD	25D20CD	31D20CD
Rated speed	n_N	rpm	2000				
Rated frequency	f_N	Hz	133.33				
Voltage class	U_N	V	380				
Rated power	P_N	kW	10.5	15.7	19.3	24.1	31.4
Rated torque	T_N	N·m	50	75	92	115	150
Rated current	I_N	A	17.5	26.2	33	40.2	52.4
Rated efficiency	η	%	94.0%	94.4%	94.9%	95.2%	95.5%
Peak torque at rated speed	T_{max}	N·m	123	170	225	263	373
Peak current at rated speed	I_{max}	A	49.20	67.00	90.00	101.30	150.00
Angular acceleration at peak torque	a_{pk}	rad/s2	16400	18889	21429	21917	24867
Max. speed	n_{max}	rpm	2500				
Peak torque at max. speed	T_{max}	N·m	97.9	131	170	195	285
Peak current at max. speed	I_{max}	A	43.6	60	79.2	87	130.3
Standstill torque	$T_N = 0$	N·m	63	94	115	144	188
Standstill current	$I_N = 0$	N·m	22	33	41	50	66
Number of motor poles	2p	-	8				
D-axis inductance	L_d	mH	5.95	4.74	3.46	2.98	2.37
Q-axis inductance	L_q	mH	9.63	7.67	5.61	4.82	3.84
Phase resistance at 20°C	R_{phi}	mΩ	360.00	231.40	151.80	130.00	92.85

Model: ESMG1-XXXXXXX-XXA1F-K			11D20CD	15D20CD	19D20CD	25D20CD	31D20CD
Torque constant at 20°C	K_T	N·m/A	3.08	3.08	3.00	3.08	3.08
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09				
Rotor inertia	Jm	$mkg \cdot m^2$	7.5	9	10.5	12	15
Insulation class	-	-	Class F				
Cooling mode	-	-	IC 416				
IP rating	-	-	IP54				
Installation mode	-	-	IM B35				
Max. impact acceleration	S	m/s^2	200				
Max. vibration in radial direction	V_r	m/s^2	200				
Max. vibration in axial direction	V_a	m/s^2	45	40	35	30	20
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ				
Withstand peak voltage	-	-	1800 VAC				
Net weight	N.W.	kg	45.2	51.9	59	66	79.8
Fan type	-	-	Single-phase capacitor-run centrifugal fan				
Fan power	-	W	41				
Fan voltage	-	VAC	220/230				
Fan frequency	-	-	50/60				
Threshold of built-in PTC	PTCt	°C	130				
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652				
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)				
Operating ambient humidity	-	-	20%–90% RH (no condensation)				
Storage temperature	-	°C	-20°C to +60°C (no freezing)				
Storage humidity	-	-	20%–90% RH (no condensation)				
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)				
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	0.947	0.887	0.824	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	45°C	50°C	55°C	60°C
	-	-	1	0.952	0.901	0.855	0.781

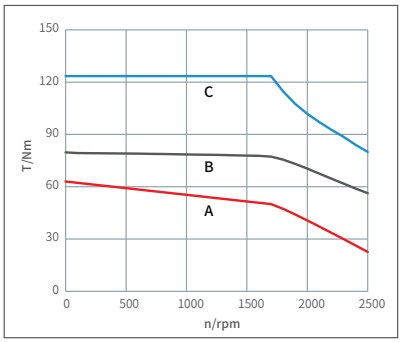
■ Motor curves

A —— Continuous working area

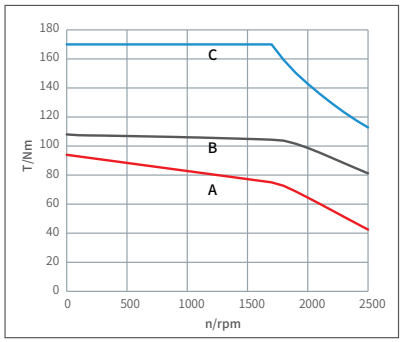
B —— 100 K temperature rise working area

C —— Short-time working area

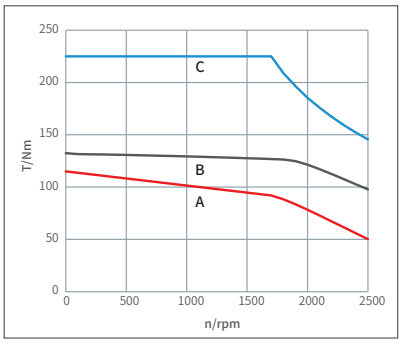
89C17CD



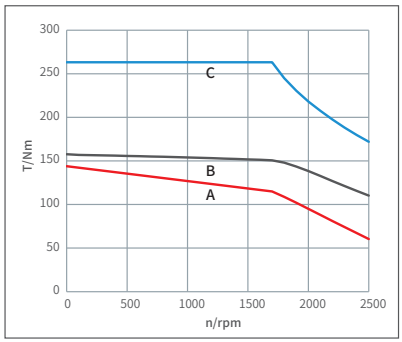
13D17CD



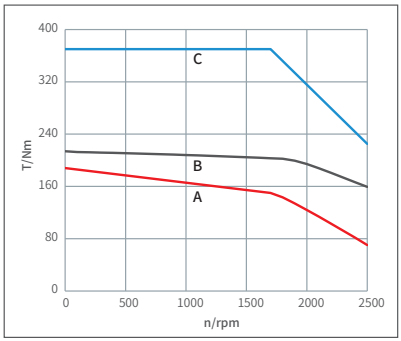
17D17CD



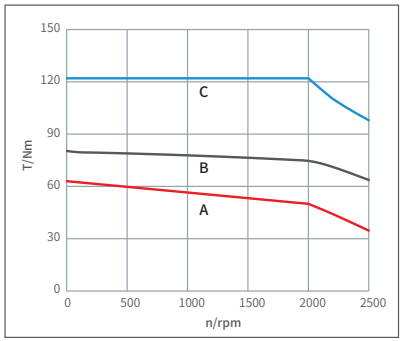
21D17CD

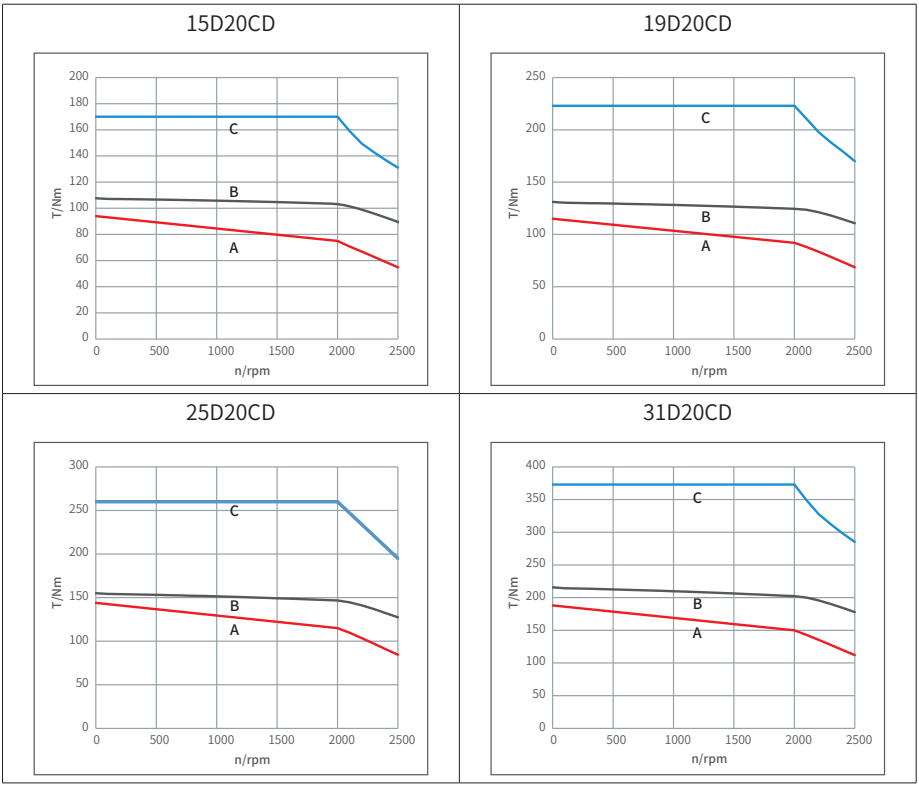


27D17CD



11D20CD





9.3 Selection of the ESMG2 Series Servo Motor

■ Technical specifications

Model: ESMG2-XXXXXXX-XXA1F-K			30D17CD	42D17CD	50D17CD	62D17CD	80D17CD
Rated speed	n_N	rpm	1700				
Rated frequency	f_N	Hz	113.33				
Voltage class	U_N	V	380				
Rated power	P_N	kW	30.2	40.9	50.7	60.5	78.3
Rated torque	T_N	N·m	170	230	285	340	440
Rated current	I_N	A	51.9	73.9	91.5	103.8	145
Rated efficiency	η	%	95.9%	96.2%	96.4%	96.6%	96.7%
Peak torque at rated speed	T_{max}	N·m	280	415	510	530	750
Peak current at rated speed	I_{max}	A	113	142	201	171	312
Angular acceleration at peak torque	a_{pk}	rad/s^2	9459	11277	11751	10600	11719
Max. speed	n_{max}	rpm	2500				
Peak torque at max. speed	T_{max}	N·m	185	267	305	342	510

Model: ESMG2-XXXXXXX-XXA1F-K			30D17CD	42D17CD	50D17CD	62D17CD	80D17CD
Peak current at max. speed	I_{max}	A	86	122.7	135	139	240.5
Standstill torque	$T_N = 0$	N·m	213	288	356	425	550
Standstill current	$I_N = 0$	N·m	65	92	114	130	181
Number of motor poles	2p	-	8				
D-axis inductance	L_d	mH	3.8	2.59	2.07	1.9	1.29
Q-axis inductance	L_q	mH	9.18	6.25	5	4.59	3.12
Phase resistance at 20°C	R_{phi}	mΩ	70.7	42.45	30.85	26.75	16.8
Torque constant at 20°C	K_T	N·m/A	3.60	3.43	3.43	3.60	3.43
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09				
Rotor inertia	J_m	mkg·m^2	29.6	36.8	43.4	50	64
Insulation class	-	-	Class F				
Cooling mode	-	-	IC 416				
IP rating	-	-	IP54				
Installation mode	-	-	IM B35				
Max. impact acceleration	S	m/s^2	200				
Max. vibration in radial direction	Vr	m/s^2	200				
Max. vibration in axial direction	Va	m/s^2	50	45	45	40	35
Insulation resistance at 500 VDC	Rins	MΩ	≥ 20 MΩ				
Withstand peak voltage	-	-	1800 VAC				
Net weight	N.W.	kg	122	141.3	158.4	175.4	217
Fan type	-	-	Single-phase capacitor-run centrifugal fan				
Fan power	-	W	134				
Fan voltage	-	VAC	220/230				
Fan frequency	-	-	50/60				
Threshold of built-in PTC	PTCt	°C	130				
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652				
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)				
Operating ambient humidity	-	-	20%–90% RH (no condensation)				
Storage temperature	-	°C	-20°C to +60°C (no freezing)				
Storage humidity	-	-	20%–90% RH (no condensation)				
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)				
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	0.947	0.887	0.824	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	45°C	50°C	55°C	60°C
	-	-	1	0.952	0.901	0.855	0.781

Model: ESMG2-XXXXXXX-XXA1F-K			36D20CD	48D20CD	60D20CD	72D20CD	92D20CD
Rated speed	n_N	rpm	2000				
Rated frequency	f_N	Hz	133.33				
Voltage class	U_N	V	380				
Rated power	P_N	kW	35.6	48.2	59.7	71.2	92.1
Rated torque	T_N	N·m	170	230	285	340	440
Rated current	I_N	A	62.2	84.1	107.2	124.4	154
Rated efficiency	η	%	95.7%	96.1%	96.3%	96.4%	96.6%
Peak torque at rated speed	T_{max}	N·m	280	350	470	540	705
Peak current at rated speed	I_{max}	A	105	130	195	206	320
Angular acceleration at peak torque	a_{pk}	rad/s^2	9459	9511	10829	10800	11016
Max. speed	n_{max}	rpm	2500				
Peak torque at max. speed	T_{max}	N·m	212	285	360	422	524
Peak current at max. speed	I_{max}	A	88	115	163	180	248
Standstill torque	$T_N = 0$	N·m	213	288	356	425	550
Standstill current	$I_N = 0$	N·m	78	105	134	156	193
Number of motor poles	2p	-	8				
D-axis inductance	L_d	mH	2.72	2.17	1.58	1.36	0.96
Q-axis inductance	L_q	mH	3.63	2.89	2.11	1.82	1.28
Phase resistance at 20°C	R_{phi}	mΩ	51.3	33.8	23.7	19.7	16.8
Torque constant at 20°C	K_T	N·m/A	3.08	3.08	3.00	3.08	3.43
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09				
Rotor inertia	J_m	$mkg \cdot m^2$	29.6	36.8	43.4	50	64
Insulation class	-	-	Class F				
Cooling mode	-	-	IC 416				
IP rating	-	-	IP54				
Installation mode	-	-	IM B35				
Max. impact acceleration	S	m/s^2	200				
Max. vibration in radial direction	V_r	m/s^2	200				
Max. vibration in axial direction	V_a	m/s^2	50	45	45	40	40
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ				
Withstand peak voltage	-	-	AC 1800 V				
Net weight	N.W.	kg	122	141.3	158.4	175.4	217
Fan type	-	-	Single-phase capacitor-run centrifugal fan				
Fan power	-	W	134				
Fan voltage	-	VAC	220/230				
Fan frequency	-	-	50/60				
Threshold of built-in PTC	PTCt	°C	130				

Model: ESMG2-XXXXXXX-XXA1F-K			36D20CD	48D20CD	60D20CD	72D20CD	92D20CD
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652				
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)				
Operating ambient humidity	-	-	20%–90% RH (no condensation)				
Storage temperature	-	°C	-20°C to +60°C (no freezing)				
Storage humidity	-	-	20%–90% RH (no condensation)				
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)				
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	0.947	0.887	0.824	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	45°C	50°C	55°C	60°C
	-	-	1	0.952	0.901	0.855	0.781

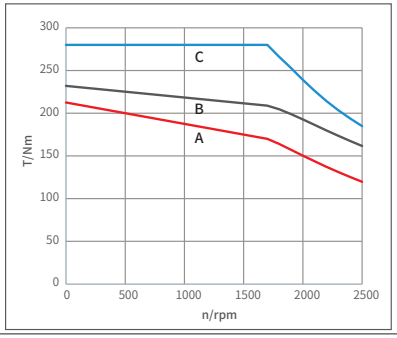
■ Motor curves

A Continuous working area

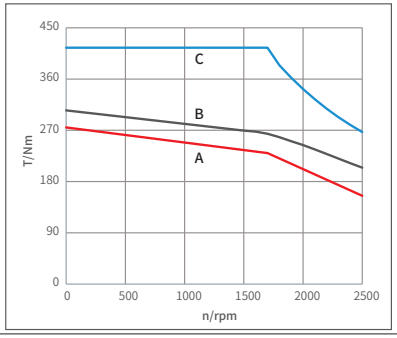
B 100 K temperature rise working area

C Short-time working area

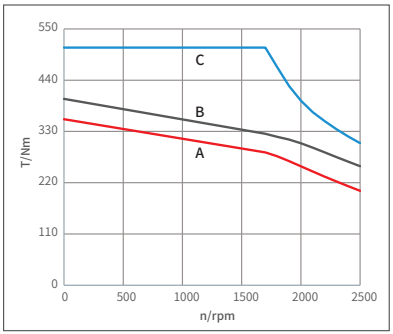
30D17CD



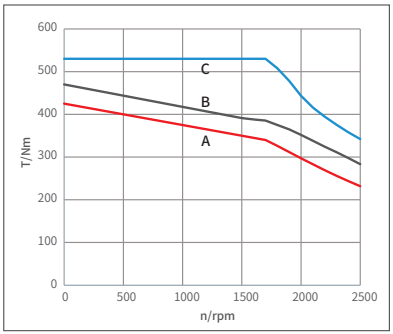
42D17CD



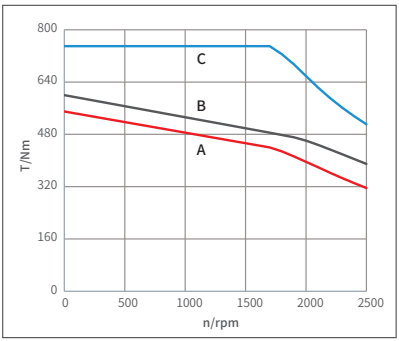
50D17CD



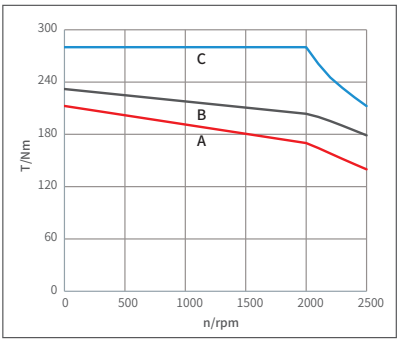
62D17CD



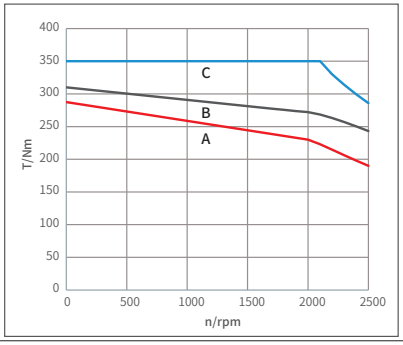
80D17CD



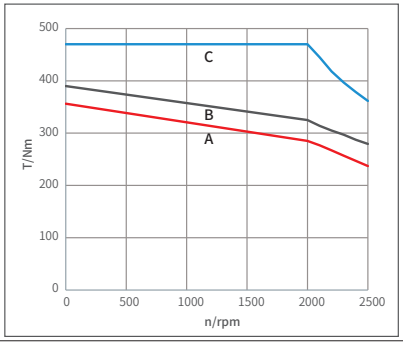
36D20CD



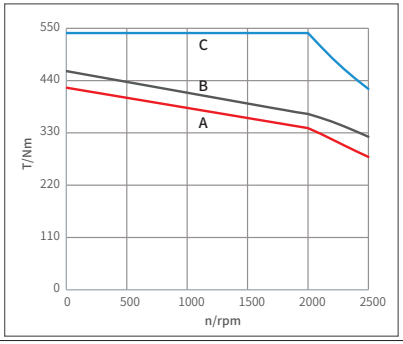
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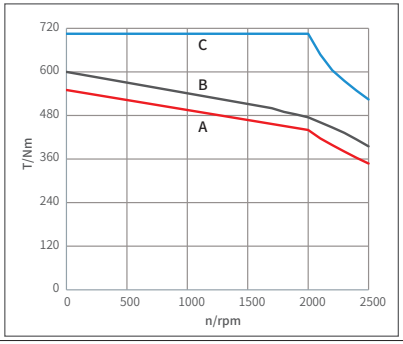
60D20CD



72D20CD



92D20CD



9.4 Selection of the ISMG1 Series Servo Motor

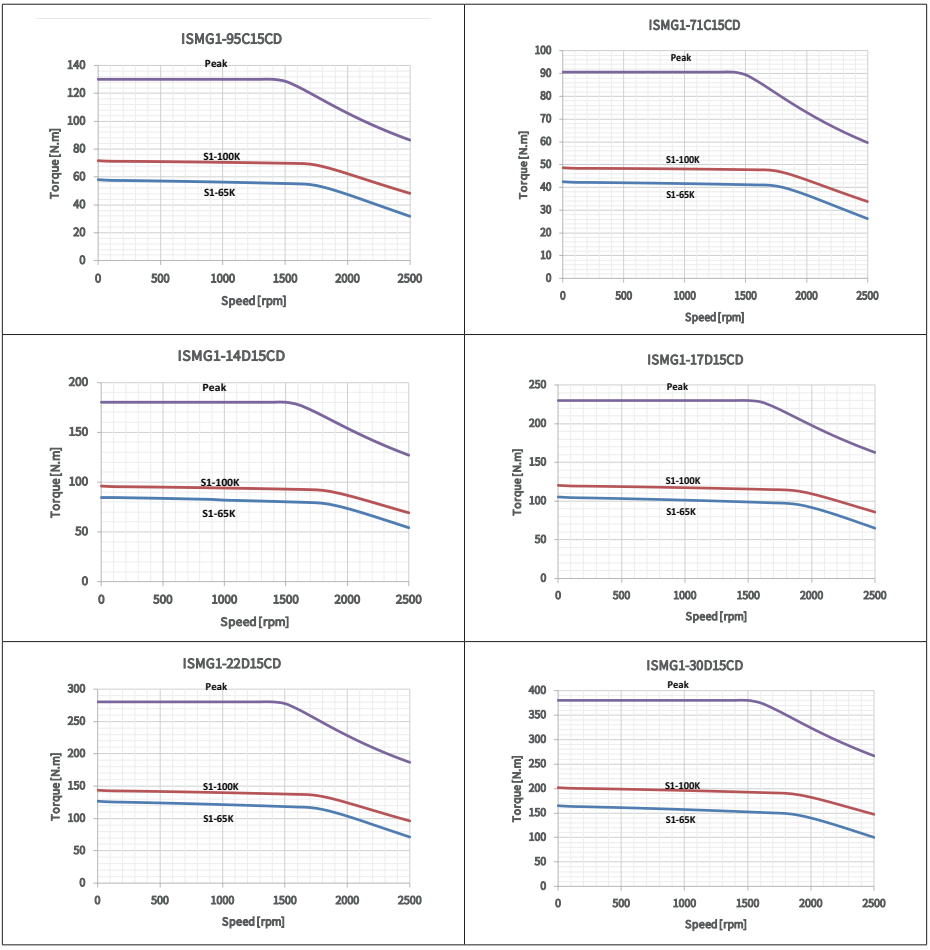
9.4.1 Specifications of Models with Forced Air Cooling

ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-XXA1FA					
Item			71C15CD	95C15CD	14D15CD	17D15CD	22D15CD	30D15CD
Rated speed	n_N	rpm	1500	1500	1500	1500	1500	1500
Rated frequency	f_N	Hz	100	100	100	100	100	100
Voltage class	U_N	V	380	380	380	380	380	380
Rated power	P_N	kW	7.1	9.5	14.1	17.3	22	30.6
Rated torque	T_N	N·m	45	60	90	110	135	195
Rated current	I_N	A	13.9	18.5	29.2	35.7	41.7	63.3
Rated efficiency	η	%	93.9	94.3	95	95.2	95.5	95.9
Peak torque	T_{max}	N·m	90	130	180	230	280	380
Peak current	I_{max}	A	27.80	40.08	58.40	74.65	86.49	123.35
Angular acceleration at peak torque	a_{pk}	rad/s^2	15000	17333	20000	21905	23333	25333
Max. speed	n_{max}	rpm	2500	2500	2500	2500	2500	2500
Number of motor poles	2p	-	8	8	8	8	8	8
D-axis inductance	L_d	mH	16.55	11	7.48	5.99	5.5	3.74
Q-axis inductance	L_q	mH	32.4	21.5	14.63	11.7	10.75	7.31
Phase resistance at 20°C	R_{phi}	mΩ	826.7	478.5	283.5	201.5	175	110
Back EMF at rated speed (20°C)	E_0	V	318.2	318.2	303	303	318.2	303
Torque constant at 20°C	K_T	N·m/A	3.51	3.51	3.34	3.34	3.51	3.34
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
Rotor inertia	J_m	$10^{-3}kg·m^2$	$6x10^{-3}$	7.5	9	10.5	12	15
Insulation class	-	-	Class F	Class F	Class F	Class F	Class F	Class F
Cooling mode	-	-	IC 416	IC 416	IC 416	IC 416	IC 416	IC 416
IP rating	-	-	IP54	IP54	IP54	IP54	IP54	IP54
Installation mode	-	-	IM B35	IM B35	IM B35	IM B35	IM B35	IM B35
Max. impact acceleration	S	m/s^2	200	200	200	200	200	200
Max. vibration in radial direction	V_r	m/s^2	200	200	200	200	200	200
Max. vibration in axial direction	V_a	m/s^2	45	45	40	35	30	20
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ
Withstand peak voltage	-	-	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC

ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-XXA1FA					
Item			71C15CD	95C15CD	14D15CD	17D15CD	22D15CD	30D15CD
Dimensions of packaging box	-	mm	522 x 302 x 467	522 x 302 x 467	602 x 302 x 467	602 x 302 x 467	682 x 302 x 467	682 x 302 x 467
Weight	W	kg	37.2	45.2	51.9	59	66	79.8
Fan type	-	-	Single-phase capacitor-run centrifugal fan					
Fan power	-	W	41	41	41	41	41	41
Fan voltage	-	VAC	220/230	220/230	220/230	220/230	220/230	220/230
Fan frequency	-	Hz	50/60	50/60	50/60	50/60	50/60	50/60
Threshold of built-in PTC	PTCt	°C	130	130	130	130	130	130
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652	514–652	514–652	514–652	514–652	514–652
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)					
Operating ambient humidity	-	-	20%–90% RH (no condensation)					
Storage temperature	-	°C	-20°C to +60°C (no freezing)					
Storage humidity	-	-	20%–90% RH (no condensation)					
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)					
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	1	0.947	0.887	0.824	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	40°C	45°C	50°C	55°C	60°C
	-	-	1	1	0.952	0.901	0.855	0.781
Certification	-	-	CE	CE	CE	CE	CE	CE

■ Tn curves

Color	Definition	Description	Remarks
	Peak	Describes the relationship between the peak torque and the motor speed, indicating the short-time overload capacity of the motor.	Select a motor whose operating curve is between S1-65 K and S1-100 K curve.
	S1-100K	Describes the relationship between the torque and the motor speed in the case of 100 K temperature rise in S1 duty (continuous duty).	
	S1-65K	Describes the relationship between the torque and the motor speed in the case of 65 K temperature rise in S1 duty (continuous duty).	
Note: If the bus voltage is too low, the torque will decline when the motor speed exceeds the rated speed. Therefore, consult the technical personnel of Inovance for motor selection.			



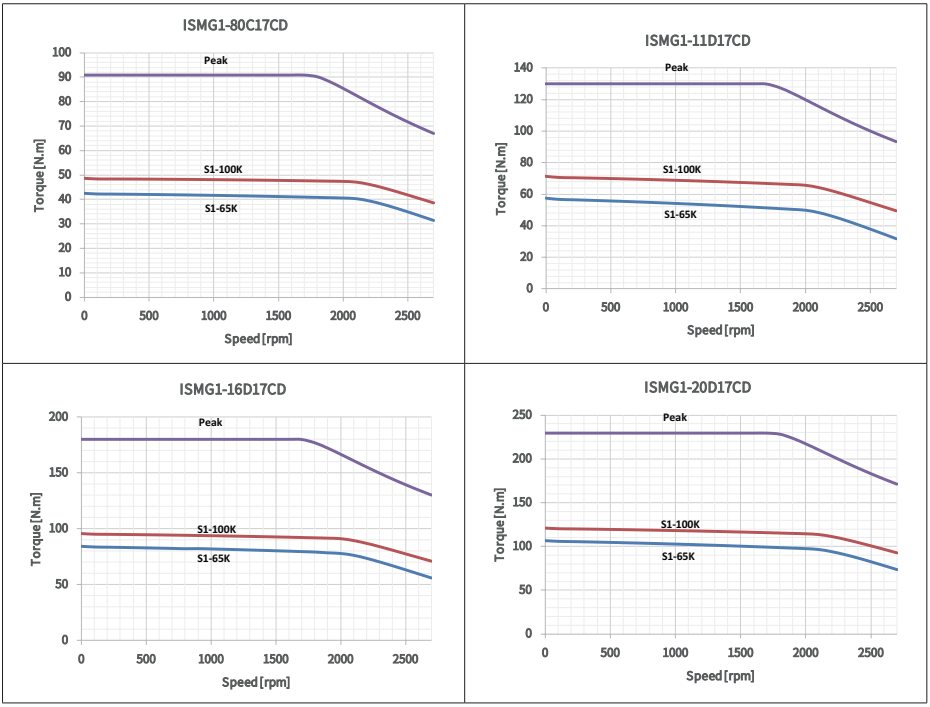
ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-XXA1FA					
Item			80C17CD	11D17CD	16D17CD	20D17CD	24D17CD	34D17CD
Rated speed	n_N	rpm	1700	1700	1700	1700	1700	1700
Rated frequency	f_N	Hz	113.33	113.33	113.33	113.33	113.33	113.33
Voltage class	U_N	V	380	380	380	380	380	380
Rated power	P_N	kW	8	11	16	19.6	24	34.7
Rated torque	T_N	N·m	45	60	90	110	135	195
Rated current	I_N	A	16.6	21.7	32.5	40.7	48.7	70.4
Rated efficiency	η	%	94.1	94.6	95.1	95.4	95.6	96
Peak torque	T_{max}	N·m	90	130	180	230	280	380
Peak current	I_{max}	A	33.20	47.02	65.00	85.10	101.01	137.19
Angular acceleration at peak torque	a_{pk}	rad/s^2	15000	17333	20000	21905	23333	25333

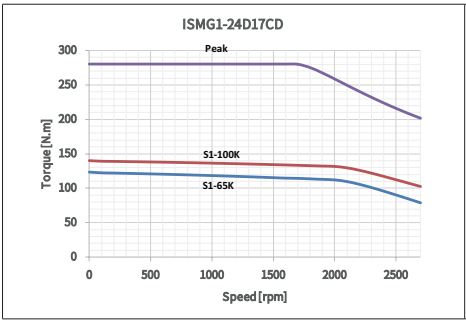
ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-XXA1FA					
Item			80C17CD	11D17CD	16D17CD	20D17CD	24D17CD	34D17CD
Max. speed	n_{max}	rpm	2700	2700	2700	2700	2700	2700
Number of motor poles	2p	-	8	8	8	8	8	8
D-axis inductance	L_d	mH	11.5	8.08	6.06	4.58	4.04	3.03
Q-axis inductance	L_q	mH	22.5	15.8	11.85	8.96	7.9	5.92
Phase resistance at 20°C	R_{phi}	mΩ	574.1	359.5	231	153.5	132	90.5
Back EMF at rated speed (20°C)	E_0	V	300.5	309.1	309.1	300.5	309.1	309.1
Torque constant at 20°C	K_T	N·m/A	2.92	3.01	3.01	2.92	3.01	3.01
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
Rotor inertia	J_m	mkg·m^2	6	7.5	9	10.5	12	15
Insulation class	-	-	Class F	Class F	Class F	Class F	Class F	Class F
Cooling mode	-	-	IC 416	IC 416	IC 416	IC 416	IC 416	IC 416
IP rating	-	-	IP54	IP54	IP54	IP54	IP54	IP54
Installation mode	-	-	IM B35	IM B35	IM B35	IM B35	IM B35	IM B35
Max. impact acceleration	S	m/s^2	200	200	200	200	200	200
Max. vibration in radial direction	V_r	m/s^2	200	200	200	200	200	200
Max. vibration in axial direction	V_a	m/s^2	35	35	35	30	30	25
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ
Withstand peak voltage	-	-	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC
Dimensions of packaging box	-	-	522 x 302 x 467	522 x 302 x 467	602 x 302 x 467	602 x 302 x 467	682 x 302 x 467	682 x 302 x 467
Weight	W	kg	37.2	45.2	51.9	59	66	79.8
Fan type	-	-	Single-phase capacitor-run centrifugal fan					
Fan power	-	W	41	41	41	41	41	41
Fan voltage	-	VAC	220/230	220/230	220/230	220/230	220/230	220/230
Fan frequency	-	Hz	50/60	50/60	50/60	50/60	50/60	50/60
Threshold of built-in PTC	PTCt	°C	130	130	130	130	130	130
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652	514–652	514–652	514–652	514–652	514–652
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)					
Operating ambient humidity	-	-	20%–90% RH (no condensation)					
Storage temperature	-	°C	-20°C to +60°C (no freezing)					
Storage humidity	-	-	20%–90% RH (no condensation)					
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)					
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	1	0.947	0.887	0.824	0.645

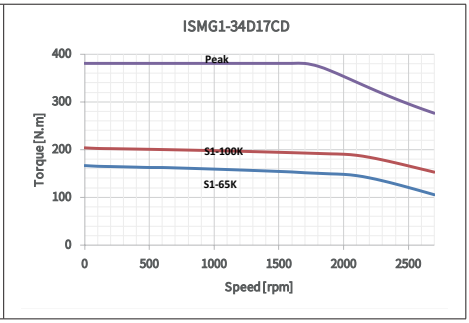
ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-XXA1FA					
Item			80C17CD	11D17CD	16D17CD	20D17CD	24D17CD	34D17CD
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	40°C	45°C	50°C	55°C	60°C
	-	-	1	1	0.952	0.901	0.855	0.781
Certification	-	-	CE	CE	CE	CE	CE	CE

■ Tn curves

Color	Definition	Description	Remarks
	Peak	Describes the relationship between the peak torque and the motor speed, indicating the short-time overload capacity of the motor.	Select a motor whose operating curve is between S1-65 K and S1-100 K curve.
	S1-100K	Describes the relationship between the torque and the motor speed in the case of 100 K temperature rise in S1 duty (continuous duty).	
	S1-65K	Describes the relationship between the torque and the motor speed in the case of 65 K temperature rise in S1 duty (continuous duty).	
Note: If the bus voltage is too low, the torque will decline when the motor speed exceeds the rated speed. Therefore, consult the technical personnel of Inovance for motor selection.			





