Inovance

IS580 Series
Servo Drive User Manual

This user manual is only applicable to the IS580****-**-1 drives.

V1.0
Data Code: 19010350

Preface

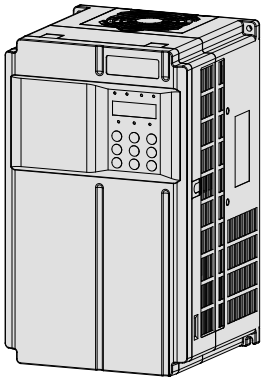
Thank you for purchasing the IS580 series servo drive developed and manufactured by Inovance.

The IS580 is an upgrade product compared with the IS300 series servo drive. It is specially designed to drive the permanent magnet synchronous motor (PMSM) and implement high-performance vector control of the PMSM. By integrating the process control during driving of the injection molding machine (IMM), such as precise control of injection speed and pressure holding, and stability control during cooperation with the IMM controller, the IS580 can well control the servo pump and provide general-purpose servo functions. The IS580 is highly cost-effective and reliable. It has obvious energy saving effect compared with traditional IMM control mode.

It is applicable to plastic molding, pipe extrusion, shoe making, rubber producing, and metal casting. Compared with the IS300, the IS580 features better oil pressure control performance, faster pressure and speed response, smaller steady pressure fluctuation and smaller size.

This manual is a guideline for the selection, installation, parameter setting, on-site commissioning and troubleshooting of the IS580 servo drive. It is only applicable to the IS580****-**-1 series servo drives.

Before using the servo drive, read this manual carefully to have a thorough understanding of the product. Keep the manual well and forward it to end users with the product.



Note

- The drawings in the manual are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the manual are shown for description only and may not match the product you purchased.
- The instructions are subject to change, without notice, due to product upgrade, specification modification as well as efforts to increase the accuracy and convenience of the manual.
- Contact our agents or customer service center if you have any problem during the use.

Note

This user manual is only applicable to the IS580****-**-1 series servo drives.

Introduction

■ Advantages

Compared with the IS300, the IS580 has improvements in the following aspects:

Improvement	Description
More stable pressure	The pressure fluctuation is smaller. The stability obvious at high pressure and low speed.
Faster pressure and speed response	The pressure and speed responsiveness improves, satisfying the quick response requirements of the quick hydraulic IMM.
Higher injection molding product consistency	The IS580 sees a rise in the qualified rate of the injection moudling products, especially the quick injection molding products.
Smaller size	The IS580 is over 40% smaller than the IS300 for the same power class.
Wide voltage range design	Rated voltage input: 380 to 480 V, wide voltage range: 323 to 528 V
Built-in DC reactor	The IS580 of 30 kW and above have built-in DC reactor.
Built-in braking unit and related protective function	The power class of the IS580 with built-in braking unit extends to 75 kW (optional for the models of 90 kW above). The protective functions including braking resistor short-circuit, braking circuit overcurrent, brake pipe overload and brake pipe shoot-through.
Longer serving life	The bus capacitor has high disposition and long servicing life.
Cooling fan drive circuit protection	When short-circuit occurs on the cooling fan, the cooling fan drive circuit provides protection.
Complete protective functions	The whole series of IS580 drives have the protections on short-circuit to ground and pre-charge relay (contactor) close fault.
Complete EMC solution	Complete EMC solution (including optional EMI filter, common mode rejector / zero-phase reactor and simple filter) could be provided to satisfy the actual application and certification requirements.

■ Product Checking

Upon unpacking, check:

- Whether the nameplate model and the drive ratings are consistent with your order. The box contains the servo drive, certificate of conformity, user manual and warranty card.
- Whether the servo drive is damaged during transportation. If you find any omission or damage, contact Inovance or your supplier immediately.

■ First-time Use

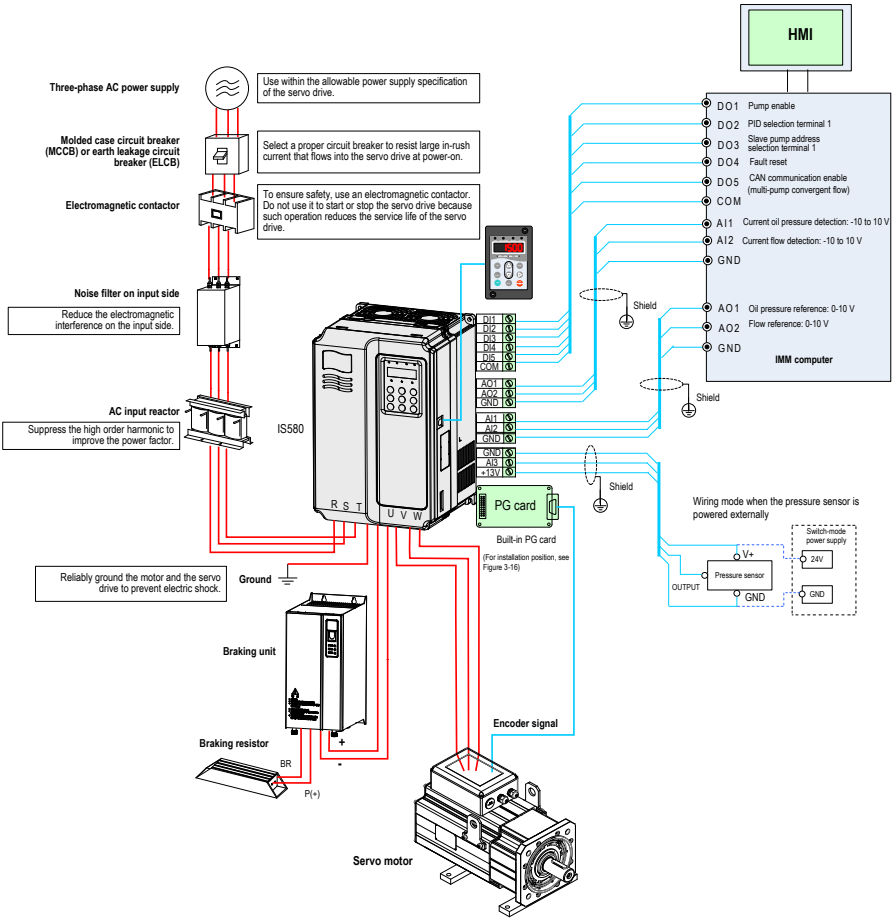
For the users who use this product for the first time, read the manual carefully. If you have any problem concerning the functions or performance, contact the technical support personnel of Inovance to ensure correct use.

■ Standard Compliant

The IS580 series servo drive complies with the international standards listed in the following table.

Directive	Directive Code	Standard
EMC directive	2004/108/EC	EN 61800-3 EN 55011 EN 61000-6-2
LVD directive	2006/95/EC 93/68/EEC	EN 61800-5-1

The IS580 series servo drive complies with the requirements of standard IEC/EN 61800-3 on the condition of correct installation and use by following the instructions in sections 8.3.2 and 8.3.5.


HMI
Three-phase AC power supply
Use within the allowable power supply specification of the servo drive.
Molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB)
Select a proper circuit breaker to resist large in-rush current that flows into the servo drive at power-on.
Electromagnetic contactor
To ensure safety, use an electromagnetic contactor. Do not use it to start or stop the servo drive because such operation reduces the service life of the servo drive.
Noise filter on input side
Reduce the electromagnetic interference on the input side.
AC input reactor
Suppress the high order harmonic to improve the power factor.
IS580
R S T
U V W
DI1
DI2
DI3
DI4
DI5
COM
AO1
AO2
GND
AI1
AI2
GND
GND
AI3
+13V
PG card
Built-in PG card
(For installation position, see Figure 3-16)
DO1 Pump enable
DO2 PID selection terminal 1
DO3 Slave pump address selection terminal 1
DO4 Fault reset
DO5 CAN communication enable (multi-pump convergent flow)
COM
AI1 Current oil pressure detection: -10 to 10 V
AI2 Current flow detection: -10 to 10 V
GND
AO1 Oil pressure reference: 0-10 V
AO2 Flow reference: 0-10 V
GND
IMM computer
Shield
Shield
Shield
Wiring mode when the pressure sensor is powered externally
Switch-mode power supply
24V
GND
V+
Pressure sensor
OUTPUT
GND
Reliably ground the motor and the servo drive to prevent electric shock.
Ground
Braking unit
Braking resistor
BR
P(+)
+
-
Encoder signal
Servo motor

Contents

1

Safety Information and Precautions

Chapter 1 Safety Information and Precautions

This user manual includes some very important safety warnings and notices. There are two types of safety notice, and you must comply with both types of notice.

⚠ DANGER

It indicates that failure to comply with the notice will result in severe personal injury or even death.

⚠ WARNING

It indicates that failure to comply with the notice will result in moderate or minor personal injury or damage to equipment.

1.1 Safety Information

Use Stage	Safety Grade	Precautions
Before installation	⚠ DANGER	• Never use the servo drive if you find component missing or damage upon unpacking. Failure to comply may result in personal injury. • Always use a motor with the insulation level of B above. Failure to comply may result in electric shock..
During installation	⚠ DANGER	• Install the equipment on incombustible objects such as metal, and keep it away from combustible materials. Failure to comply may result in a fire.
	⚠ WARNING	• Do not drop wire end or screw into the equipment. Failure to comply will result in equipment damage. • When two servo drives are installed in the same cabinet, arrange the installation positions properly to ensure the cooling effect.

Use Stage	Safety Grade	Precautions
At wiring	⚠ DANGER	• Wiring must be performed only by qualified personnel. Failure to comply may result in electric shock. • A circuit breaker must be used to isolate the power supply and the equipment. Failure to comply may result in a fire. • Ensure that the power supply is cut off before wiring. Failure to comply may result in electric shock. • Ground the equipment properly. Failure to comply may result in electric shock.
	⚠ WARNING	• Never connect the power cables to the output terminals (U, V, W) of the servo drive. Failure to comply will result in equipment damage. • Ensure that all wiring complies with the EMC requirements and local safety standard. Use wire sizes recommended in the manual. Failure to comply may result in accidents. • Never connect the braking resistor between the (+) and (-) terminals of the DC bus. Failure to comply may result in a fire.
Before power-on	⚠ DANGER	• Check that the following requirements are met: - The voltage class of the power supply is consistent with the rated voltage class of the servo drive. - The input terminals (R, S, T) and output terminals (U, V, W) are properly connected. - No short-circuit exists in the peripheral circuit. - The wiring is secured. Failure to comply may result in equipment damage. • Cover the servo drive properly before power-on to prevent electric shock..
	⚠ WARNING	• Do not perform the voltage resistance test on any part of the servo drive because such test has been done in the factory. Failure to comply may result in accidents. • All peripheral devices must be connected properly under the instructions described in this manual. Failure to comply may result in accidents
After power-on	⚠ DANGER	• Do not open the cover after power-on. Failure to comply may result in electric shock. • Do not touch the servo drive or peripheral circuit with wet hands. Failure to comply may result in electric shock. • Do not touch the terminals (including I/O terminals) of the servo drive. Failure to comply may result in electric shock. • The servo drive automatically performs safety detection on the external strong power circuit immediately upon power-on. This moment do not touch the U, V, W terminals of the servo drive or wiring terminals of the motor. Failure to comply may result in electric shock.
	⚠ WARNING	• Prevent personal injury during motor rotation if motor auto-tuning is required. Failure to comply may result in accidents. • Do not change the factory parameters of the servo drive to prevent equipment damage.

Use Stage	Safety Grade	Precautions
During operation	⚠ DANGER	• Do not get close to the mechanical equipment when the restart function is enabled. Failure to comply may result in personal injury. • Do not touch the fan or the discharging resistor to check the temperature. Otherwise, you may get burnt. • Signal detection must be performed only by qualified personnel during operation. Failure to comply may result in personal injury or equipment damage.
	⚠ WARNING	• Prevent dropping objects into the equipment during the drive running. Failure to comply may result in damage to the equipment. • Do not start or stop the servo drive by turning on or off the contactor. Failure to comply may result in equipment damage.
During maintenance	⚠ DANGER	• Do not repair or maintain the servo drive at power-on. Failure to comply will result in electric shock. • Repair or maintain the servo drive only after the CHARGE indicator on the servo drive goes off. This allows for the residual voltage in the capacitor to discharge to a safe value. Failure to comply will result in personal injury. • Repair or maintenance of the servo drive can be performed only by qualified personnel. Failure to comply will result in personal injury or damage to the servo drive.

1.2 General Precautions

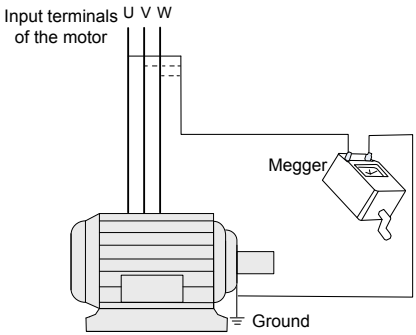
1. Motor insulation test

   Arrange for a qualified technician to perform an insulation test on the motor under the following conditions:

   - Before the motor is used for the first time
   - When the motor is reused after being stored for a long time
   - During regular maintenance checks

   This precaution detects poor insulation of the motor windings so that early actions can be taken to prevent damage to the servo drive. The motor must be disconnected from the servo drive during the insulation test. A 500 V volt insulation tester is recommended for this test, and the insulation resistance must not be less than 5 MΩ.

   Figure 1-1 Connections required for a motor insulation test



2. Thermal protection of the motor

   If the rated capacity of the motor does not match that of the servo drive, adjust the motor protection parameters on the operation panel or install a thermal relay in the motor circuit for protection. It is especially important to take this precaution if the servo drive has a higher power rating than the motor.

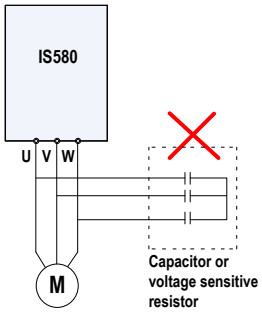
3. Motor heat and noise

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

4. Voltage-sensitive device or capacitor on the output side of the servo drive

   Do not install a capacitor for improving power factor, or a voltage sensitive resistor for lightning protection, on the output side of the servo drive. This is because the output is a PWM waveform and the servo drive might suffer transient overcurrent or become damaged.

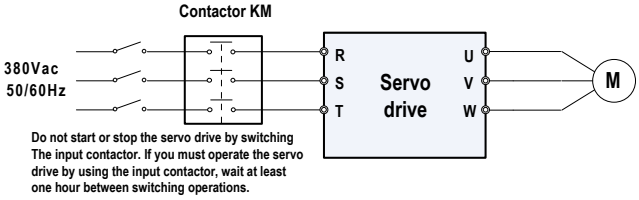
   Figure 1-2 Disallowed connections to the servo drive output



5. Contactor at the input terminal of the servo drive

   If there is a contactor installed between the input side of the servo drive and the power supply, DO NOT use it to start or to stop the servo drive. However, if there is a real and urgent need to use the contactor to start or to stop the servo drive, make sure the time interval between switching is at least one hour. If the interval between switching is shorter than one hour, this will reduce the service life of the capacitor inside the servo drive.

   Figure 1-3 Input contactors



6. When the external voltage exceeds the rated voltage range

   Do not operate the servo drive outside the rated voltage range specified in this User Manual. Failure to comply may result in damage to the components inside the servo drive. If necessary, use an appropriate voltage step-up or step-down device to match the supply voltage to the rated voltage range for the servo drive.

7. Prohibition of three-phase input changed into two-phase input

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

8. Surge suppressor

   The servo drive has a built-in voltage-dependent resistor (VDR) for suppressing the surge voltage generated when the inductive loads around the servo drive (for example the electromagnetic contactor, electromagnetic relay, solenoid valve, electromagnetic coil and electromagnetic brake) are switched on or off.

   If the inductive loads generate a very high surge voltage, use a surge suppressor for the inductive load and possibly also use a diode.

   Note

   Do not connect the surge suppressor to the output side of the servo drive.

9. Altitude and de-rating

   In places where the altitude is above 1000 m, the cooling effect reduces due to thin air, and it is necessary to de-rate the servo drive. For details, contact Inovance for advice.

10. Some special usages

    If your installation requires special cabling that this user manual does not describe, for example to support a common DC bus, contact Inovance for technical support and advice.

11. Disposal

    If it becomes necessary to dispose of any part of the servo drive system, DO NOT attempt to burn the parts on a fire. If you do, the electrolytic capacitors might explode, and the plastic components will create poisonous gases. Treat any parts for disposal as ordinary industrial waste.

12. Adaptable motor

    - The standard adaptable motor is a PMSM.
    - The standard parameters of the adaptable motor have already been configured inside the servo drive. However, it is still necessary to perform motor auto-tuning or to modify the default values based on actual conditions. Otherwise, the running result and protection performance will be adversely affected.
    - The servo drive might cause an alarm or might be damaged when a short-circuit exists on cables or inside the motor. Therefore, perform insulation short-circuit test when the motor and cables are newly installed or during routine maintenance. During the test, disconnect the servo drive from the tested parts.

13. Overcurrent and overload

    When an overcurrent fault (Err02, Err03, or Err04) or overload fault (Err10) occurs, if the fault persists after you power off the servo drive and start it again, find out the causes rather than starting the servo drive frequently. Otherwise, the inverter module will be damaged by the large rush-in current.

2

Product Information

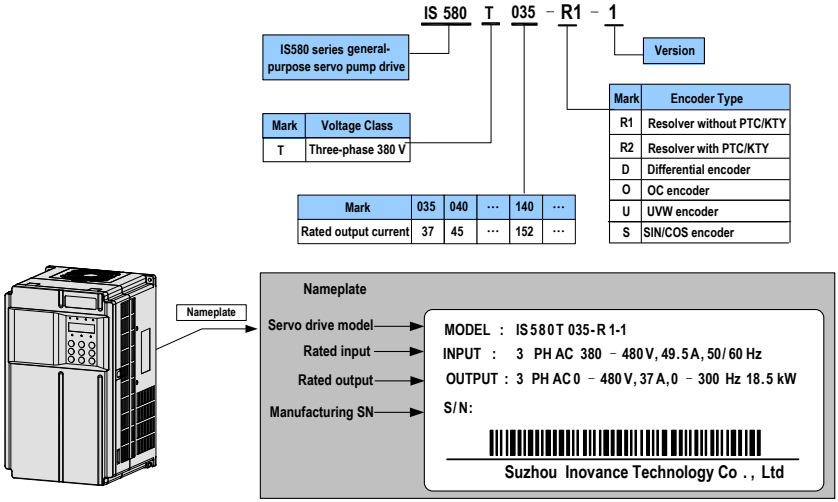
Chapter 2 Product Information

2.1 Product Type Identification

Each model in the range of IS580 servo drive systems has a model number that identifies important characteristics and specifications for that particular unit.

The following figure shows an example of a model number and explains how it is derived from the system specification.

Figure 2-1 Nameplate and designation rules of the IS580



Note

The IS580 is configured with the PG card for connecting the resolver.

Note

This user manual is only applicable to the IS580****-**-1 series servo drives.

2.2 Components of the IS580

The IS580 series servo drives have two housing types, plastic housing and sheet metal housing, according to different voltage and power classes.

Figure 2-2 Components of the IS580 of plastic housing (three-phase 380 to 480 V, IS580T020-R1-1 to IS580T070-R1-1)

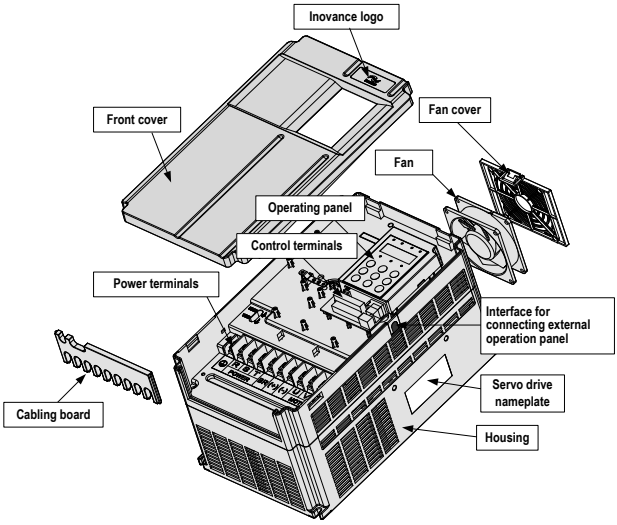


Figure 2-3 Components of the IS580 of sheet metal housing (three-phase 380 to 480 V, IS580T080-R1-1 to IS580T210-R1-1)

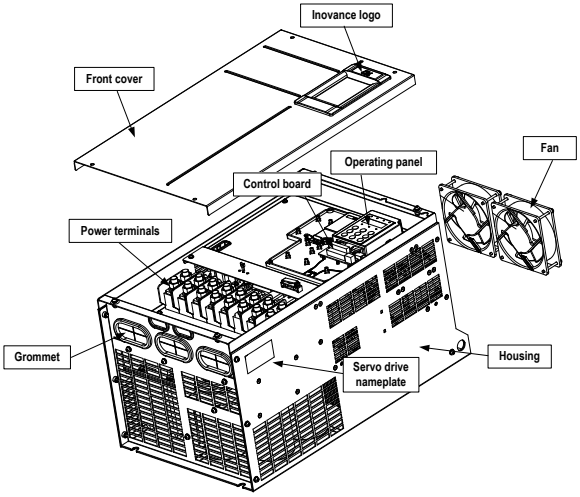
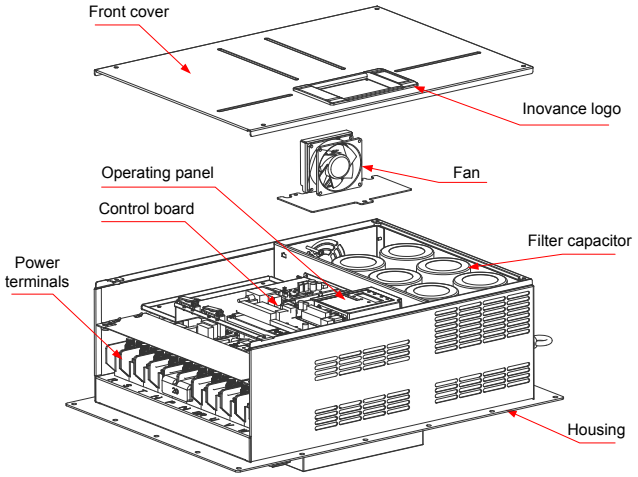


Figure 2-4 Components of the IS580 of sheet metal housing (three-phase 380 to 480 V, IS580T080-R1-H-1 to IS580T210-R1-H-1)



2.3 Technical Specifications

Table 2-1 Technical specifications of the IS580

Item		Description
Standard functions	Max. frequency	300 Hz
	Carrier frequency	1 to 8 kHz
	Input frequency resolution	Digital setting: 0.01 Hz Analog setting: Max. frequency x 0.1%
	Control mode	Closed-loop vector control (CLVC), voltage/frequency (V/F) control
	Startup torque	0 Hz/180% (CLVC)
	Speed range	1:1000 (CLVC)
	Speed stability accuracy	±0.02% (CLVC)
	Torque control accuracy	±5% (CLVC)
	V/F curve	Straight-line V/F curve
	Ramp mode	Straight-line ramp
	Overload capacity	• 60s for 150% of the rated current • 3s for 180% of the rated current
	Motor overheat protection	• PTC temperature protection
	Encoder type	• Supporting resolver and ABZ optical encoder
Protective functions	Protections	Motor short-circuit detection at power-on, input/output phase loss protection, overcurrent protection, overvoltage protection, undervoltage protection, overheat protection and overload protection
Communication	Modbus	Supports the Modbus-RTU protocol.
	CAN	Supports the CANopen protocol and the CANlink protocol.
Environment	Installation location	Install the IS580 servo drive where it is indoors and protected from direct sunlight, dust, corrosive or combustible gases, oil smoke, vapour, ingress from water or any other liquid, and salt.
	Altitude	Below 1000 m (de-rated if the altitude is above 1000 m)
	Ambient temperature	–10°C to 40°C (de-rated if the ambient temperature is between 40°C and 50°C)
	Humidity	Less than 95 % RH, non-condensing
	Vibration	Less than 5.9 m/s² (0.6 g)
	Storage temperature	–20°C to 60°C
	IP level	IP20

3

Mechanical and Electrical Installation

Chapter 3 Mechanical and Electrical Installation

3.1 Mechanical Installation

3.1.1 Installation Environment

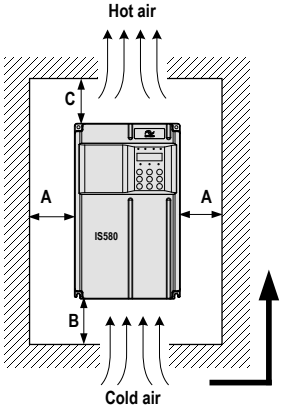
Item	Requirements
Ambient temperature	-10°C to 50°C
Heat dissipation	Install the servo drive on an incombustible supporting surface and make sure there is sufficient space around the enclosure to allow for efficient heat dissipation. Use strong screws or bolts to secure the enclosure on the supporting surface.
Mounting location	Make sure the mounting location is: • Away from direct sunlight • Not in an area that has high humidity or condensation • Protected against corrosive, combustible or explosive gases and vapours • Free from oil, dirt, dust or metallic powders.
Vibration	Make sure the mounting location is not affected by levels of vibration that exceed 0.6 g. Avoid installing the enclosure near to punching machines or other mechanical machinery that generates high levels of vibration or mechanical shock.

3.1.2 Mounting Orientation and Clearance

■ Mounting Clearance

The mechanical clearance requirements for the IS580 vary with power classes of the servo drive.

Figure 3-1 Mounting clearance of the IS580



Installation clearance requirements on the IS580 series servo drives of different power classes

Power Class	Clearance Requirements (Unit: mm)		
IS580T020-R1-1 to IS580T040-R1-1	A ≥ 10	B ≥ 200	B ≥ 200
IS580T050-R1-1 to IS580T070-R1-1	A ≥ 50	B ≥ 200	B ≥ 200
IS580T080-R1-1 to IS580T210-R1-1	A ≥ 50	B ≥ 300	B ≥ 300
IS580T080-R1-H-1 to IS580T210-R1-H-1	A ≥ 80	B ≥ 200	B ≥ 20

Minimum air duct area for a servo drive

(If N servo drives are required, enlarge the air duct area by N times.)

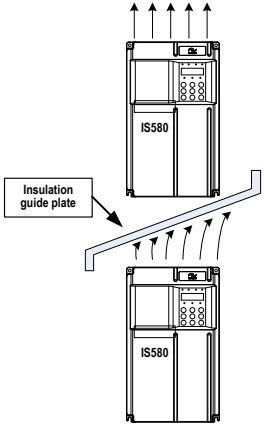
Power Class	Minimum Air Duct Area (mm^2)
IS580T020-R1-1 to IS580T040-R1-1	19200
IS580T050-R1-1 to IS580T070-R1-1	30400
IS580T080-R1-1 to IS580T100-R1-1	48400
IS580T140-R1-1 to IS580T210-R1-1	78600
IS580T140-R1-H-1 to IS580T210-R1-H-1	33800

The servo drive shall be installed vertically upward.

The IS580 series servo drive dissipates heat from the bottom to the top. The drive of IS580T080-R1-H-1 to IS580T210-R1-H-1dissipates heat from the left to the right. When multiple servo drives are required to work together, install them side by side.

For the application of installing multiple servo drives, if one row of Servo drives need to be installed above another row, install an insulation guide plate to prevent servo drives in the lower row from heating those in the upper row and causing faults.

Figure 3-2 Installation of the insulation guide plate

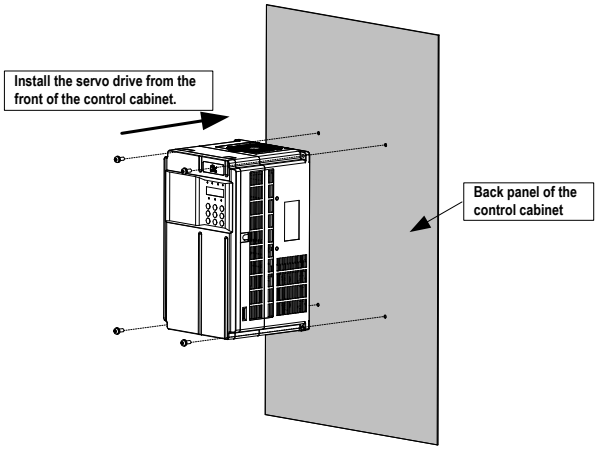


■ 3.1.3 Installation Method and Process

The IS580 series has two housing types, plastic housing and sheet metal housing, according to different power classes. The IS580 supports both surface mounting and embedded mounting.