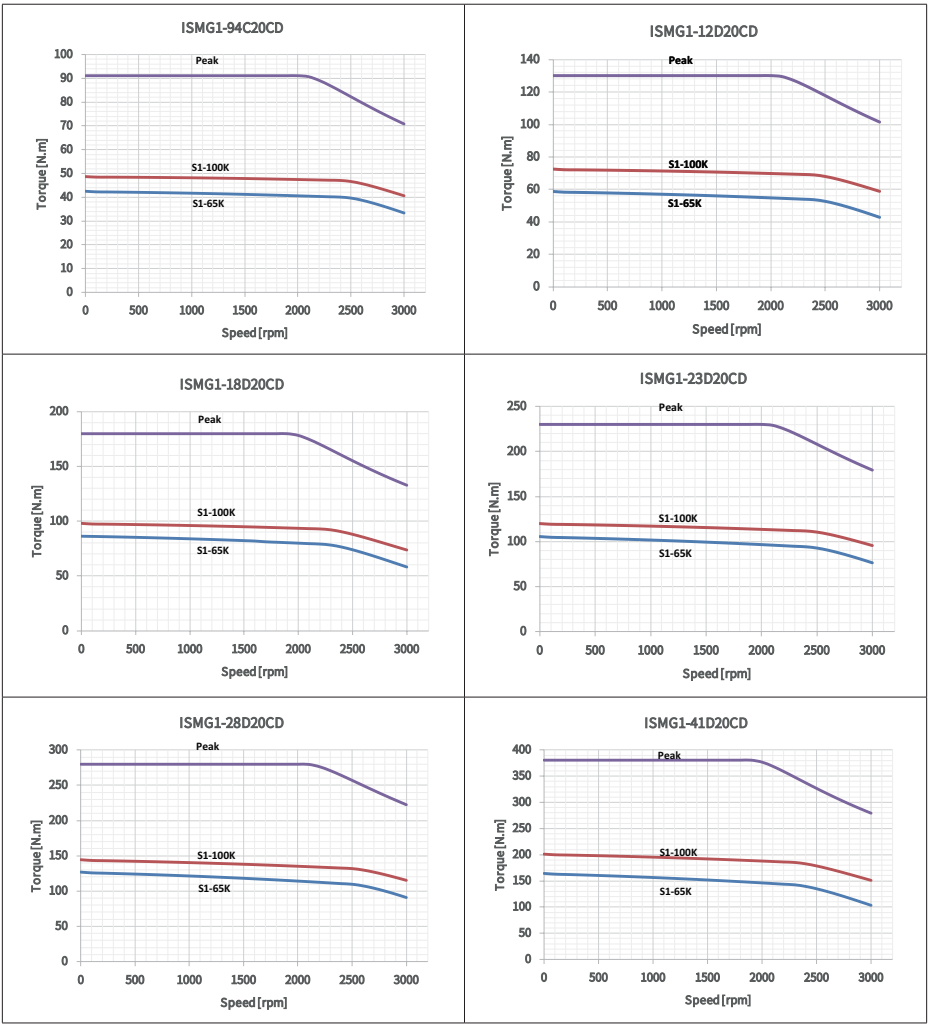


ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-XXA1FA					
Item			94C20CD	12D20CD	18D20CD	23D20CD	28D20CD	41D20CD
Rated speed	n_N	rpm	2000	2000	2000	2000	2000	2000
Rated frequency	f_N	Hz	133.33	133.33	133.33	133.33	133.33	133.33
Voltage class	U_N	V	380	380	380	380	380	380
Rated power	P_N	kW	9.4	12.6	18.8	23	28.3	41
Rated torque	T_N	N·m	45	60	90	110	135	195
Rated current	I_N	A	19.4	26	36.4	47.6	58.4	78.9
Rated efficiency	η	%	93.7	94.2	94.9	95.1	95.4	95.9
Peak torque	T_{max}	N·m	90	130	180	230	280	380
Peak current	I_{max}	A	38.80	56.33	72.80	99.53	121.13	153.75
Angular acceleration at peak torque	a_{pk}	rad/s^2	15000	17333	20000	21905	23333	25333
Max. speed	n_{max}	rpm	3000	3000	3000	3000	3000	3000
Number of motor poles	2p	-	8	8	8	8	8	8
D-axis inductance	L_d	mH	8.44	5.61	4.97	3.37	2.81	2.39
Q-axis inductance	L_q	mH	16.52	10.97	9.63	6.58	5.48	4.68
Phase resistance at 20°C	R_{phi}	mΩ	421.8	240.5	174	115.5	90	71.5
Back EMF at rated speed (20°C)	E_0	V	303	303	323.2	303	303	323.2
Torque constant at 20°C	K_T	N·m/A	2.51	2.51	2.67	2.51	2.51	2.67
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
Rotor inertia	J_m	mkgm^2	6	7.5	9	10.5	12	15
Insulation class	-	-	Class F	Class F	Class F	Class F	Class F	Class F
Cooling mode	-	-	IC 416	IC 416	IC 416	IC 416	IC 416	IC 416
IP rating	-	-	IP54	IP54	IP54	IP54	IP54	IP54
Installation mode	-	-	IM B35	IM B35	IM B35	IM B35	IM B35	IM B35
Max. impact acceleration	S	m/s^2	200	200	200	200	200	200
Max. vibration in radial direction	V_r	m/s^2	200	200	200	200	200	200
Max. vibration in axial direction	V_a	m/s^2	35	35	35	30	25	20

ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-XXA1FA					
Item			94C20CD	12D20CD	18D20CD	23D20CD	28D20CD	41D20CD
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ
Withstand peak voltage	-	-	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC
Dimensions of packaging box	-	-	522 x 302 x 467	522 x 302 x 467	602 x 302 x 467	602 x 302 x 467	682 x 302 x 467	682 x 302 x 467
Weight	W	kg	37.2	45.2	51.9	59	66	79.8
Fan type	-	-	Single-phase capacitor-run centrifugal fan					
Fan power	-	W	41	41	41	41	41	41
Fan voltage	-	VAC	220/230	220/230	220/230	220/230	220/230	220/230
Fan frequency	-	Hz	50/60	50/60	50/60	50/60	50/60	50/60
Threshold of built-in PTC	PTCt	°C	130	130	130	130	130	130
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652	514–652	514–652	514–652	514–652	514–652
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)					
Operating ambient humidity	-	-	20%–90% RH (no condensation)					
Storage temperature	-	°C	-20°C to +60°C (no freezing)					
Storage humidity	-	-	20%–90% RH (no condensation)					
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)					
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	1	0.947	0.887	0.824	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	40°C	45°C	50°C	55°C	60°C
	-	-	1	1	0.952	0.901	0.855	0.781
Certification	-	-	CE	CE	CE	CE	CE	CE

■ Tn curves

Color	Definition	Description	Remarks
	Peak	Describes the relationship between the peak torque and the motor speed, indicating the short-time overload capacity of the motor.	Select a motor whose operating curve is between S1-65 K and S1-100 K curve.
	S1-100K	Describes the relationship between the torque and the motor speed in the case of 100 K temperature rise in S1 duty (continuous duty).	
	S1-65K	Describes the relationship between the torque and the motor speed in the case of 65 K temperature rise in S1 duty (continuous duty).	
Note: If the bus voltage is too low, the torque will decline when the motor speed exceeds the rated speed. Therefore, consult the technical personnel of Inovance for motor selection.			



9.4.2 Specifications of Models with Natural Cooling

ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-R1A1XA		
Item			55C15CD	62C17CD	75C20CD
Rated speed (S1)	n_N	rpm	1500	1700	2000
Rated frequency	f_N	Hz	100	113.33	133.33
Voltage class	U_N	V	380	380	380
Rated power (S1)	P_N	kW	5.5	6.2	7.3
Rated torque	T_N	N·m	35	35	35
Rated current (S1)	I_N	A	10.8	12.6	15.2

ISMG1 Series	Symbol	Unit	Model: ISMG1-XXXXXXX-R1A1XA		
Item			55C15CD	62C17CD	75C20CD
Rated efficiency	η	%	89.6	90.1	90.9
Peak torque	T_{max}	N·m	130	130	130
Max. speed	n_{max}	rpm	1800	2040	2040
Back EMF at rated speed (20°C)	E_0	V	311.9	303	297
Torque constant at 20°C	K_T	N·m/A	3.24	2.77	2.31
Rotor inertia	J_m	$kgcm^2m^2$	75	75	75
Net weight	N.W.	kg	35	35	35

9.5 Selection of the ISMG2 Series Servo Motor

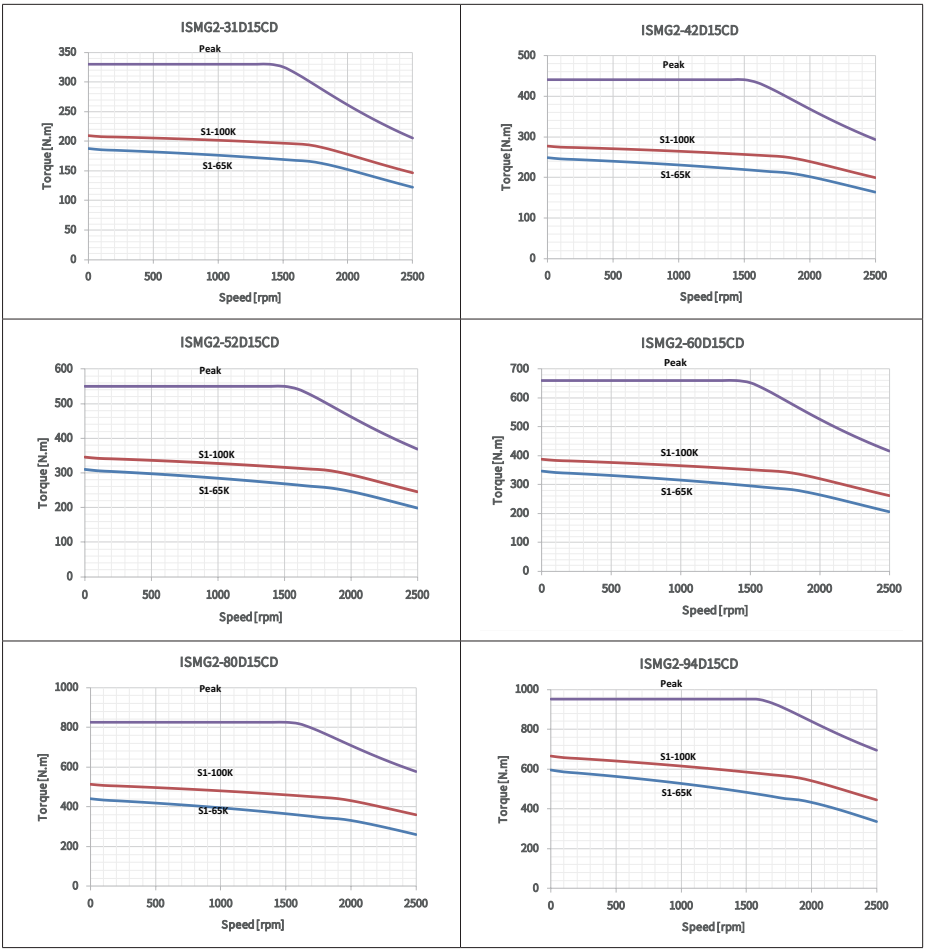
■ Technical specifications

ISMG2 Series	Symbol	Unit	Model: ISMG2-XXXXXXX-XXA1FA					
Item			31D15CD	42D15CD	52D15CD	60D15CD	80D15CD	94D15CD
Rated speed	n_N	rpm	1500	1500	1500	1500	1500	1500
Rated frequency	f_N	Hz	100	100	100	100	100	100
Voltage class	U_N	V	380	380	380	380	380	380
Rated power	P_N	kW	31.4	42.4	52.6	60.5	80.1	94.2
Rated torque	T_N	N·m	200	270	335	385	510	600
Rated current	I_N	A	61.7	87.7	111	119	166	198
Rated efficiency	η	%	95.9	96.2	96.4	96.5	96.7	96.9
Peak torque	T_{max}	N·m	330	440	550	660	825	950
Peak current	I_{max}	A	118	165	206	235	309	355
Angular acceleration at peak torque	a_{pk}	rad/s^2	11149	11957	12673	13200	12891	11875
Max. speed	n_{max}	rpm	2500	2500	2500	2500	2500	2500
Number of motor poles	2p	-	8	8	8	8	8	8
D-axis inductance	L_d	mH	3.8	2.59	2.07	1.9	1.29	1.03
Q-axis inductance	L_q	mH	9.18	6.25	5	4.59	3.12	2.5
Phase resistance at 20°C	R_{phi}	mΩ	72	43.5	31.8	31.2	20.1	13.1
Back EMF at rated speed (20°C)	E_0	V	318.2	303	303	318.2	303	303
Torque constant at 20°C	K_T	N·m/A	3.51	3.34	3.34	3.51	3.34	3.34
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
Rotor inertia	J_m	$mkg·m^2$	29.6	36.8	43.4	50	64	80
Insulation class	-	-	Class F	Class F	Class F	Class F	Class F	Class F

ISMG2 Series	Symbol	Unit	Model: ISMG2-XXXXXXX-XXA1FA					
Item			31D15CD	42D15CD	52D15CD	60D15CD	80D15CD	94D15CD
Cooling mode	-	-	IC 416	IC 416	IC 416	IC 416	IC 416	IC 416
IP rating	-	-	IP54	IP54	IP54	IP54	IP54	IP54
Installation mode	-	-	IM B35	IM B35	IM B35	IM B35	IM B35	IM B35
Max. impact acceleration	S	m/s^2	200	200	200	200	200	200
Max. vibration in radial direction	V_r	m/s^2	200	200	200	200	200	200
Max. vibration in axial direction	V_a	m/s^2	50	45	45	40	35	35
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ
Withstand peak voltage	-	-	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC
Dimensions of packaging box	-	-	702 x 422 x 557	752 x 422 x 557	952 x 422 x 557	952 x 422 x 557	952 x 422 x 557	1099 x 410 x 456
Weight	W	kg	122	141.3	158.4	175.4	217	260
Fan type	-	-	Single-phase capacitor-run centrifugal fan					
Fan power	40	40	134	134	134	134	134	134
Fan voltage	-	VAC	220/230	220/230	220/230	220/230	220/230	220/230
Fan frequency	-	Hz	50/60	50/60	50/60	50/60	50/60	50/60
Threshold of built-in PTC	PTCt	°C	130	130	130	130	130	130
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652	514–652	514–652	514–652	514–652	514–652
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)					
Operating ambient humidity	-	-	20%–90% RH (no condensation)					
Storage temperature	-	°C	-20°C to +60°C (no freezing)					
Storage humidity	-	-	20%–90% RH (no condensation)					
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)					
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	2000 m	3000 m	4000 m	5000 m	5000 m
	-	-	1	0.947	0.887	0.824	0.645	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	45°C	50°C	55°C	60°C	60°C
	-	-	1	0.952	0.901	0.855	0.781	0.781
Certification	-	-	CE	CE	CE	CE	CE	CE

■ Tn curves

Color	Definition	Description	Remarks
	Peak	Describes the relationship between the peak torque and the motor speed, indicating the short-time overload capacity of the motor.	Select a motor whose operating curve is between S1-65 K and S1-100 K curve.
	S1-100K	Describes the relationship between the torque and the motor speed in the case of 100 K temperature rise in S1 duty (continuous duty).	
	S1-65K	Describes the relationship between the torque and the motor speed in the case of 65 K temperature rise in S1 duty (continuous duty).	
Note: If the bus voltage is too low, the torque will decline when the motor speed exceeds the rated speed. Therefore, consult the technical personnel of Inovance for motor selection.			

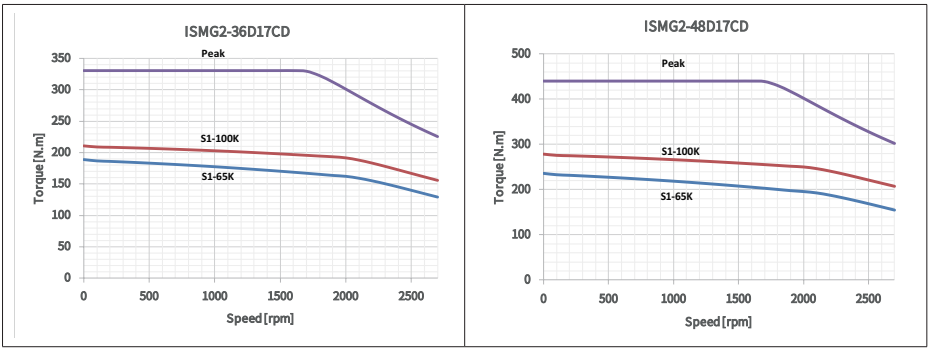


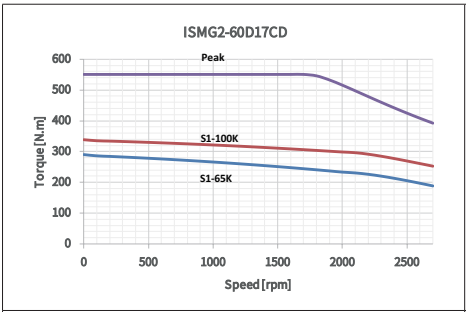
ISMG2 Series	Symbol	Unit	Model: ISMG2-XXXXXXX-XXA1FA				
Item			36D17CD	48D17CD	60D17CD	68D17CD	91D17CD
Rated speed	n_N	rpm	1700	1700	1700	1700	1700
Rated frequency	f_N	Hz	113.33	113.33	113.33	113.33	113.33
Voltage class	U_N	V	380	380	380	380	380
Rated power	P_N	kW	35.6	48.1	59.6	68.5	90.8
Rated torque	T_N	N·m	200	270	335	385	510
Rated current	I_N	A	72.2	97.5	126	139	166
Rated efficiency	η	%	96	96.4	96.5	96.6	96.9
Peak torque	T_{max}	N·m	330	440	550	660	825
Peak current	I_{max}	A	137	183	235	274	309
Angular acceleration at peak torque	a_{pk}	rad/s^2	11149	11957	12673	13200	12891
Max. speed	n_{max}	rpm	2700	2700	2700	2700	2700
Number of motor poles	2p	-	8	8	8	8	8
D-axis inductance	L_d	mH	2.97	2.09	1.59	1.4	1.29
Q-axis inductance	L_q	mH	6.74	5.06	3.83	3.37	3.12
Phase resistance at 20°C	R_{phi}	mΩ	52.5	37.75	27.8	21.3	23.7
Back EMF at rated speed (20°C)	E_0	V	309.1	309.1	300.5	309.1	343.4
Torque constant at 20°C	K_T	N·m/A	3.01	3.01	2.92	3.01	3.34
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09	-0.09	-0.09	-0.09	-0.09
Rotor inertia	J_m	$mkg·m^2$	29.6	36.8	43.4	50	64
Insulation class	-	-	Class F	Class F	Class F	Class F	Class F
Cooling mode	-	-	IC 416	IC 416	IC 416	IC 416	IC 416
IP rating	-	-	IP54	IP54	IP54	IP54	IP54
Installation mode	-	-	IM B35	IM B35	IM B35	IM B35	IM B35
Max. impact acceleration	S	m/s^2	200	200	200	200	200
Max. vibration in radial direction	V_r	m/s^2	200	200	200	200	200
Max. vibration in axial direction	V_a	m/s^2	45	40	35	35	30
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ
Withstand peak voltage	-	-	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC
Dimensions of packaging box	-	-	702 x 422 x 557	752 x 422 x 557	952 x 422 x 557	952 x 422 x 557	952 x 422 x 557
Weight	W	kg	122	141.3	158.4	175.4	217
Fan type	-	-	Single-phase capacitor-run centrifugal fan				
Fan power	-	W	134	134	134	134	134
Fan voltage	-	VAC	220/230	220/230	220/230	220/230	220/230
Fan frequency	-	Hz	50/60	50/60	50/60	50/60	50/60
Threshold of built-in PTC	PTCt	°C	130	130	130	130	130
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652	514–652	514–652	514–652	514–652

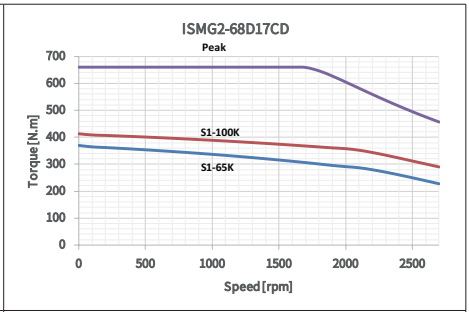
ISMG2 Series	Symbol	Unit	Model: ISMG2-XXXXXXX-XXA1FA				
Item			36D17CD	48D17CD	60D17CD	68D17CD	91D17CD
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)				
Operating ambient humidity	-	-	20%–90% RH (no condensation)				
Storage temperature	-	°C	-20°C to +60°C (no freezing)				
Storage humidity	-	-	20%–90% RH (no condensation)				
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)				
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	0.947	0.887	0.824	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	45°C	50°C	55°C	60°C
	-	-	1	0.952	0.901	0.855	0.781
Certification	-	-	CE	CE	CE	CE	CE

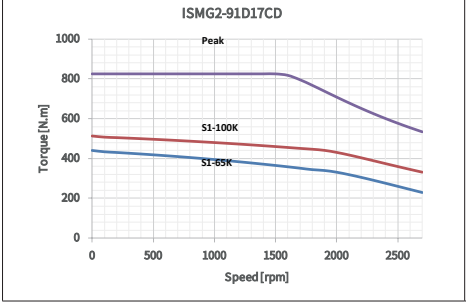
■ Tn curves

Color	Definition	Description	Remarks
	Peak	Describes the relationship between the peak torque and the motor speed, indicating the short-time overload capacity of the motor.	Select a motor whose operating curve is between S1-65 K and S1-100 K curve.
	S1-100K	Describes the relationship between the torque and the motor speed in the case of 100 K temperature rise in S1 duty (continuous duty).	
	S1-65K	Describes the relationship between the torque and the motor speed in the case of 65 K temperature rise in S1 duty (continuous duty).	
Note: If the bus voltage is too low, the torque will decline when the motor speed exceeds the rated speed. Therefore, consult the technical personnel of Inovance for motor selection.			







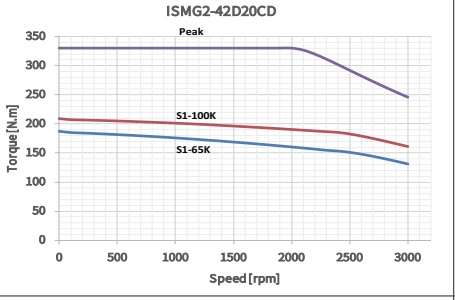


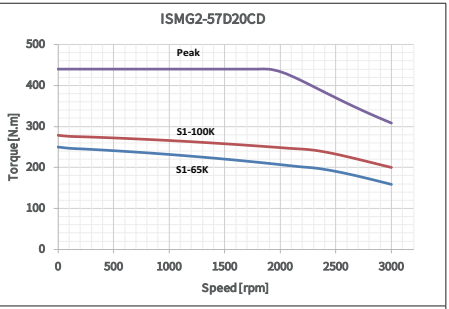
ISMG2 Series	Symbol	Unit	Model：ISMG2-XXXXXXX-XXA1FA				
Item			42D20CD	57D20CD	70D20CD	80D20CD	11E20CD
Rated speed	n_N	rpm	2000	2000	2000	2000	2000
Rated frequency	f_N	Hz	133.33	133.33	133.33	133.33	133.33
Voltage class	U_N	V	380	380	380	380	380
Rated power	P_N	kW	41.9	56.5	70.2	80.6	106.8
Rated torque	T_N	N·m	200	270	335	385	510
Rated current	I_N	A	86.6	109	148	167	207
Rated efficiency	η	%	95.9	96.2	96.4	96.5	96.8
Peak torque	T_{max}	N·m	330	440	550	660	825
Peak current	I_{max}	A	165	206	274	329	386
Angular acceleration at peak torque	a_{pk}	rad/s^2	11149	11957	12673	13200	12891
Max. speed	n_{max}	rpm	3000	3000	3000	3000	3000
Number of motor poles	2p	-	8	8	8	8	8
D-axis inductance	L_d	mH	1.94	1.65	1.16	0.97	0.83
Q-axis inductance	L_q	mH	4.68	4	2.81	2.34	2
Phase resistance at 20°C	R_{phi}	mΩ	297	27.85	18	18.5	14.8
Back EMF at rated speed (20°C)	E_0	V	303	323.2	303	303	323.2
Torque constant at 20°C	K_T	N·m/A	2.51	2.67	2.51	2.51	2.67
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09	-0.09	-0.09	-0.09	-0.09
Rotor inertia	J_m	mkg·m^2	29.6	36.8	43.4	50	64
Insulation class	-	-	Class F	Class F	Class F	Class F	Class F
Cooling mode	-	-	IC 416	IC 416	IC 416	IC 416	IC 416
IP rating	-	-	IP54	IP54	IP54	IP54	IP54

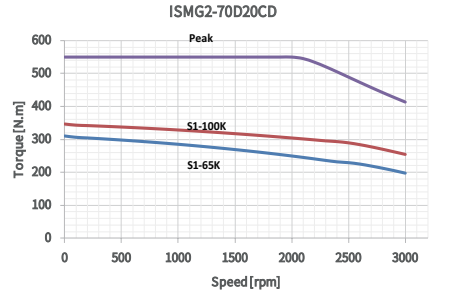
ISMG2 Series	Symbol	Unit	Model：ISMG2-XXXXXXX-XXA1FA				
Item			42D20CD	57D20CD	70D20CD	80D20CD	11E20CD
Installation mode	-	-	IM B35	IM B35	IM B35	IM B35	IM B35
Max. impact acceleration	S	m/s^2	200	200	200	200	200
Max. vibration in radial direction	V_r	m/s^2	200	200	200	200	200
Max. vibration in axial direction	V_a	m/s^2	40	35	35	30	20
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ	≥ 20 MΩ
Withstand peak voltage	-	-	1800 VAC	1800 VAC	1800 VAC	1800 VAC	1800 VAC
Dimensions of packaging box	-	-	702 x 422 x 557	752 x 422 x 557	952 x 422 x 557	952 x 422 x 557	952 x 422 x 557
Weight	W	kg	122	141.3	158	175.4	217
Fan type	-	-	Single-phase capacitor-run centrifugal fan				
Fan power	-	W	134	134	134	134	134
Fan voltage	-	VAC	220/230	220/230	220/230	220/230	220/230
Fan frequency	-	Hz	50/60	50/60	50/60	50/60	50/60
Threshold of built-in PTC	PTCt	°C	130	130	130	130	130
KTY resistance at 10°C to 30°C	R-KTY	Ω	514–652	514–652	514–652	514–652	514–652
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)				
Operating ambient humidity	-	-	20%–90% RH (no condensation)				
Storage temperature	-	°C	-20°C to +60°C (no freezing)				
Storage humidity	-	-	20%–90% RH (no condensation)				
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)				
De-rating coefficient when the altitude is above 1000 m	-	-	1000 m	2000 m	3000 m	4000 m	5000 m
	-	-	1	0.947	0.887	0.824	0.645
De-rating coefficient when the ambient temperature is above 40°C	-	-	40°C	45°C	50°C	55°C	60°C
De-rating coefficient when the ambient temperature is above 40°C	-	-	1	0.952	0.901	0.855	0.781
Certification	-	-	CE	CE	CE	CE	CE

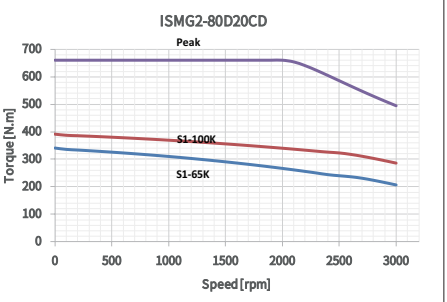
■ Tn curves

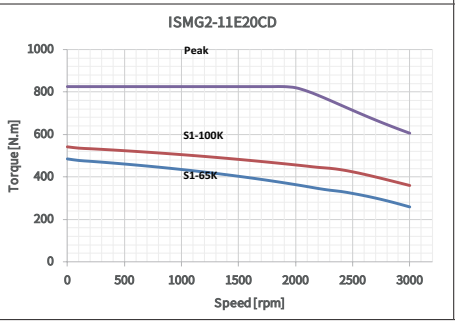
Color	Definition	Description	Remarks
	Peak	Describes the relationship between the peak torque and the motor speed, indicating the short-time overload capacity of the motor.	Select a motor whose operating curve is between S1-65 K and S1-100 K curve.
	S1-100K	Describes the relationship between the torque and the motor speed in the case of 100 K temperature rise in S1 duty (continuous duty).	
	S1-65K	Describes the relationship between the torque and the motor speed in the case of 65 K temperature rise in S1 duty (continuous duty).	
Note: If the bus voltage is too low, the torque will decline when the motor speed exceeds the rated speed. Therefore, consult the technical personnel of Inovance for motor selection.			


ISMG2-42D20CD
Peak
S1-100K
S1-65K
Torque [N.m]
Speed [rpm]
0
50
100
150
200
250
300
350
0
500
1000
1500
2000
2500
3000


ISMG2-57D20CD
Peak
S1-100K
S1-65K
Torque [N.m]
Speed [rpm]
0
100
200
300
400
500
0
500
1000
1500
2000
2500
3000


ISMG2-70D20CD
Peak
S1-100K
S1-65K
Torque [N.m]
Speed [rpm]
0
100
200
300
400
500
600
0
500
1000
1500
2000
2500
3000


ISMG2-80D20CD
Peak
S1-100K
S1-65K
Torque [N.m]
Speed [rpm]
0
100
200
300
400
500
600
700
0
500
1000
1500
2000
2500
3000


ISMG2-11E20CD
Peak
S1-100K
S1-65K
Torque [N.m]
Speed [rpm]
0
200
400
600
800
1000
0
500
1000
1500
2000
2500
3000

9.6 Selection of the ISMQ2 Series Servo Motor

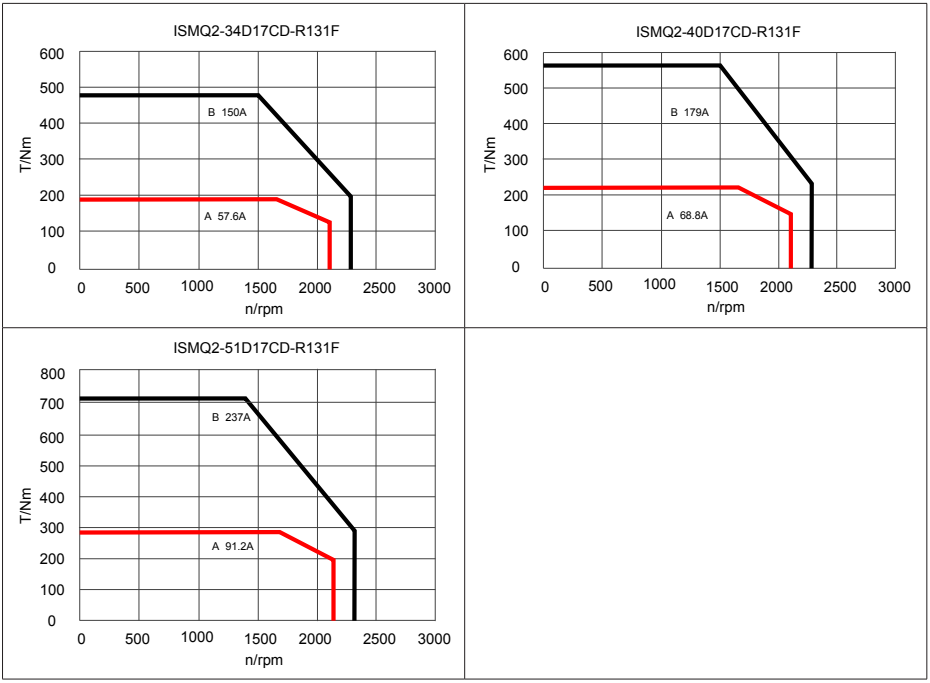
ISMQ2 Series	Symbol	Unit	ISMQ2-XXXXXXX-R131F		
Item			34D17CD	40D17CD	51D17CD
Rated speed	n_N	rpm	1700	1700	1700
Rated frequency	f_N	Hz	113.33	113.33	113.33
Voltage class	U_N	V	380	380	380
Rated power (S1)	P_N	kW	34	39.9	51
Rated torque (S1)	T_N	N·m	191	224	286.5
Rated current (S1)	I_N	A	57.6	68.8	91.2
Rated efficiency	η	%	93.9	94.3	94.8
Peak torque	T_{max}	N·m	478	560	716
Peak current	I_{max}	A	150	179	237
Angular acceleration at peak torque	a_{pk}	rad/s^2	18106	18667	19247
Max. speed	n_{max}	rpm	2300	2300	2300
Standstill torque	Tn = 0	N·m	239	280	358
Standstill current	In = 0	A	69	82	109
Min. demagnetization current	Idm	Apk	369	439	608
Number of motor poles	2p	-	8	8	8
Winding connection type	-	-	Y	Y	Y
Back EMF at rated speed (20°C)	E_0	V	357.6	351.3	338.7
Torque constant at 20°C	K_T	N·m/A	3.48	3.42	3.30
Temperature coefficient of back EMF	dK_e/dT	%/°C	-0.09	-0.09	-0.09
Rotor inertia	J_m	mkg·m^2	26.4	30	37.2
Insulation class	-	-	Class F	Class F	Class F
Cooling mode	-	-	IC 416	IC 416	IC 416
IP rating	-	-	IP54	IP54	IP54
Installation mode	-	-	IM B35	IM B35	IM B35
Max. impact acceleration	S	m/s^2	200	200	200
Max. vibration in radial direction	V_r	m/s^2	200	200	200
Max. vibration in axial direction	V_a	m/s^2	25	20	20
Insulation resistance at 500 VDC	R_{ins}	MΩ	≥ 50 MΩ	≥ 50 MΩ	≥ 50 MΩ
Withstand peak voltage	-	-	1800 VAC	1800 VAC	1800 VAC
Net weight	N.W.	kg	109	120	142
Gross weight	G.W.	kg	119	135	162
Fan type	-	-	Single-phase capacitor-run centrifugal fan		
Fan power	-	W	58	58	58
Fan voltage	-	VAC	220/230	220/230	220/230
Motor power loss at rated power	L_N	W	2209	2412	2797
Thermal impedance (motor-air)	R_{th}	°C/W	0.054	0.050	0.043
Heat capacity	C_{th}	J/°C	69244	73519	83295
Thermal time constant	T_a	s	3762	3658	3573

ISMQ2 Series	Symbol	Unit	ISMQ2-XXXXXXX-R131F		
Item			34D17CD	40D17CD	51D17CD
Threshold of built-in PTC	PTCt	°C	130	130	130
PTC resistance at 10°C to 30°C	R-PTC	Ω	60–360	60–360	60–360
Operating ambient temperature	-	°C	-20°C to +40°C (no freezing)		
Operating ambient humidity	-	-	20%–90% RH (no condensation)		
Storage temperature	-	°C	-20°C to +60°C (no freezing)		
Storage humidity	-	-	20%–90% RH (no condensation)		
Altitude	-	-	≤ 1000 m (de-rating is required when the altitude is above 1000 m)		
De-rating coefficient when the altitude is above 1000 m	1000 m	2000 m	3000 m	4000 m	5000 m
	1	1.056	1.127	1.213	1.48
De-rating coefficient when the ambient temperature is above 40°C	40°C	45°C	50°C	55°C	60°C
	1	1.05	1.11	1.17	1.28

■ Tn curves

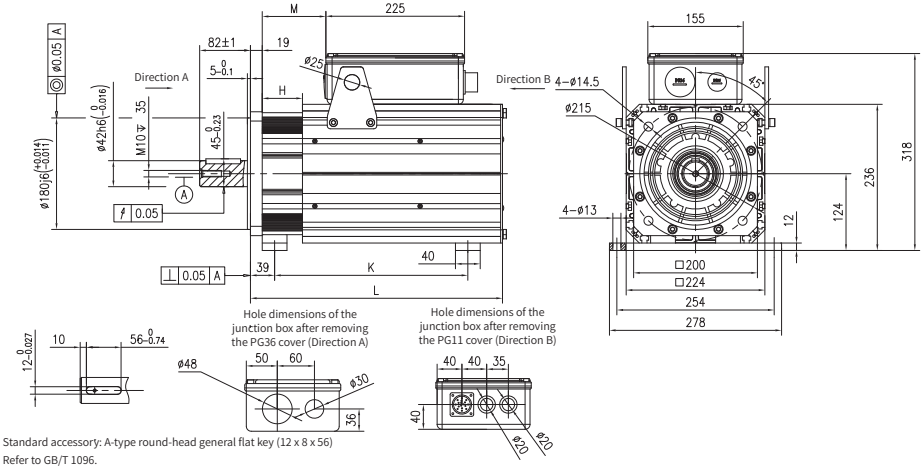
A ——— Continuous working area

B ——— Short-time working area



9.7 Dimensions of Servo Motors

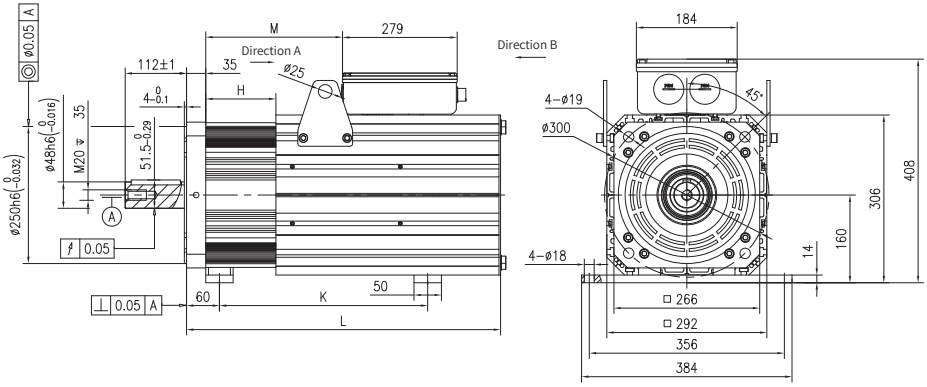
9.7.1 ESMG1 Series Servo Motor (200 x 200 Frame)

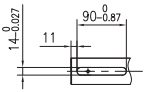


Standard accessory: A-type round-head general flat key (12 x 8 x 56)
Refer to GB/T 1096.

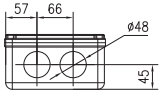
Model	L (mm)	K (mm)	H (mm)	M (mm)	Weight (kg)
ESMG1-89C17CD-XXA1F-K	375	285	65	74	45.2
ESMG1-11D20CD-XXA1F-K					
ESMG1-13D17CD-XXA1F-K	409	312	115	112	51.9
ESMG1-15D20CD-XXA1F-K					
ESMG1-17D17CD-XXA1F-K	444	354	115	147	59
ESMG1-19D20CD-XXA1F-K					
ESMG1-21D17CD-XXA1F-K	481	396	115	184	66
ESMG1-25D20CD-XXA1F-K					
ESMG1-27D17CD-XXA1F-K	552	471	115	254	79.8
ESMG1-31D20CD-XXA1F-K					

9.7.2 ESMG2 Series Servo Motor (266 x 266 Frame)

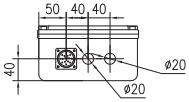




Hole dimensions of the junction box after removing the PG36 cover (Direction A)



Hole dimensions of the junction box after removing the PG11 cover (Direction B)

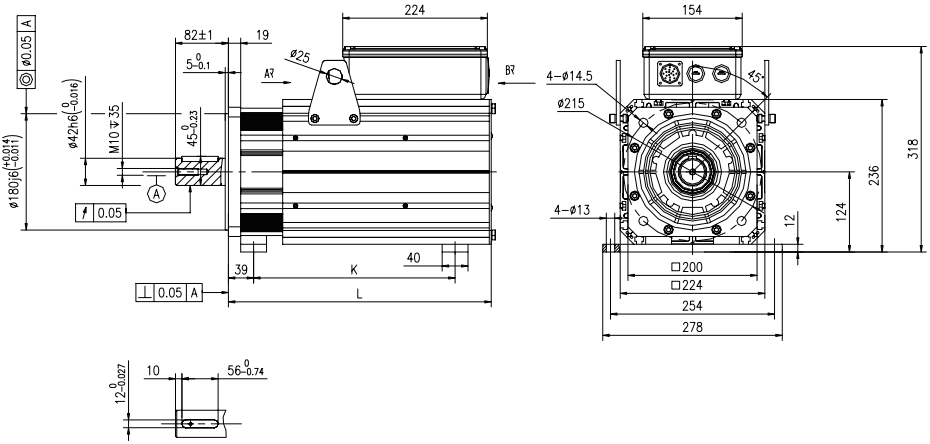


Standard accessory: A-type round-head general flat key (14 x 9 x 90)
Refer to GB/T 1096.

Model	L (mm)	K (mm)	H (mm)	M (mm)	Weight (kg)
ESMG2-30D17CD-XXA1F-K	525	360	88	92	122
ESMG2-36D20CD-XXA1F-K					
ESMG2-42D17CD-XXA1F-K	577	370	128	143	141.3
ESMG2-48D20CD-XXA1F-K					
ESMG2-50D17CD-XXA1F-K	629	476	128	195	158.4
ESMG2-60D20CD-XXA1F-K					
ESMG2-62D17CD-XXA1F-K	680	476	128	246	175.4
ESMG2-72D20CD-XXA1F-K					
ESMG2-80D17CD-XXA1F-K	783	583	128	384	217
ESMG2-92D20CD-XXA1F-K					

9.7.3 ISMG1 Series Servo Motor (200 x 200 Frame)

■ Models of forced air cooling



Standard accessory: A-type round-head general flat key (12 x 8 x 56)
Refer to GB/T 1096.

Figure 9-2 Dimension diagram of ISMG1 series servo motor (200 x 200 frame, forced air cooling)

Table 9-1 Outline dimensions of ISMG1 series servo motor (200 x 200 frame, forced air cooling)

Model	K (mm)	L (mm)
ISMG1-71C15CD-R1A1FA	258	340
ISMG1-80C17CD-R1A1FA		
ISMG1-94C20CD-R1A1FA		
ISMG1-95C15CD-R1A1FA	285	375
ISMG1-11D17CD-R1A1FA		
ISMG1-12D20CD-R1A1FA		
ISMG1-14D15CD-R1A1FA	312	410
ISMG1-16D17CD-R1A1FA		
ISMG1-18D20CD-R1A1FA		
ISMG1-17D15CD-R1A1FA	354	445
ISMG1-20D17CD-R1A1FA		
ISMG1-23D20CD-R1A1FA		
ISMG1-22D15CD-R1A1FA	396	480
ISMG1-24D17CD-R1A1FA		
ISMG1-28D20CD-R1A1FA		
ISMG1-30D15CD-R1A1FA	471	550
ISMG1-34D17CD-R1A1FA		
ISMG1-41D20CD-R1A1FA		

■ Models of natural cooling

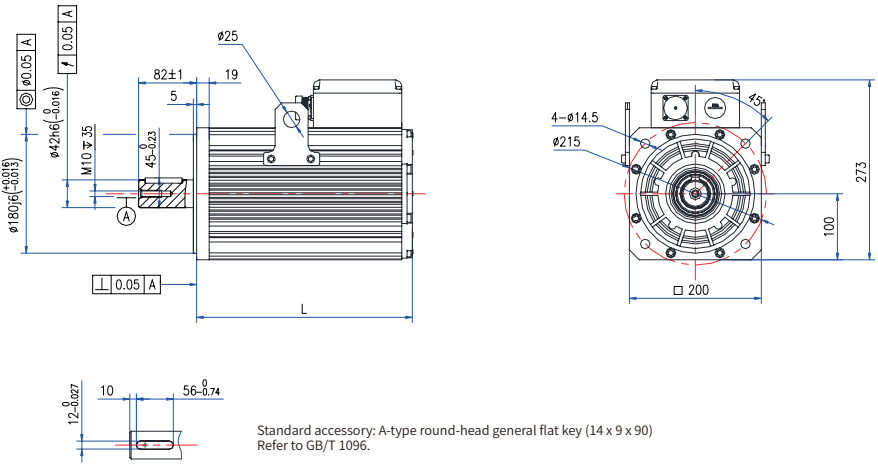


Figure 9-3 Dimension diagram of ISMG1 series servo motor (200 x 200 frame, natural cooling)

Table 9-2 Outline dimensions of ISMG1 series servo motor (200 x 200 frame, natural cooling)

Model	L (mm)
ISMG1-55C15CD-R131XA	290
ISMG1-62C17CD-R131XA	290
ISMG1-75C20CD-R131XA	290

9.7.4 ISMG2 Series Servo Motor (266 x 266 Frame)

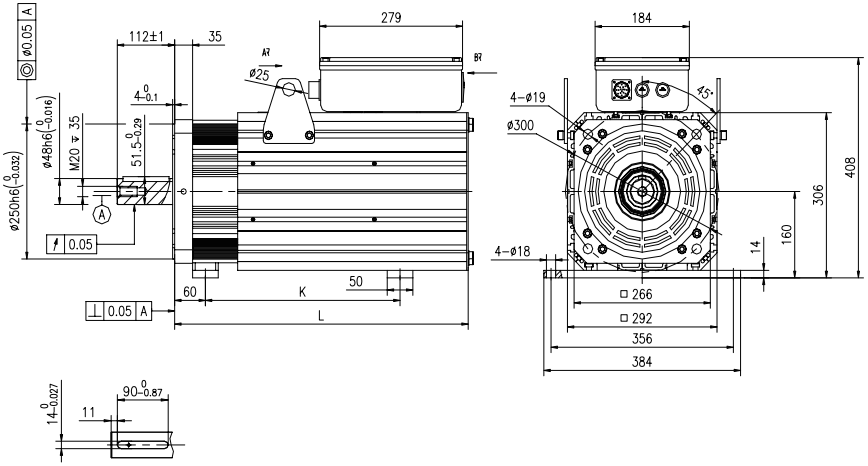
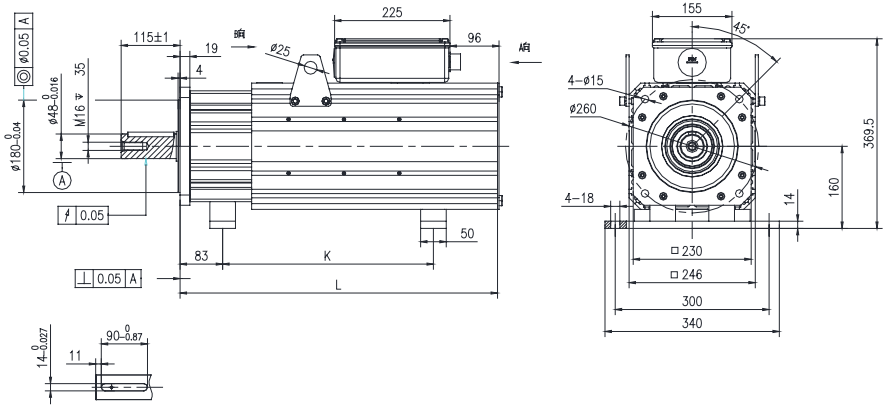


Figure 9-4 Dimension diagram of ISMG2 series servo motor (266 x 266 frame)

Table 9-3 Outline dimensions of ISMG2 series servo motor (266 x 266 frame)

Model	K (mm)	L (mm)
ISMG2-31D15CD-R1A1FA	360	525
ISMG2-36D17CD-R1A1FA		
ISMG2-42D20CD-R1A1FA		
ISMG2-42D15CD-R1A1FA	370	575
ISMG2-48D17CD-R1A1FA		
ISMG2-57D20CD-R1A1FA		
ISMG2-52D15CD-R1A1FA	476	625
ISMG2-60D17CD-R1A1FA		
ISMG2-70D20CD-R1A1FA		
ISMG2-60D15CD-R1A1FA	476	675
ISMG2-68D17CD-R1A1FA		
ISMG2-80D20CD-R1A1FA		
ISMG2-80D15CD-R1A1FA	583	780
ISMG2-91D17CD-R1A1FA		
ISMG2-11E20CD-R1A1FA		
ISMG2-94D15CD-R1A1FA	590	950

9.7.5 ISMQ2 Series Servo Motor (230 x 230 Frame)



Standard accessory: A-type round-head general flat key (14 x 9 x 90)
Refer to GB/T 1096.

Figure 9-5 Dimension diagram of ISMQ2 series servo motor (230 x 230 frame)

Table 9-4 Outline dimensions of ISMQ2 series servo motor (230 x 230 frame)

Model	K (mm)	L (mm)
ISMQ2-34D17CD-R131F	367.5	578.5
ISMQ2-40D17CD-R131F	411	622
ISMQ2-51D17CD-R131F	498	709

9.8 Wiring of Servo Motors

9.8.1 Layout and Wiring of the Junction Box

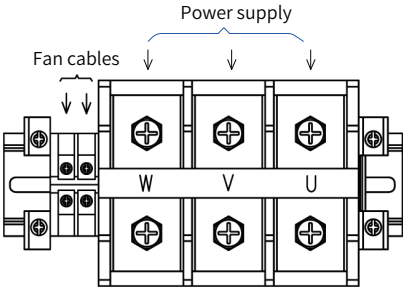


Figure 9-6 Main power terminals

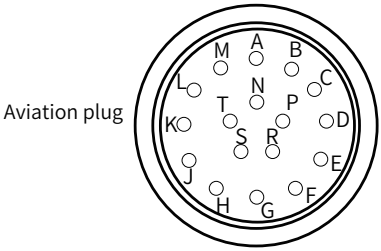


Figure 9-7 Aviation plug

Definition of matching signal cables and motor aviation plug signals (for reference only):

17P aviation plug	A	B	C	D	E	F	G	H	L	K	J
Male of DB9 connector on the resolver cable	1	2	3	4	5	9	7	8		6	Housing
Signal	REF-	REF+	Cos+	Cos-	Sin+	Sin-	PTC+	KTY-	PTC-	KTY+	Shield
Color of cable core	Yellow/ Black	Red/ Black	Red	Black	Yellow	Blue	Orange	Brown		Gray	Shield
Remarks	One pair		One pair		One pair			Common point of KTY and PTC			

Table 9-5 Specifications of motor main power terminals

Motor Model	Screw Specification
ESMG1/ISMG1	M8
ESMG2/ISMG2	M10
ISMQ2	M8

9.8.2 Precautions for Using Motor Main Power Terminals

When wiring the main circuit, make sure that motor cables are connected according to terminal marks. Connect the PE terminal to the retaining screw marked in the junction box.

NOTE

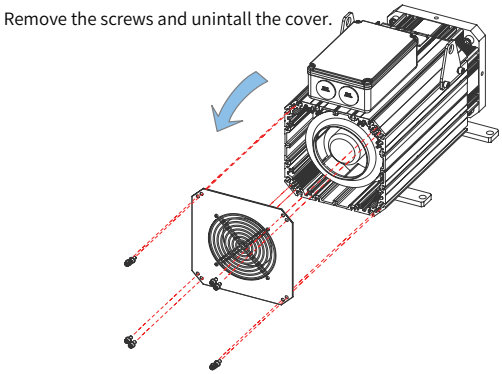
- For the position of jumpers, see the PCB silkscreen. Never connect signal cables of the PTC, KTY, and resolver to 220 V power supply. Failure to comply will damage the motor.
- The motor has been tested by IP54 experiment. Before wiring, however, protective treatment must be given to the cable outlet hole to prevent foreign objects from entering into the motor.
- If there is adhesive dust in the operating environment, the dust will be stuck on the surface of the motor, affecting the heat dissipation of the motor. Clean the fan according to *"9.9 Cleaning the Motor Fan" on page 209*.

9.9 Cleaning the Motor Fan

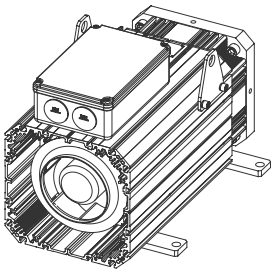
The service life of the fan is estimated to be 40,000 h when it keeps full-speed running at the rated voltage at 40°C. Foreign objects stuck on the fan will degrade the fan performance and reduce the airflow. The air resistance will increase and the airflow will decrease after the air filter is blocked, thereby affecting the heat dissipation of the motor. The servo drive reports Err45 if the motor winding temperature exceeds the motor protection temperature.

Clean the fan as follows:

1) Remove the eight screws (G1 are M4 hexagon socket screws and G2 are M5 hexagon socket screws) on the air filter cover at the end of the motor and uninstall the cover.



2) Use a straight screwdriver to completely remove the foreign objects on the surface of the fan and in the air filter so that no foreign object obstructs the air path. Then, blow the fan again with a high-pressure air gun.



3) Install the cover and fasten the removed screws to complete the cleaning.

NOTE

- Determine the cleaning frequency of the fan according to the actual working conditions.

10 Optional Cards

The IS580 supports various fieldbuses by connecting with external expansion cards and supports different types of encoders. This chapter describes the installation and use of expansion cards.

10.1 Installation and Functions of Expansion Cards

10.1.1 Installation

The IS580 is equipped with the fieldbus cards for Modbus RTU, CANopen, PROFIBUS-DP, EtherCAT, and PROFINET. For the installation position of these cards, see *"3.2.4 Layout of the Control Board" on page 76*.

10.1.2 Functions

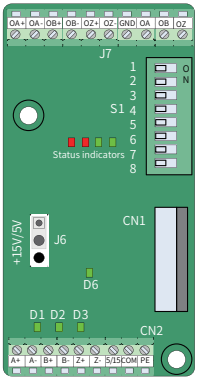
Table 10-1 Function description of expansion cards

Model	Name	Function and Specification	Applicable Model
MD38PGMD	Multi-functional PG card	Supports differential input, collector input, push-pull input, differential output, and collector output.	All models
MD38CAN1	CAN communication expansion card	Supports CANopen.	All models
MD38TX1	RS485 communication expansion card	Supports Modbus RTU.	All models
MD38DP2	PROFIBUS-DP fieldbus adapter card	Supports PROFIBUS-DP communication.	All models
S58-ETH-CAT	EtherCAT expansion card	Supports EtherCAT.	All models
MD500-PN1	PROFINET communication expansion card	PROFINET communication adapter card	All models

10.2 Layout and Functions of Terminals on Expansion Cards

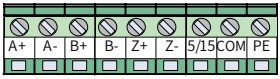
10.2.1 Multi-Functional PG Card (MD38PGMD)

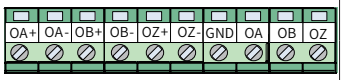
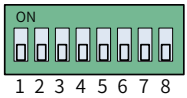
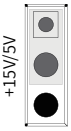
MD38PGMD



MD38PGMD	
User interface	Oblique-inserting terminal block
Clearance	3.5 mm
Screw	Flathead
Pluggable	No
Cable specification	16AWG to 26AWG
Maximum rate	Differential: 500 kHz; Collector: 100 kHz
Type of encoder interface	Differential, collector, or push-pull
Type of frequency division interface	Differential or collector

Table 10-2 Function description of terminals on MD38PGMD

Terminal Mark		Description	Terminal Layout
CN1		Interface connecting the PG card and the control board of the servo drive	
CN2	A+	Encoder output signal A (+)	
	A-	Encoder output signal A (-)	
	B+	Encoder output signal B (+)	
	B-	Encoder output signal B (-)	
	Z+	Encoder output signal Z (+)	
	Z-	Encoder output signal Z (-)	
	5/15	5/10 V power supply for the encoder	
	COM	Encoder power ground	
	PE	Shield wiring terminal	

Terminal Mark		Description	Terminal Layout
J7	OA+	Differential frequency division output signal A (+)	
	OA-	Differential frequency division output signal A (-)	
	OB+	Differential frequency division output signal B (+)	
	OB-	Differential frequency division output signal B (-)	
	OZ+	Differential frequency division output signal Z (+)	
	OZ-	Differential frequency division output signal Z (-)	
	GND	Frequency division output reference ground	
	OA	Collector frequency division output signal A	
	OB	Collector frequency division output signal B	
	OZ	Collector frequency division output signal Z	
S1		DIP switch used to set the frequency division coefficient and the filtering function	
J6		Jumper used to select the encoder power supply (5 V or 15 V output)	
Status indicators	LED1	Encoder input signal indicator	
	LED2	PG card signal processing indicator	
	LED3	Inter-lock status indicator	
	LED4	System status indicator	
Encoder input signal indicators	D1	The indicators flash or remain steady on when there is an encoder input signal. Indicator D1 corresponds to signals A+ and A-, indicator D2 corresponds to signals B+ and B-, and indicator D3 corresponds to signals Z+ and Z-.	
	D2		
	D3		
D6		Power indicator	

10.2.2 CAN Communication Expansion card (MD38CAN1)

1) Layout and functions of terminals on MD38CAN1

MD38CAN1 is an expansion card used for CAN communication of the servo drive. It enables the servo drive to access the high-speed CANopen communication network to implement the fieldbus control.

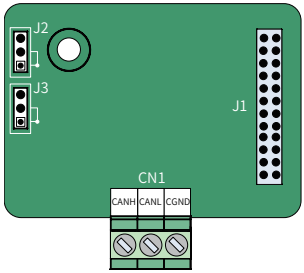


Figure 10-1 Layout of terminals on MD38CAN1

Table 10-3 Function description of terminals on MD38CAN1

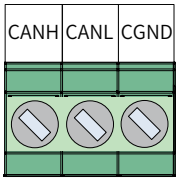
Terminal Mark		Terminal Name	Function Description	Terminal Layout
CN1	CANH	CAN input (+)	Connected to the positive pole of the CAN bus.	
	CANL	CAN input (-)	Connected to the negative pole of the CAN bus.	
	CGND	Power ground	Connected to the reference ground of all CAN nodes.	

Table 10-4 Jumper description of MD38CAN1 expansion card

Terminal Mark	Terminal Name	Position of the Jumper/DIP Switch	Function Description	Remarks
J2, J3	Jumper used to set the CAN terminating resistor		With terminating resistor used	The status of jumpers J2 and J3 must be consistent.
			Do not use the terminating resistor.	

NOTE

◆ For the position of jumpers, see the PCB silkscreen.

2) Use of CAN bus

■ CAN bus connection

The CAN bus connection topology is shown in the following figure. STPs are recommended for CAN bus connection and twisted pair cables are recommended for CANH and CANL connections. Install a 120 Ω terminating resistor at both ends of the CAN bus to prevent signal reflection. Connect the reference grounds of CAN signal of all nodes together. A maximum of 64 nodes are supported and the branch distance of each node must be smaller than 0.3 m.

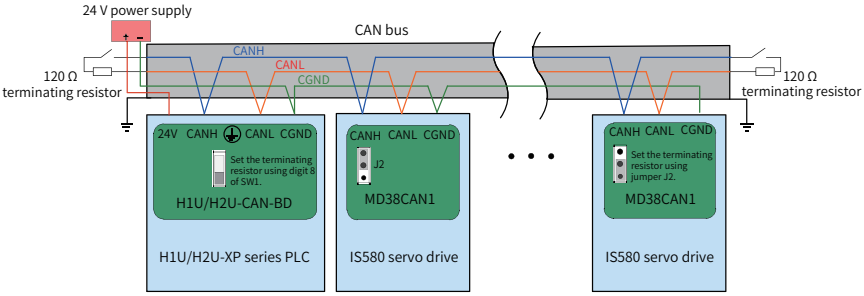
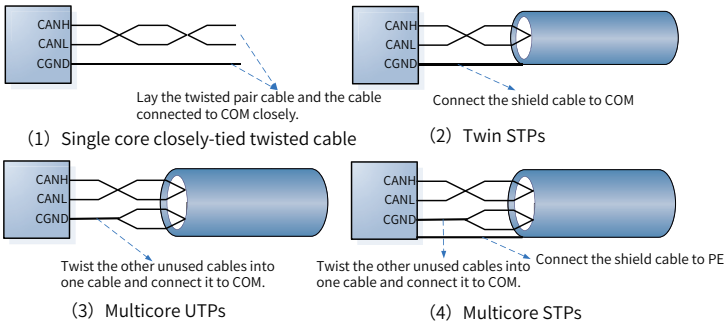


Figure 10-2 CAN bus connection topology

■ Recommended usage of different cables on the site:



■ Transmission distance of CAN bus

The transmission distance of CAN bus depends on the baud rate and communication cable. The following table shows the relationship between the maximum transimission distance of CAN bus and the baud rate.

No.	Transmission Distance	Baud Rate	Number of Nodes	Cable Diameter
1	25 m	1 Mbps	64	0.205 mm^2
2	95 m	500 kbps	64	0.34 mm^2
3	560 m	100 kbps	64	0 5 mm^2
4	1100 m	50 kbps	64	0.75 mm^2

10.2.3 RS485 Communication Expansion Card (MD38TX1)

1) Layout and functions of terminals on MD38TX1

MD38TX1 communication card, which is designed for RS485 communication function of the servo drive, adopts an isolation scheme. With international standards-compliant electrical parameters, it can be used for the running control and parameter setting of servo drive through remote serial communication. Use this card according to actual requirements.

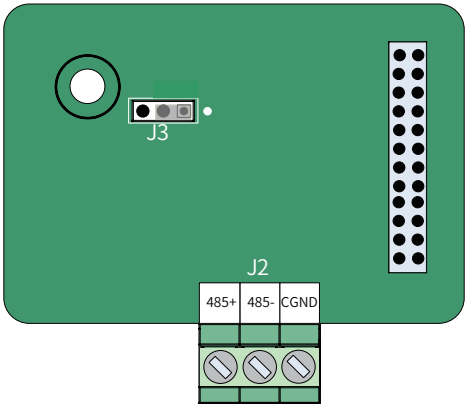


Figure 10-3 Layout of terminals on MD38TX1

Table 10-5 Function description of terminals on MD38TX1

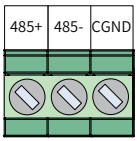
Terminal Mark		Terminal Name	Function Description	Terminal Layout
J2	485+	RS485 communication signal (+)	RS485 communication input terminal (isolated)	
	485-	RS485 communication signal (-)	RS485 communication input terminal (isolated)	
	CGND	Reference ground of RS485 communication signal	The power supply is isolated.	

Table 10-6 Jumper description of the MD38TX1 expansion card

Terminal Mark	Terminal Name	Function Description	Position of the Jumper/DIP Switch
J3	Jumper used to set the RS485 communication terminating resistor	With terminating resistor used	
		Do not use the terminating resistor.	

NOTE

◆ For the position of jumpers, see the PCB silkscreen.

2) Use of RS485 bus

■ RS485 bus connection topology

The RS485 bus connection topology is shown in the following figure. STPs are recommended for RS485 bus connection and twisted pair cables are recommended for 485+ and 485- connections. Install a 120 Ω terminating resistor at both ends of the bus to prevent signal reflection. Connect the reference ground of RS485 signal of all nodes together. A maximum of 128 nodes are supported and the branch distance of each node must be smaller than 3 m.