1. Surface mounting of the IS580 of plastic housing (IS580T020-R1-1 to IS580T070-R1-1)

   Figure 3-3 Surface mounting of the IS580 of plastic housing



2. Embedded mounting the IS580 of plastic housing (IS580T020-R1-1 to IS580T070-R1-1)

Figure 3-4 External hanging bracket for the IS580 of plastic housing

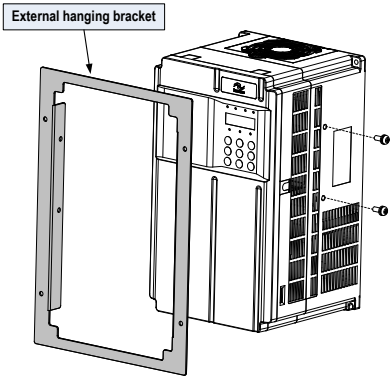
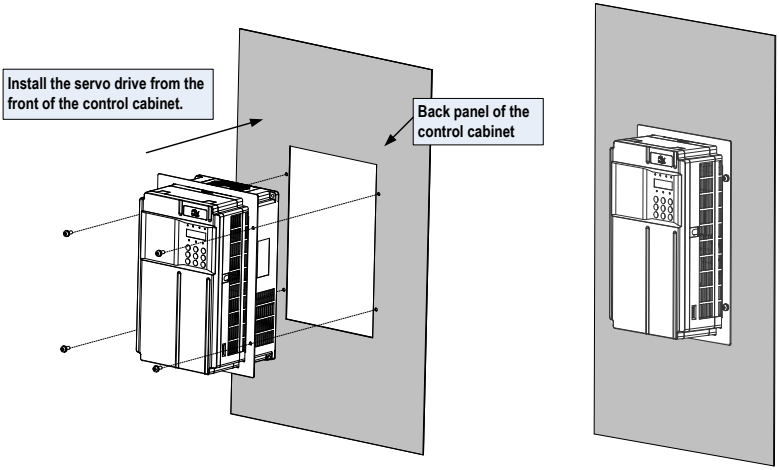


Figure 3-5 Embedded mounting of the IS580 of plastic housing



3. Surface mounting of the IS580 of sheet metal housing (IS580T080-R1-1 to IS580T210-R1-1)

Figure 3-6 Surface mounting of the IS580 of sheet metal housing

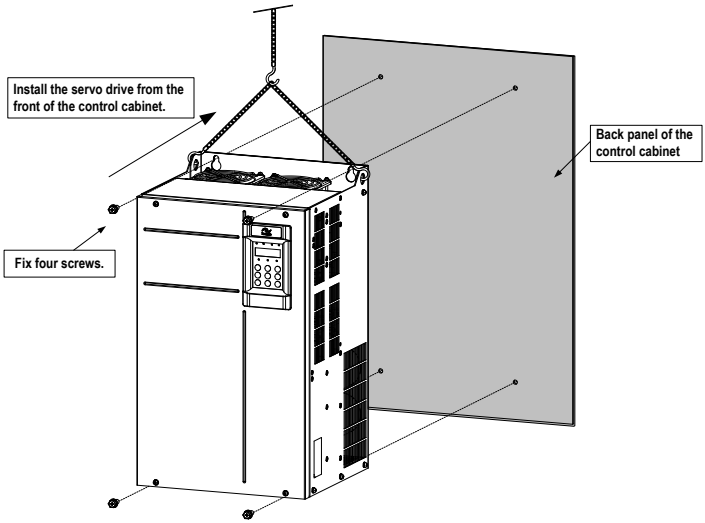
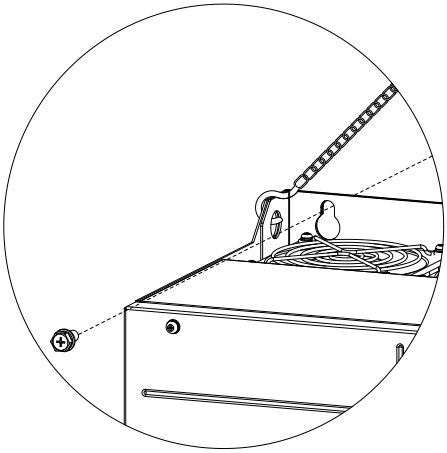


Figure 3-7 Hoisting the IS580 of sheet metal housing



4. Embedded mounting of the IS580 of sheet metal housing (IS580T080-R1-1 to IS580T210-R1-1)

Figure 3-8 External hanging bracket for the IS580 of sheet metal housing

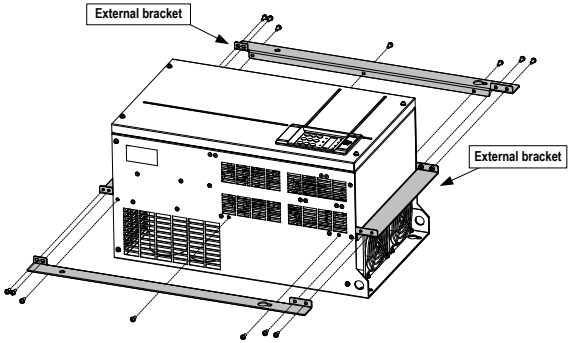
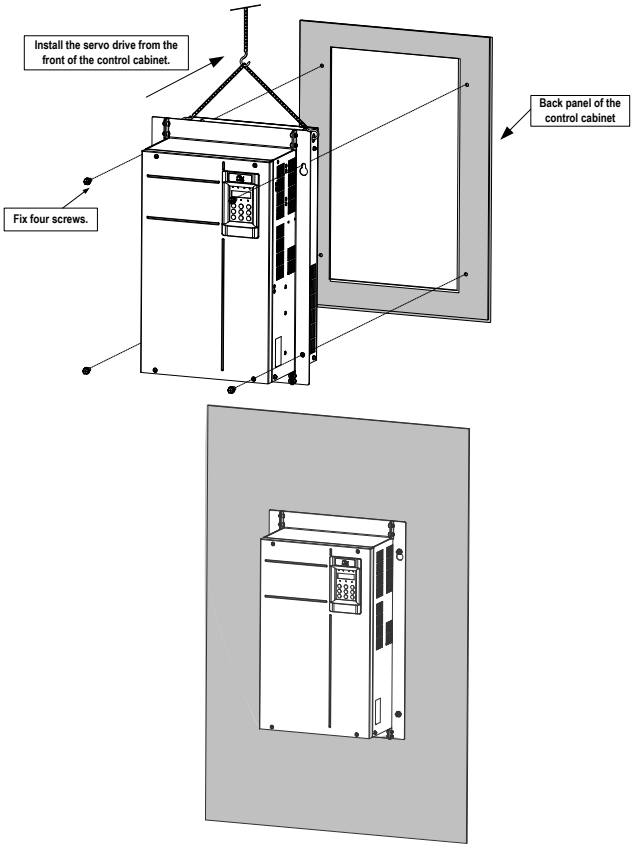


Figure 3-9 Embedded mounting of the IS580 of sheet metal housing



5. Embedded mounting of the IS580 of sheet metal housing (IS580T080-R1-H-1 to IS580T210-R1-H-1)

Figure 3-10 Embedded mounting from the cabinet front

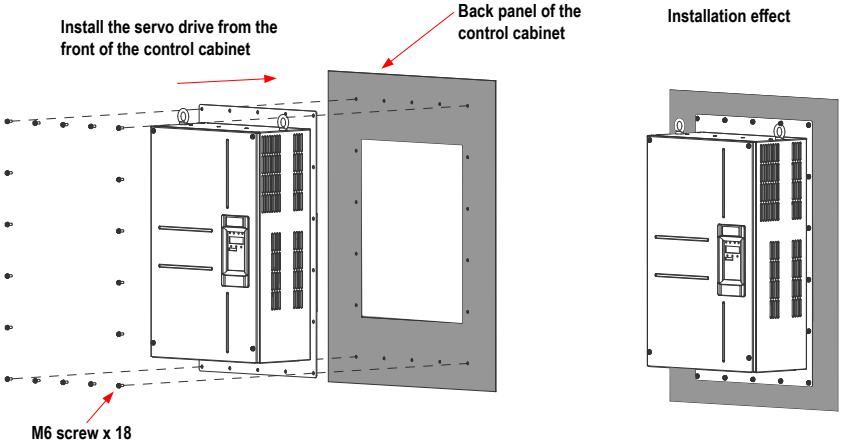
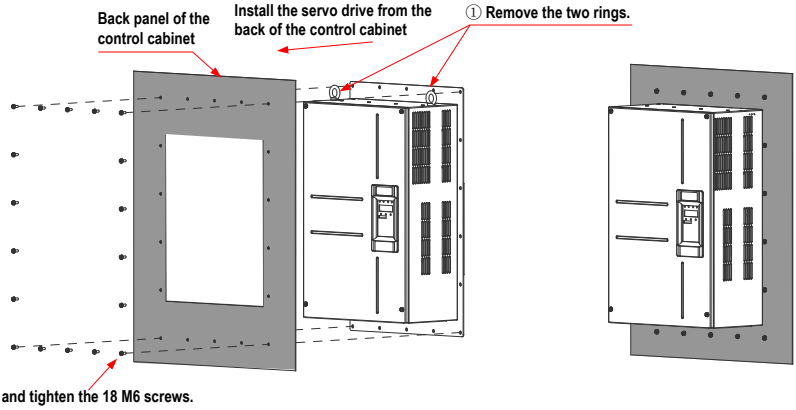


Figure 3-11 Embedded mounting from the cabinet back



The installation precautions are as follows:

- Reserve the installation clearances as specified in Figure 3-1 to ensure sufficient space for heat dissipation. Take heat dissipation of other components in the cabinet into consideration.
- Install the Servo drives upright to facilitate heat dissipation. If multiple Servo drives are installed in the cabinet, install them side by side. If one row of Servo drives need to be installed above another row, install an insulation guide plate, as shown in Figure 3-2.
- Use the incombustible hanging bracket.
- In scenarios with heavy metal powder, install the heatsink outside the cabinet, and ensure that the room inside the fully-sealed cabinet is as large as possible.

3.1.4 Removal of the Front Cover

For the IS580 series servo drives, you need to remove the front cover before wiring the main circuit and control circuit. The following figures show how to remove the front cover of the IS580.

Figure 3-12 Removal of the front cover of IS580 plastic housing (IS580T020-R1-1 to IS580T070-R1-1)

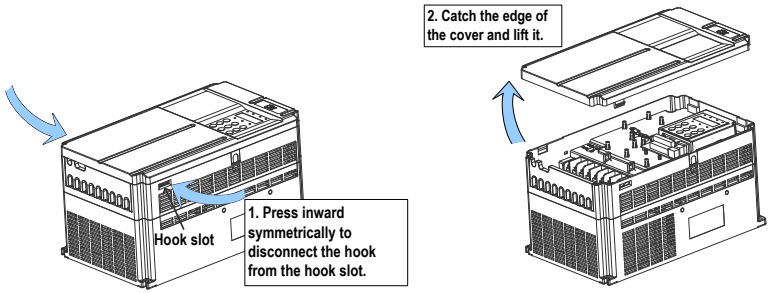


Figure 3-13 Removal of the front cover of IS580 sheet metal housing (IS580T080-R1-1 to IS580T210-R1-1)

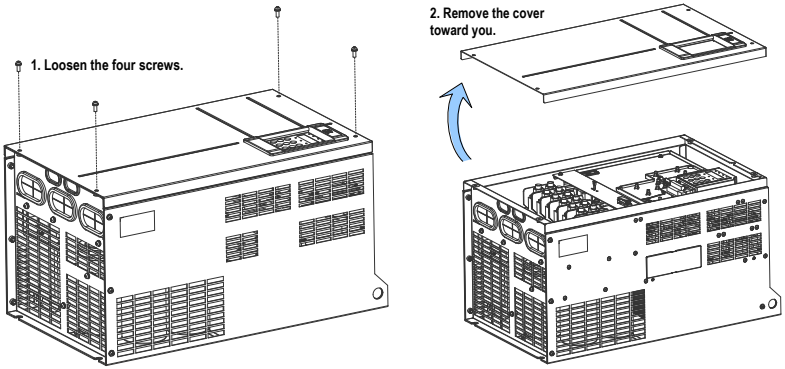
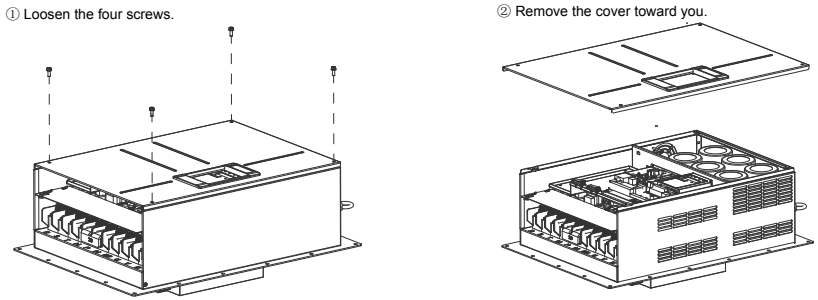


Figure 3-14 Removal of the front cover of IS580 sheet metal housing (IS580T080-R1-H-1 to IS580T210-R1-H-1)



Note

- Be careful when removing the front cover of the servo drive. Falling off of the cover may cause damage to the servo drive or personal injury.

3.2 Wiring Mode

The wiring of the IS580 series servo drive is shown in the foldout at the end of this chapter.