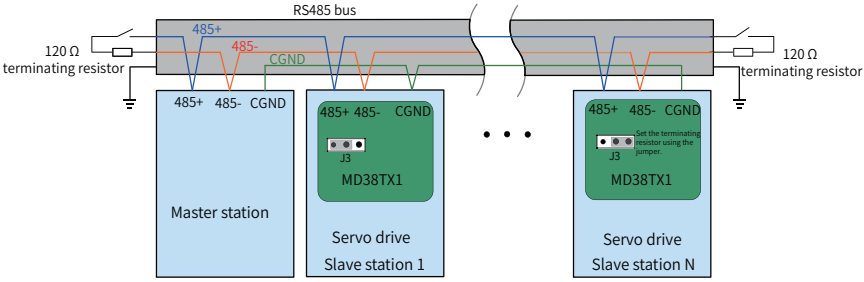
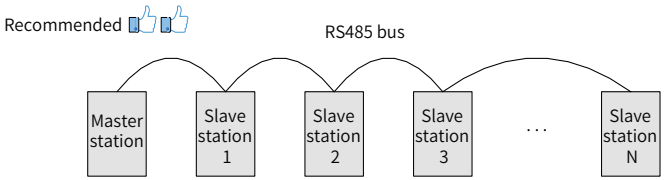


Figure 10-4 RS485 bus connection topology

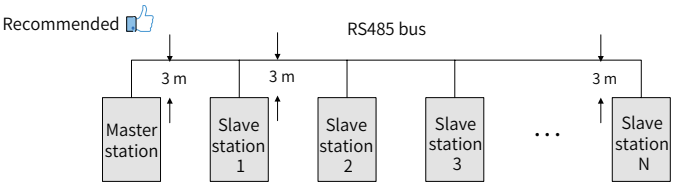
■ Multi-node connection mode

When the number of nodes is large, the RS485 bus must be daisy-chained. If branch connection is required, the cable between the bus and the node must be as short as possible (≤ 3 m). The following figure shows the common bus structure.

■ Daisy chain connection

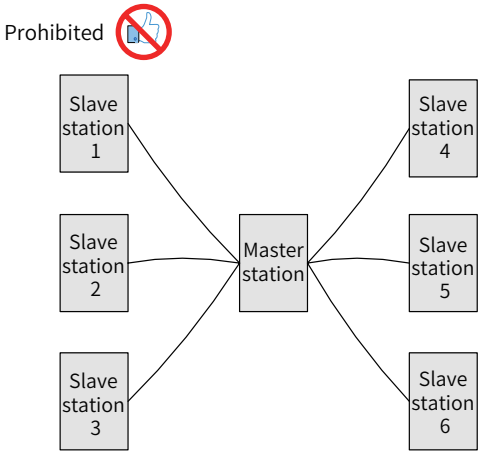


■ Branch connection



Note: The branch cable between the bus and the node cannot exceed 3 m.

■ Star connection (prohibited)

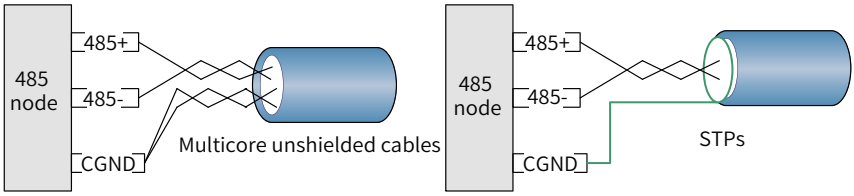


3) Terminal wiring

■ Terminal wiring for nodes with terminal CGND

MD38TX1 has three cables used to connect terminals 485+, 485-, and CGND respectively. Check whether the RS485 fieldbus has the three cables and terminals are connected correctly. If a shielded cable is used, the shield must be connected to CGND. In any node, only connect the shield to CGND. Never connect the shield to any other position, including the drive enclosure and grounding terminal.

If the cable exceeds 3 m, 26AWG or thicker cables are recommended due to cable attenuation. Always use twisted pair cables to connect 485+ and 485-.



a. Multicore unshielded cables b. STPs

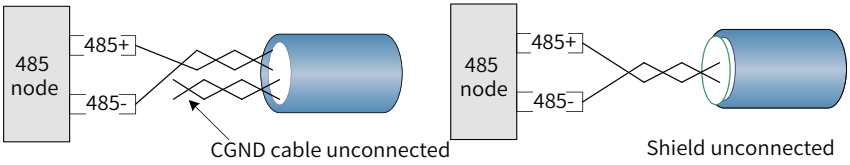
Recommended cable 1: Multicore twisted pair cables
Use one twisted pair to connect 485+ and 485- and twist the remaining pairs into one and connect it to CGND.

Recommended cable 2: STPs
Connect the twisted pair to 485+ and 485- and the shield to CGND.

In applications where STPs are used, the shield can be connected to CGND only. Never connect the shield to the ground.

■ Terminal wiring for nodes without terminal CGND

For nodes without CGND, do not connect CGND or the shield to the PE terminal directly. The recommended connections are as follows.



a. Multicore unshielded cables b. STPs

Method 1: Check whether there is a reference ground used by the RS485 circuit on other terminals of this node. If yes, connect the CGND cable (the shield) to this pin.

Method 2: Find the reference ground used by the RS485 circuit on the PCB of this node and connect the drain wire to CGND or the shield.

Method 3: If you cannot find the reference ground used by the RS485 circuit, keep the CGND cable or the shield unconnected and connect this node to the PE terminal of other nodes using an extra grounding cable.

4) Transmission distance and number of nodes

The maximum number of nodes and transmission distance supported by the standard Inovance RS485 circuit vary with the baud rate, as listed in the following table:

No.	Baud Rate	Transmission Distance	Number of Nodes	Cable Diameter
1	115.2 kbps	100 m	128	26AWG
2	19.2 kbps	1000 m	128	26AWG

10.2.4 PROFIBUS-DP Fieldbus Card (MD38DP2)

MD38DP2 is a PROFIBUS-DP fieldbus card that needs to be installed in the servo drive. Before installation, cut off the power supply of the servo drive and wait for about 10 minutes until the CHARGE indicator becomes OFF. Then, insert the MD38DP2 in the required position and fix the screws to prevent the connector from being damaged by the external signal cable tension.

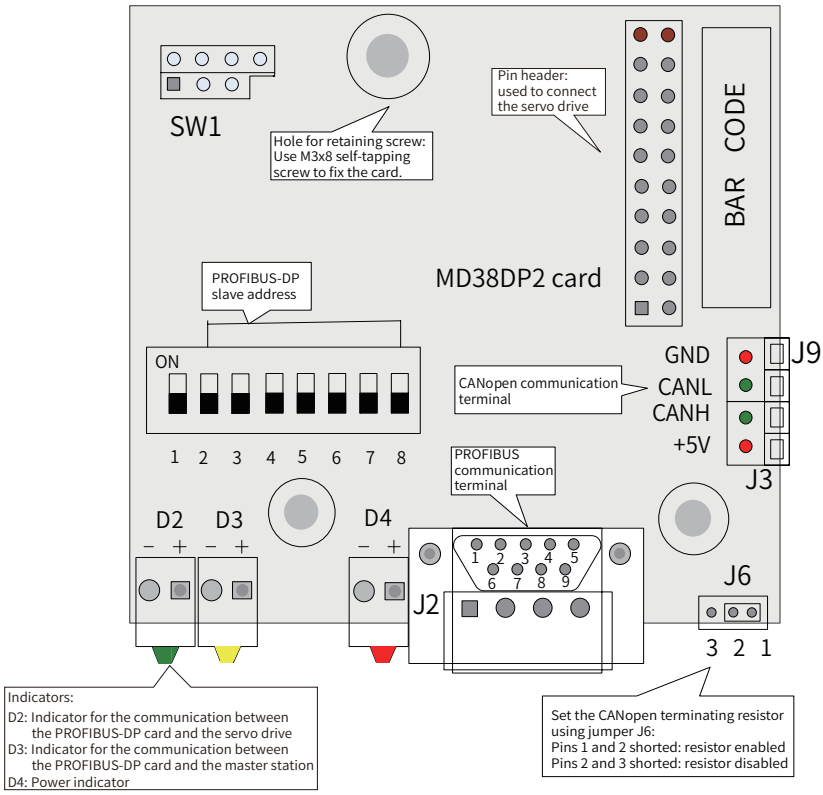


Figure 10-5 Layout of MD38DP2

1) DIP switch



Digit	Function	Description
1	PROFIBUS-DP card type switchover	OFF: MD38DP2 (default) ON: MD38DP1
2 to 8	PROFIBUS-DP slave address	The address of station 0 to station 125 can be set using digits 2 to 8 of the binary DIP switch. For example: Address Switch setting 0 000 0000 7 000 0111 20 001 0100 125 111 1101

NOTE

◆ The change of digit 1 is valid only after power-on again. The change of digits used to set the slave address takes effect immediately after setting.

2) DB9 connector

MD38DP2 is connected to the PROFIBUS master station using the standard DB9 connector. The pins of the DB9 connector are defined in the same way as those of Siemens DB9 connector, as shown in the following figure.

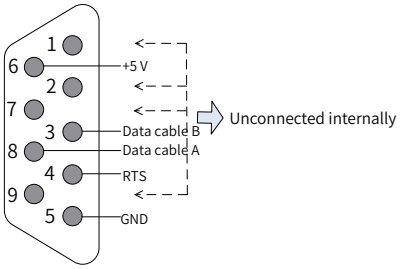


Figure 10-6 Pins of DB9 connector

3) Function description of control terminals

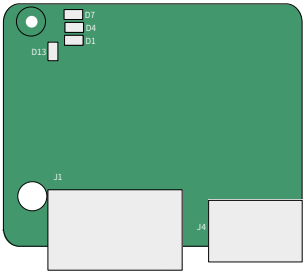
Category	Terminal Mark	Terminal Name	Function Description
PROFIBUS communication terminals (J2)	1, 2, 7, 9	NC	Unconnected internally
	3	Data cable B	Positive pole of the data cable
	4	RTS	Request transmission signal
	5	GND	Isolated 5 V power ground
	6	+5 V	Isolated 5 V power supply
	8	Data cable A	Negative pole of the data cable
CANopen communication terminals (J3, J9)	CANH	CAN input (+)	Positive pole of the data cable
	CANL	CAN input (-)	Negative pole of the data cable
	GND	Power ground	Isolated 5 V power ground
Programming	SW1	Programming terminal	Interface for production commissioning Do not use it.
Jumper	J6	CANopen terminating resistor selection	Pins 1 and 2 shorted: resistor enabled Pins 2 and 3 shorted: resistor disabled
Indicators	D4 (red)	Power indicator	Steady ON: The drive is energized. OFF: The drive is not connected with the power supply or the PROFIBUS-DP card is installed incorrectly.
	D3 (yellow)	Indicator for the communication between the PROFIBUS-DP card and the master station	Steady ON: The communication between the PROFIBUS-DP card and the PROFIBUS master station is normal. OFF: There is no communication between the PROFIBUS-DP card and the PROFIBUS master station (check the connection of PROFIBUS cables and the setting of station number). Flashing: The master station does not run or a fault occurs on the communication between the PROFIBUS-DP card and the PROFIBUS master station.
	D2 (green)	Indicator for the communication between the PROFIBUS-DP card and the servo drive	Steady ON: The communication between the PROFIBUS-DP card and the drive is normal. OFF: The communication between the PROFIBUS-DP card and the drive failed. (check whether the baud rate is set correctly). Flashing: Interference exists on the communication between the PROFIBUS-DP card and the drive, or the expansion card address is beyond the range of 1 to 125.

NOTE

◆ For some products, the indicator color may be inconsistent with the number. The number is preferred. The indicators are D2, D3, and D4 from left to right. See *"Figure 10-5 Layout of MD38DP2" on page 220* for details.

10.2.5 EtherCAT Expansion Card (S58-ETH-CAT)

The EtherCAT system is a master–slave type system, with the expansion card as the master and the control card as the slave. SPI is used for the communication between the master and the slave. An external 24 V power supply is required for the EtherCAT card to enable the EtherCAT communication before applying a high voltage, ensuring the normal communication between the host controller and the servo drive during this period.



Item	Specification
Communication protocol	Real-time EtherCAT industrial bus
Max. communication speed	100 Mbps
Network port/LAN cable	Standard network port with Cat 5e cable
Supported service	CoE
Synchronization mode	DC synchronous clock
Physical layer	100Base-TX
Baud rate	100 Mbit/s (100Base-TX)
Duplex mode	Full duplex
Topology	Linear topology
Transmission medium	LAN cable
Transmission distance	Less than 100 m between two nodes
EtherCAT frame length	44–1498 bytes
Process data	Single frame up to 1498 bytes

Figure 10-7 Terminal layout

Table 10-7 Description of terminal functions

Mark	Color	Meaning	Status Description
D1	Green	SPI communication indicator	Normal: even flashing Abnormal: steady OFF or uneven flashing
D13	Green	3.3 V power indicator	Normal: steady ON Abnormal: steady OFF or flashing
D4	Green	EtherCAT interaction indicator	OP mode: steady ON Initial mode: steady OFF PREOP/SAFOP mode: flashing
D7	Red	EtherCAT fault indicator	Normal: steady OFF Abnormal: steady ON or flashing
Network ports (from left to right)			
1	Yellow	U5 operating indicator of PHY2 chip	LAN cable (OUT) connected: ON Data exchange: flashing Offline: steady OFF
2	Green	Transmission rate:100 MHz	LAN cable (OUT) connected: ON Offline: steady OFF
3	Yellow	U6 operating indicator of PHY2 chip	LAN cable (OUT) connected: ON Data exchange: flashing Offline: steady OFF
4	Green	Transmission rate:100 MHz	LAN cable (OUT) connected: ON Offline: steady OFF

■ Requirement for Ethernet cable

Use Cat 5e STP and injection cable with iron housing.

■ Cable preparing

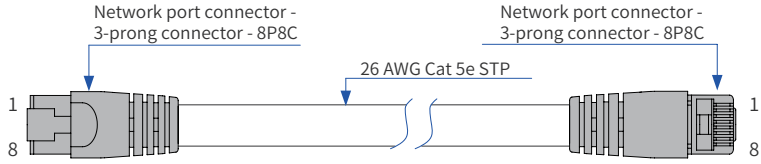


Figure 10-8 Requirement for EtherCAT cable preparing

■ Signal pin assignment

Pin No.	Signal (1000 Mbps Ethernet)	Signal Direction	Description
1	TD+	Output	Data transmission (+)
2	TD-	Output	Data transmission (-)
3	RD+	Input	Data receiving (+)
4	--(DC+*)	--(bidirectional)	Unused (data C+)
5	--(DC-)	--(bidirectional)	Unused (data C+)
6	RD-	Input	Data receiving (-)
7	--(DD+)	--(bidirectional)	Unused (data D+)
8	--(DD-)	--(bidirectional)	Unused (data D+)

NOTE

◆ The definition of pins 4, 5, 7 and 8 in a baud rate of 1000 Mbps are different from those in 100 Mbps. Pay attention to the contents in parentheses.

■ Technical requirements

1) There is no evidence of short circuit, open circuit, displacement and poor contact during the 100% continuity test.

2) The cable length is within allowed tolerance.

STP is used as EtherCAT bus for network data transmission. Cables with the following specifications are recommended:

Item	Specification
Cable type	Elastic crossover cable, S-FTP, Cat 5e
Compliant standards	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36
Conductor cross-section	26AWG
Cable type	Twisted pair
Number of pairs	4

10.2.6 Profinet Communication Expansion Card (MD500-PN1)

The MD500-PN1 card is a PROFINET fieldbus adapter card complying with the international PROFINET standards. It can increase the communication efficiency and implement the AC drive networking function, which enables the drive to be a slave controlled by the fieldbus master station.

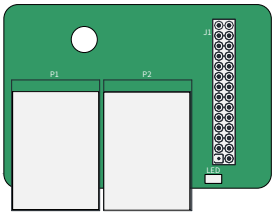


Figure 10-9 Terminal layout

Table 10-8 Description of terminal functions

Terminal Mark	Terminal Name	Function Description
P1	Port 1	Direction-insensitive terminals, either of them connected to the PLC 485 communication terminal with isolation input
P2	Port 2	
J1	Pin header	Used to connect the servo drive.

Table 10-9 Indicator description of the MD500-PN1 card

Mark	Name	Status Description
LED	Power indicator	ON: power-on normal OFF: power-on abnormal (Check whether the installation is correct.)

NOTE

- For more details about the PROFINET communication expansion card (MD500-PN1), see *MD500 Series PROFINET Expansion Card User Guide* (data code: 19011287).

10.2.7 EMC Guidance

1) During on-site installation and commissioning, the signal cables (such as encoder cables) and power cables must be laid in different cable trays. Never bundle the encoder cables and power cables together to prevent the encoder interference.
2) Connect the motor housing to the PE terminal of the servo drive. Meanwhile, connect the grounding cable on the motor housing side properly. Failure to comply will result in poor grounding effect.
3) STPs are recommended. For the differential encoder, connect the twisted pair cable according to the differential pair and connect the cable shield to the PE terminal of the servo drive.
4) For some large-scale equipment, the long motor cable (>10 m) will result in high inductance, which weakens the grounding effect. In this case, the encoder shield need not be connected to the PE terminal of the servo drive.

Appendix A Standards Compliance

A.1 CE Standard Compliance

A.1.1 Precautions



Figure A-1 CE mark

1) The CE mark indicates compliance with European safety and environmental regulations. The European Norm includes the Machinery Directive for machinery manufacturers, the Low Voltage Directive for electronics manufacturers, and EMC Directive for electromagnetic interference control.

2) The CE mark is required for engaging in commercial business (production, import, and distribution) in Europe.

3) This drive carries the CE mark and complies with the following directives:

- Low Voltage Directive: 2006/95/EC
- EMC Directive: 2004/108/EC

4) Machines and devices integrating this drive must also be CE certified and marked.

5) The integrator who integrates this drive into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE standards and the European Norm.

A.1.2 Low Voltage Directive Compliance

This drive has been tested according to EN61800-5-1 and complies with the Low Voltage Directive.

To enable machines and devices integrating this drive to comply with the Low Voltage Directive, ensure the following conditions are met:

1) Installation location

Install the servo drive in places with an overvoltage of category 3 and a pollution degree of PD1 or PD2 in accordance with IEC60664.

2) Installing a fuse on the input side (primary side)

To prevent accidents caused by a short circuit, install a fuse that complies with UL standards on the input side.

For the input/output current of the servo drive, see *"1.3 Technial Data" on page 24*. For the fuse selection, see *"8.1 Cables, Circuit Breaker and Contactor" on page 145*.

3) Preventing entry of foreign objects

The servo drive must be installed in a cabinet to be used in a final system with a fireproof enclosure providing both electrical and mechanical protections. The installation must conform to local laws and regulations and related IEC requirements.

4) Grounding

For a drive of 400 V class, ground the neutral point of the drive power supply.

5) Wiring

See "3.2.1 Standard Wiring Diagram" on page 64 for the wiring complying with the Low Voltage Directive.

A.1.3 EMC Directive Compliance

EMC describes the ability of electrical and electronic devices or systems to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. In other words, EMC includes two aspects: 1) The electromagnetic interference generated by a device or system during normal running must be within a certain limit; 2) Each device or system must have sufficient immunity to the electromagnetic interference in the environment in which it is meant to function.

This product complies with the directive 2004/108/EC and category C2 of standard EN 61800-3:2004+A1:2012. It is applicable to both the first environment and the second environment.

Safety Instruction
 WARNING ◆ When applied in the first environment, the drive may generate radio interference. Therefore, take measures to prevent radio interference if necessary.

To satisfy the EMC directive and requirements of related standards, install the recommended external EMC filter on the drive's input side and the shielded cable on the output side. Ensure that the filter is reliably grounded and the shield of output cables is grounded 360 degrees with a cable gland. For the selection of the EMC filter, see "8 Selection of Electrical Peripherals" on page 145. For the selection and installation of drive cables on the output side, see "3 Installation and Wiring" on page 40.

The manufacturer of the system integrating this drive is responsible for the system's compliance with European EMC directive and the requirements of category C2, C3 or C4 of standard EN 61800-3:2004+A1:2012 according to the system application environment.

A.1.4 Introduction to EMC Standard

First environment: Environment that includes domestic premises. It also includes establishments directly connected to a low-voltage power supply network (without intermediate transformers) which supplies buildings used for domestic purposes.

Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes.

Category C1 drive: Power drive system (PDS) with rated voltage lower than 1000 V, intended for use in the first environment.

Category C2 drive: PDS with rated voltage lower than 1000 V, which is neither a plug-in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by professionals.

Category C3 drive: PDS with rated voltage lower than 1000 V, intended for use in the second environment and not intended for use in the first environment.

Category C4 drive: PDS with rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

A.1.5 Cable Requirements and Wiring

1) To fulfill the EMC requirements of CE mark, use shielded cables. Shielded cables are classified into three-conductor cables and four-conductor cables. If the conductivity of the cable shield cannot meet the requirement, add a separate PE cable, or use a four-conductor shielded cable with one phase conductor being PE cable. The cable shield, which serves to suppress the emission and conduction of the radio frequency interference, must be made of co-axial copper braids with a weaving density larger than 90% to enhance shielding effectiveness and conductivity performance. For the selection and grounding of shielded cables, see *"3.2.2 Functions of Main Circuit Terminals and Precautions" on page 65*.
2) The motor cables and PE shielded conductor (twisted) must be as short as possible to reduce the electromagnetic radiation and the external stray current and capacitive current. For motor cables over 100 m, install an output filter or a dv/dt reactor.
3) Use shielded control cables.
4) The motor cables must be laid away from other cables. The motor cables of several drives can be laid in parallel.
5) It is recommended that motor cables, power input cables, and control cables be laid in different cable trays. Avoid long parallel runs of motor cables with other cables to eliminate the electromagnetic interference caused by rapid change of the drive output voltage.
6) If the control cable must run across the power cable, make sure the angle between

them is close to 90 degrees. Other cables cannot run across the drive.

7) Power input/output cables and low-voltage signal cables such as control cables of the drive should, if possible, be laid vertically rather than in parallel.
8) Cable trays must be in good connection and well-grounded. Aluminum cable trays can be used to improve equal potential.
9) The filter, drive, and motor must be properly connected to systems (machines or devices), with spraying protection applied at the installation part and the conductive metal kept in full contact.
10) For detailed wiring requirements, see *"3.2.2 Functions of Main Circuit Terminals and Precautions" on page 65*.

A.1.6 Solutions to Leakage Current

The high-speed pulse voltage output by the servo drive will generate high-frequency leakage current. Each drive produces more than 100 mA leakage current. Therefore, select an RCD whose rated operating current is above 100 mA. The RCD must be type B (time-delayed) because the drive outputs DC leakage current in the protective conductor.

Install an RCD for each drive in multi-drive applications.

1) Factors that influence the leakage current are listed as follows:

- Capacity of the drive
- Carrier frequency
- Type and length of motor cables
- EMI filter

2) When the leakage current generated by the drive triggers the RCD to operate, take the following measures:

- Increase the rated operating current of the RCD.
- Replace the RCD with a time-delayed type B RCD with high-frequency suppression function.
- Reduce the carrier frequency.
- Shorten the length of output drive cables.
- Install a leakage current suppression device.

Recommended RCD brands are Chint and Schneider.

A.1.7 Solutions to Common EMC Interference Problems

The drive generates strong interference. Although EMC measures are taken, interference may still exist due to improper wiring or grounding during use. When the drive interferes with other devices, adopt the following solutions.

Table A-1 Solutions to common EMC interference problems

Interference Type	Solution
ELCB tripping	◆ Reduce the carrier frequency. ◆ Shorten the drive cable length. ◆ Wind the ferrite core around the input drive cables except the PE cable. ◆ For tripping at the moment of power-on, cut off the large capacitor to ground on the power input side by disconnecting the grounding terminal of the external or built-in filter and disconnecting the grounding terminal of Y capacitor to ground of input ports. ◆ For tripping during running or when the drive is enabled, take leakage current suppression measures on the input side (install a leakage current filter, install safety capacitor + wind ferrite core, or wind ferrite core).
Interference generated during running	◆ Connect the motor housing to the PE terminal of the drive. ◆ Connect the PE terminal of the drive to that of the mains power supply. ◆ Wind the power input cables with the ferrite core. ◆ Add a capacitor or ferrite core to the interfered signal port. ◆ Apply additional common-ground connection between devices.
Communication interference	◆ Connect the motor housing to the PE terminal of the drive. ◆ Connect the PE terminal of the drive to that of the mains power supply. ◆ Wind the power input cables with the ferrite core. ◆ Add a terminating resistor between the communication cable source and the load. ◆ Add an auxiliary reference ground wire if the differential cable pair is used for external communication. ◆ Adopt shielded communication cables, and connect the cable shield to the common communication ground. ◆ Adopt daisy chain wiring mode for multi-node communication, with the branch shorter than 30 cm.
I/O interference	◆ Enlarge the capacitance filter of low-speed DI terminals. The recommended maximum value is 0.1 μF. ◆ Enlarge the capacitance filter of AI terminals. The recommended maximum value is 0.22 μF.

A.2 UL Standard Compliance

The UL/cUL mark indicates that UL has performed product tests and evaluation, and determined that their stringent standards for product safety have been met.

This product has been tested in accordance with UL508C and confirmed to pass it. Abide by the following requirements to maintain compliance with UL standards when integrating this drive into other machines and devices.

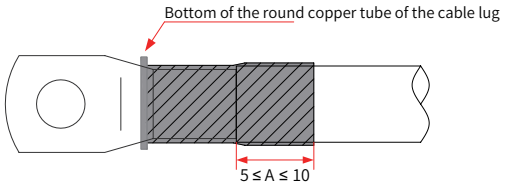
1) Installation location

Install the drive in a place with a pollution degree of PD1 or PD2 (UL standard).

2) Wiring of main circuit terminals

To meet UL standards, use crimping terminals that fulfill UL standards to connect the cables to the main circuit terminals. Use the tools recommended by terminal manufactures to crimp the terminals. Insulate the crimping terminals by using the heat-shrinkable sleeve with insulated cladding or UL certification. Select UL-certified insulated cables with vinyl resin coating at an ambient temperature of 40°C. The allowable continuous maximum temperature and maximum voltage of the cables are 75°C and 600 V respectively.

The heat-shrinkable sleeve is installed as follows:



A: overlap between the sleeve and the cable jacket (unit: mm)

Before ordering, contact the agents or sales representatives of Inovance.

3) Fuse on the input side

To meet UL standards, install a fuse recommended in *"8.1 Cables, Circuit Breaker and Contactor" on page 145* on the drive's input side.

4) Low-voltage wiring of control circuit terminals

Connect the low-voltage cables to the circuit cables of NEC division 1. Follow local regulations to perform wiring. Use class 2 (UL standard) power supply for control circuit terminals.

Table A-2 Power supply for control circuit terminals

Input/Output	Terminal Mark	Power Supply Specification
Multi-functional DI	DI1, DI2, DI3, DI4, DI5, COM	Internal LVLC power supply of the servo drive If an external power supply is used, it must be of class 2.
Multi-functional AI	AI1, AI2, AI3, GND	Internal LVLC power supply of the servo drive If an external power supply is used, it must be of class 2.
Multi-functional DO	DO1, COM	Internal LVLC power supply of the servo drive If an external power supply is used, it must be of class 2.
Multi-functional AO	AO1, AO2, GND	Internal LVLC power supply of the servo drive If an external power supply is used, it must be of class 2.

5) Short circuit capacity

Short circuit test has been performed on this product using a power supply with a current below 100,000 A and a voltage below 480 V.

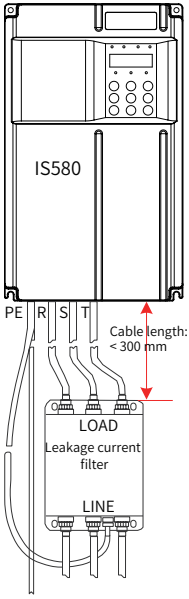
During wiring, install the circuit breaker (MCCB) and the fuse on the input side used for short circuit protection. Use a drive with a short circuit capacity not lower than that of the power supply.

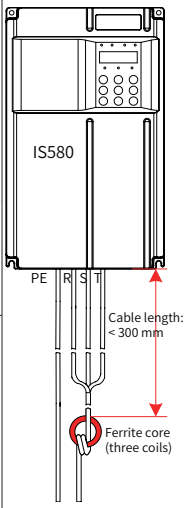
6) Overtemperature protection

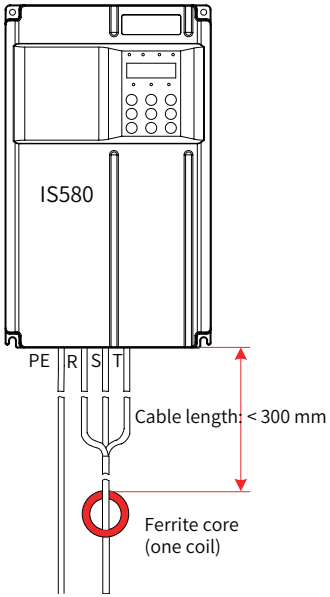
The motor overtemperature protection is not tested during UL certification. Therefore, contact the agents or sales representatives of Inovance for details about this function.

Appendix B Leakage Current Suppression Solutions and RCD Selection

"-" indicates that the solution is unavailable to servo drives of these models.

<table>
<tr><th rowspan="3">Drive Model</th><th colspan="5">Solution 1: Running Leakage Current < 30 mA (Leakage Current Filter)</th></tr>
<tr><th rowspan="2">Leakage Current Suppression Solution and Recommended RCD</th><th rowspan="2">Recommended RCD Without Leakage Current Suppression</th><th colspan="3">With Leakage Current Suppression</th></tr>
<tr><th>Model of Leakage Current Filter</th><th>Wiring</th><th>Recommended RCD</th></tr>
<tr><td>IS580T020-R1
IS580T030-R1</td><td rowspan="14">◆ CHINT DZ/ NM1LE series
◆ Changshu MCCBCM3L series
◆ ABB F200 series
◆ Schneider iID RCD</td><td rowspan="7">Operating current I △ n ≥ 100 mA</td><td>DL-15EB1/10</td><td rowspan="6">Note: Connect the load side of the leakage current filter to the servo drive.
 
</td><td rowspan="13">Operating current I △ n ≥ 100 mA</td></tr>
<tr><td>DL-35EB1/10</td></tr>
<tr><td>IS580T035-R1
IS580T035-R1-H</td><td rowspan="2">DL65EB1/10</td></tr>
<tr><td>IS580T040-R1
IS580T040-R1-H
IS580-2T040-R1</td></tr>
<tr><td>IS580T050-R1
IS580T050-R1-H
IS580-2T050-R1</td><td rowspan="7">Operating current I △ n ≥ 300 mA</td></tr>
<tr><td>IS580T070-R1
IS580T070-R1-H
IS580-2T070-R1</td><td rowspan="2">DL-120EB1/10</td></tr>
<tr><td>IS580T080-R1
IS580T080-R1-H
IS580-2T080-R1</td></tr>
<tr><td>IS580T100-R1
IS580T100-R1-H
IS580-2T100-R1</td><td rowspan="2">DL-180EB1/10</td></tr>
<tr><td>IS580T140-R1
IS580T140-R1-H
IS580-2T140-R1</td></tr>
<tr><td>IS580T170-R1
IS580-2T170-R1</td></tr>
<tr><td>IS580T210-R1
IS580-2T210-R1</td><td>-</td><td>-</td><td>Operating current I △ n ≥ 300 mA</td></tr>
</table>

<table>
<tr><th rowspan="3">Drive Model</th><th colspan="4">Solution 2: Running Leakage Current < 100 mA (Three Coils of Ferrite Core)</th></tr>
<tr><th rowspan="2">Leakage Current Suppression Solution and Recommended RCD</th><th rowspan="2">Recommended RCD Without Leakage Current Suppression</th><th colspan="3">With Leakage Current Suppression</th></tr>
<tr><th>Model of Ferrite Core</th><th>Wiring</th><th>Recommended RCD</th></tr>
<tr><td>IS580T020-R1
IS580T030-R1</td><td rowspan="12">◆ CHINT DZ/ NM1LE series
◆ Changshu MCCBCM3L series
◆ ABB F200 series
◆ Schneider ilD RCD</td><td rowspan="5">Operating current I △ n ≥ 100 mA</td><td>DY644020</td><td rowspan="3">The grounding cable and RST cable cannot run across the ferrite core together.
 
</td><td rowspan="6">Operating current I △ n ≥ 100 mA</td></tr>
<tr><td>IS580T035-R1
IS580T035-R1-H</td><td rowspan="3">DY805020H</td></tr>
<tr><td>IS580T040-R1
IS580T040-R1-H
IS580-2T040-R1</td></tr>
<tr><td>IS580T050-R1
IS580T050-R1-H
IS580-2T050-R1</td><td rowspan="7">Operating current I △ n ≥ 300 mA</td></tr>
<tr><td>IS580T070-R1
IS580T070-R1-H
IS580-2T070-R1</td></tr>
<tr><td>IS580T080-R1
IS580T080-R1-H
IS580-2T080-R1</td><td>DY1207030H</td></tr>
<tr><td>IS580T100-R1
IS580T100-R1-H
IS580-2T100-R1</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td>IS580T140-R1
IS580T140-R1-H
IS580-2T140-R1</td></tr>
<tr><td>IS580T170-R1
IS580-2T170-R1</td><td>-</td><td>-</td><td rowspan="2">Operating current I △ n ≥ 300 mA</td></tr>
<tr><td>IS580T210-R1
IS580-2T210-R1</td><td>-</td><td>-</td></tr>
</table>

<table>
<tr><th rowspan="2">Drive Model</th><th colspan="3">Solution 3: Running Leakage Current < 200 mA (One Coil of Ferrite Core)</th></tr>
<tr><th>Model of Ferrite Core</th><th>Wiring</th><th>Recommended RCD</th></tr>
<tr><td>IS580T020-R1
IS580T030-R1</td><td>DY644020H</td><td rowspan="15">The grounding cable and RST cable cannot run across the ferrite core together.
 
</td><td rowspan="15">Operating current
I △ n ≥ 100 mA</td></tr>
<tr><td>IS580T035-R1
IS580T035-R1-H</td><td rowspan="4">DY805020H</td></tr>
<tr><td>IS580T040-R1
IS580T040-R1-H
IS580-2T040-R1</td></tr>
<tr><td>IS580T050-R1
IS580T050-R1-H
IS580-2T050-R1</td></tr>
<tr><td>IS580T070-R1
IS580T070-R1-H
IS580-2T070-R1</td></tr>
<tr><td>IS580T080-R1
IS580T080-R1-H
IS580-2T080-R1</td><td rowspan="3">DY1207030H</td></tr>
<tr><td>IS580T100-R1
IS580T100-R1-H
IS580-2T100-R1</td></tr>
<tr><td>IS580T140-R1
IS580T140-R1-H
IS580-2T140-R1</td></tr>
<tr><td>IS580T170-R1
IS580-2T170-R1</td><td rowspan="2">DY1207030H</td></tr>
<tr><td>IS580T210-R1
IS580-2T210-R1</td></tr>
</table>

Appendix C Multi-Pump Mode of the Injection Molding Machine

C.1 Parallel Pump Control Modes of the Servo Hydraulic Pump

The parallel pump control of the servo hydraulic pump includes multi-pump convergent flow and multi-pump distributed flow.

Multi-pump convergent flow: One servo drive works as the main drive and other drives connected in parallel work as slave drives. The host controller outputs a group of flow/pressure analog signals.

- In the flow control state (the feedback pressure is smaller than the reference pressure), the master drive and slave drives run at the same speed.
- In the pressure control state (the feedback pressure is greater than or equal to the reference pressure), the slave drives automatically stop working and the main drive controls the pumps.

Multi-pump distributed flow: Multiple servo drives may work in multi-pump convergent flow mode or multi-pump distributed flow mode (independent oil pressure PID control for each pump). The host controller outputs multiple groups of flow/pressure analog signals.

1) Multi-pump convergent flow diagram

The following figure shows multi-pump convergent flow control.

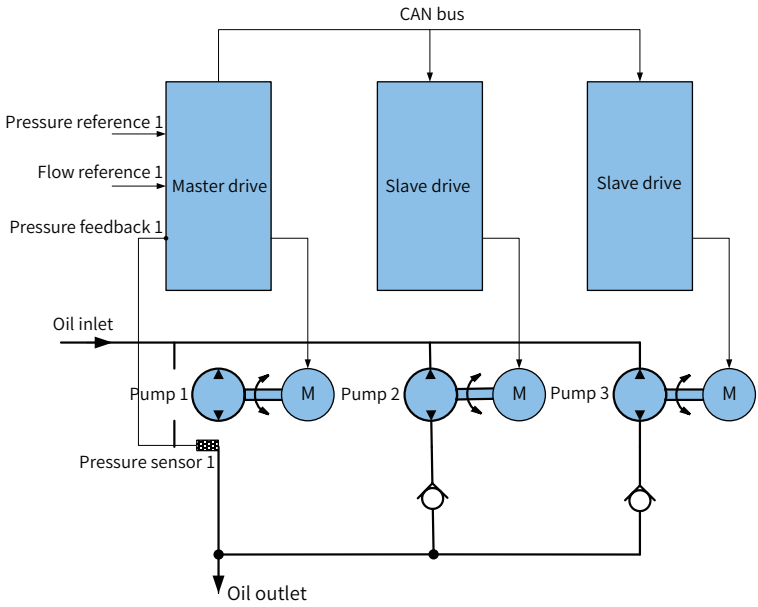


Figure C-1 Multi-pump convergent flow diagram

NOTE

- For detailed wiring and CAN communication wiring, see "1) Wiring (parallel pump running)" on page 238. For the setting of parameters, see "2) Parameter setting for slave pump response to master pump references" on page 239.

Set the same speed for motors through communication.

2) Multi-pump distributed flow diagram

The following figure shows multi-pump distributed flow control.

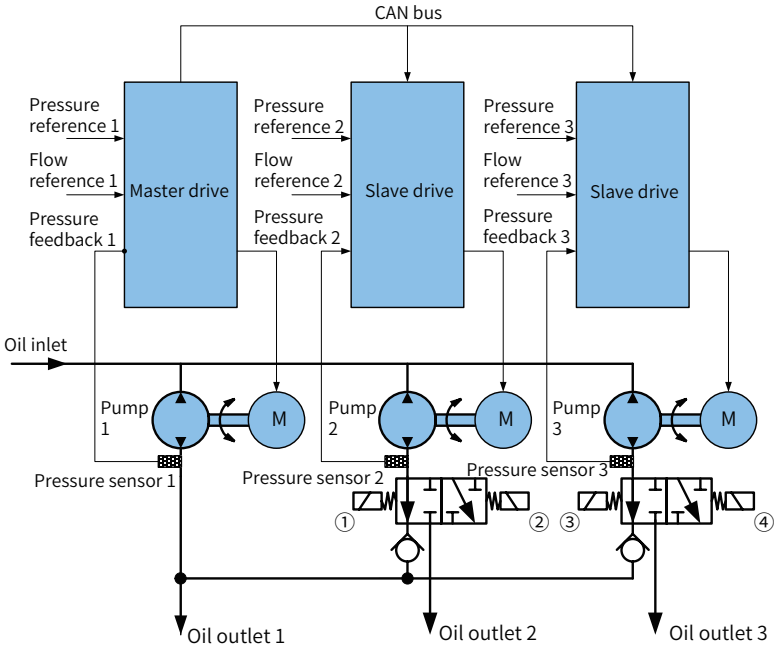


Figure C-2 Multi-pump distributed flow diagram

NOTE

- For detailed wiring and CAN communication wiring, see "1) Wiring (parallel pump running)" on page 238. For the setting of parameters, see "2) Parameter setting for slave pump response to master pump references" on page 239.

Set the same speed for motors through communication.

Control the convergent/distributed flow of pumps 2 and 3 by powering on and off solenoid valves ① , ② , ③ , and ④ .

When the convergent flow control is enabled, the pressure and flow references and pressure feedback signals received by slave drives are invalid.

When the distributed flow control is enabled, the CAN communication references received by slave drives are invalid.

C.2 Multi-Pump Control Modes

Parameter No.	Parameter Name	Setting Range
A2-03	CAN multi-pump mode	0: Multi-pump mode 1 (broadcasting mode) 1: Multi-pump mode 2 (multi-master mode)

The IS580 supports both multi-pump mode 1 and multi-pump mode 2.

Multi-pump mode 1

Multi-pump mode 1 is the broadcasting mode applicable to simple multi-pump control.

- The slave pump cannot control other slave pumps after it switches to the master pump.
- Enable the multi-pump mode using the 50# DI terminal.
- If you disconnect the 50# DI terminal of a slave pump, the slave pump will switch to the master pump.

Multi-pump mode 2

Multi-pump mode 2 is the multi-master mode. To meet the requirements of complex multi-pump convergent/distributed flow control, the IS580 supports up to four multi-pump convergent/distributed flow control combinations.

The following sections introduce detailed wirings and applications of multi-pump mode 1 and multi-pump mode 2.

1) Wiring (parallel pump running)

Multi-pump convergent flow

See *Figure C-19* and *Figure C-20* for detailed wirings. In this mode, connect the slave pump alarm output signal (set F5-02 to 25) to the host controller for alarm display.



NOTE

In the pressure control state, high pressure will occur without cause on the oil circuit of slave pumps when the leakage of the check valve is large while the internal leakage of the slave pumps is small. To relieve the high pressure of the oil circuit, take the following measures:

- Reduce the discharge of slave pumps to a proper range.
- Decrease the upper torque limit of the slave drive to a reasonable range.
- Set the speed response curve of slave pumps according to the maximum leakage speed of the master pump, ensuring that the slave drive implements automatic pressure relief in low-speed pressure holding state. For detailed parameter settings, see *"2) Parameter setting for slave pump response to master pump references" on page 239*.

Multi-pump distributed flow

See *Figure C-21* and *Figure C-22* for detailed wirings. Connect the slave pump alarm output signal (set F5-02 to 25) to the host controller for alarm display. In this control mode, the slave drive receives the pressure feedback 2 from the pressure sensor installed in the oil circuit of the slave pump. Therefore, the high pressure without cause will never occur in the oil circuit of the slave pump in the pressure control state.

■ Communication connection: connect the CAN bus of all pumps together, as shown in the following figure.

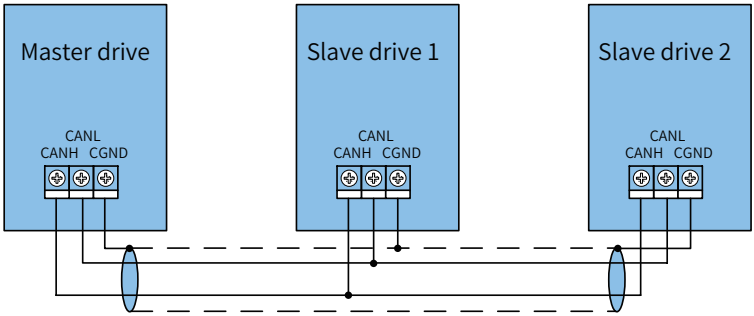


Figure C-3 CAN bus connection diagram

Note: Use STPs for CAN bus connection. Connect the CANH and CANL terminals on the control board of all drives together, and connect all CGND terminals together using the shield. The CAN communication terminating resistor of the front drive and the end drive at the CAN bus must be connected using jumper J4.

2) Parameter setting for slave pump response to master pump references

Parameter No.	Parameter Name	Default	Description
A3-32	Slave speed reference minimum input	0.0%	Drive setting for the slave pump
A3-33	Corresponding value of slave speed reference minimum input	0.0%	
A3-34	2nd point input of slave speed reference	0.0%	
A3-35	Corresponding value of the 2nd point input of slave speed reference	0.0%	
A3-36	Slave speed reference maximum input	100.0%	
A3-37	Corresponding value of slave speed reference maximum input	100.0%	

Set parameters A3-32 to A3-37 to proper values so that the slave pump can implement automatic pressure relief when the master pump is in the low-speed pressure holding state. This prevents high pressure holding of the slave pump and ensures the system's flow linearity.

Example:

Condition 1: The maximum pressure holding speed of the master pump is 50 rpm, and the maximum speed of the master pump and the slave pump are both 2000 rpm.

Condition 2: During pressure holding, the master pump works and the slave pump stops.

Condition 3: To ensure the flow linearity, the slave pump runs at the same speed as the master pump when the speed of the master pump exceeds 100 rpm.

It means that when the master pump speed is below 50 rpm, the slave pump does not work. When the master pump speed exceeds 100 rpm, the master pump and the slave pump run at the same speed.

The master pump speed reference is 0% to 100%. The three-point curve showing the slave pump response to the master pump speed reference is as follows:

(A3-32, A3-33) = (Slave pump input reference: 50 rpm, slave pump response reference: 0 rpm) = (2.5%, 0.0%)

(A3-34, A3-35) = (Slave pump input reference: 100 rpm, slave pump response reference: 100 rpm) = (5.0%, 5.0%)

(A3-36, A3-37) = (Slave pump input reference: 2000 rpm, slave pump response reference: 2000 rpm) = (100%, 100%)

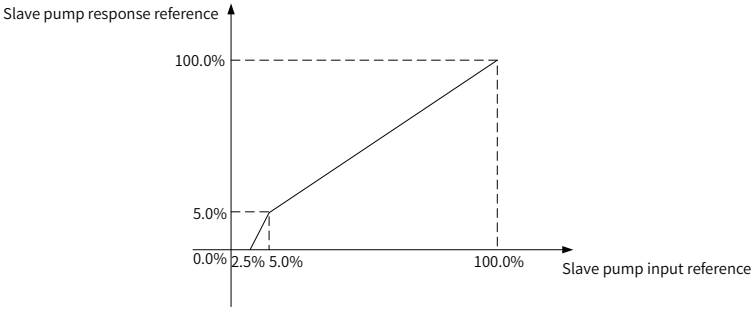


Figure C-4 Slave pump response to the master pump speed reference

NOTE

◆ The two multi-pump modes have identical settings for the slave pump response to the master pump speed reference.

C.3 Parameter Settings of the Master Drive

■ Multi-pump mode 1 (A2-03 = 0)

Enable the 50# DI terminal of all servo drives.

Parameter No.	Parameter Name	Value	Description
A2-01	CAN communication address	1	-
A2-03	Multi-pump mode 1	0	-
F4-**	Multi-pump control enabling	50	Short DI5 to COM directly.
F5-02	Output selection of the relay (T/A2-T/C2) on the control board	25	Slave pump alarm output (NO)

■ Multi-pump mode 2 (A2-03 = 1)

The 1# servo drive must be the master pump. A maximum of four convergent/ distributed flow control combinations can be set. The related parameter settings are as follows:

Parameter No.	Parameter Name	Value	Description
F4-**	Slave pump address selection input terminal 1	53	In multi-pump distributed flow control, the two parameters are used to set the slave pumps to be controlled by the master pump for convergent flow.
F4-**	Slave pump address selection input terminal 2	54	
F5-02	Output selection of the relay (T/A2-T/C2) on the control board	25	Slave pump alarm output (NO)
A2-01	CAN communication address	1	-
A2-03	Multi-pump mode 2	1	-
A2-04	CAN slave pump address 1	0	Working with the 53# and 54# input terminals, these parameters are used to implement the four convergent/ distributed flow control combinations.
A2-05	CAN slave pump address 2	0	
A2-06	CAN slave pump address 3	0	
A2-07	CAN slave pump address 4	0	

■ DI terminal selection for slave pump address input

54# DI Terminal Input	53# DI Terminal Input	Selection of CAN Slave Address
0	0	A2-04: CAN slave pump address 1
0	1	A2-05: CAN slave pump address 2
1	0	A2-06: CAN slave pump address 3
1	1	A2-07: CAN slave pump address 4

■ Salve pump address setting

The LED displays of slave pump addresses are as follows:

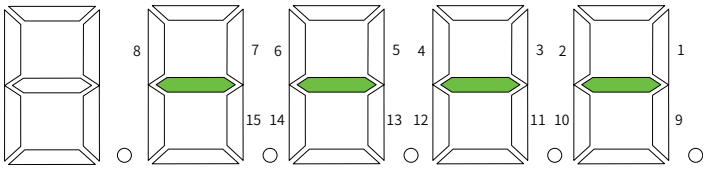


Figure C-5 LED display of initial slave pump address setting

■ The numbers indicate the station number of slave pump addresses.

■ If the LED corresponding to a number is ON, it indicates that the slave pump with that station number is controlled.

■ The IS580 supports the setting of up to 15 slave pump addresses.

For example, the 1# pump serves as the master pump, and the slave pump addresses set in A2-04 (CAN slave pump address 1) are shown in the following figure. It indicates that the 1# pump, the master pump, works with slave pumps 2#, 3# and 4# in convergent flow mode.

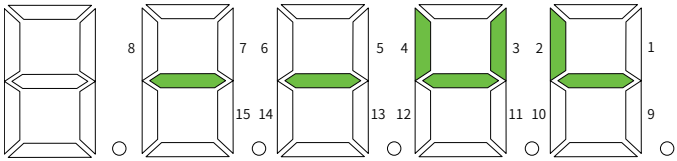


Figure C-6 Slave address setting

Set the slave pump addresses by operating the keys as follows:

Set the address of pumps 1# to 8# by using and .

Set the address of pumps 9# to 15# by using and .

C.4 Parameter Setting of Slave Drives

■ Multi-pump mode 1 (A2-03 = 0)

The following table lists the parameters set for slave drives. Set other parameters according to the general method used for the servo hydraulic pump.

Parameter No.	Parameter Name	Value	Description
A2-01	CAN communication address	> 1	Slave drive
F4-**	Multi-pump control enabling	50	The slave pump may switch to the master pump.

Switch a slave pump to the master pump by disconnecting the 50# DI terminal of that pump.

■ Multi-pump mode 2 (A2-03 = 1)

The following table lists the parameters set for slave drives. Set other parameters according to the general method used for the servo hydraulic pump.

Parameter No.	Parameter Name	Value	Description
A2-01	CAN communication address	> 1	Slave drive
F4-**	Slave pump address selection input terminal 1	53	When a slave pump is used as the master pump, terminal triggering is required. For the slave pump address setting, see "C.3 Parameter Settings of the Master Drive" on page 241.
F4-**	Slave pump address selection input terminal 2	54	

C.5 Applications of the Multi-Pump Convergent/Distributed Flow

1 Multi-pump mode 1 (A2-03 = 0)

For example, the hydraulic pump system of the injection molding machine consists of three pumps whose addresses are set to 1#, 2# and 3#, respectively. In multi-pump mode 1, a slave pump cannot control other slave pumps. Therefore, two pump combinations are available in this case:

1) Combination 1: 3-pump convergent flow

2) Combination 2: (2 + 1) distributed flow, with the 2# slave pump controlled by the 1# master pump and the 3# slave pump switching to the master pump.

The following section describes the wiring of the two combinations.

1) Combination 1: 3-pump convergent flow

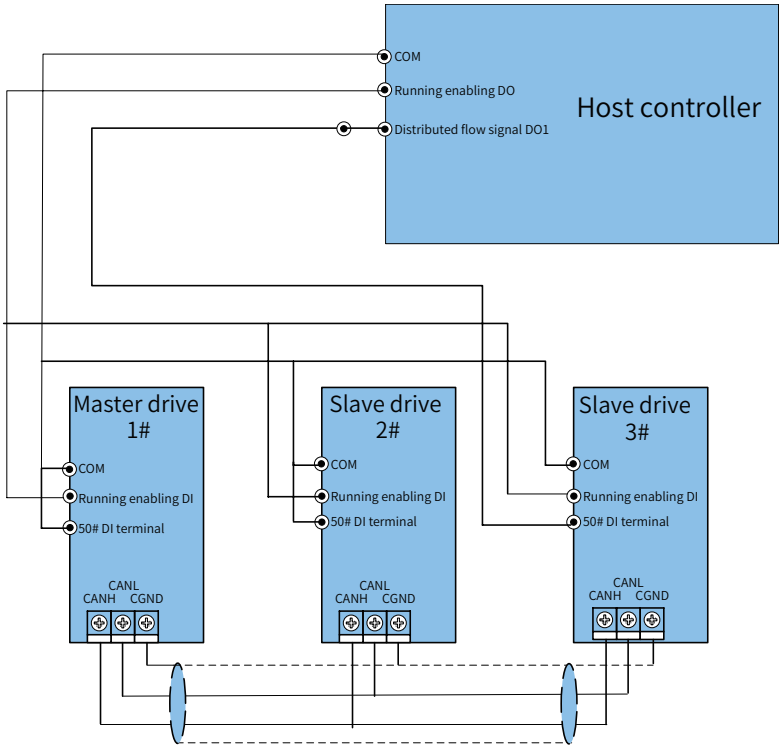


Figure C-7 Wiring of 3-pump convergent flow

Wiring description:

The 1# pump is always the master pump and the 2# pump is always the slave pump. Therefore, short their 50# DI terminals directly.

An external switchover signal is required for the 3# pump to switch to the master pump in combination 2. The host controller sends a closing signal to disconnect the 50# DI terminal of the 3# slave pump, which enables the 3# pump to enter the multi-pump convergent flow state.

2) Combination 2: (2 + 1) distributed flow, with the 2# slave pump controlled by the 1# master pump and the 3# pump switching to the master pump.

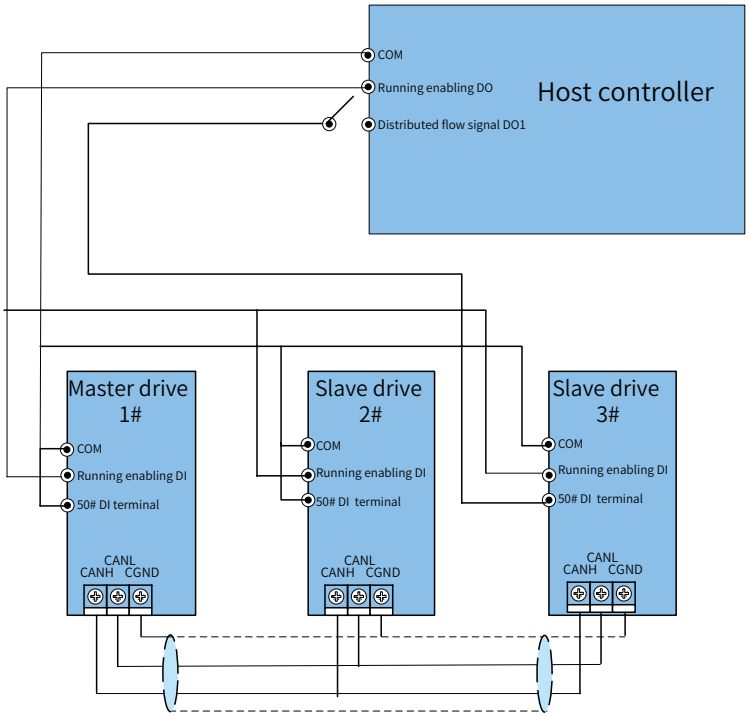


Figure C-8 Wiring of (2 + 1) distributed flow

The 1# master pump controls the 2# slave pump, and the 3# pump switches from the slave pump to the master pump by disconnecting the 50# DI terminal. The same rule applies to other pumps.

2 Multi-pump mode 2 (A2-03 = 1)

For example, the hydraulic pump system of the injection molding machine consists of four pumps whose addresses are set to 1#, 2#, 3#, and 4#, respectively. The following three combinations are available:

1) Combination 1: 4-pump convergent flow

2) Combination 2: (2 + 2) distributed flow, with the 2# slave pump controlled by the 1# master pump and the 4# slave pump controlled by the 3# master pump.

3) Combination 3: (3 + 1) distributed flow, with the 2# and 3# slave pumps controlled by the 1# master pump and the 4# slave pump switching to the master pump.

The following section describes the wirings and parameter settings of the above three combinations.

The CAN communication address (A2-01) of the four pumps are set to 1#, 2#, 3# and 4#, respectively. Set the address of the pump used as the master pump in three combinations to 1#.

1) Combination 1: 4-pump convergent flow

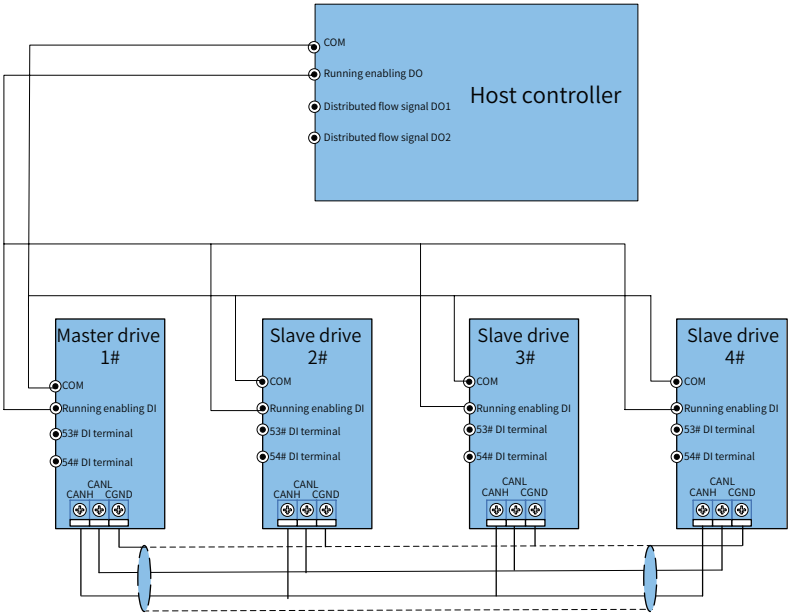


Figure C-9 Wiring of 4-pump convergent flow

■ Wiring description

In this mode, you just need to connect all the CAN buses and running enabling DI terminals.

■ Parameter setting

The 1# pump is the master pump, and the 2#, 3# and 4# pumps are slave pumps. Set the slave pump addresses in A2-04 (CAN slave pump address 1) as follows:

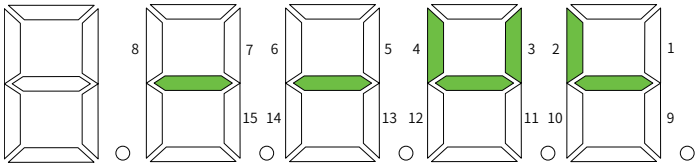


Figure C-10 Slave pump address setting

2) Combination 2: (2 + 2) distributed flow, with the 2# slave pump controlled by the 1# master pump and the 4# slave pump controlled by the 3# master pump.

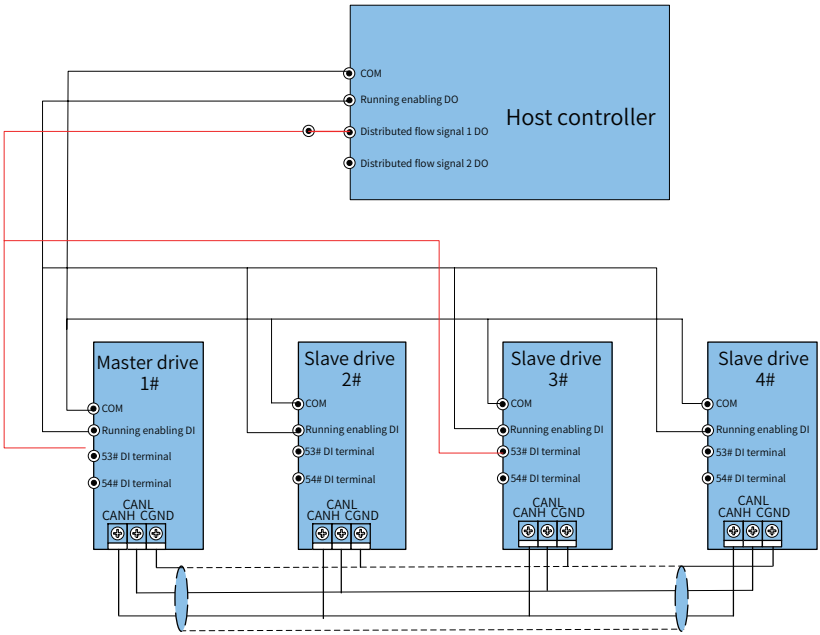


Figure C-11 Wiring of (2 + 2) distributed flow

■ Wiring description

The host controller that sends the distributed flow signal is connected to the 53# DI terminal of the servo drive driving the master pump. Using the 53# DI signal, the 1# master pump identifies the slave pump to be controlled, and the 3# slave pump switches to the master pump and identifies the other slave pump to be controlled.

■ Parameter setting

In this combination, both 1# pump and 3# pump are used as the master pump. The slave pump(s) controlled by each master change(s). Therefore, you need to set the address of slave pumps again. The 2# pump works as the slave pump controlled by the 1# master pump. Set its address in A2-05 (CAN slave pump address 2) as follows:

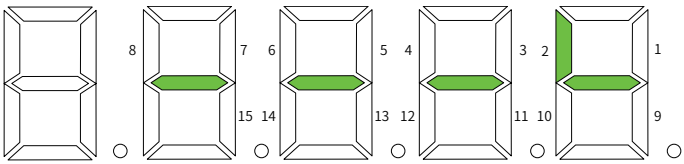


Figure C-12 Slave pump address setting in A2-05 (CAN slave pump address 2)

The 4# pump works as the slave pump controlled by the 3# master pump. Set its address in A2-05 (CAN slave pump address 2) as follows:

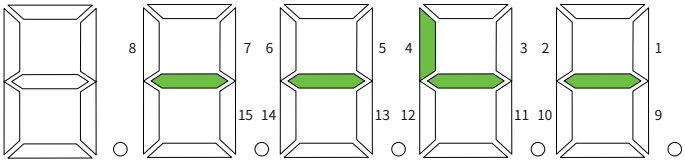


Figure C-13 Slave pump address setting in A2-05 (CAN slave pump address 2)

3) Combination 3: (3 + 1) distributed flow, with the 2# and 3# slave pumps controlled by the 1# master pump and the 4# pump switching to the master pump.

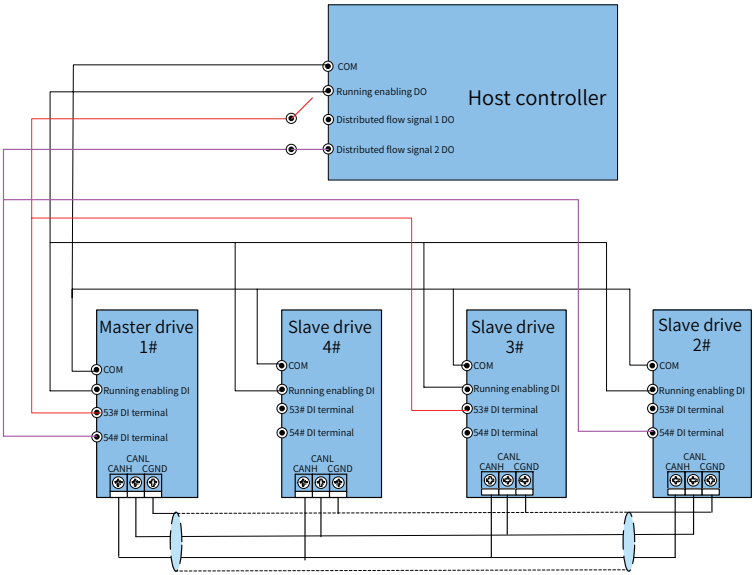


Figure C-14 Wiring of (3 + 1) distributed flow

■ Wiring description

The host controller that sends the distributed flow signal is connected to the 54# DI terminal of the servo drive driving the master pump. Using the 54# DI signal, the 1# master pump identifies the slave pumps to be controlled, and the 4# slave pump switches to the master pump. All the 53# DI terminals are disconnected.

■ Parameter setting

In this combination, both 1# pump and 4# pump are used as the master pump. The slave pump(s) controlled by each master change(s). Therefore, you need to set the address of slave pumps again. The 2# and 3# pumps are slave pumps controlled by the 1# master pump. Set their addresses in A2-06 (CAN slave pump address 3) as follows:

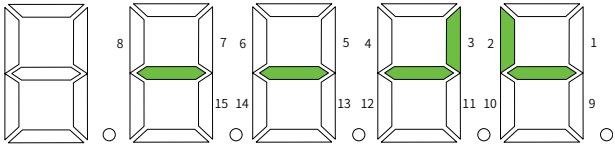


Figure C-15 Slave pump address setting in A2-06 (CAN slave pump address 3)

After the 4# slave pump switches to the master pump, no slave pump is controlled by it. Therefore, you need not to set A2-06 (CAN slave address 3).