3.3 Main Circuit Terminals and Wiring

Figure 3-15 Terminal arrangement of the main circuit

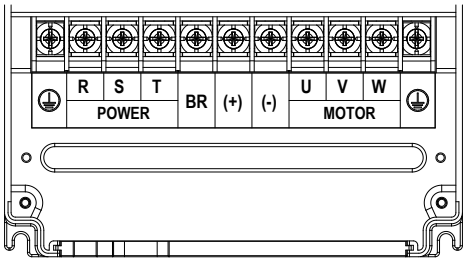
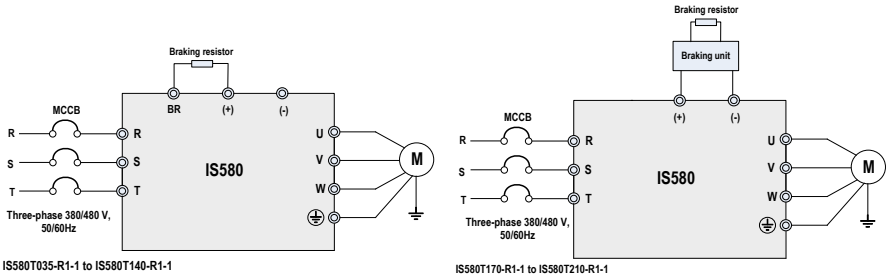


Figure 3-16 Wiring mode of the IS580 of three-phase 380 to 480 V

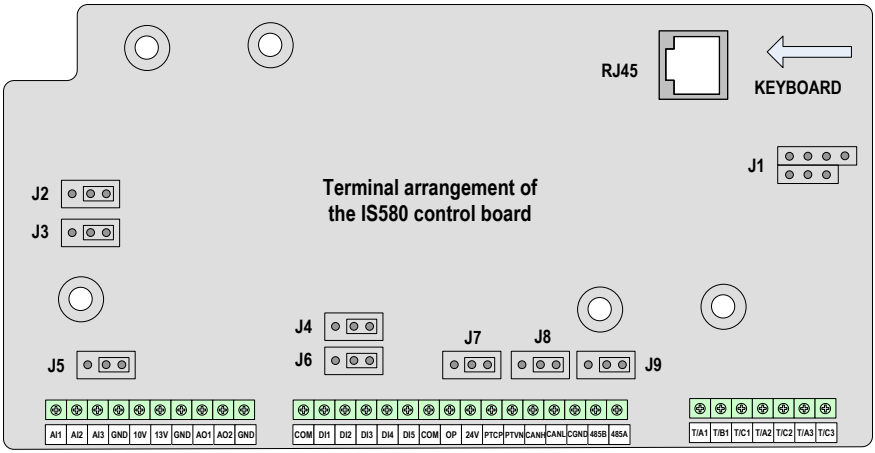


The terminals of the main circuit terminals are described in the following table.

Terminal	Name	Description
R, S, T	Three-phase power input terminals	Connect to the three-phase power supply.
(+), (-)	Positive and negative terminals of DC bus	Common DC bus input point. Connect to the external braking unit for the models of 90 kW and above.
(+), BR	Terminals for connecting braking resistor	Connect to a braking resistor for the models of 75 kW and below.
U, V, W	Servo drive output terminals	Connect to a three-phase motor.
⏚	Grounding terminal	Must be grounded.

3.4 Control Circuit Terminals and Wiring

Figure 3-17 The control circuit terminal arrangement



■ Function Description of Jumpers of the IS580

Jumper	Position	Function Description	Position	Function Description
J2		GND connected to capacitance to earth. (Adopted when the drive is well grounded.)		GND not connected to capacitance to earth. (Adopted when the drive is poorly grounded.)
J3		COM connected to capacitance to earth. (Adopted when the drive is well grounded.)		COM not connected to capacitance to earth. (Adopted when the drive is poorly grounded.)
J4		AO1 provides voltage output (0 to 10 VDC).		AO1 provides current output (0 to 20 mA).
J5		AI3 receives voltage input (-10 to 10 VDC)		AI3 receives current input (0 to 20 mA)
J6		AO2 provides voltage output (0 to 10 VDC).		AO2 provides current output (0 to 20 mA).
J7		Apply internal power supply to terminals DI1 to DI5.		Apply external power supply to terminals DI1 to DI5.
J8		Connecting terminal resistor at CAN communication. (Adopted by the end drive in multi-drive communication mode.)		Not connecting terminal resistor at CAN communication. (Adopted by the middle drive in multi-drive communication mode.)
J9		Connecting terminal resistor at RS485 communication. (Adopted by the end drive in multi-drive communication mode.)		Not connecting terminal resistor at RS485 communication. (Adopted by the middle drive in multi-drive communication mode.)

Note

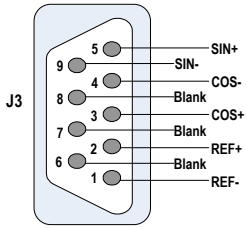
The jumper position is seen when you face the wiring terminals.

■ Description of Control Circuit Terminals

Type	Terminal	Name	Description
Power Supply	+10V-GND	+10 V power supply	Provide +10 V±10% power supply externally. Generally, it provides power supply to the external potentiometer with resistance range of 1 to 5 kΩ. Maximum output current: 10 mA
	+13V-GND	Pressure sensor power supply	Provide 13 V±10% power supply externally. Generally, it provides power supply to the pressure sensor. Maximum output current: 10 mA
	+24V-GND	+24 V power supply	Provides a +24 V power supply to an external unit. Generally used to supply the DI/DO terminals and external sensors 24 V±10%, no-load virtual voltage of 30 V or less Max. output current: 200 mA, internally isolated from GND
	OP	Input terminal of external power supply	Internally isolated from COM and 24 V and shorted with +24V by using a jumper by default. When DI1 to DI5 need to be driven by external signals, OP must be disconnected from +24 V and connected to an external power supply. This is determined by the jumper J7.
Analog input	AI1-GND	Analog input 1 (pressure reference by default)	Input voltage range: ±10 V, 12-bit resolution, correction accuracy 0.5% Input impedance: 100 kΩ
	AI2-GND	Analog input 2 (flow reference by default)	Input voltage range: ±10 V, 12-bit resolution, correction accuracy 0.5% Input impedance: 100 kΩ
	AI3-GND	Analog input 3 (pressure senor signal input by default)	Input range: ±10 V or 0–20 mA (determined by jumper J5 on the control board), 12-bit resolution, correction accuracy 0.5% Input impedance: 100 kΩ (voltage input), 500 Ω (current input)
Digital Input	(DI1 to DI5)-COM	Digital input	Isolated sink/source input programmable terminals, input frequency < 100 Hz Input impedance: 3.3 kΩ Voltage range at level input: 9 to 30 V
	PTCP-PTCN	Motor overheat protection input	The motor overheat PTC sensor, supporting PTC130 and PTC150.
Communication	CANH/CANL/CGND	CAN communication terminal	Max. baud rate: 1 Mbps Whether to connect the terminal resistor is determined by the jumper J8.
	485B/485A	RS485 communication terminal	It is a reserved terminal and this function is not configured by default. Max. baud rate: 230 Kbps Whether to connect the terminal resistor is determined by the jumper J9.

Type	Terminal	Name	Description
Analog output	AO1-GND	Analog output 1	Voltage or current output is decided by jumper J4. Output range: 0–10 V/0–20 mA 12-bit resolution, correction accuracy 1%, maximum load resistance value ≤ 500 Ω
	AO2-GND	Analog output 2	Voltage or current output is decided by jumper J6. Output range: 0–10 V/0–20 mA 12-bit resolution, correction accuracy 1%, maximum load resistance value ≤ 500 Ω
Relay output	T/A1-T/B1	NC terminal	Contact driving capacity: 250 VAC, 3 A, COSφ = 0.4; 30 VDC, 1 A
	T/A1-T/A3-T/C1-T/C3	NO terminal	
Auxiliary interface	CNR1	External operation panel interface	Connect to the external operation panel.

3.5 Description of PG Card Terminals on the IS580

No.	Name	Description	Pin Definition
1	REF-	Excitation signal	
2	REF+		
3	COS+	COS feedback signal	
4	COS-		
5	SIN+	SIN feedback signal	
9	SIN-		
6–8	-	-	

The following table defines the matching signal cables for the IS580 (for reference only)

Signal Definition	REF-	REF+	COS+	COS-	SIN+	SIN-
Color of Matching Encoder Cable	Yellow-white	Red-white	Red	Black	Yellow	Blue
Corresponding PG Card and DB9 Pin	1	2	3	4	5	9

Figure 3-18 Connecting the PG card to the motor (1)

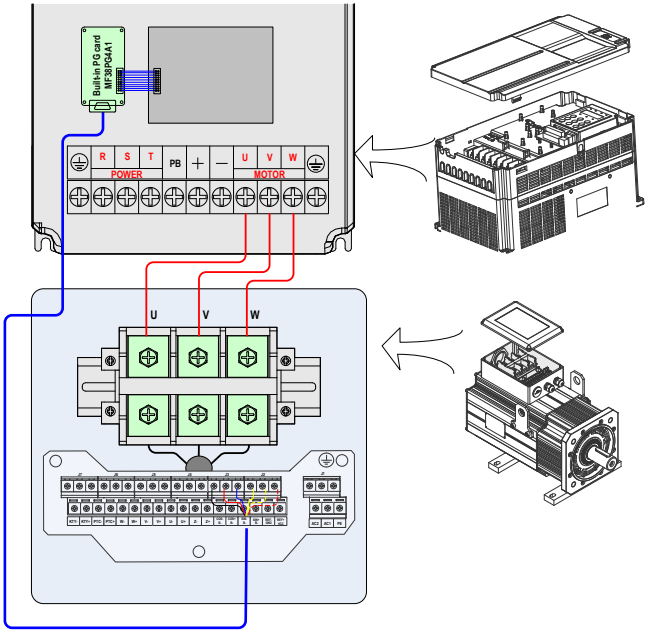
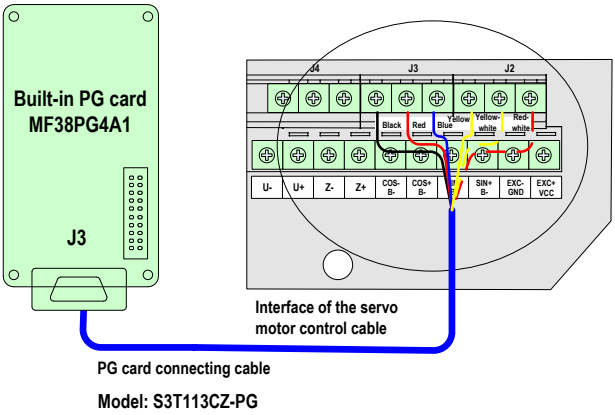


Figure 3-19 Connecting the PG card to the motor (2)



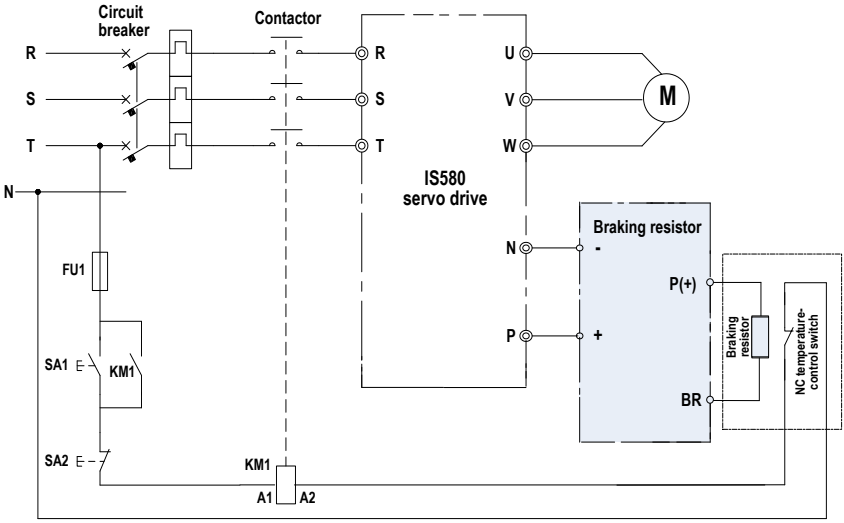
3.6 Wiring the External Braking Unit

Two wiring methods are provided, differing in the wiring of braking resistor overheat protection.

Wiring method 1: After the signal of the braking resistor overheat relay is sent, the power supply of the IS580 is cut off.

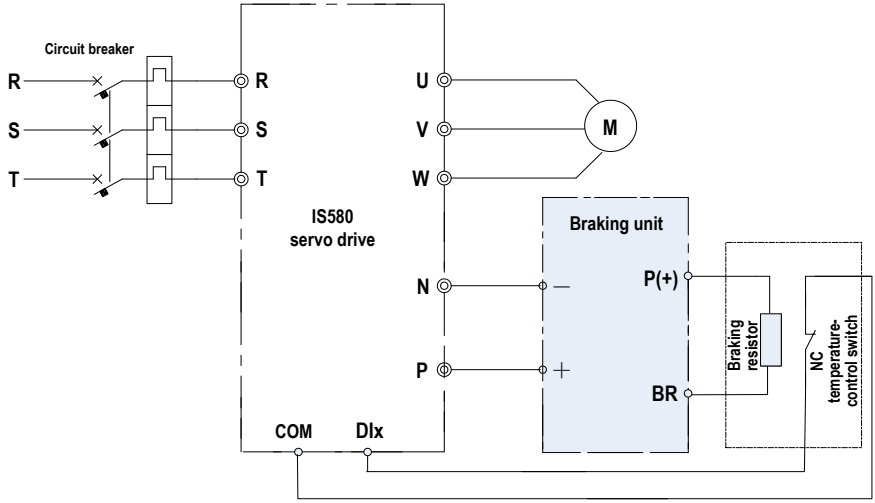
Wiring method 2: The signal of the braking resistor overheat relay is used as input of the IS580 external fault (Err15).

Figure 3-20 Basic wiring method 1



In this wiring method, the input voltage class of the contactor control coil is 220 VAC. The NC contact of the thermal relay is connected to the power supply of the wire package driven by the main contactor. When a fault occurs, the driving power supply of the contactor is cut off to disconnect the main contactor.

Figure 3-21 Basic wiring method 2



In this wiring method, the braking unit is connected to COM on one side and DIx on the other side. The function code setting is as follows when the braking unit is connected to different DI terminals:

DI1: F4-00 = 11; DI2: F4-01 = 11; DI3: F4-02 = 11; DI4: F4-03 = 11; DI5: F4-04 = 11

2. Pay much attention to the power and heat dissipation conditions of the braking resistor. If Err15 is reported, immediately cut off the power supply of the main circuit. Otherwise, a fire may result.