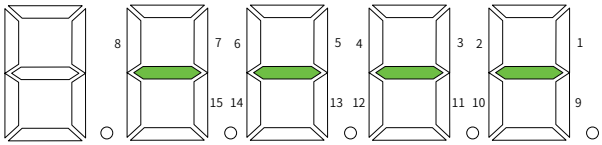


Figure C-16 Slave pump address setting in A2-06 (CAN slave pump address 3)

C.6 Fault Alarms

The following figures describe the faults specific to the multi-pump control.

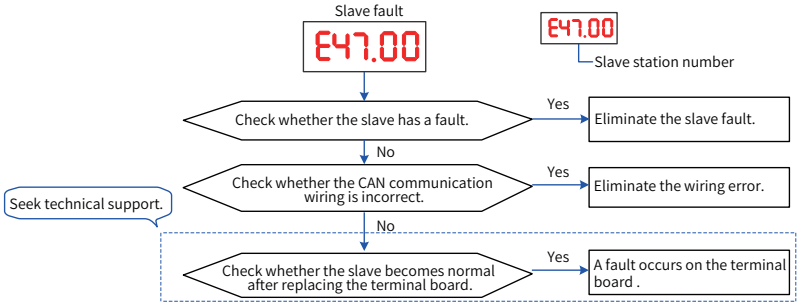


Figure C-17 Slave fault alarm (E47.00)

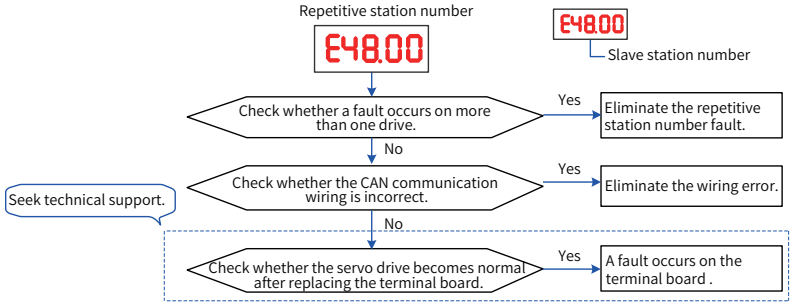


Figure C-18 CAN address conflict (E48.00)

Wiring of the main circuit and control terminals:

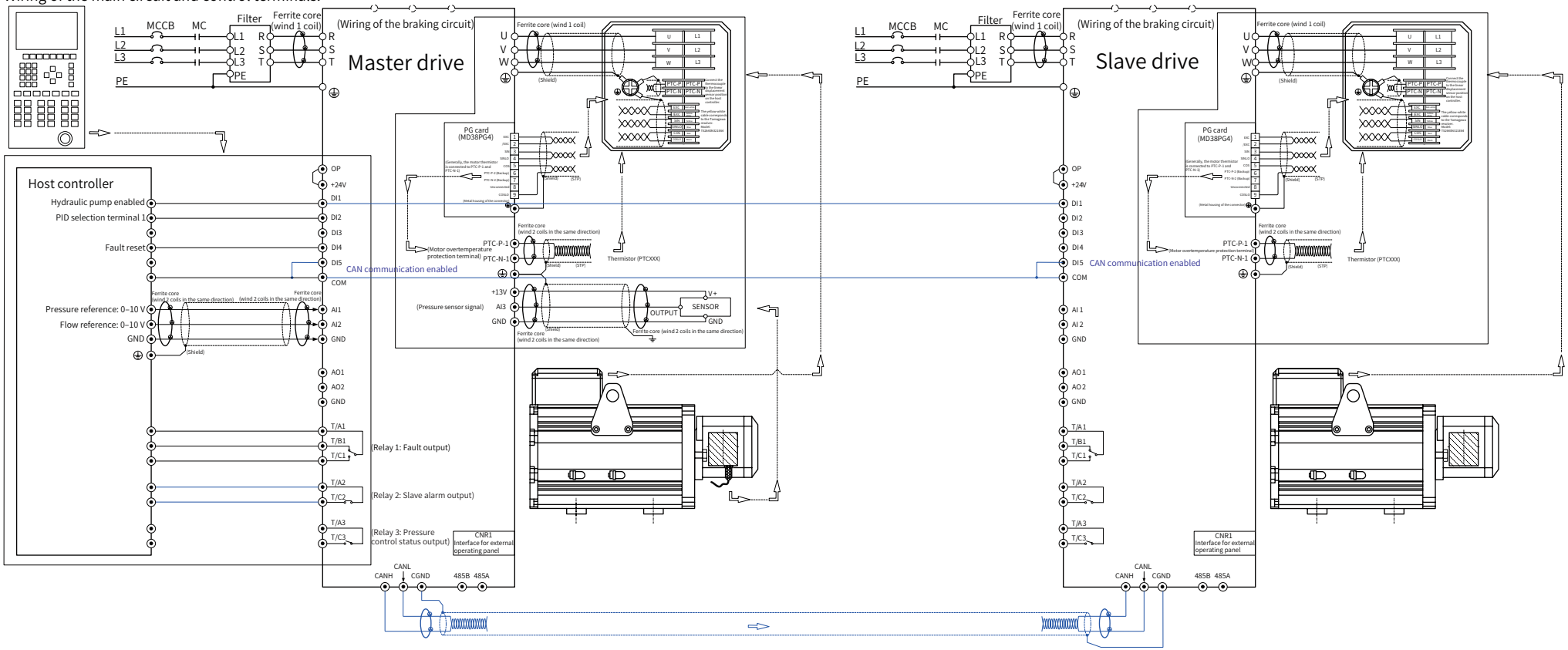


Figure C-19 Wiring diagram for multi-pump convergent flow in multi-pump mode 1

NOTE

◆ In multi-pump mode 1, the 50# DI terminal of slave and master pumps must be ON to enable the multi-pump convergent flow control.

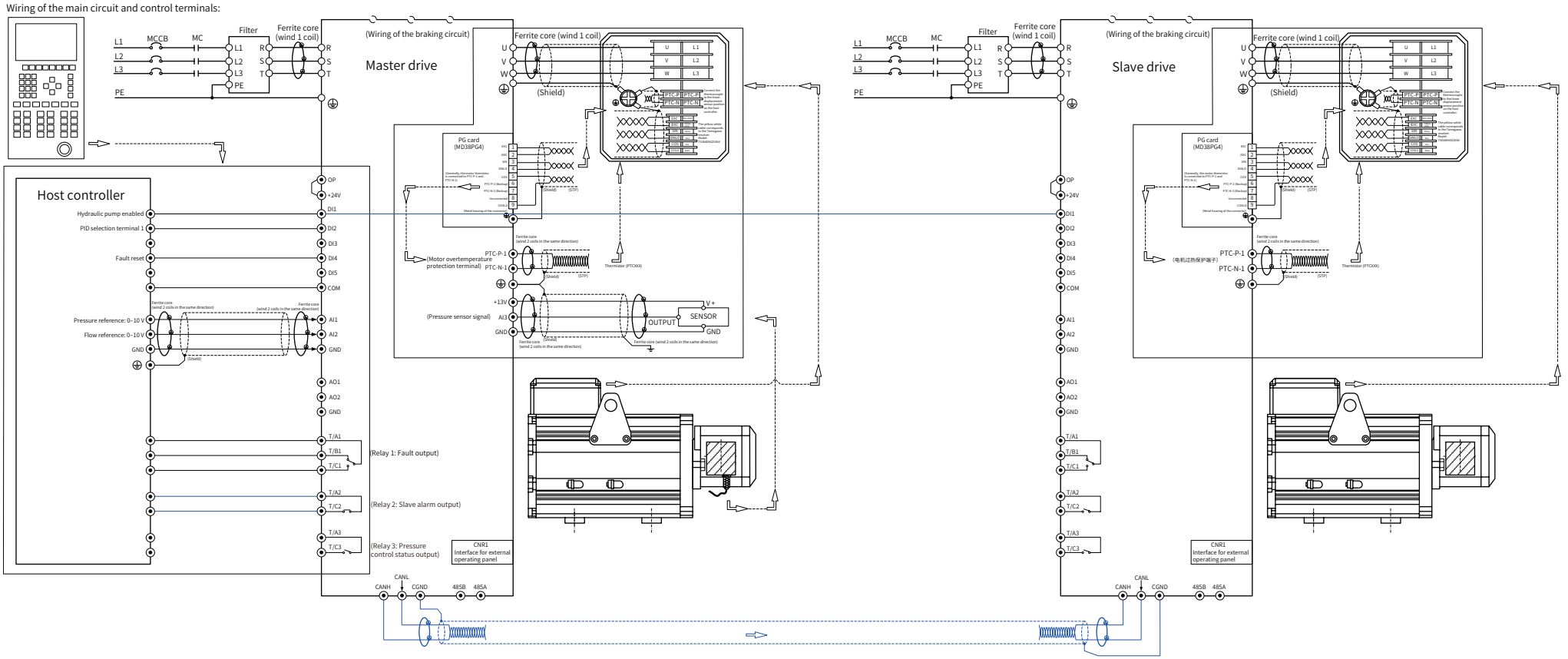


Figure C-20 Wiring diagram for multi-pump convergent flow in multi-pump mode 2

NOTE

◆ In multi-pump mode 2, connect the CAN bus correctly and set the correct address for the slave pump responding to the flow reference from the master pump. For detailed parameter setting, see "C.3 Parameter Settings of the Master Drive" on page 241.

Wiring of the main circuit and control terminals:

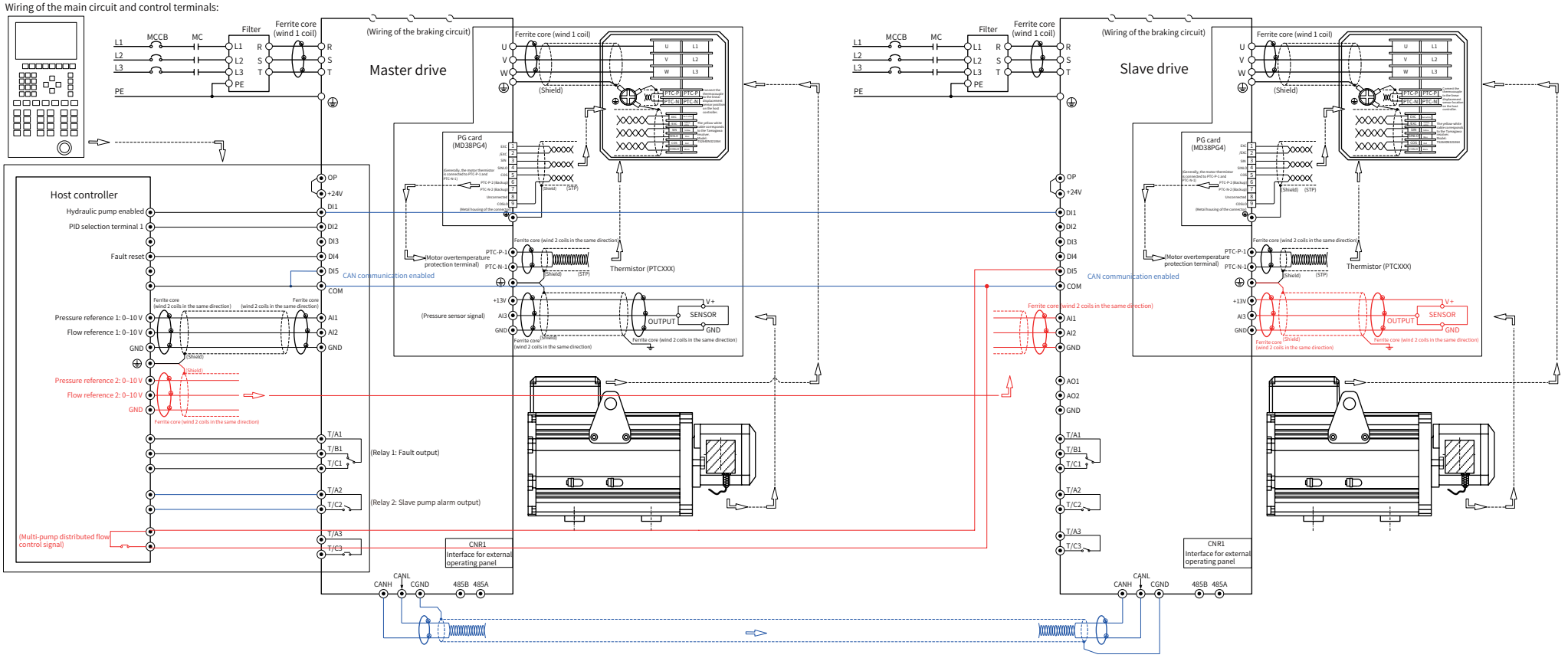


Figure C-21 Wiring diagram for multi-pump distributed flow in multi-pump mode 1

NOTE

◆ The host controller sends a divergent flow signal to disconnect the 50# DI terminal of the slave drive so that the slave drive enters the oil pressure PID control state by receiving the pressure/flow reference 2 and pressure feedback 2.

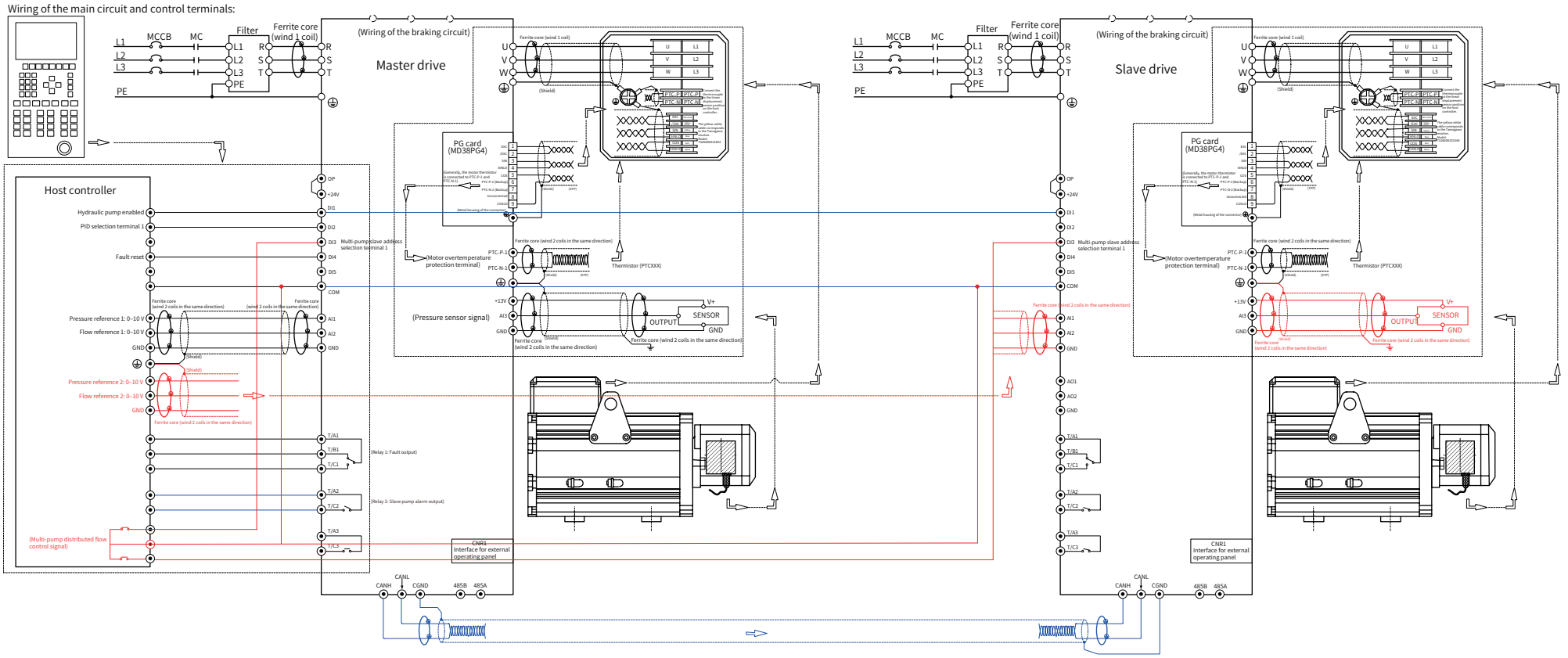


Figure C-22 Wiring diagram for multi-pump distributed flow in multi-pump mode 2

NOTE

- Connect the slave pump alarm output signal (set F5-02 to 25) to the host controller for alarm display.
- In this control mode, the slave drive independently receives the pressure feedback 2 sent by the pressure sensor installed in the oil circuit of the slave pump. Therefore, high pressure without cause will never occur in the oil circuit of the slave pump in the pressure control state.

Appendix D Modbus Communication Protocol

The IS580 provides a RS485 communication interface and supports Modbus RTU communication protocol. Through the Modbus communication protocol, you can implement the centralized control of the drive, such as setting the running commands, modifying or reading parameters, and reading the running status and fault information, by using a computer or programmable logic controller (PLC).

This protocol defines the content and format of messages transmitted through serial communication, including the master polling (or broadcasting) format and the master coding method (parameter No. for the action, transmission data, and error check). The slave uses the same structure in the response, including action confirmation, data returning, and error check. If an error occurs when the slave receives a message, or the slave cannot complete the action required by the master, the slave returns a fault message (response) to the master.

D.1 Application Method

As a slave, the servo drive is connected to a "single-master multi-slave" PC/PLC control network with RS485 bus.

D.2 Bus Structure

1) Hardware interface

An RS485 expansion card MD38TX1 is required for the drive.

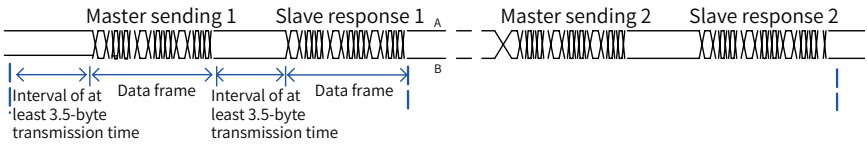
2) Topological structure

The system consists of a single master and multiple slaves. Each device in the network has a unique slave address. Among them, a device (usually a PC, PLC or HMI) serves as the master and initiates communication to read or write parameters of the slaves. Other devices serve as slaves and respond to query or communication operations from the master. Only one device is allowed to transmit data at the same moment, and other devices receive data.

The address range of slaves is 1 to 247. The value "0" is a broadcasting communication address. A slave must have a unique address in the network.

3) Communication transmission mode

The asynchronous serial and half-duplex transmission mode is used. In the process of asynchronous serial communication, data is sent frame by frame in the form of message. In Modbus RTU protocol, an interval of at least 3.5-byte transmission time marks the end of the previous message. A new message starts to be sent after this interval.



The built-in communication protocol of the IS580 is the Modbus RTU slave communication protocol, which allows the drive to provide data to respond to a "query/command" from the master or execute the action according to "query/command" from the master.

The master can be a PC, an industrial control device, or a PLC. It can communicate with a single slave or send broadcast messages to all slaves. When the master communicates with a single slave, the slave needs to return a message (response) to the "query/command" from the master, but it does not need to return a response to a broadcast message sent by the master.

Appendix E Use of CANopen

E.1 Servo Drive Parameter Setting

Set parameters in the following order.

Table E-1 Parameter setting in the CANopen mode

Parameter No.	Setting Range	Description
A2-00	4: 500 Kbps	Baud rate
A2-01	1–8	Drive station number
A3-00	6	CANopen mode
F0-02	2	Command source: communication control

E.2 Default RPDO Setting

By default, the IS580 receives references from the host controller through RPDO1. The mapping objects for RPDO1 include PQ control word, multi-pump control word, pressure reference, and flow reference, as shown in the following table.

Table E-2 Default mapping objects for RPDO1

RPDO1: 0x20x (x indicates node ID)				
	Mapping object 1	Mapping object 2	Mapping object 3	Mapping object 4
Object Name	PQ control word	Multi-pump control word	Pressure (0.1 bar)	Flow (0.01%)
Object index	0x2073-01	0x2073-02	0x2073-03	0x7303-04

E.2.1 Description of PQ Control Word

PQ control word includes the running mode and the drive running command information. As shown in the following table, the value of reserved bits (Bit3, Bit4, Bit5, and Bits 8 to 15) is 0 and the value of Bit6 and Bit7 is fixed to 1. By adjusting the control word of Bit0, Bit1, and Bit2, you can enable, disable or reset the servo drive.

Table E-3 Content definition of PQ control word

Item	Bits 8 to 15	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Bit description	Reserved	1	1	Reserved	Reserved	Reserved	Control word 001: Forward running 010: Reverse running 101: Coast to stop 110: Decelerate to stop 111: Fault reset		
Forward running (H00C1)	H00	1	1	0	0	0	001		
Coast to stop (H00C5)	H00	1	1	0	0	0	101		

Item	Bits 8 to 15	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Fault reset (H00C7)	H00	1	1	0	0	0	111		

E.2.2 Description of Multi-Pump Control Word

The multi-pump control word is used to set the working mode (master pump mode and slave pump mode) of the servo drive. The control words are 16-bit unsigned integers. The following table shows the meaning of each bit.

Table E-4 Description of multi-pump control word

Example	Multi-Pump Control Word							
	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
H0441	-	0	0	0	0	1	0	0
	-	Master pump	Master pump	Master pump	Master pump	Slave pump	Master pump	Master pump
Example	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
H0441	0	1	0	0	0	0	0	1
	Master pump	Slave pump	Master pump	Master pump	Master pump	Master pump	Master pump	Slave pump

◆ Note: Bit0 to Bit14 correspond to drives with node IDs 1 to 15. If the bit corresponding to the multi-pump control word received by the drive is 0, the drive runs in the master pump mode. Otherwise, the drive runs in the slave pump mode.

E.2.3 Description of Pressure Reference

The pressure references are 16-bit unsigned integers with a unit of 0.1 bar. The following table gives some examples of pressure reference.

Table E-5 Examples of pressure reference

Reference Data	Reference Meaning
H01F4 (500)	50.0 bar
H03E8 (1000)	100.0 bar
H07D0 (2000)	200.0 bar

E.2.4 Description of Flow Reference

Table E-6 Examples of flow reference

Reference Data	Reference Meaning
H07D0 (2000)	20.00%
H1388 (5000)	50.00%
H2710 (10000)	100.00%

E.3 Applications

E.3.1 Running in Single-Master Mode

In applications where there is only one servo drive, the drive is used as the independent master pump. If the node ID of the drive is 1, the drive runs in the forward direction at a pressure of 70 bar and a flow of 50%. The host controller uses default RPDO1 for communication. The RPDO1 data is as follows.

Table E-7 Example of independent master pump running

COB-ID	PQ Control Word	Multi-Pump Control Word	Pressure (0.1 bar)	Flow (0.01%)
201	H00C1	H0000	H02BC (700)	H1388 (5000)

E.3.2 Running in Single-Master Multi-Slave Mode

When there are three drives whose node IDs are 1, 2, and 3 respectively in the network, the drive whose node ID is 1 serves as the master pump, and the other two drives work as slave pumps running by following the master pump. If the pressure is 70 bar and the flow is 50%, the RPDO1 data sent by the host controller to servo drives is as follows.

Table E-8 Example of single-master multi-slave mode

COB-ID	PQ Control Word	Multi-Pump Control Word	Pressure (0.1 bar)	Flow (0.01%)
201	H00C1	H0006	H02BC (700)	H1388 (5000)
202	H00C1	H0006	H02BC (700)	H1388 (5000)
203	H00C1	H0006	H02BC (700)	H1388 (5000)

E.3.3 Running in Multi-Master Multi-Slave Mode

When there are four drives whose node IDs are 1, 2, 3, and 4 respectively in the network, the drive whose node ID is 2 serves as the slave pump of the drive whose node ID is 1, and the drive whose node ID is 3 serves as the slave pump of the drive whose node ID is 4. If the pressure is 70 bar and the flow is 50%, the RPDO1 data sent by the host controller to drives whose node IDs are 1 and 2 are shown in Table E-9, and the data sent to drives whose node IDs are 3 and 4 are shown in Table E-10.

Table E-9 RPDO1 data received by drives whose node IDs are 1 and 2

COB-ID	PQ Control Word	Multi-Pump Control Word	Pressure (0.1 bar)	Flow (0.01%)
201	H00C1	H0002	H02BC (700)	H1388 (5000)
202	H00C1	H0002	H02BC (700)	H1388 (5000)

Table E-10 RPDO1 data received by drives whose node IDs are 3 and 4

COB-ID	PQ Control Word	Multi-Pump Control Word	Pressure (0.1 bar)	Flow (0.01%)
203	H00C1	H0004	H02BC (700)	H1388 (5000)
204	H00C1	H0004	H02BC (700)	H1388 (5000)



NOTE

- The references for the master and slave pumps in the same group are identical. The multi-pump control word received by each group of master and slave pumps is different when there are multiple groups of master and slave pumps.

E.4 Transmitting Time of TPDO1 and TPDO2

TPDO1 Triggers 0x1800/TPDO2 Triggers 0x1801			
Sub-index	Description	Default	Unit
3	Disabling time	500 (50 ms)	100 μs
5	Event time	150 (150 ms)	1 ms

E.5 Object Indices of Commonly-Used Monitoring Data

Object Index	Description	Minimum Unit	Description
0x2071-03	Feedback oil pressure	0.1 kg/cm^2	-
0x2071-04	Motor speed	1 rpm	-
0x2070-05	Output current	0.1 A	-
0x2070-07	Output torque	0.1%	-
0x2070-06	Output power	0.1 kW	-
0x2070-0E	Output voltage	1 V	-
0x2073-0F	Fault code	-	High 8 bits indicate the fault code and low 8 bits indicate the fault subcode.
0x2070-03	Bus voltage	0.1 V	-

E.6 Heartbeat Protection

Heartbeat Consumption Time (0x1016)		
Sub-index	Default	Description
Sub1	0x007F012C	12C indicates 300 ms. If the drive does not receive a heartbeat message from the master station within 300 ms, E42.11 will be reported.

E.7 RPDO1 Communication Time Setting

RPDO1 Time Setting (0x1400)			
Sub-index	Description	Default	Unit
3	Disabling time	30 (3 ms)	100 μs
5	Event time	10 (10 ms)	1 ms

E.8 EDS File

You can ask the technical personnel of Inovance for EDS files.



NOTE

- In the case of low network load rate, you can increase the PDO transmission cycle to 2 ms to improve the drive response.
- RPDO4 is used in the IS580 to support multi-pump function. It cannot be modified externally. Therefore, do not use it.

Appendix F Parameter Table

If FP-00 (User password) is set to a non-zero value, the password protection is enabled. The parameter menu is accessible in the parameter and user-modified modes only after the correct password is entered. To disable the password protection, set FP-00 (User password) to 0.

The user password is only used for locking the operating panel. If the password protection is enabled, you must enter the correct password to read or write parameters using the operating panel. However, you need to enter the password again to get access if you want to operate the operating panel one hour later. Reading and writing of parameters (except parameters in group FP) are allowed without the password during communication control.

Groups FX and AX include basic function parameters, and group U includes the monitoring function parameters. The symbols in the following parameter tables are described as follows:

☆ : The parameter can be modified when the drive is in the stop or running state.

★ : The parameter cannot be modified when the drive is running.

● : The parameter value is the measured value and cannot be modified.

*: The parameter is a factory parameter and can be set only by the manufacturer.