3.7 Wiring Diagram of System Application

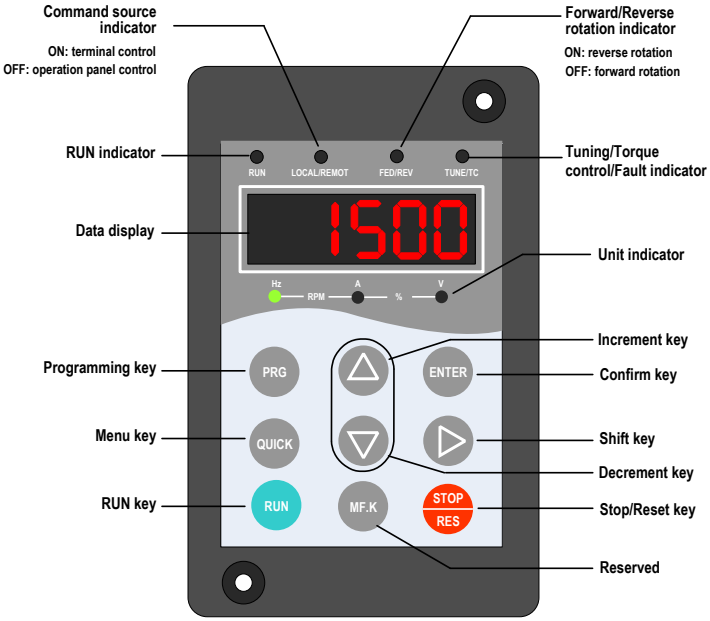
For wiring diagram of system application, see the foldout at the end of this chapter.

3.8 Use of the Operation Panel

The IS580 has a built-in LED operation panel. An external LED operation panel can also be connected to the RJ45 interface of the IS580 by an 8-core flat cable.

You can modify the parameters, monitor the working status and start or stop the IS580 by operating the operation panel, as shown in the following figure.

Figure 3-22 Diagram of the operation panel



3.8.1 Description of Indicators

- RUN

  ON indicates that the servo drive is in the running state, and OFF indicates that the servo drive is in the stop state.

- LOCAL/REMOT

  It indicates whether the servo drive is operated by means of operation panel, terminal or communication (remote).

○ LOCAL/REMOT: OFF	Operation panel control
● LOCAL/REMOT: ON	Terminal control
◑ LOCAL/REMOT: blinking	Communication control

- FWD/REV

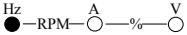
  ON indicates reverse rotation, and OFF indicates forward rotation.

- TUNE/TC

  When the indicator is ON, it indicates torque control mode. When the indicator is blinking slowly, it indicates the auto-tuning state. When the indicator is blinking quickly, it indicates the fault state.

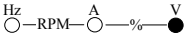
- Unit indicators

  ● means that the indicator is ON, and ○ means that the indicator is OFF.

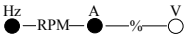


Hz: unit of frequency

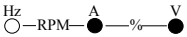
A: unit of current



V: unit of voltage



RPM: unit of rotational speed



%: percentage

3.8.2 Digital Display

The 5-digit LED display is able to display the set frequency, output frequency, monitoring data and fault codes.

The following table describes the keys on the operation panel.

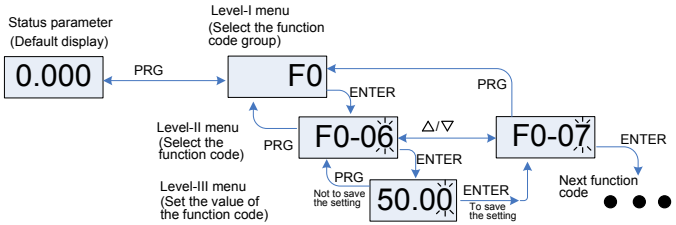
Key	Name	Function
PRG	Programming	Enter or exit Level I menu.
ENTER	Confirm	Enter the menu interfaces level by level, and confirm the parameter setting.
△	Increment	Increase data or function code.
▽	Decrement	Decrease data or function code.
▷	Shift	Select the displayed parameters in turn in the stop or running state, and select the digit to be modified when modifying parameters.
RUN	Run	Start the servo drive in the operation panel control mode.
STOP RES	Stop/Reset	Stop the servo drive when it is in the running state and perform the reset operation when it is in the fault state.
QUICK	Quick	Enter or exit Level I quick menu.
MF.K	Reserved	Reserved

3.8.3 Viewing and Modifying Function Codes

The operation panel of the IS580 adopts three-level menu.

The three-level menu consists of function code group (Level I), function code (Level II), and function code setting value (level III), as shown in the following figure.

Figure 3-23 Operation procedure on the operation panel

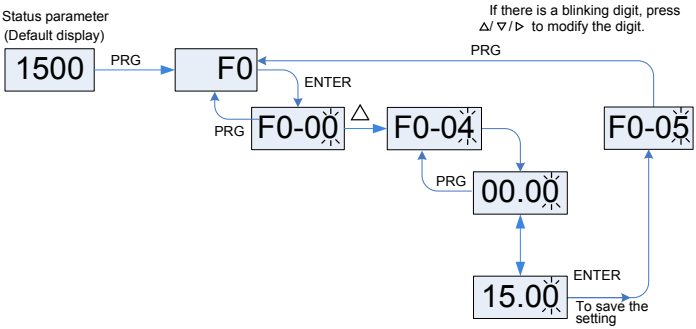


You can return to Level II menu from Level III menu by pressing PRG or ENTER.

- After you press ENTER, the system saves the parameter setting first, and then goes back to Level II menu and shifts to the next function code.
- After you press PRG, the system does not save the parameter setting, but directly returns to Level II menu and remains at the current function code.

Here is an example of changing the value of F0-04 to 15.00 Hz.

Figure 3-24 Example of changing the parameter value



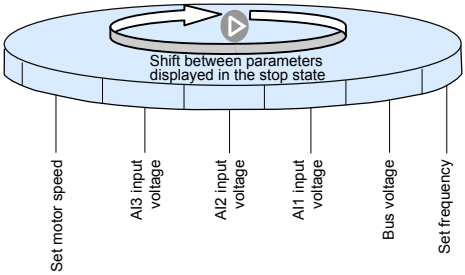
In Level III menu, if the parameter has no blinking digit, it means that the parameter cannot be modified. This may be because:

- Such a function code is only readable, such as, servo drive model, actually detected parameter and running record parameter.
- Such a function code cannot be modified in the running state and can only be changed at stop.

In the stop or running state, the operation panel can display multiple status parameters.

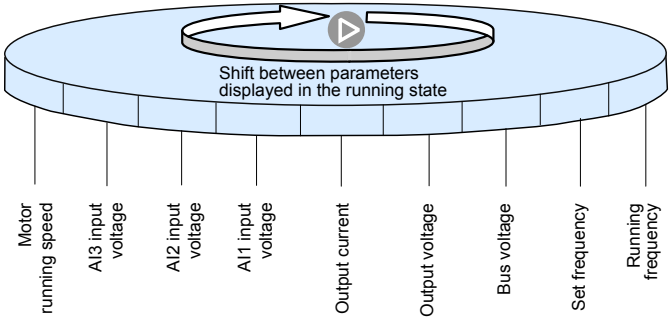
In the stop state, you can press to view the parameters circularly. For details on the parameters that can be displayed, see the description of group U0.

Figure 3-25 Shift between parameters displayed in the stop state



In the running state, you can press to view the parameters circularly. For details on the parameters that can be displayed, see the description of group U1.

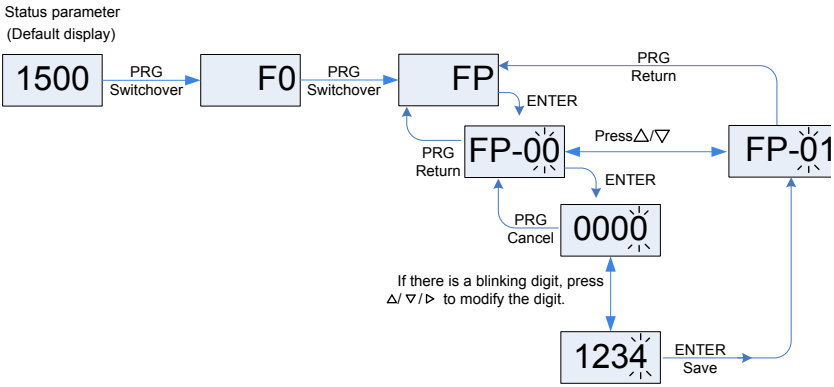
Figure 3-26 Shift between parameters displayed in the running state



3.8.4 Password Setting

The servo drive provides the user password protection function. The following figure shows how to set the password to 1234.

Figure 3-27 Setting the password



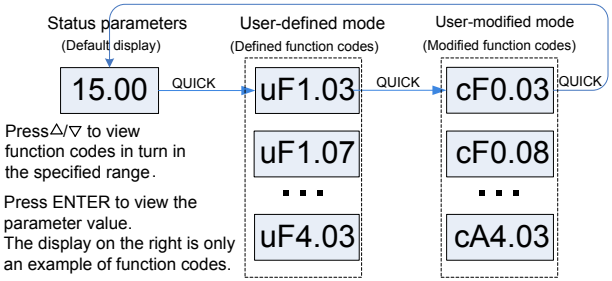
3.8.5 Quick View of Function Codes

The IS580 provides two quick modes of viewing the required function codes.

- You can define a group and combine a maximum of 16 commonly used function codes into the group.
- The IS580 automatically lists the modified function codes.

You can perform switchover amongst the function code display modes by pressing QUICK. The method of viewing and modifying function codes in each mode is the same as the method of operating the operation panel described above.

Figure 3-28 Switchover between function code display modes



■ User-defined Group

The user-defined menu is set to facilitate viewing and modifying of commonly used function codes. In this mode, the display parameter uF3.02 indicates function code F3-02. You can also modify parameters in this mode as in common editing state.

The user-defined group has already stored commonly used function codes at initialization.

It contains different function codes in the oil pressure control mode and non-oil pressure control mode (A3-00 = 0).

The following table lists the function codes in the user-defined group in non-oil pressure control mode (A3-00 = 0)

Function Code	Parameter Name	Function Code	Parameter Name
F0-01	Control mode	F0-02	Command source selection
F0-03	Main frequency source X selection	F0-08	Preset frequency
F0-10	Max. frequency	F0-17	Acceleration time
F0-18	Deceleration time	F2-10	Torque upper limit
F8-00	Jog acceleration time	F8-01	Jog deceleration time
F8-02	Jog deceleration time		

Table 3-3 Function codes in the user-defined group in non-oil pressure control mode (A3-00 is set the other values)

Function Code	Parameter Name	Function Code	Parameter Name
A3-01	Max. motor speed	A3-02	System oil pressure
A3-03	Max. oil pressure	A3-04	Oil pressure command slope time
A3-05	Oil pressure control Kp1	A3-06	Oil pressure control ti1
A3-07	Oil pressure control td1	A3-08	Maximum reverse motor speed
A3-09	Min. flow	A3-10	Min. pressure
A3-20	AI zero drift auto correction	F2-00	Speed loop proportional gain 1
F2-01	Speed loop integral time 1	F2-03	Speed loop proportional gain 2
F2-04	Speed loop integral time 2	F4-32	AI3 input filter time

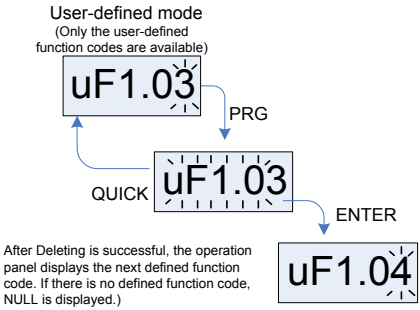
The user-defined group allows adding and deleting function codes, which requires unlocking set in F7-03.

F7-03 determines whether to allow adding or deleting function codes to or from the user-defined group.

Function Code	Parameter Name	Setting Range	Default
F7-03	Selection of unlocking user-defined group	0: Enabled (Press PRG, ENTER to add/delete function codes to/from the user-defined group.) 1: Disabled (You are not allowed to add/delete function codes to/from the user-defined group.)	1

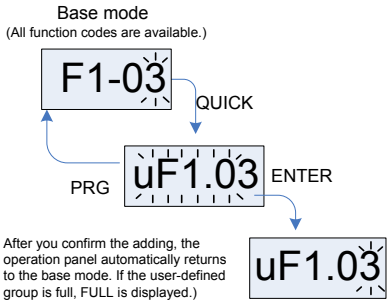
In the non-oil pressure control mode, deleting function codes from the user-defined group is as shown in the following figure.

Figure 3-29 Deleting function codes from the user-defined group



In the non-oil pressure control mode, adding function codes to the user-defined group is as shown in the following figure.

Figure 3-30 Adding function codes to the user-defined group



■ User-modified Group

In user-modified menu, only the parameters that are modified to a non-default value are displayed. The menu is generated by the AC drive automatically, facilitating you to read the modified function codes quickly.

3.8. 6 Starting or Stopping the Servo Drive

■ Selecting the Start/Stop Command Source

There are three start/stop command sources, namely, operation panel control, terminal control, and communication control. You can select the command source in F0-02.

Function Code	Parameter Name	Setting Range	Description	Default
F0-02	Command source selection	0: Operation panel control (indicator OFF) 1: Terminal control (indicator ON) 2: Communication control (indicator blinking)	0: Press RUN or STOP RES to start or stop the servo drive. 1: A DI terminal needs to be defined as the run/stop terminal. 2: The communication protocol (Modbus-RTU or CAN bus) is used.	0

- 0: Operation panel control

  After you press RUN, the servo drive starts running (the RUN indicator is ON). After you press STOP RES when the servo drive is in running state, the servo drive stops running (the RUN indicator is OFF).