F.1 Basic Function Parameters

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
Group A0: Flux-Weakening Control Parameters					
A0-00	Flux-weakening control mode of synchronous motor	0: Direct computing 1: Automatic adjustment	1	0	★
A0-01	Flux-weakening current coefficient	0–500	1	5	☆
A0-02	Flux-weakening depth of synchronous motor	0% to 50%	1%	5%	☆
A0-03	Maximum force adjustment gain of synchronous motor	20% to 300%	1%	100%	☆
A0-04	Exciting current adjustment gain calculated by synchronous motor	40% to 200%	1%	100%	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
Group A1: PG Card Parameters					
A1-00	Type of PG card	0: Resolver 1: 23-bit PG card 2: Standard ABZ encoder	1	0	★
A1-02	Encoder installation angle	0.0° to 359.9°	0.1°	0.0	☆
A1-03	Speed feedback direction	0: Same as the motor rotation direction 1: Reverse to the motor rotation direction	1	—	★
A1-04	Number of resolver poles	1–50	1	Model dependent	★
A1-05	Detection time of PG card disconnection protection	0.000s to 0.050s	0.001s	0.020s	☆
A1-06	Encoder PPR	3–65535	1	1024	★
A1-07	23-bit PG card disconnection detection	0: Disabled 1: Enabled	1	1	★
A1-08	Number of detected encoder interferences	0–60000	1	0	☆
A1-09	"Auto-tuning free" function	0: Disabled 1: Enabled	1	0	★
Group A2: CAN Communication Parameters					
A2-00	Baud rate	0: 20 K 1: 50 K 2: 125 K 3: 250 K 4: 500 K 5: 1 M	1	4	☆
A2-01	CAN communication address	1–64	1	1	☆
A2-02	Communication disconnection detection time	0.1s to 600.0s	0.1s	0.3s	☆
A2-03	CAN multi-pump mode	0: Broadcasting mode 1: Multi-master mode	1	0	☆
A2-04	CAN slave pump address 1	0–65535	1	0	☆
A2-05	CAN slave pump address 2	0–65535	1	0	☆
A2-06	CAN slave pump address 3	0–65535	1	0	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A2-07	CAN slave pump address 4	0–65535	1	0	☆
A2-09	CAN protocol in speed mode	0: Reserved 1: CANopen 2: Reserved	1	0	★
A2-10	CANopen expert mode	0: Disabled 1: Enabled	1	0	★
A2-11	PDO disabling time in CANopen mode	0–65535	1	0	★
A2-12	CANopen event trigger time	0 ms to 65535 ms	1 ms	2 ms	★
Group A3: Basic Oil Pressure Parameters					
A3-00	Oil pressure control mode	0: Non-oil pressure control mode 1: Oil pressure control mode 1 (CAN channel setting) 2: Oil pressure control mode 2 (Analog channel setting) 3: EST mode 1 4: RS485/PN mode 5: EST mode 3 6: CANopen mode (See "Appendix E Use of CANopen" on page 256 for details about CANopen communication protocol) 7: Reserved	1	0	★
A3-01	Maximum motor speed	1–30000 rpm	1 rpm	2000 rpm	★
A3-02	System pressure	0.0 kg/cm^2 to A3-03	0.1 kg/cm^2	175.0 kg/cm^2	☆
A3-03	Maximum oil pressure	A3-02 to 500.0 kg/cm^2	0.1 kg/cm^2	250.0 kg/cm^2	☆
A3-04	Rising time of 1st group of oil pressure references	0.000s to 2.000s	0.001s	0.125s	☆
A3-05	1st group of oil pressure control K_p	0.0–800.0	0.1	210.0	☆
A3-06	1st group of oil pressure control T_i	0.001s to 10.000s	0.001s	0.040s	☆
A3-07	1st group of oil pressure control T_d	0.000s to 1.000s	0.001s	0.000s	☆
A3-08	Maximum reverse motor speed	0.0% to 100.0%	0.1%	10.0%	☆
A3-09	Base flow	0.0% to 50.0%	0.1%	0.5%	☆
A3-10	Base pressure	0.0–50.0 kg/cm^2	0.1 kg/cm^2	0.5 kg/cm^2	☆
A3-11	2nd group of oil pressure control K_p	0.0–800.0	0.1	210.0	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A3-12	2nd group of oil pressure control T_i	0.001s to 10.000s	0.001s	0.040s	☆
A3-13	2nd group of oil pressure control T_d	0.000s to 1.000s	0.001s	0.000s	☆
A3-14	3rd group of oil pressure control K_p	0.0–800.0	0.1	210.0	☆
A3-15	3rd group of oil pressure control T_i	0.001s to 10.000s	0.001s	0.100s	☆
A3-16	3rd group of oil pressure control T_d	0.000s to 1.000s	0.001s	0.000s	☆
A3-17	4th group of oil pressure control K_p	0.0–800.0	0.1	210.0	☆
A3-18	4th group of oil pressure control T_i	0.001s to 10.000s	0.001s	0.100s	☆
A3-19	4th group of oil pressure control T_d	0.000s to 1.000s	0.001s	0.000s	☆
A3-20	Zero drift self-adjustment of analog channel	0: Disabled 1: Enabled	1	0	★
A3-21	Pressure sensor disconnection detection time	0.001s to 60.000s	0.001s	0.500s	☆
A3-22	Maximum output speed in pressure control state	0.0% to 100.0%	0.1%	10.0%	☆
A3-23	Minimum output oil pressure in pressure control state	0.0% to 100.0%	0.1%	60.0%	☆
A3-24	Output delay time in pressure control state	0.001s to 10.000s	0.001s	0.100s	☆
A3-25	Rising S-curve filter time of 1st group of oil pressure references	0.001s to 1.000s	0.001s	0.030s	☆
A3-26	Falling S-curve filter time of 1st group of oil pressure references	0.001s to 1.000s	0.001s	0.030s	☆
A3-27	Overshoot suppression detection level of 1st group of oil pressure	0–2000	1	80	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A3-28	Overshoot suppression coefficient of 1st group of oil pressure	0–3.000	0.001	0.200	☆
A3-29	Oil pressure loop gain coefficient	0.20–5.00	0.01	1.00	☆
A3-30	Torque upper limit for switchover from pressure mode to speed mode	50.0% to 250.0%	0.1%	160.0%	☆
A3-31	Delay of 1st group of oil pressure reference	0.000s to 0.500s	0.001s	0.000s	☆
A3-32	Slave speed reference minimum input	0.0% to A3-34	0.1%	0.0%	☆
A3-33	Corresponding value of slave speed reference minimum input	-100.0% to 100.0%	0.1%	0.0%	☆
A3-34	2nd point input of slave speed reference	A3-32 to A3-36	0.1%	0.0%	☆
A3-35	Corresponding value of the 2nd point input of slave speed reference	-100.0% to 100.0%	0.1%	0.0%	☆
A3-36	Slave speed reference maximum input	A3-34 to 100.0%	0.1%	100.0%	☆
A3-37	Corresponding value of slave speed reference maximum input	-100.0% to 100.0%	0.1%	100.0%	☆
A3-38	Whether the slave speed consistent with master speed in multi-pump mode	0: Inconsistent 1: Consistent	1	0	☆
A3-39	Pressure holding gain in multi-pump convergent flow mode	20–800	1	100	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A3-40	Deviation of pressure jitter elimination by decreasing PI during multi-pump injection	0.0–50.0 kg	0.1 kg	5.0 kg	☆
A3-41	Lower limit of flow jitter elimination by decreasing PI during multi-pump injection	0–30000 rpm	1 rpm	0 rpm	☆
A3-42	Detection time of flow jitter elimination by decreasing PI durinh multi-pump injection	0.200s to 2.000s	0.001s	0.400s	☆
A3-43	Pressure deviation when the slave pump does not run in multi-pump CAN communication mode	0–50.0 kg	0.1 kg	5.0kg	☆
A3-44	Flow lower limit when the slave pump does not run in multi-pump CAN communication mode	-100.0% to 100.0%	0.1%	0.0%	☆
A3-45	Stop judging delay when the slave pump receives no speed reference	0.100s to 5.000s	0.001s	1.000s	☆
A3-46	Deceleration time before stop when the slave pump receives no speed reference	0.001s to 5.000s	0.001s	0.200s	☆
A3-47	Pressure relief delay when starting the valve	0.001s to 5.000s	0.001s	0.100s	☆
A3-48	Pressure relief delay when exiting the valve	0.001s to 5.000s	0.001s	0.100s	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A3-49	Pressure deviation lower limit of pressure relief when starting the valve	0.0 to A3-02	0.1 kg	0.0 kg	☆
A3-50	Pressure setting lower limit of pressure relief when starting the valve	0.0 to A3-02	0.1 kg	0.0 kg	☆
A3-51	Current lower limit of pressure sensor fault detection	20% to 300%	1%	100%	☆
A3-52	Speed upper limit of pressure sensor fault detection	20% to 100%	1%	50.0%	☆
A3-53	Falling time of 2nd group of high-speed flow	0.000s to 5.000s	0.001s	0.100s	☆
A3-54	Judging value of 2nd group of high-speed flow	0 to 100.0%	0.1%	100.0%	☆
A3-55	Pressure deviation of pressure relief when stopping the valve	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2	0.0 kg/cm^2	☆
A3-56	Torque upper limit in zero torque mode	0.0% to 250.0%	0.1%	0.00%	☆
A3-57	Upper limit of pressure sensor fault detection	A3-58 to 11.000 V	0.001 V	10.000 V	☆
A3-58	Lower limit of pressure sensor fault detection	0.000 V to A3-57	0.001 V	0 V	☆
A3-59	Pressure sensor fault detection time	0.000s to 60.000s	0.001s	0.000s	☆
A3-60	Pressure sensor signal output mode	0: 0–10 V output (4–20 mA, jumper is required) 1: 1–5 V output 2: 1–6 V output 3: 1–10 V output 4: 0.25–10.25 V output	1	0	☆
A3-61	Update cycle of multi-master pump reference in EST mode 3	10–30 ms	1 ms	10 ms	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A3-63	High-voltage/ Low-voltage PI parameter switchover	0: Disabled 1: Enabled	1	0	☆
A3-64	1st group of low-voltage control K_p	0.0–800.0	0.1	210.0	☆
A3-65	1st group of low-voltage control T_i	0.001–10.000	0.001	0.500	☆
A3-66	1st group of high-voltage control K_p	0.0–800.0	0.1	260.0	☆
A3-67	1st group of high-voltage control T_i	0.001–10.000	0.001	0.020	☆
A3-68	Lower-voltage threshold	0.0 to A3-69	0.1 bar	50.0 bar	☆
A3-69	High-voltage threshold	A3-69 to A3-02	0.1 bar	100.0 bar	☆
A3-70	Lower-voltage threshold to stop salve pump	A3-71 to A3-02	0.1 bar	0.0 bar	☆
A3-71	Allowable range of oil pressure threshold to stop salve pump	0 to A3-70	0.1 bar	0.0 bar	☆
A3-72	Delay of switchover from DI52 function to DI57 function	0.000s to 0.500s	0.001s	0.000s	☆
A3-73	Automatic exit time of DI52 function	0.000s to 0.500s	0.001s	0.000s	☆
Group A4: Optimized Oil Pressure Parameters					
A4-00	Filter time of current display	0.000s to 5.000s	0.001s	0.005s	☆
A4-01	Filter time of motor speed display	0.000s to 5.000s	0.001s	0.010s	☆
A4-02	Falling time of 1st group of oil pressure references	0.001s to 2.000s	0.001s	0.020s	☆
A4-03	Rising time of 1st group of flow references	0s to 5.000s	0.001s	0.080s	☆
A4-04	Falling time of 1st group of flow references	0s to 5.000s	0.001s	0.080s	☆
A4-05	Reserved	Reserved	-	-	-
A4-06	Flow leakage compensation	0.0% to 50.0%	0.1%	0.0%	☆
A4-08	Minimum relief pressure during reverse rotation	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2	0.0 kg/cm^2	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A4-09	Protection time for long-time pressure relief during reverse rotation	0.0s to 500.0s	0.1s	0.000s	☆
A4-10	Rising S-curve filter time of 2nd group of oil pressure references	0.001s to 1.000s	0.001s	0.030s	☆
A4-11	Falling S-curve filter time of 2nd group of oil pressure references	0.001s to 1.000s	0.001s	0.030s	☆
A4-12	Rising time of 2nd group of flow references	0.001s to 5.000s	0.001s	0.080s	☆
A4-13	Falling time of 2nd group of flow references	0.001s to 5.000s	0.001s	0.080s	☆
A4-14	Rising time of 2nd group of oil pressure references	0.001s to 2.000s	0.001s	0.125s	☆
A4-15	Falling time of 2nd group of oil pressure references	0.001s to 2.000s	0.001s	0.150s	☆
A4-16	Overshoot suppression detection level of 2nd group of oil pressure	1–2000	1	80	☆
A4-17	Overshoot suppression coefficient of 2nd group of oil pressure	0.001s to 3.000s	0.001s	0.200s	☆
A4-18	Delay of 2nd group of oil pressure references	0.000s to 0.500s	0.001s	0.000s	☆
A4-22	Oil pressure deviation threshold of oil pressure suppression canceling	0 to A3-02	0.1 kg	10.0 kg	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A4-23	Maximum integral limit deviation	0 to A3-02	0.1 kg	45.0 kg	☆
A4-24	Integral limit mode selection	0–1	1	0	☆
A4-25	Increase of pressure loop output upper limit	0–50.0	0.1s	2.0	☆
A4-26	Oil pressure PID algorithm selection	0: Standard oil pressure algorithm 1: Specialized algorithm 1 2: Specialized algorithm 2 3: Specialized algorithm 3	1	3	★
A4-29	Overshoot suppression pressure threshold of 1st group of oil pressure impact	0 to 100.0% (Perform overshoot suppression when A4-29 exceeds 100%)	0.1%	70.0%	☆
A4-30	Overshoot suppression coefficient K_d of 1st group of oil pressure impact	0–1.00 (A larger value indicates a stronger suppression)	0.01	0.4	☆
A4-31	Overshoot suppression pressure threshold of 2nd group of oil pressure impact	0 to 100.0% (Perform overshoot suppression when A4-31 exceeds 100%)	0.1%	70.0%	☆
A4-32	Overshoot suppression coefficient K_d of 2nd group of oil pressure impact	0–1.00 (A larger value indicates a stronger suppression)	0.01	0.4	☆
A4-33	Integral regulation coefficient 1 of algorithm 3	0–1.00	0.01	0.08	☆
A4-34	Integral regulation coefficient 2 of algorithm 3	0–1.00	0.01	0.08	☆
A4-35	Integral regulation coefficient 3 of algorithm 3	0–1.00	0.01	0.08	☆
A4-36	Integral regulation coefficient 4 of algorithm 3	0–1.00	0.01	0.08	☆

<table>
<tr><th>Param. No.</th><th>Param. Name</th><th>Setting Range</th><th>Min. Unit</th><th>Default</th><th>Property</th></tr>
<tr><td colspan="6">Group A6: Multi-Speed Parameters</td></tr>
<tr><td>A6-00</td><td>Speed change point 1 in multi-speed mode</td><td rowspan="16">Set F0-03 (Main frequency source) to 6 (Multi-speed) to set the speed by using DI terminals allocated with functions 12, 13, 14, and 15. By taking terminals DI1 to DI4 as an example, the following table describes the relationship between terminals and speed segments:
<table><tr><th rowspan="2">Speed Segment</th><th colspan="4">Terminal Status</th></tr><tr><th>DI4
15#</th><th>DI3
14#</th><th>DI2
13#</th><th>DI1
12#</th></tr><tr><td>A6-00</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>A6-01</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>A6-02</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>A6-03</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>A6-04</td><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>A6-05</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>A6-06</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>A6-07</td><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>A6-08</td><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>A6-09</td><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>A6-10</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>A6-11</td><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>A6-12</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>A6-13</td><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>A6-14</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>A6-15</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>Setting range: 1 to A6-16</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-01</td><td>Speed change point 2 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-02</td><td>Speed change point 3 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-03</td><td>Speed change point 4 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-04</td><td>Speed change point 5 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-05</td><td>Speed change point 6 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-06</td><td>Speed change point 7 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-07</td><td>Speed change point 8 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-08</td><td>Speed change point 9 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-09</td><td>Speed change point 10 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-10</td><td>Speed change point 11 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-11</td><td>Speed change point 12 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-12</td><td>Speed change point 13 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-13</td><td>Speed change point 14 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-14</td><td>Speed change point 15 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
<tr><td>A6-15</td><td>Speed change point 16 in multi-speed mode</td><td>1 rpm</td><td>100 rpm</td><td>☆</td></tr>
</table>

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
A6-16	Speed upper limit	0–65535 rpm	1 rpm	3000 rpm	*
Group F0: Basic Control Parameters					
F0-00	Model selection	1: G type	1	1	●
F0-01	Control mode	0: SVC 1: FVC 2: V/f control	1	1	★
F0-02	Command source	0: Operating panel control 1: Terminal control 2: Communication control	1	0	☆
F0-03	Main frequency source	0: Set by digits, with adjustment using UP or DOWN key (not retentive) 1: Set by digits, with adjustment using UP or DOWN key (retentive) 2: AI1 3: AI2 4: AI3 5 to 8: Reserved 9: Communication	1	0	★
F0-08	Preset frequency	0.00 Hz to F0-10	0.01 Hz	100.00 Hz	☆
F0-09	Rotational direction selection	0: Same as the default direction 1: Reverse to the default direction	1	0	★
F0-10	Maximum frequency	50.00–300.00 Hz	0.01 Hz	200.00 Hz	★
F0-11	Source of frequency upper limit	0: F0-12 1: AI1 2: AI2 3: AI3 4: Reserved 5: Communication	1	0	★
F0-12	Frequency upper limit	F0-14 to F0-10	0.01 Hz	200.00 Hz	☆
F0-13	Frequency upper limit offset	0.00 Hz to F0-10	0.01 Hz	0.00 Hz	☆
F0-14	Frequency lower limit	0.00 Hz to F0-12	0.01 Hz	0.00 Hz	☆
F0-15	Carrier frequency	2.0–8.0 kHz	0.1 kHz	Model dependent	☆
F0-16	Carrier frequency adjusted with temperature	0: Disabled 1: Enabled	1	1	☆
F0-17	Acceleration time	0.0s to 6500.0s	0.1s	20.0s	☆
F0-18	Deceleration time	0.0s to 6500.0s	0.1s	20.0s	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
Group F1: Motor Parameters					
F1-00	Motor type	0: Asynchronous motor 1: Variable frequency asynchronous motor 2: PMSM	1	2	★
F1-01	Rated power	0.4–1000.0 kW	0.1 kW	Model dependent	★
F1-02	Rated voltage	0–800 V	1 V	Model dependent	★
F1-03	Rated current	0.0–6500.0 A	0.1 A	Model dependent	★
F1-04	Rated frequency	0.00–300.00 Hz	0.01 Hz	Model dependent	★
F1-05	Rated speed	0–30000 rpm	1 rpm	Model dependent	★
F1-11	D-axis inductance (synchronous motor)	0–65.535 mH	1 mH	Model dependent	★
F1-12	Q-axis inductance (synchronous motor)	0–65.535 mH	1 mH	Model dependent	★
F1-13	Synchronous motor stator resistance	0–65.535 Ω	1 Ω	Model dependent	★
F1-14	Motor manufacturer selection	0: Disabled 1: Manual input of A1-02 (Encoder installation angle) 2: Reserved 3: Inovance	1	0	☆
F1-15	Back EMF of synchronous motor	0–65535 V	1 V	Model dependent	★
F1-16	Auto-tuning mode	0: No action 1: No-load static auto-tuning 2: No-load dynamic auto-tuning, high-speed rotation in reverse direction 3: With-load static auto-tuning 4: Rapid no-load dynamic auto-tuning, high-speed rotation in reverse direction 5: No-load dynamic auto-tuning, high-speed rotation in forward direction 6: Rapid no-load dynamic auto-tuning, high-speed rotation in forward direction	1	0	★

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
Group F2: Vector Control Parameters					
F2-00	Speed loop proportional gain 1	1–400	1	60	☆
F2-01	Speed loop integral time 1	0.01s to 10.00s	0.01s	0.3s	☆
F2-02	Speed loop switchover frequency 1	0.00 Hz to F2-05	0.01 Hz	5.00 Hz	☆
F2-03	Speed loop proportional gain 2	1–400	1	60	☆
F2-04	Speed loop integral time 2	0.01s to 10.00s	0.01s	0.3s	☆
F2-05	Speed loop switchover frequency 2	F2-02 to F0-10	0.01 Hz	10.00 Hz	☆
F2-06	Switchover frequency in PWM mode	0.00 Hz to F0-10	0.01 Hz	0.00 Hz	☆
F2-07	Speed feedback filter time	0.5–10.0 ms	0.1 ms	1.0 ms	☆
F2-08	Torque control selection	0: Speed control 1: Torque control	0	0	☆
F2-09	Torque source selection	0: F2-10 1: AI1 2: AI2 3: AI3 4: Reserved 5: Communication	0	0	☆
F2-10	Torque upper limit	0.0% to 250.0%	0.1%	200.0%	☆
F2-11	Torque filter bandwidth	0–1500 Hz	1 Hz	500 Hz	☆
F2-12	VC overvoltage suppression	0: Disabled 1: Enabled	1	0	☆
F2-13	Low-speed proportional gain of current loop	0.2–5.0	0.1	1.0	★
F2-14	Low-speed integral gain of current loop	0.2–5.0	0.1	1.0	★
F2-15	High-speed proportional gain of current loop	0.2–5.0	0.1	1.0	★
F2-16	High-speed integral gain of current loop	0.2–5.0	0.1	1.0	★

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F2-17	High-speed adjustment of M-axis current loop	1% to 100%	1%	1%	☆
F2-18	High-speed adjustment of T-axis current loop	1% to 100%	1%	1%	☆
F2-19	VC excitation boost	0 to 20.0%	0.1%	0.1%	☆
F2-20	ASR switchover frequency during position lock	0 Hz to F0-10	0.01 Hz	50.00 Hz	★
F2-21	VC slip compensation coefficient	0.5% to 2.00%	0.01%	0.7%	☆
F2-22	VC oscillation suppression mode	0–2	1	0	☆
F2-23	VC oscillation suppression gain	0–100	1	0	☆
F2-24	VC overexcitation gain	0–200	1	0	☆
F2-25	Overvoltage modulation coefficient	100% to 120%	1%	110%	☆
F2-26	Bus voltage filter	0.000–0.100	0.001	0.000	☆
F2-29	Back EMF compensation	0: Disabled 1: Enabled	1	0	★
F2-30	Speed loop parameter	0: Disabled 1: Enabled	1	0	★
F2-31	Expected speed loop bandwidth (high speed)	1.0–200.0 Hz	0.1 Hz	10.0 Hz	☆
F2-32	Expected speed loop bandwidth (low speed)	1.0–200.0 Hz	0.1 Hz	10.0 Hz	☆
F2-33	Expected speed loop bandwidth (zero speed)	1.0–200.0 Hz	0.1 Hz	10.0 Hz	☆
F2-34	Speed loop stiffness level	1–9	1	7	☆
F2-35	System inertia	0.001–50.000	0.001	0.001	★
F2-36	Motor inertia	0.001–50.000	0.001	0.001	★

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F2-37	Maximum frequency of inertia auto-tuning	20% to 100%	1%	80%	★
F2-38	Acceleration/ Deceleration time of inertia auto-tuning	1.0s to 50.0s	0.1s	15.0s	★
F2-39	Bandwidth 1 of speed loop dynamic optimization test	1.0–200.0 Hz	0.1 Hz	5.0 Hz	★
F2-40	Bandwidth 2 of speed loop dynamic optimization test	1.0–200.0 Hz	0.1 Hz	10.0 Hz	★
F2-41	Bandwidth 3 of speed loop dynamic optimization test	1.0–100.0 Hz	0.1 Hz	15.0 Hz	★
F2-42	Bandwidth 4 of speed loop dynamic optimization test	1.0–200.0 Hz	0.1 Hz	20.0 Hz	★
F2-43	Inertia auto-tuning and dynamic speed reference	0 to 100%	1%	30%	★
F2-44	Rotor time constant check	0: Disabled 1: Enabled	1	0	★
F2-45	Torque amplitude of rotor time constant check	10% to 100%	1%	30%	★
F2-46	Number of times of rotor time constant check	1–6	1	3	★
F2-47	Inertia auto-tuning	0: Disabled 1: Enabled	1	0	★
F2-48	Speed loop bandwidth during inertia auto-tuning	0.1–100.0 Hz	0.1 Hz	10.0 Hz	★
F2-49	Inertia auto-tuning direction	0–1	1	1	★
F2-50	Inertia auto-tuning mode	0–1	1	0	★

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F2-51	Acceleration/ Deceleration coefficient of inertia auto-tuning	0.1–10.0	0.1	1	★
Group F3: V/f Control Parameters					
F3-00	V/f curve selection	0: Linear V/f 1: Multi-point V/f 2: Square V/f 3: 1.2-power V/f 4: 1.4-power V/f 6: 1.6-power V/f 8: 1.8-power V/f 9: Reserved 10: V/f complete separation mode 11: V/f half separation mode	0	0	★
F3-01	Torque boost	0.0% to 30.0%	0.1%	1.0%	☆
F3-02	Torque boost cut-off frequency	0.00 Hz to F0-10	0.01 Hz	50.00 Hz	★
F3-03	Multi-point Vf frequency 1	0.00 Hz to F3-05	0.01 Hz	0.00 Hz	★
F3-04	Multi-point V/f voltage 1	0.0% to 100.0%	0.1%	0.0%	★
F3-05	Multi-point V/f frequency 2	0.00 Hz to F3-07	0.01 Hz	0.00 Hz	★
F3-06	Multi-point V/f voltage 2	0.0% to 100.0%	0.1%	0.0%	★
F3-07	Multi-point V/f frequency 3	0.00 Hz to F1-04	0.01 Hz	0.00 Hz	★
F3-08	Multi-point V/f voltage 3	0.0% to 100.0%	0.1%	0.0%	★
F3-09	V/f slip compensation coefficient	0.0% to 200.0%	0.1%	0.0%	☆
F3-10	V/f overexcitation gain	0–200	1	64	☆
F3-11	V/f oscillation suppression gain	0–100	1	0	☆
F3-12	VC oscillation suppression mode	0–3	1	3	★
F3-13	Voltage source for V/f separation	0–8	1	0	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F3-14	Digital setting of voltage source for V/f separation	0 to F1-02	0	0	☆
F3-15	Voltage rise time of V/f separation	0–1000.0	0.1	0	☆
F3-16	Voltage decline time of V/f separation	0–1000.0	0.1	0	☆
F3-17	Stop mode selection for V/f separation	0–1	1	0	★
F3-18	Operating current of V/f current limit	0–200	1	130	★
F3-19	V/f current limit	0–1	1	1	★
F3-20	V/f current limit suppression gain	0–100	1	20	☆
F3-21	Compensation coefficient of V/f speed multiplying current limit	50–200	1	50	★
F3-22	Operating voltage of V/f voltage limit	650.0–800.0 V	0.1 V	780.0 V	★
F3-23	V/f voltage limit	0–1	1	1	★
F3-24	Suppression frequency gain of V/f voltage limit	0–100	1	30	☆
F3-25	Suppression voltage gain of V/f voltage limit	0–100	1	30	☆
F3-26	Maximum rising limit frequency of V/f voltage limit	0–50	1	5	★
F3-27	Slip compensation time constant	0.1–10.0	0.1	0.5	☆
F3-28	Automatic frequency rise	0–1	1	0	★
F3-29	Minimum motoring torque current	10–100	1	50	★
F3-30	Maximum motoring torque current	10–100	1	20	★
F3-31	Automatic frequency rise K_P	0–100	1	50	☆
F3-32	Automatic frequency rise K_I	0–100	1	50	☆
F3-33	Online torque compensation gain	80–150	1	100	★

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
Group F4: Input Terminals					
F4-00	DI1 function selection	0: No function 1: Forward running enabled 2: Reverse running enabled 3: Three-wire control 4: Forward jog enabled 5: Reverse jog enabled 6 and 7: Reserved 8: Coast to stop 9: Fault reset 10: Reserved 11: External fault NO input 12: Multi-speed terminal 1 13: Multi-speed terminal 2 14: Multi-speed terminal 3 15: Multi-speed terminal 4 16 and 17: Reserved 18: Frequency source switchover 19 to 32: Reserved 33: External fault NC input 34 to 38: Reserved 39: Switchover between frequency source X and preset frequency 40: Switchover between frequency source Y and preset frequency 41 to 47: Reserved 48: PID selection terminal 1 for servo hydraulic pump 49: PID selection terminal 2for servo hydraulic pump 50: CAN communication enabled 51: Slave used as the master 52: Switchover from pressure mode to speed mode (Torque upper limit = AI1/Maximum voltage x A3-30) 53: Slave pump address selection terminal 1 54: Slave pump address selection terminal 2 55: Terminal used for switchover from injection to pressure holding 56: Fault reset terminal 2 (The overcurrent fault cannot be reset.) 57: Switchover from pressure mode to speed mode (Torque upper limit = F2-10.)	1	1	★
F4-01	DI2 function selection		1	48	★
F4-02	DI3 function selection		1	53	★
F4-03	DI4 function selection		1	9	★
F4-04	DI5 function selection		1	50	★
F4-05	DI6 function selection (control card)		1	0	★
F4-06	DI7 function selection (control card)		1	0	★
F4-07	DI8 function selection (control card)		1	0	★

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F4-15	Valid filter time of DI input	1–10	1	4	☆
F4-18	AI1 minimum input	0–10 V	0.01 V	0.02 V	☆
F4-19	Corresponding value of AI1 minimum input	-100.0% to +100.0%	0.1%	0.0%	☆
F4-20	AI1 maximum input	0–10 V	0.01 V	10.00 V	☆
F4-21	Corresponding value of AI1 maximum input	-100.0% to +100.0%	0.1%	100.0%	☆
F4-22	AI1 input filter time	0.000s to 10.000s	0.001s	0.01s	☆
F4-23	AI2 minimum input	0–10 V	0.01 V	0.02 V	☆
F4-24	Corresponding value of AI2 minimum input	-100.0% to +100.0%	0.1%	0.0%	☆
F4-25	AI2 maximum input	0–10 V	0.01 V	10.00 V	☆
F4-26	Corresponding value of AI2 maximum input	-100.0% to +100.0%	0.1%	100.0%	☆
F4-27	AI2 input filter time	0.000s to 10.000s	0.001s	0.005s	☆
F4-28	AI3 minimum input	0–10 V	0.01 V	0.02 V	☆
F4-29	Corresponding value of AI3 minimum input	-100.0% to +100.0%	0.1%	0.0%	☆
F4-30	AI3 maximum input	0–10 V	0.01 V	10.00 V	☆
F4-31	Corresponding value of AI3 maximum input	-100.0% to +100.0%	0.1%	100.0%	☆
F4-32	AI3 input filter time	0.000s to 10.000s	0.001s	0.000s	☆
F4-43	Displayed AI1 voltage 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F4-44	Measured AI1 voltage 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F4-45	Displayed AI1 voltage 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
F4-46	Measured AI1 voltage 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
F4-47	Displayed AI2 voltage 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F4-48	Measured AI2 voltage 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F4-49	Displayed AI2 voltage 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
F4-50	Measured AI2 voltage 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
F4-51	Displayed AI3 voltage 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F4-52	Measured AI3 voltage 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F4-53	Displayed AI3 voltage 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
F4-54	Measured AI3 voltage 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
Group F5: Output Terminals					
F5-01	Control board relay (T/A1-T/B1-T/C1) output selection	0: No output 1: Servo drive in running state 2: Fault output 3 to 5: Reserved 6: Motor overload pre-warning 7: Servo drive overload pre-warning 8 to 11: Reserved 12: Running time reached 13 and 14: Reserved 15: RUN ready 16: AI1 absolute value calibrated by users greater than AI2 absolute value 17 to 19: Reserved 20: Communication setting 21 and 22: Reserved 23: Swashplate switchover 1 of double-discharge piston pump 24: Pressure control status output 25: Slave pump alarm output 26: Swashplate switchover 2 of double-discharge piston pump 27: Bus voltage establishment 28: Business running time reached 29: Business running time less than 24 h 30: DO output of maximum reverse speed 31: Warning output 32: KTY temperature reached output	1	2	☆
F5-02	Control board relay (T/A2-T/C2) output selection		1	23	☆
F5-03	DO1 output selection		1	24	☆
F5-10	AO1 output selection	0: Running frequency 1: Set frequency 2: Output current 3: Output torque 4: Output power 5: Output voltage 6: Reserved 7: AI1 voltage 8: AI2 voltage 9: AI3 voltage 10: Feedback speed 11: Feedback pressure 14: Communication control 12 to 16: Reserved	1	10	☆
F5-11	AO2 output selection		1	11	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F5-14	Zero offset coefficient of AO1 output	-100.0% to +100.0%	0.1%	0.0%	☆
F5-15	AO1 gain	-10.00 to +10.00	0.01	1.00	☆
F5-16	Zero offset coefficient of AO2 output	-100.0% to +100.0%	0.1%	0.0%	☆
F5-17	AO2 gain	-10.00 to +10.00	0.01	1.00	☆
F5-23	Measured AO1 value 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F5-24	Theoretical AO1 output value 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F5-25	Measured AO1 value 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
F5-26	Theoretical AO1 output value 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
F5-27	Measured AO2 value 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F5-28	Theoretical AO2 output value 1	-9.999 V to +9.999 V	0.001 V	2.000 V	☆
F5-29	Measured AO2 value 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
F5-30	Theoretical AO2 output value 2	-9.999 V to +9.999 V	0.001 V	8.000 V	☆
Group F6: Start/Stop Control Parameters					
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	1	0	☆
Group F7: Operating Panel and Display Parameters					
F7-02	STOP/RESET key function	0: STOP/RESET key enabled for both stop and fault reset only in the operating panel control mode 1: STOP/RESET key enabled for stop in terminal control mode 2: STOP/RESET key enabled for fault reset in terminal control mode 3: STOP/RESET key enabled for both stop and fault reset in terminal control mode	1	2	☆
F7-04	LED display parameters during running	H.0000 to H.FFFF	1	H.0270	☆
F7-05	LED display parameters at stop	H.0000 to H.0FFF	1	H.0473	☆
F7-06	Load linear velocity display coefficient	0.0001–6.5000	0.0001	1.0000	☆
F7-07	Heatsink temperature	-1000°C to 1000°C	1°C	-	●
F7-09	Accumulative running time	0–65535 h	1 h	-	●
F7-10	Software version 1	-	-	-	●
F7-11	Software version 2	-	-	-	●

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F7-12	Temporary software version 1	-	-	-	●
F7-13	Temporary software version 2	-	-	-	●
F7-14	Software version of 23-bit PG card (no software version for resolver PG card)	-	-	-	●
Group F8: Auxiliary Function Parameters					
F8-17	Set running time	0–65000 h	1 h	0 h	☆
F8-18	Startup protection	0: Disabled 1: Enabled	1	0	☆
F8-22	Protection against short circuit to ground upon power-on	0: Disabled 1: Enabled	1	1	☆
F8-23	Action selection upon running time reached	0: Disabled 1: Enabled	1	0	☆
F8-24	Software undervoltage threshold	148.5–321.7 VAC (bus voltage = AC voltage input x $\sqrt{2}$)	0.1 V	247.5 V	☆
F8-25	Allowable braking unit enabling time	0.0s to 3600.0s	0.1s	5.0s	☆
F8-27	Protection against short circuit to ground before running	0: Disabled 1: Enabled	1	0	☆
F8-28	Output phase loss protection before running	0: Disabled 1: Enabled	1	0	☆
Group F9: Protection and Fault Parameters					
F9-08	Braking transistor applied voltage	220 V model: 373.2–466.6 V	0.1 V	400.0 V	☆
		380 V model: 644.7–780 V		760.0 V	
F9-12	Input phase loss protection	0: Disabled 1: Enabled	1	1	☆
F9-13	Output phase loss protection	0: Disabled 1: Enabled	1	1	☆
F9-14	Detection value of excessive speed deviation	0.50–50.00 Hz	0.01 Hz	10.00 Hz	☆
F9-15	Detection time of excessive speed deviation	0.0s to 40.0s	0.1s	10.0s	☆
F9-16	Motor overtemperature protection	0: Disabled 1: Enabled	1	1	☆
F9-17	Locked motor rotor judging time	0.000s to 65.535s	0.001s	0.500s	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F9-18	1st fault type	0: No fault 1: Detection circuit fault (E01) 2: Overcurrent during acceleration (E02) 3: Overcurrent during deceleration (E03) 4: Overcurrent at constant speed (E04) 5: Overvoltage during acceleration (E05) 6: Overvoltage during deceleration (E06) 7: Overvoltage at constant speed (E07) 8: Pre-charge resistor fault (E08) 9: Undervoltage (E09) 10: Drive overload (E10) 11: Motor overload (E11) 12: Input phase loss (E12) 13: Output phase loss (E13) 14: IGBT overheat (E14) 15: External input fault (E15) 16: Serial port communication fault (E16) 17: Contactor fault (E17) 18: Current detection fault (E18) 19: Motor auto-tuning fault (E19) 20: Encoder fault (E20) 21: EEPROM reading/writing fault (E21) 22: Reserved (E22) 23: Short circuit to ground (E23) 24: Output inter-phase short circuit (E24) 25: EEPROM address incorrect (E25) 26: Running time reached (E26) 27: Business running time reached (E27) 30: Output load loss(E30) 40: Pulse-by-pulse current limit fault (E40) 41: Reserved 42: CAN communication fault (E42) 43: Encoder auto-tuning fault (E43) 44: Speed deviation protection fault (E44) 45: Motor overtemperature (E45) 46: Pressure sensor fault (E46) 47: Salve fault in multi-pump convergent flow mode (E47) 48: Station number conflict (E48) 49: Encoder fault (E49) 52: Multi-master fault in multi-pump convergent flow mode (E52) 58: Parameter restoring fault (E58) 59: Back EMF auto-tuning fault (E59) 61: Braking transistor working overtime (E61) 62: Braking transistor fault (E62) 63: Reverse running time reached (E63) 66: Regenerative resistor fault (E66) 67: Parameter initialization abnormal (E67)	1	-	●
F9-19	2nd fault type		1	-	●
F9-20	3rd (latest) fault type		1	-	●