  Note that the following operations can be performed only on the operation panel:

  - Motor auto-tuning
  - AI zero drift auto correction

- 1: Terminal control

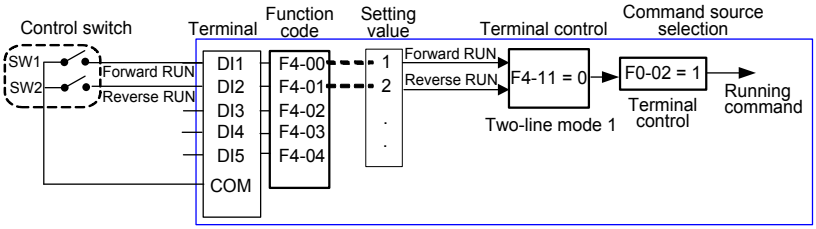
  This control mode is applicable to scenarios where the DIP switch or electromagnetic button is used to start or stop the application system or scenarios where the dry contact signal is used to start or stop the servo drive.

  The input terminals of the start/stop signal are set in F4-00 to F4-04.

  Example:

  To use the DIP switch as the start/stop source, and allocate the forward rotation switch signal to DI1 and the reverse rotation switch signal to DI2, perform the setting as shown in the following figure.

  Figure 3-31 Setting of using the DIP switch for start/stop

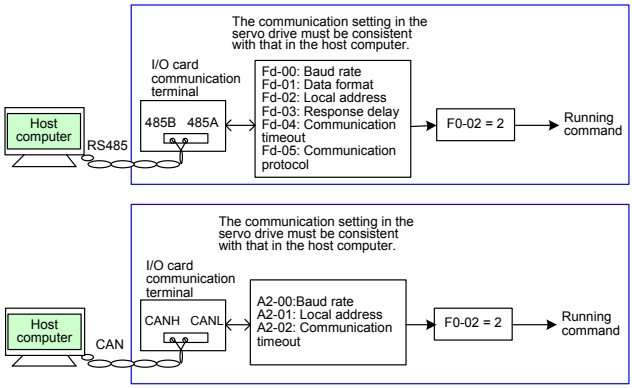


In the oil pressure mode, DI1 with function 1 (Forward RUN) is used to enable the pump.

- 2: Communicatoin control

  Set F0-02 to 2. Then, you can start or stop the servo drive in communication mode. The following figure shows the setting method.

  Figure 3-32 Setting for start/stop using the communication control mode



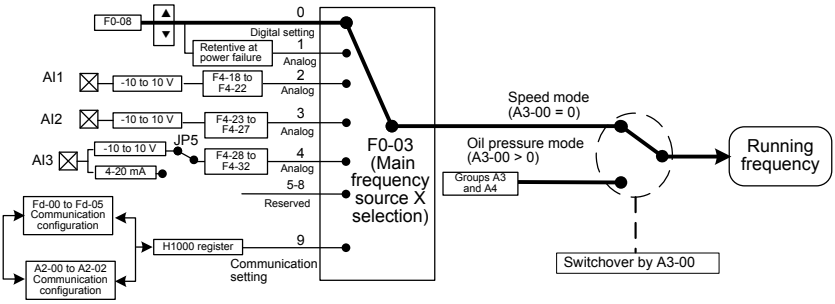
  For details on the communication protocols, consult Inovance.

3.8.7 Setting the Running Frequency

The IS580 supports two control modes: speed mode and oil pressure mode, set in A3-00.

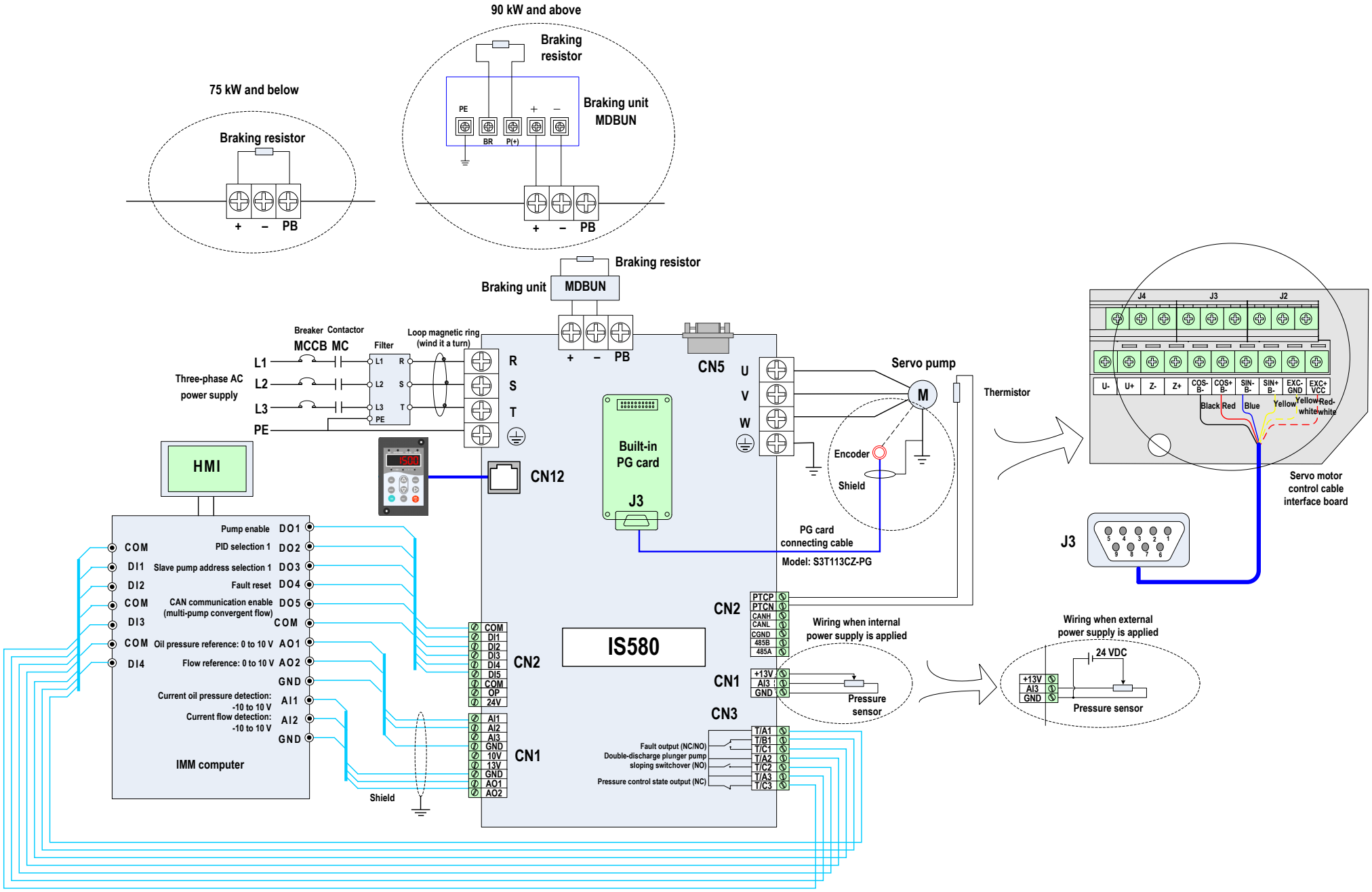
In the speed mode, there are six frequency setting sources, digital setting (UP/DOWN modification, non-retentive at power failure), (UP/DOWN modification, retentive at power failure), AI1, AI2, AI3, and communication setting. You can select one in F0-03.

Figure 3-33 Selecting the frequency source



3.8.8 Setting the Motor Rotating Direction

After you restore the default setting of the servo drive and set the motor parameters correctly and motor auto-tuning is completed, press RUN to drive the motor to rotate, and the rotating direction is regarded as the forward rotation. If the rotating direction is reverse to the direction required by the equipment, power off the servo drive and exchange any two of the output UVW cables (wait until the main capacitor of the servo drive is completely discharged). Then perform motor auto-tuning and trial running to check that the rotating direction is correct.


90 kW and above
Braking resistor
Braking unit MDBUN
PE
BR
P(+)
+
–
PB
75 kW and below
Braking resistor
Braking unit
MDBUN
Braking resistor
Breaker
MCCB
Contactor
MC
Filter
Loop magnetic ring (wind it a turn)
Three-phase AC power supply
L1
L2
L3
PE
R
S
T
CN5
U
V
W
Servo pump
M
Encoder
Shield
Thermistor
J4
J3
J2
U-
U+
Z-
Z+
COS-
B-
COS+
B-
SIN-
B-
SIN+
B-
EXC-
GND
EXC+
VCC
Black
Red
Blue
Yellow
Yellow-white
Red-white
Servo motor control cable interface board
HMI
CN12
Built-in PG card
J3
PG card connecting cable
Model: S3T113CZ-PG
J3
Pump enable
DO1
COM
PID selection 1
DO2
DI1
Slave pump address selection 1
DO3
DI2
Fault reset
DO4
COM
CAN communication enable (multi-pump convergent flow)
DO5
DI3
COM
COM
Oil pressure reference: 0 to 10 V
AO1
DI4
Flow reference: 0 to 10 V
AO2
GND
Current oil pressure detection: -10 to 10 V
AI1
Current flow detection: -10 to 10 V
AI2
GND
IMM computer
Shield
COM
DI1
DI2
DI3
DI4
DI5
COM
OP
24V
CN2
AI1
AI2
AI3
GND
10V
13V
GND
AO1
AO2
CN1
IS580
CN2
PTCP
PTCN
CANH
CANL
CGND
485B
485A
CN1
+13V
AI3
GND
Pressure sensor
CN3
T/A1
T/B1
T/C1
T/A2
T/C2
T/A3
T/C3
Fault output (NC/NO)
Double-discharge plunger pump sloping switchover (NO)
Pressure control state output (NC)
Wiring when internal power supply is applied
Wiring when external power supply is applied
24 VDC
+13V
AI3
GND
Pressure sensor

4

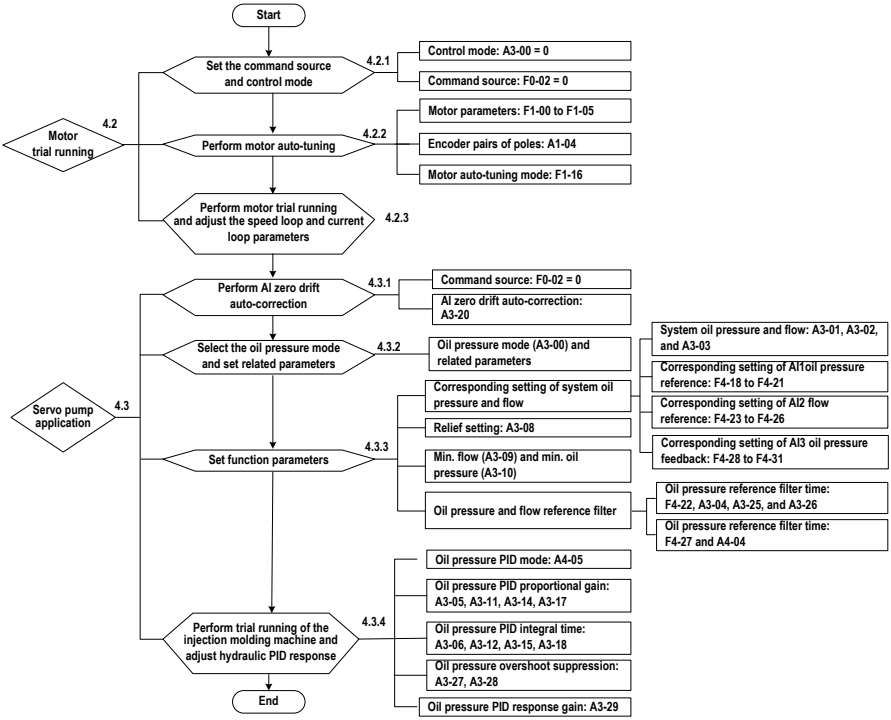
Servo Pump Commissioning

Chapter 4 Servo Pump Commissioning

4.1 Servo Pump Commissioning Flowchart

The servo pump commissioning process mainly includes motor auto-tuning, motor trial running, and servo oil pressure commissioning, as shown in the following figure.

Figure 4-1 Servo pump commissioning flowchart



4.2 Motor Trial Running

4.2.1 Procedure of Motor Trial Running

Step	Parameter Setting	Parameter Description	Remarks
1. Set the control mode.	A3-00 = 0	Non-hydraulic control mode	Set the non-hydraulic control mode.
2. Set the command source.	F0-02 = 0	Operation panel control	The LOCAL/REMOT indicator is OFF.
3. Perform motor auto-tuning.	Group F1 and A1 parameters	Motor and encoder parameters	For details, see section 4.2.2 "Setting and Auto-tuning of Motor Parameters".
4. Perform motor trial running.	F0-08 = 5.00 Hz	Trial running frequency	Start trial running in operation panel control and monitor whether the output current is normal. For details, see section 4.2.3 "Trial Running Check".

Note

Ensure that the overflow valve is opened completely so that there is no load during trial running.

4.2.2 Setting and Auto-tuning of Motor Parameters

■ Parameter Setting

The IS580 controls the servo pump in closed-loop vector control (CLVC) mode. This mode requires accurate motor parameters. To guarantee good driving performance and running efficiency, set the motor parameters strictly according to the nameplate of the standard adaptable motor. The following table lists the parameters to be set.

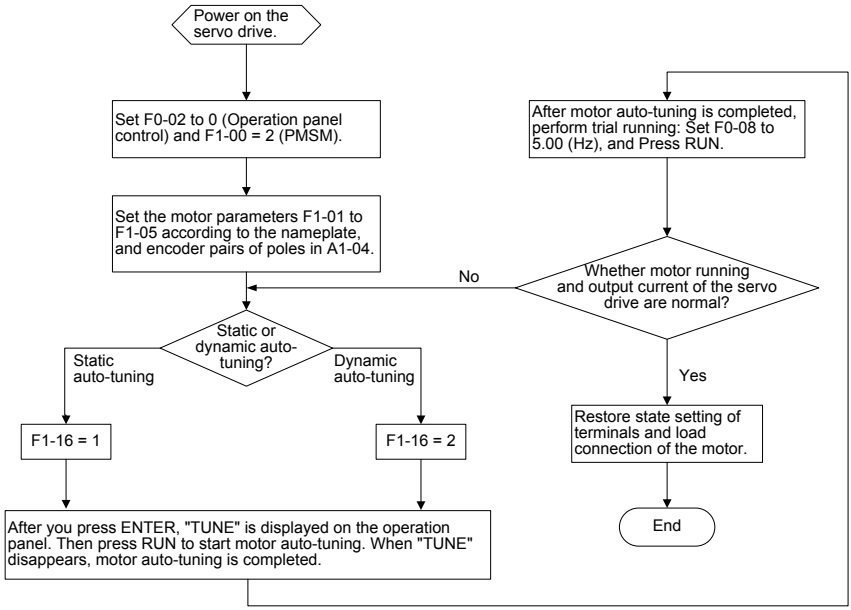
Function Code	Parameter Name	Description
F1-00	Motor type	0: Common asynchronous motor 1: Variable-frequency asynchronous motor 2: PMSM
F1-01 to F1-05	Rated motor power Rated motor voltage Rated motor current Rated motor frequency Rated motor rotational speed	Model parameters, manual input
A1-04	Number of pole pairs of resolver	-
F1-15	Back EMF	1: Obtain the value directly from the manual provided by the motor manufacturer. 2: Obtain the value by means of dynamic auto-tuning if the value cannot be obtained from the motor manufacturer.
F1-16	Auto-tuning mode	Dynamic and static

■ Motor Auto-tuning Setting

Auto-tuning Mode	Function Code Setting	Application
No operation	F1-16 = 0	After motor auto-tuning is completed, the value of F1-16 is restored to 0 automatically.
Static auto-tuning 1	F1-16 = 1	This mode is used when the back EMF of the motor is known. The motor runs at a low speed during auto-tuning, and therefore, the overflow valve need not be opened.
Dynamic auto-tuning 1	F1-16 = 2 or 5	This mode is used when the back EMF of the motor is unknown. The motor runs at a high speed during auto-tuning, and therefore, the overflow valve must be opened. With-load auto-tuning reduces the accuracy of motor auto-tuning, affecting the system control performance. When F1-16 = 2, the motor rotating direction is clockwise when you face the motor shaft. When F1-16 = 5, the motor rotating direction is counterclockwise when you face the motor shaft.
Static auto-tuning 2	F1-16 = 3	This mode is used when the back EMF of the motor is known and there is heavy load. The motor runs at a low speed during auto-tuning, and therefore, the overflow valve need not be opened. When wiring of the encoder and motor is correct but Err43 is reported during static auto-tuning 1 or dynamic auto-tuning, use this mode.
Dynamic auto-tuning2	F1-16 = 4 or 6	This mode enables you to obtain parameters such as back EMF and the encoder installation angle within short time. The auto-tuning accuracy is bad. This mode is used only for verifying whether the motor is demagnetized. The motor runs at a high speed during auto-tuning, and therefore, the overflow valve must be opened. When F1-16 = 4, the motor rotating direction is clockwise when you face the motor shaft. When F1-16 = 6, the motor rotating direction is counterclockwise when you face the motor shaft.

■ Motor Auto-tuning Procedure

Figure 4-2 Motor auto-tuning procedure



4.2.3 Trial Running Check

1. After motor auto-tuning is completed, set F0-08 to 5.00 Hz to make the motor carry out low-speed trial running and check whether the running current of the servo drive is small and stable.
2. If the running current is large, check whether the setting of motor parameters in group F1 and pole pairs of resolver in A1-04 are correct. If there is any modification, perform motor auto-tuning again and perform low-speed running to check whether the servo drive becomes normal.
3. After ensuring that motor running is normal, check whether the rotating direction is correct. If not, exchange any two of motor UVW cables and perform motor auto-tuning again.
4. If the motor oscillates or generates low noise during running, weaken the speed loop and current loop properly, for example, decreasing the values of F2-00, F2-03, and F2-13 to F2-16, and increasing the values of F2-01 and F2-04.
5. If the motor speed is unstable during running, strengthen the speed loop and current loop properly, for example, increase F2-00, F2-03, and F2-13 to F2-16, and decrease F2-01 and F2-04.

Note

- Ensure that the overflow valve is opened completely so that there is no load during running.
- The parameters of speed loop and current loop are defined in group F2.
- The speed loop and current loop response directly affects pressure stability. Set stronger speed loop and current loop response if allowed.

4.3 Application Commissioning of Servo Pump

4.3.1 AI Zero Drift Auto Correction

Step	Function Code Setting	Parameter Description	Remarks
1. Set the command source.	F0-02 = 0	The operation panel control mode is used.	The LOCAL/REMOT indicator is OFF.
2. Perform AI zero drift auto correction.	A3-20 = 1	The AI zero drift auto correction function is enabled.	After the operation panel displays "Alcod", press RUN. Then, AI zero drift auto correction is carried out.

Note

- You can also perform AI zero drift correction manually: When A3-20= 0 (that is, AI zero drift auto correction is disabled), view the values of three AIs in U1-04 to U1-06, add 10 mA to each of the values and then enter the results in F4-18, F4-23, and F4-28.
- After AI zero drift auto correction is completed, the value of A3-20 is automatically restored to 0.

4.3.2 Selection and Parameter Setting of Hydraulic Control Mode

Hydraulic Mode Selection	Function Code Setting	Description
Non-oil pressure control mode	A3-00 = 0	The speed mode is used.
Oil pressure control mode 1	A3-00 = 1	The host computer provides the oil pressure reference and flow reference by using CAN communication; AI3 provides the oil pressure feedback; the servo drive conducts hydraulic control.
Oil pressure control mode 2	A3-00 = 2	AI1 provides the oil pressure reference; AI2 provides flow reference; AI3 provides the oil pressure feedback; the servo drive conducts oil pressure control.
CAN oil pressure control mode (specialized)	A3-00 = 3	It is the oil pressure control mode implemented by using CAN communication with the host computer. The servo pump control parameters in group A3 are invalid.
Reserved	A3-00 = 4	Reserved

When the non-oil pressure control mode (A3-00 = 0) is switched over to the oil pressure control mode (A3-00 ≠ 0), the related parameters are set automatically, as listed in the following table.

Function Code	Parameter Name	Setting
F0-01	Control mode	1: Closed-loop vector control (CLVC)
F0-02	Command source selection	1: Terminal
F0-03	Main frequency source X selection	If A3-00 = 2, set F0-03 to 3 (AI2). If A3-00 = 1 or 3, set F0-03 to 9 (Communication).
F0-17	Acceleration time1	0.0s
F0-18	Deceleration time1	0.0s
F1-00	Motor type	2: PMSM

Function Code	Parameter Name	Setting
F4-00	DI1 function selection	1: Forward RUN (FWD enabled)
F4-01	DI2 function selection	48: Servo pump PID selection terminal 1
F4-02	DI3 function selection	53: Slave pump address selection terminal 1
F4-03	DI4 function selection	9: Fault reset (RESET)
F4-04	DI5 function selection	50: CAN communication enabled
F5-01	Control board relay (T/A1-T/B1-T/C1) function selection	2: Fault output
F5-02	Control board relay (T/A2-T/C2) function selection	23: Double-discharge plunger pump sloping switchover (NO)
F5-03	Control board relay (T/A3-T/C3) function selection	24: Oil pressure control output (NC)

In the oil pressure control mode, modification of these parameters is retentive at power failure. The parameters will restore to the values automatically set when the servo drive is powered on again. After the oil pressure control mode is switched over to the non-oil pressure control mode, the parameters are restored to the values before the system is switched over to the oil pressure control mode.

4.3.4 Oil Pressure PID Response Control

■ Oil Pressure PID Group Determined by DI

The IS580 provides four groups of PID parameters, one of which is selected based on the state combinations of DI2 with function 48# and DI3 with function 49#. The following table describes the relationship between PID group selection and states of the DIs.

The following table describes how to set the DI states to select the PID group.

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

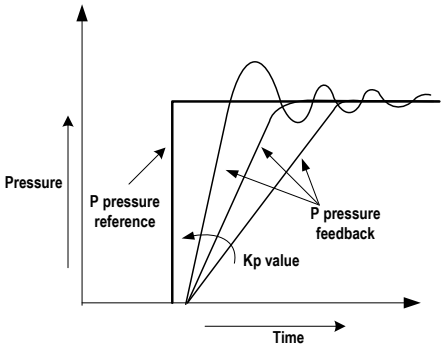
To achieve a faster system response, increase the proportional gain Kp and derivative time Kd and decrease the integral time Ki. Be aware that quicker response may lead to overshoot and system oscillation.

Decreasing the proportional gain Kp and derivative time Kd and increasing the integral time will slow the system response. Be aware that too slow response will reduce system efficiency and product stability.

■ Oil Presure PID Proportional Gain (A3-05, A3-11, A3-14, and A3-17)

The larger the proportional gain, the faster the system response. Too large setting will cause system oscillation, but too small setting will slow the system response.

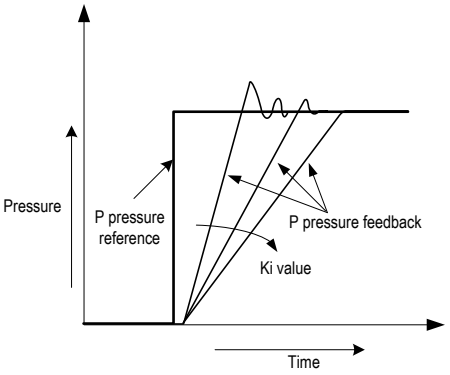
Figure 4-3 Relationship between the proportional gain and system response



■ Oil Pressure PID Integral Time (A3-06, A3-12, A3-15, and A3-18)

The shorter the integral time is, the faster the system response is. Too short setting will cause overshoot and system oscillation. But too long setting will slow system response and make the oil pressure unstable.

Figure 4-4 Relationship between the integral time and system response



■ Oil Pressure Overshoot Suppression (A3-27/A4-16, A3-28/A4-17)

This function is used for pressure overshoot suppression at high speed.

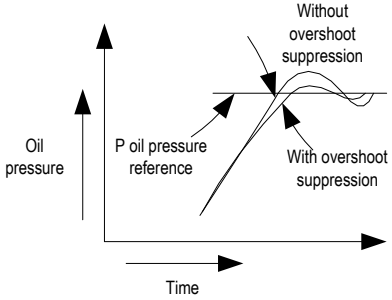
- Overshoot suppression detection level (A3-27/A4-16)

  The larger the value of the parameter is, the later the overshoot suppression starts, the poorer the suppression effect becomes, and the bigger the overshoot will be. The smaller the value is, the sooner the overshoot suppression starts, and the better the suppression effect and the smaller the overshoot will be.

- Overshoot suppression Coefficient (A3-28/A4-17)

  The larger the value of the parameter is, the better the suppression effect will be. But too large value will cause the pressure curve to be unsmooth. The smaller the value is, the poorer the suppression effect becomes and the bigger the overshoot will be.

Figure 4-15 Overshoot suppression



■ Oil Pressure Loop PID Response Gain (A3-29)

It is used to adjust the response of the entire hydraulic loop. The larger the gain is, the faster the response is; however, this will cause system oscillation. The smaller the gain is, the slower the response is.

Reduce the gain when the inertia of the hydraulic system is large or the oil pipe is slim.

4.3.5 Commissioning of Pressure Holding Stability

If the holding pressure fluctuates greatly during commissioning, increase the low-speed loop response; that is, increase the value of F2-00 and decrease the value of F2-01. Note that these two parameters must be modified properly to avoid motor oscillation.

5

Maintenance and Trouble-shooting

Chapter 5 Maintenance and Troubleshooting

5.1 Maintenance of the Servo Drive

5.1.1 Daily Maintenance

The influence of the ambient temperature, humidity, dust and vibration will cause the aging of the devices in the servo drive, which may cause potential faults or reduce the service life of the servo drive. Therefore, it is necessary to carry out routine and periodic maintenance.

Check the following items every day.

Inspection Item	Inspection Points
Motor	Check whether abnormal oscillation during the motor running.
	Check whether noise exists during the motor running.
Installation environment	Check whether the installation environment changes.
Fan	Check whether the cooling fan of the servo drive works abnormally.
Servo drive	Check whether the servo drive is overheated.

The routine cleaning involves:

- Keep the servo drive clean all the time.
- Remove the dust, especially metal powder on the surface of the servo drive, to prevent the dust from entering the servo drive.
- Clear the oil stain on the cooling fan of the servo drive.

5.1.2 Periodic Inspection

Perform periodic inspection in places where daily inspection is difficult.

The periodic inspection involves:

- Check and clean the air duct periodically.
- Check whether the screws become loose.
- Check whether the servo drive is corroded.
- Check whether the wiring terminals have arc signs.
- Carry out the main circuit insulation test.

Note

- Before measuring insulating resistance with megameter (500 VDC megameter recommended), disconnect the main circuit from the AC drive.
- Do not use the insulating resistance meter to test the insulation of the control circuit. The high voltage test need not be performed again because it has been completed before delivery.

5.1.3 Replacement of Vulnerable Components

Vulnerable components of the servo drive include the cooling fan and filter electrolytic capacitor. Their service life is related to the operating environment and maintenance status. Generally, the service life is shown as follows:

Component	Service Life	Possible Cause	Judging Criteria
Fan	2 to 3 years	• Bearing worn • Blade aging	• Whether there is crack on the blade • Whether there is abnormal vibration noise upon startup
Electrolytic capacitor	4 to 5 years	• Input power supply in poor quality • High ambient temperature • Frequent load jumping • Electrolytic aging	• Whether there is liquid leakage. • Whether the safe valve has projected. • Measure the static capacitance. • Measure the insulating resistance.

The standard service time indicates the service time when the servo drive is used on the following conditions:

- Ambient temperature: about 30°C on average yearly
- Load rate: below 80%
- Operating rate: below 20 hours per day

You can determine when to replace these parts according to the actual operating time.

5.1.4 Storage of the Servo Drive

For storage of the Servo drive, pay attention to the following two aspects:

- Pack the Servo drive with the original packing box provided by Inovance.
- Long-term storage degrades the electrolytic capacitor. Thus, the servo drive must be energized once every 2 years, each time lasting at least 5 hours. The input voltage must be increased slowly to the rated value with the regulator.