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F9-21	Frequency upon 3rd fault	-	-	-	●
F9-22	Current upon 3rd fault	-	-	-	●
F9-23	Bus voltage upon 3rd fault	-	-	-	●
F9-24	Input terminal status upon 3rd fault	-	-	-	●
F9-25	Output terminal status upon 3rd fault	-	-	-	●
F9-26	3rd fault subtype	-	-	-	●
F9-30	Frequency upon 2nd fault	-	-	-	●
F9-31	Current upon 2nd fault	-	-	-	●
F9-32	Bus voltage upon 2nd fault	-	-	-	●
F9-33	Input terminal status upon 2nd fault	-	-	-	●
F9-34	Output terminal status upon 2nd fault	-	-	-	●
F9-35	2nd fault subtype	-	-	-	●
F9-39	Frequency upon 1st fault	-	-	-	●
F9-40	Current upon 1st fault	-	-	-	●
F9-41	Bus voltage upon 1st fault	-	-	-	●
F9-42	Input terminal status upon 1st fault	-	-	-	●
F9-43	Output terminal status upon 1st fault	-	-	-	●
F9-44	1st fault subtype	-	-	-	●
F9-48	Digital output when KTY temperature reached	0–300.0	0.1	0	☆
F9-58	KTY temperature	-40.0°C to +300.0°C	0.1°C	-	●
F9-59	KTY fault temperature threshold	-40.0°C to +300.0°C	0.1°C	130.0	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F9-61	Fault protection action selection	Tens: undervoltage (09) 0: Coast to stop Hundreds: Drive overload (10) 0: Coast to stop 1: Decelerate to stop	1	6000	★
F9-62	Fault protection action selection	Ones: Input phase loss (12) 0: Coast to stop 1: Decelerate to stop Tens: Output phase loss (13) 0: Coast to stop 1: Decelerate to stop Hundreds: Heatsink overheat (14) 0: Coast to stop 1: Decelerate to stop Thousands: External fault (15) 0: Coast to stop 1: Decelerate to stop	1	0	★
F9-63	Fault protection action selection	Ones: RS485 communication fault (16) 0: Coast to stop 1: Decelerate to stop	1	0	★
F9-65	Fault protection action selection	Hundreds: Running time reached (26) 0: Coast to stop 1: Decelerate to stop Thousands: Business running time reached (27) 0: Coast to stop 1: Decelerate to stop	1	0	★
F9-69	Fault protection action selection	Hundreds: CAN communication fault (42) 0: Coast to stop 1: Decelerate to stop Thousands: Auto-tuning fault (43) 0: Coast to stop	1	0	★
F9-70	Fault protection action selection	Ones: Runaway (44) 0: Coast to stop 1: Decelerate to stop Tens: Motor temperature fault (45) 0: Coast to stop 1: Decelerate to stop Hundreds: Sensor fault (46) 0: Coast to stop 1: Decelerate to stop	1	0	★

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
F9-71	Fault protection action selection	Ones: CAN address conflict (48) 0: Coast to stop 1: Decelerate to stop Tens: Resolver PG card disconnection (49) 0: Coast to stop 1: Decelerate to stop	1	0	★
F9-72	Fault protection action selection	Ones: Multi-master fault in multi-pump convergent flow mode (52) 0: Coast to stop 1: Decelerate to stop	1	0	★
F9-73	Fault protection action selection	Thousands: Back EMF fault during auto-tuning (59) 0: Coast to stop 1: Decelerate to stop	1	0	★
F9-74	Fault protection action selection	Thousands: Reverse running time reached (63) 0: Coast to stop 1: Decelerate to stop	1	0	★
F9-87	Runaway protection judging time	0.000s to 5.000s	0.001s	0.030s	☆
Group FA: Business Timing Running Parameters					
These parameters cannot be read and written and are not displayed in the software.					
FA-00	1st running time protection password	0–65535	1	0	☆
FA-01	Timed 1st running time	0–65535 h	1 h	0	☆
FA-02	2nd running time protection password	0–65535	1	0	☆
FA-03	Timed 2nd running time	0–65535 h	1 h	0:	☆
FA-04	3rd running time protection password	0–65535	1	0	☆
FA-05	Timed 3rd running time	0–65535 h	1 h	0:	☆
FA-06	4th running time protection password	0–65535	1	0	☆
FA-07	Timed 4th running time	0–65535 h	1 h	0	☆
FA-08	Accumulative business running time (hour)	0–65535 h	1 h	0	●

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
FA-09	Accumulative business running time (second)	0s to 3600s	1s	0	●
Group FB: Optimized Parameter					
FB-04	Pulse-by-pulse current limit function	0: Disabled 1: Enabled	1	1	★
Group FC: Multi-Point AI Check Parameters					
FC-00	Multi-point AI1 check	0: No check 1: Multi-point check of AI1 2: Multi-point check of AI2 3: Multi-point check of AI1 and AI2	0	0	★
FC-01	Multi-point AI1 minimum input	0–10 V	0.01 V	0.02 V	☆
FC-02	Corresponding value of multi-point AI1 minimum input	-100.0% to +100.0%	0.1%	0.0%	☆
FC-03	Multi-point AI1 inflexion point 1 input	0–10 V	0.01 V	1.00 V	☆
FC-04	Corresponding value of multi-point AI1 inflexion point 1 input	-100.0% to +100.0%	0.1%	10.0%	☆
FC-05	Multi-point AI1 inflexion point 2 input	0–10 V	0.01 V	2.00 V	☆
FC-06	Corresponding value of multi-point AI1 inflexion point 2 input	-100.0% to +100.0%	0.1%	20.0%	☆
FC-07	Multi-point AI1 inflexion point 3 input	0–10 V	0.01 V	3.00 V	☆
FC-08	Corresponding value of multi-point AI1 inflexion point 3 input	-100.0% to +100.0%	0.1%	30.0%	☆
FC-09	Multi-point AI1 inflexion point 4 input	0–10 V	0.01 V	4.00 V	☆
FC-10	Corresponding value of multi-point AI1 inflexion point 4 input	-100.0% to +100.0%	0.1%	40.0%	☆
FC-11	Multi-point AI1 inflexion point 5 input	0–10 V	0.01 V	5.00 V	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
FC-12	Corresponding value of multi-point AI1 inflexion point 5 input	-100.0% to +100.0%	0.1%	50.0%	☆
FC-13	Multi-point AI1 inflexion point 6 input	0–10 V	0.01 V	6.00 V	☆
FC-14	Corresponding value of multi-point AI1 inflexion point 6 input	-100.0% to +100.0%	0.1%	60.0%	☆
FC-15	Multi-point AI1 inflexion point 7 input	0–10 V	0.01 V	7.00 V	☆
FC-16	Corresponding value of multi-point AI1 inflexion point 7 input	-100.0% to +100.0%	0.1%	70.0%	☆
FC-17	Multi-point AI1 inflexion point 8 input	0–10 V	0.01 V	8.00 V	☆
FC-18	Corresponding value of multi-point AI1 inflexion point 8 input	-100.0% to +100.0%	0.1%	80.0%	☆
FC-19	Multi-point AI1 inflexion point 9 input	0–10 V	0.01 V	9.00 V	☆
FC-20	Corresponding value of multi-point AI1 inflexion point 9 input	-100.0% to +100.0%	0.1%	90.0%	☆
FC-21	Multi-point AI1 inflexion point 10 input	0–10 V	0.01 V	10.00 V	☆
FC-22	Corresponding value of multi-point AI1 inflexion point 10 input	-100.0% to +100.0%	0.1%	100.0%	☆
FC-23	Multi-point AI1 inflexion point 11 input	0–10 V	0.01 V	10.00 V	☆
FC-24	Corresponding value of multi-point AI1 inflexion point 11 input	-100.0% to +100.0%	0.1%	100.0%	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
FC-25	Multi-point AI1 inflexion point 12 input	0–10 V	0.01 V	10.00 V	☆
FC-26	Corresponding value of multi-point AI1 inflexion point 12 input	-100.0% to +100.0%	0.1%	100.0%	☆
FC-27	Multi-point AI1 inflexion point 13 input	0–10 V	0.01 V	10.00 V	☆
FC-28	Corresponding value of multi-point AI1 inflexion point 13 input	-100.0% to +100.0%	0.1%	100.0%	☆
FC-29	Multi-point AI1 inflexion point 14 input	0–10 V	0.01 V	10.00 V	☆
FC-30	Corresponding value of multi-point AI1 inflexion point 14 input	-100.0% to +100.0%	0.1%	100.0%	☆
FC-31	Multi-point AI1 inflexion point 15 input	0–10 V	0.01 V	10.00 V	☆
FC-32	Corresponding value of multi-point AI1 inflexion point 15 input	-100.0% to +100.0%	0.1%	100.0%	☆
FC-33	Multi-point AI1 inflexion point 16 input	0–10 V	0.01 V	10.00 V	☆
FC-34	Corresponding value of multi-point AI1 inflexion point 16 input	-100.0% to +100.0%	0.1%	100.0%	☆
FC-35	Multi-point AI1 inflexion point 17 input	0–10 V	0.01 V	10.00 V	☆
FC-36	Corresponding value of multi-point AI1 inflexion point 17 input	-100.0% to +100.0%	0.1%	100.0%	☆
FC-37	Multi-point AI1 maximum input	0–10 V	0.01 V	10.00 V	☆
FC-38	Corresponding value of multi-point AI1 maximum input	-100.0% to +100.0%	0.1%	100.0%	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
FC-39	Multi-point AI2 minimum input	0–10 V	0.01 V	0.02 V	☆
FC-40	Corresponding value of multi-point AI2 minimum input	-100.0% to +100.0%	0.1%	0.0%	☆
FC-41	Multi-point AI2 inflexion point 1 input	0–10 V	0.01 V	1.00 V	☆
FC-42	Corresponding value of multi-point AI2 inflexion point 1 input	-100.0% to +100.0%	0.1%	10.0%	☆
FC-43	Multi-point AI2 inflexion point 2 input	0–10 V	0.01 V	2.00 V	☆
FC-44	Corresponding value of multi-point AI2 inflexion point 2 input	-100.0% to +100.0%	0.1%	20.0%	☆
FC-45	Multi-point AI2 inflexion point 3 input	0–10 V	0.01 V	3.00 V	☆
FC-46	Corresponding value of multi-point AI2 inflexion point 3 input	-100.0% to +100.0%	0.1%	30.0%	☆
FC-47	Multi-point AI2 inflexion point 4 input	0–10 V	0.01 V	4.00 V	☆
FC-48	Corresponding value of multi-point AI2 inflexion point 4 input	-100.0% to +100.0%	0.1%	40.0%	☆
FC-49	Multi-point AI2 inflexion point 5 input	0–10 V	0.01 V	5.00 V	☆
FC-50	Corresponding value of multi-point AI2 inflexion point 5 input	-100.0% to +100.0%	0.1%	50.0%	☆
FC-51	Multi-point AI2 inflexion point 6 input	0–10 V	0.01 V	6.00 V	☆
FC-52	Corresponding value of multi-point AI2 inflexion point 6 input	-100.0% to +100.0%	0.1%	60.0%	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
FC-53	Multi-point AI2 inflexion point 7 input	0–10 V	0.01 V	7.00 V	☆
FC-54	Corresponding value of multi-point AI2 inflexion point 7 input	-100.0% to +100.0%	0.1%	70.0%	☆
FC-55	Multi-point AI2 inflexion point 8 input	0–10 V	0.01 V	8.00 V	☆
FC-56	Corresponding value of multi-point AI2 inflexion point 8 input	-100.0% to +100.0%	0.1%	80.0%	☆
FC-57	Multi-point AI2 inflexion point 9 input	0–10 V	0.01 V	9.00 V	☆
FC-58	Corresponding value of multi-point AI2 inflexion point 9 input	-100.0% to +100.0%	0.1%	90.0%	☆
FC-59	Multi-point AI2 maximum input	0–10 V	0.01 V	10.00 V	☆
FC-60	Corresponding value of multi-point AI2 maximum input	-100.0% to +100.0%	0.1%	100.0%	☆
Group FD: Communication and Oscilloscope Parameters					
FD-00	Baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	1	5	☆
FD-01	Data format	0: No check (8-N-2) 1: Even parity 2: Odd parity 3: No check (8-N-1)	1	0	☆
FD-02	Local address	0–247	1	1	☆
FD-03	Response delay	0–20 ms	1 ms	2 ms	☆
FD-04	Communication timeout	0.0s to 60.0s	0.1s	0.0s	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
FD-30	Software oscilloscope start/ stop	0: Stop 1: Start	1	0.0	☆
FD-31	Channel 1 variable ID	0–999	1	10	☆
FD-32	Channel 2 variable ID	0–999	1	10	☆
FD-33	Channel 3 variable ID	0–999	1	10	☆
FD-34	Channel 4 variable ID	0–999	1	10	☆
FD-35	Sampling interval	0–65535	1	1	☆
FD-36	Trigger object A	0–999	1	1	☆
FD-37	Trigger condition A	0–2	1	0	☆
FD-38	Trigger level A	0–65535	1	0	☆
FD-39	Trigger object B	0–999	1	1	☆
FD-40	Trigger condition B	0–2	1	0	☆
FD-41	Trigger level B	0–65535	1	0	☆
FD-42	Trigger group selection	0: Group A 1: Group B	1	0	☆
FD-43	Carrier frequency cycle of data storage time	0–65535	1	0	★
FD-44	Fault value	0–65535	1	0	★
FD-45	Stored setting value	0–2	1	0	☆
FD-46	Data reading selection of host controller	0: RAM 1: FLASH	1	0	☆
FD-47	FLASH re-writing setting	0–1	1	1	☆
Group FE: Configuration Parameters for PN Card Process Data					
FE-00	Master sending PZD1	/	-	-	☆
FE-01	Master sending PZD2		-	-	☆
FE-02	Master sending PZD3		-	-	☆
FE-03	Master sending PZD4		-	-	☆
FE-04	Master sending PZD5		-	-	☆
FE-05	Master sending PZD6		-	-	☆
FE-06	Master sending PZD7		-	-	☆
FE-07	Master sending PZD8		-	-	☆
FE-08	Master sending PZD9		-	-	☆
FE-09	Master sending PZD10		-	-	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
FE-10	Master sending PZD11	/	-	-	☆
FE-11	Master sending PZD12		-	-	☆
FE-20	Drive response PZD1		-	-	☆
FE-21	Drive response PZD2		-	-	☆
FE-22	Drive response PZD3		-	-	☆
FE-23	Drive response PZD4		-	-	☆
FE-24	Drive response PZD5		-	-	☆
FE-25	Drive response PZD6		-	-	☆
FE-26	Drive response PZD7		-	-	☆
FE-27	Drive response PZD8		-	-	☆
FE-28	Drive response PZD9		-	-	☆
FE-29	Drive response PZD10		-	-	☆
FE-30	Drive response PZD11		-	-	☆
FE-31	Drive response PZD12		-	-	☆
Group FP: User Parameters					
FP-00	User password	0–65535	1	0	☆
FP-01	Parameter initialization	0: No operation 1: Restore factory parameters 2: Clear fault records 3: Restore user-defined parameters 4: Restore factory parameters (excluding A2-01) 5: Restore all parameters to default settings (excluding groups FP and FA, parameter backup is required)	1	0	★

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
FP-02	Motor model	0–65535 If Inovance motor is used, set FP-02 (Motor model) to corresponding motor code, and then parameters in group F1 will be automatically written into the drive. See "Appendix G List of Motor Codes and Models" on page 299 for motor code and model. Note: When using this function, make sure the correct wiring of UVW. After FP-02 is set properly, it is recommended to input motor parameters manually, set F1-16 to 1, and then perform auto-tuning to avoid wrong wiring.	1	0	★
FP-04	User parameter storage password	0–65535	1	0	☆
FP-05	User parameter storage (Advanced password is required if there is a password.)	0: No operation 1: Store user parameters (Advanced password is required if there is a password)	1	0	★
FP-06	LCD panel specification displayed in both Chinese and English	0–65535	1	0	☆
Group AF: Communication Process Data (only Displayed in CANopen Mode)					
AF-00	Communication process data	0 to 0xffff	1	0x2010	☆
AF-02	Communication process data	0 to 0xffff	1	0x2020	☆
AF-04	Communication process data	0 to 0xffff	1	0x0000	☆
AF-06	Communication process data	0 to 0xffff	1	0x0000	☆
AF-08	Communication process data	0 to 0xffff	1	0x0000	☆
AF-10	Communication process data	0 to 0xffff	1	0x0000	☆
AF-12	Communication process data	0 to 0xffff	1	0x0000	☆
AF-14	Communication process data	0 to 0xffff	1	0x0000	☆
AF-16	Communication process data	0 to 0xffff	1	0x0000	☆

Param. No.	Param. Name	Setting Range	Min. Unit	Default	Property
AF-18	Communication process data	0 to 0xffff	1	0x0000	☆
AF-20	Communication process data	0 to 0xffff	1	0x0000	☆
AF-22	Communication process data	0 to 0xffff	1	0x0000	☆
AF-24	Communication process data	0 to 0xffff	1	0x0000	☆
AF-26	Communication process data	0 to 0xffff	1	0x0000	☆
AF-28	Communication process data	0 to 0xffff	1	0x0000	☆
AF-30	Communication process data	0 to 0xffff	1	0x0000	☆
AF-32	Communication process data	0 to 0xffff	1	0x2070	☆
AF-34	Communication process data	0 to 0xffff	1	0x2070	☆
AF-36	Communication process data	0 to 0xffff	1	0x2070	☆
AF-38	Communication process data	0 to 0xffff	1	0x2080	☆
AF-40	Communication process data	0 to 0xffff	1	0x2070	☆
AF-42	Communication process data	0 to 0xffff	1	0x2070	☆
AF-44	Communication process data	0 to 0xffff	1	0x0000	☆
AF-46	Communication process data	0 to 0xffff	1	0x0000	☆
AF-48	Communication process data	0 to 0xffff	1	0x0000	☆
AF-50	Communication process data	0 to 0xffff	1	0x0000	☆
AF-52	Communication process data	0 to 0xffff	1	0x0000	☆
AF-54	Communication process data	0 to 0xffff	1	0x0000	☆
AF-56	Communication process data	0 to 0xffff	1	0x0000	☆
AF-58	Communication process data	0 to 0xffff	1	0x0000	☆
AF-60	Communication process data	0 to 0xffff	1	0x0000	☆
AF-62	Communication process data	0 to 0xffff	1	0x0000	☆

F.2 Monitoring Parameters

Param. No.	Param. Name	Setting Range	Min. Unit
Group U0: Running Monitoring Parameters			
U0-00	Running frequency	-650.00 Hz to +650.00 Hz	0.01 Hz
U0-01	Frequency reference	-650.00 Hz to +650.00 Hz	0.01 Hz
U0-02	Bus voltage	0.0–1000.0 V	0.1 V
U0-03	Output voltage	0 V to F02.03	1 V
U0-04	Output current	0.1–6553.5 A	0.1 A
U0-05	Output power	0.4–1000.0 kW	0.1 kW
U0-06	Output torque	0% to 200%	0.1
U0-07	DI status	-	-
U0-08	Output relay status	-	-
U0-09	Voltage after AI1 correction	-10.000 V to +10.000 V	0.001 V
U0-10	Voltage after AI2 correction	-10.000 V to +10.000 V	0.001 V
U0-11	Voltage after AI3 correction	-10.000 V to +10.000 V	0.001 V
U0-12	Mechanical angle of the resolver	1–4096	1
U0-13	Reserved	-	-
U0-14	Motor speed	-9999 rpm to +32767 rpm	1
U0-15 to U0-18	Reserved	-	-
U0-19	Set speed	-9999 rpm to +32767 rpm	1 rpm
U0-20	Reserved	0–65535	1
U0-21 to U0-24	Reserved	-	-
U0-25	Accumulative overload value	0–36000	1.0
U0-28	Current at the occurrence of overcurrent	0.01–655.35 A	0.01 A
U0-29	Overcurrent type	1: Hardware overcurrent 2: Software overcurrent	1
U0-30	Voltage before AI1 correction	-10.000 V to +10.000 V	0.001 V
U0-31	Voltage before AI2 correction	-10.000 V to +10.000 V	0.001 V
U0-32	Voltage before AI3 correction	-10.000 V to +10.000 V	0.001 V
U0-33	Reserved	-	-
U0-34	AO1 output voltage	0.000–10.000 V	0.001 V
U0-35	AO2 output voltage	0.000–10.000 V	0.001 V
U0-36	Real-time angle	0.0° to 359.9°	0.1°
U0-37	Set oil pressure	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2
U0-38	Feedback oil pressure	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2
U0-39	Set motor speed	-9999 rpm to 30000 rpm	1 rpm
U0-40	Feedback motor speed	-9999 rpm to 30000 rpm	1 rpm

Param. No.	Param. Name	Setting Range	Min. Unit
U0-41	Actual motor speed	0–65535	1
U0-42	Resolver interference status	0–65535	1
U0-43	Reserved	-	-
U0-44	Reserved	-	-
U0-45	Motor KTY temperature	-40.0°C to +200.0°C	-
U0-46	Number of received CAN frames	0–65535	1
U0-47	Number of CAN transmitting error	0–65535	1
U0-48	Number of CAN receiving error	0–65535	1
U0-49	Number of times of CAN bus disconnection	0–65535	1
Group U1: Oil Pressure Monitoring Parameters			
U1-00	Real-time resolver angle	0.0° to 359.9°	0.1°
U1-01	Set oil pressure	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2
U1-02	Feedback oil pressure	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2
U1-03	Feedback flow	-9999 rpm to +30000 rpm	1 rpm
U1-04	AI1 analog voltage	-9.999 V to +9.999 V	0.001 V
U1-05	AI2 analog voltage	-9.999 V to +9.999 V	0.001 V
U1-06	AI3 analog voltage	-9.999 V to +9.999 V	0.001 V
U1-07	AI1 zero drift	-9.99 V to +9.99 V	0.01 V
U1-08	AI2 zero drift	-9.99 V to +9.99 V	0.01 V
U1-09	AI3 zero drift	-9.99 V to +9.99 V	0.01 V
U1-10	Flow set on the host controller	0.00 Hz to F0-10	0.01 Hz
U1-11	Resolver signal interference status	0–1000 (resolver cable disconnected)	1
U1-12	Oil pressure reference from the host controller	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2
U1-13	CAN communication interference status	0–128 (off-line)	1

Appendix G List of Motor Codes and Models

Series	Motor Code	Motor Model
ESMG1-*****	50517	ESMG1-89C17CD-*****
	50717	ESMG1-13D17CD-*****
	50917	ESMG1-17D17CD-*****
	51117	ESMG1-21D17CD-*****
	51517	ESMG1-27D17CD-*****
	51418	ESMG1-28D18CD-*****
	50520	ESMG1-10D20CD-*****
	50720	ESMG1-15D20CD-*****
	50920	ESMG1-19D20CD-*****
	51120	ESMG1-25D20CD-*****
	51520	ESMG1-31D20CD-*****
ESMG2-*****	51717	ESMG2-31D17CD-*****
	52317	ESMG2-41D17CD-*****
	52817	ESMG2-51D17CD-*****
	53417	ESMG2-61D17CD-*****
	51720	ESMG2-36D20CD-*****
	52320	ESMG2-48D20CD-*****
ISMG1-R131FA	60615	ISMG1-95C15CD-R131FA
	60617	ISMG1-11D17CD-R131FA
	60620	ISMG1-12D20CD-R131FA
	60915	ISMG1-14D15CD-R131FA
	60917	ISMG1-16D17CD-R131FA
	60920	ISMG1-18D20CD-R131FA
	61115	ISMG1-17D15CD-R131FA
	61117	ISMG1-20D17CD-R131FA
	61120	ISMG1-23D20CD-R131FA
	61315	ISMG1-22D15CD-R131FA
	61317	ISMG1-24D17CD-R131FA
	61320	ISMG1-28D20CD-R131FA
	62015	ISMG1-30D15CD-R131FA
	62017	ISMG1-34D17CD-R131FA
	62020	ISMG1-41D20CD-R131FA

Series	Motor Code	Motor Model
ISMG1-R131F	415	ISMG1-55C15CD-R131F
	615	ISMG1-95C15CD-R131F
	617	ISMG1-11D17CD-R131F
	620	ISMG1-12D20CD-R131F
	915	ISMG1-14D15CD-R131F
	917	ISMG1-16D17CD-R131F
	920	ISMG1-18D20CD-R131F
	1115	ISMG1-17D15CD-R131F
	1117	ISMG1-20D17CD-R131F
	1120	ISMG1-23D20CD-R131F
	1315	ISMG1-22D15CD-R131F
	1317	ISMG1-24D17CD-R131F
	1320	ISMG1-28D20CD-R131F
	1915	ISMG1-30D15CD-R131F
	1917	ISMG1-34D17CD-R131F
	1920	ISMG1-41D20CD-R131F
ISMG1-R1A1FA	/	ISMG1-71C15CD-R1A1FA
	/	ISMG1-80C17CD-R1A1FA
	/	ISMG1-94C20CD-R1A1FA
	20615	ISMG1-95C15CD-R1A1FA
	20617	ISMG1-11D17CD-R1A1FA
	20620	ISMG1-12D20CD-R1A1FA
	20915	ISMG1-14D15CD-R1A1FA
	20917	ISMG1-16D17CD-R1A1FA
	20920	ISMG1-18D20CD-R1A1FA
	21115	ISMG1-17D15CD-R1A1FA
	21117	ISMG1-20D17CD-R1A1FA
	21120	ISMG1-23D20CD-R1A1FA
	21415	ISMG1-22D15CD-R1A1FA
	21417	ISMG1-24D17CD-R1A1FA
	21420	ISMG1-28D20CD-R1A1FA
ISMG1-R1A1FA	21915	ISMG1-30D15CD-R1A1FA
	21917	ISMG1-34D17CD-R1A1FA
	21920	ISMG1-41D20CD-R1A1FA

Series	Motor Code	Motor Model
ISMG1-A3A1FA	Equipped with "auto-tuningless function"	ISMG1-71C15CD-A3A1FA
		ISMG1-80C17CD-A3A1FA
		ISMG1-94C20CD-A3A1FA
		ISMG1-95C15CD-A3A1FA
		ISMG1-11D17CD-A3A1FA
		ISMG1-12D20CD-A3A1FA
		ISMG1-14D15CD-A3A1FA
		ISMG1-16D17CD-A3A1FA
		ISMG1-18D20CD-A3A1FA
		ISMG1-17D15CD-A3A1FA
		ISMG1-20D17CD-A3A1FA
		ISMG1-23D20CD-A3A1FA
		ISMG1-22D15CD-A3A1FA
		ISMG1-20D17CD-A3A1FA
		ISMG1-22D15CD-A3A1FA
ISMG1-R131XA	63515	ISMG1-55C15CD-R131XA
	63517	ISMG1-62C17CD-R131XA
	63520	ISMG1-75C20CD-R131XA
ISMG1-R1A1XA	/	ISMG1-55C15CD-R1A1XA
	/	ISMG1-62C17CD-R1A1XA
	/	ISMG1-75C20CD-R1A1XA
ISMG2-R131FA	62115	ISMG2-31D15CD-R131FA
	62117	ISMG2-36D17CD-R131FA
	62120	ISMG2-42D20CD-R131FA
	62715	ISMG2-42D15CD-R131FA
	62717	ISMG2-48D17CD-R131FA
	62720	ISMG2-57D20CD-R131FA
	63815	ISMG2-60D15CD-R131FA
	63817	ISMG2-68D17CD-R131FA
ISMG2-R131F	21315	ISMG2-20D15CD-R131F
	21317	ISMG2-23D17CD-R131F
	21320	ISMG2-27D20CD-R131F
	22015	ISMG2-31D15CD-R131F
	22017	ISMG2-36D17CD-R131F
	22020	ISMG2-42D20CD-R131F
	22715	ISMG2-42D15CD-R131F
	22717	ISMG2-48D17CD-R131F
	22720	ISMG2-57D20CD-R131F
	23815	ISMG2-60D15CD-R131F
	23817	ISMG2-68D17CD-R131F
	23820	ISMG2-80D20CD-R131F
	25115	ISMG2-80D15CD-R131F
	25117	ISMG2-91D17CD-R131F
	25120	ISMG2-11E20CD-R131F

Series	Motor Code	Motor Model
ISMG2-R1A1FA	52015	ISMG2-31D15CD-R1A1FA
	52017	ISMG2-36D17CD-R1A1FA
	52020	ISMG2-42D20CD-R1A1FA
	52715	ISMG2-42D15CD-R1A1FA
	52717	ISMG2-48D17CD-R1A1FA
	52720	ISMG2-57D20CD-R1A1FA
	53315	ISMG2-52D15CD-R1A1FA
	53317	ISMG2-60D17CD-R1A1FA
	53320	ISMG2-70D20CD-R1A1FA
	53815	ISMG2-60D15CD-R1A1FA
	53817	ISMG2-68D17CD-R1A1FA
	53820	ISMG2-80D20CD-R1A1FA
	55115	ISMG2-80D15CD-R1A1FA
	55117	ISMG2-91D17CD-R1A1FA
	55120	ISMG2-11E20CD-R1A1FA
	/	ISMG2-94D15CD-R1A1FA
	/	ISMG2-11E20CD-R1A1FA
ISMG2-31A1FA	Equipped with "auto-tuningless function"	ISMG2-31D15CD-A3A1FA
		ISMG2-36D17CD-A3A1FA
		ISMG2-42D20CD-A3A1FA
		ISMG2-42D15CD-A3A1FA
		ISMG2-48D17CD-A3A1FA
		ISMG2-57D20CD-A3A1FA
		ISMG2-52D15CD-A3A1FA
		ISMG2-60D17CD-A3A1FA
		ISMG2-70D20CD-A3A1FA
		ISMG2-60D15CD-R1A1FA
		ISMG2-68D17CD-A3A1FA
		ISMG2-80D20CD-A3A1FA
		ISMG2-80D15CD-A3A1FA
		ISMG2-91D17CD-A3A1FA
		ISMG2-11E20CD-A3A1FA
		ISMG2-94D15CD-A3A1FA
		ISMG2-11E20CD-A3A1FA
ISMQ2-R131F	61917	ISMQ2-34D17CD-R131F
	62217	ISMQ2-40D17CD-R131F
	62517	ISMQ2-46D17CD-R131F
	62817	ISMQ2-51D17CD-R131F

Warranty Agreement

1) Inovance provides an 18-month free warranty to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.
2) Within the warranty period, maintenance will be charged for the damage caused by the following reasons:
   a. Improper use or repair/modification without prior permission
   b. Fire, flood, abnormal voltage, natural disasters and secondary disasters
   c. Hardware damage caused by dropping or transportation after procurement
   d. Operations not following the user instructions
   e. Damage out of the equipment (for example, external device factors)
3) The maintenance fee is charged according to the latest Maintenance Price List of Inovance.
4) If there is any problem during the service, contact Inovance's agent or Inovance directly.
5) Inovance reserves the rights for explanation of this agreement.