5.2 Warranty Agreement

1. Free warranty only applies to the servo drive itself.
2. Inovance will provide 18-month warranty from date of manufacturing for the failure or damage under normal use conditions. If the equipment has been used for over 18 months, reasonable repair expenses will be charged.
    - Reasonable repair expenses will be charged for the damages due to the following causes:
    - Improper operation without following the instructions
    - Fire, flood or abnormal voltage.
    - Using the servo drive for non-recommended function
    - The maintenance fee is charged according to Inovance's uniform standard. If there is an agreement, the agreement prevails.

5.3 Troubleshooting

The IS580 provides alarm information and protective functions. When a fault occurs, IS580 implements the protective function, stops output, makes the fault relay act, and displays the fault code on the operation panel.

Before contacting Inovance for technical support, you can first determine the fault type, analyze the causes, and perform troubleshooting according to the description in this chapter. If the fault cannot be rectified, contact the agent or Inovance.

Table 5-1 Common faults expressed by fault codes

Common Fault Display	
Err01: Reserved	Err22: Reserved
Err02: Overcurrent during acceleration	Err23: Short-circuit to ground
Err03: Overcurrent during deceleration	Err24 to Err25: Reserved
Err04: Overcurrent at constant speed	Err26: Accumulative running time reached
Err05: Overvoltage during acceleration	Err27: Accumulative business running time reached
Err06: Overvoltage during deceleration	Err28 to Err29: Reserved
Err07: Overvoltage at constant speed	Err40: Wave-chasing current limit fault
Err08: Snubber resistor fault	Err41: Reserved
Err09: Undervoltage	Err42: CAN communication interrupted
Err10: Servo drive overload	Err43: Encoder fault during motor auto-tuning
Err11:Reserved	Err44: Speed deviation too large
Err12: Phase loss on input side	Err45: Motor overheat
Err13: Phase loss on output side	Err46: Pressure sensor fault
Err14: Module overheat	Err49: Resolver signal fault
Err15: External device fault	Err58: Parameter restoration fault
Err16: Modbus communication fault	Err59: Back EMF auto-tuning fault
Err17: Contactor fault	Err60: Reserved
Err18: Current detection fault	Err61: Brake pipe in braking protection state for long time
Err19: Motor auto-tuning fault	Err62: Reserved
Err20: Reserved	Err63: Reverse running time reached
Err21:EEPROM fault	

Note

- Err47 and Err48 are related to the multi-pump convergent flow solution. Err08 cannot be reset, please contact Inovance.
- If only one pump is controlled, disable DI5. If the multi-pump convergent flow solution is used, refer to descriptions in Appendix C.

5.3.1 Troubleshooting flowchart

Figure 5-1 Err02 (Overcurrent during acceleration)

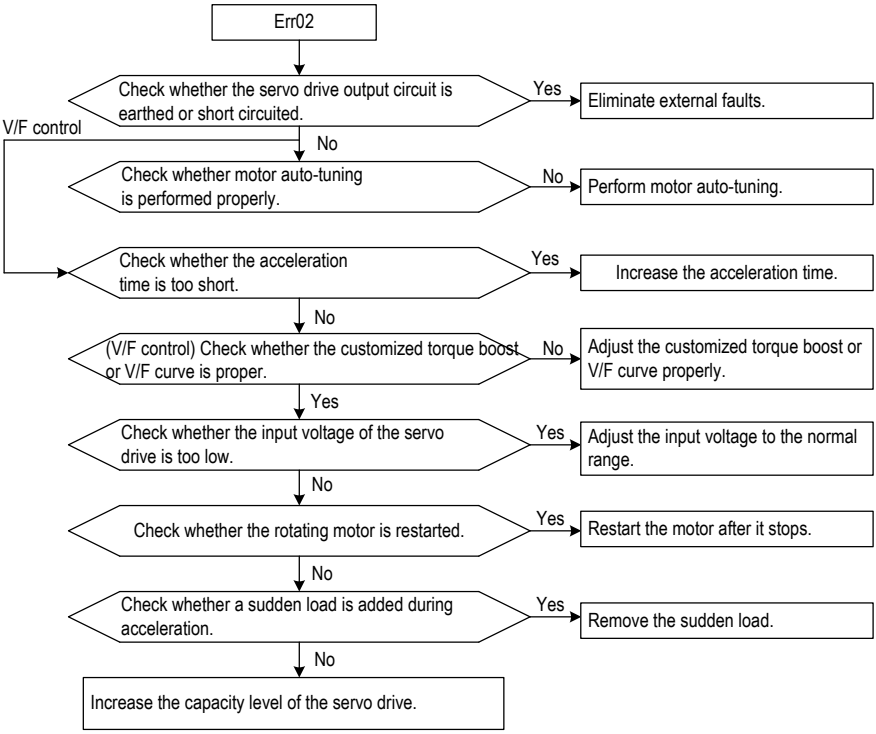


Figure 5-2 Err03 (Overcurrent during deceleration)

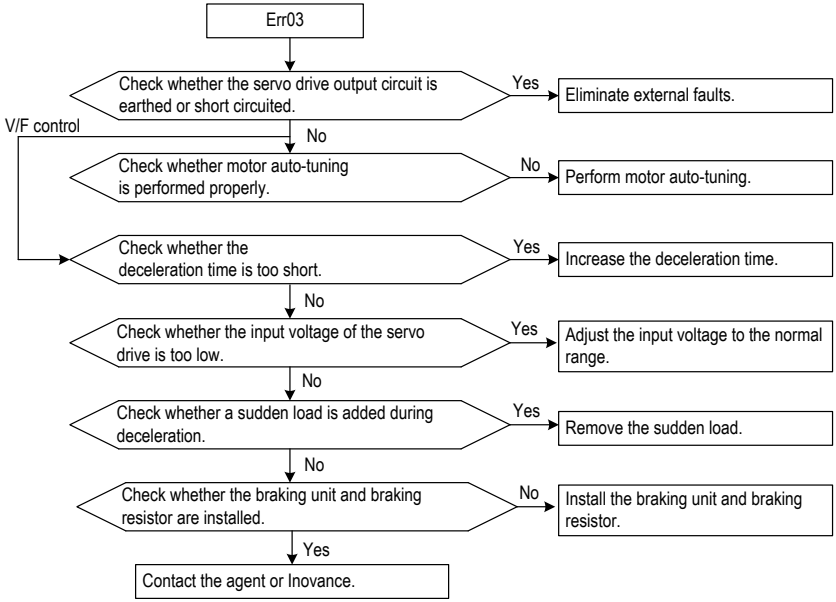


Figure 5-3 Err04 (Overcurrent at constant speed)

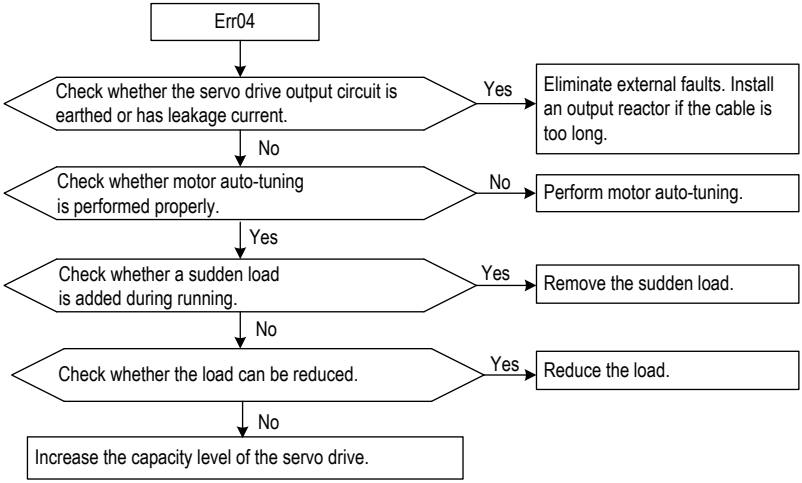


Figure 5-4 Err05 (Overvoltage during acceleration)

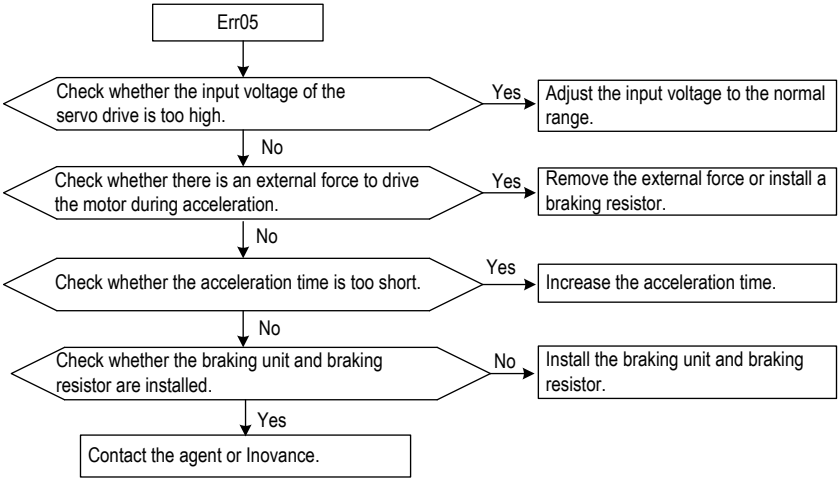


Figure 5-5 Err06 (Overvoltage during deceleration)

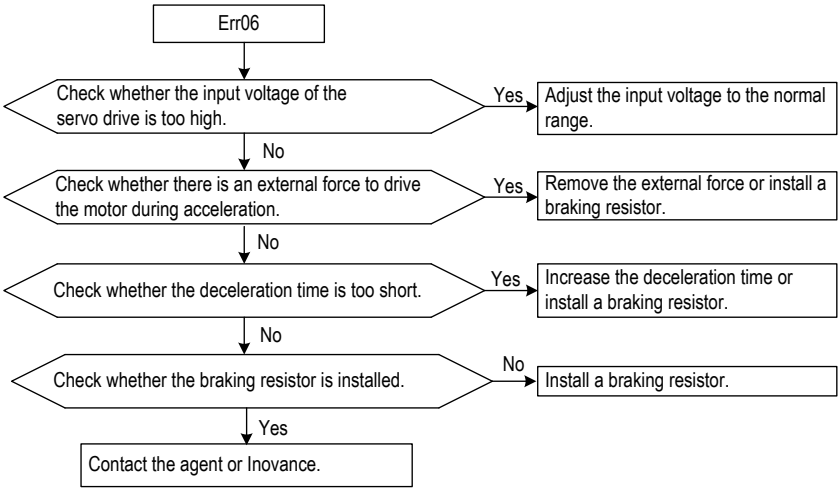


Figure 5-6 Err07 (Overvoltage at constant speed)

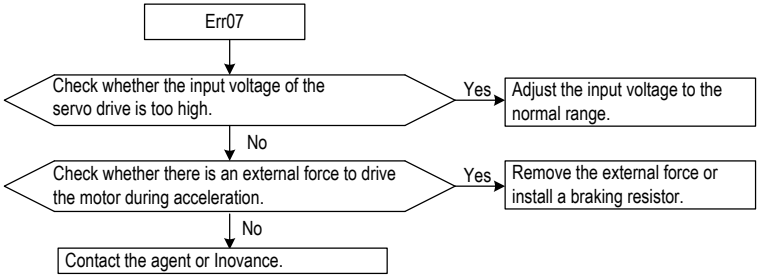


Figure 5-7 Err09 (Undervoltage)

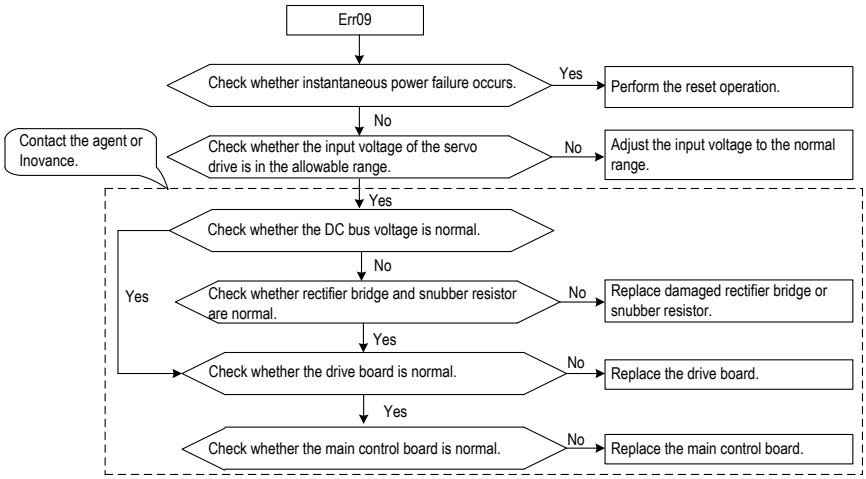


Figure 5-8 Err10 (Servo drive overload)

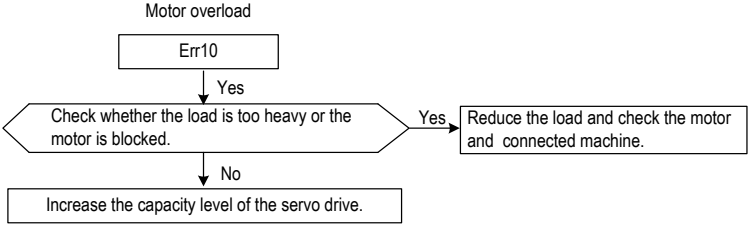


Figure 5-9 Err12 (Phase loss on input side)

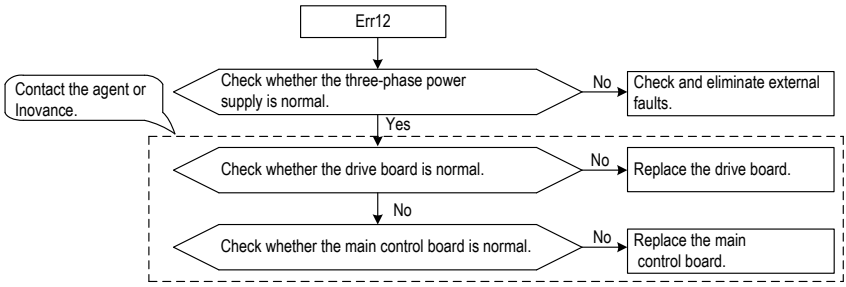


Figure 5-10 Err13 (Phase loss on output side)

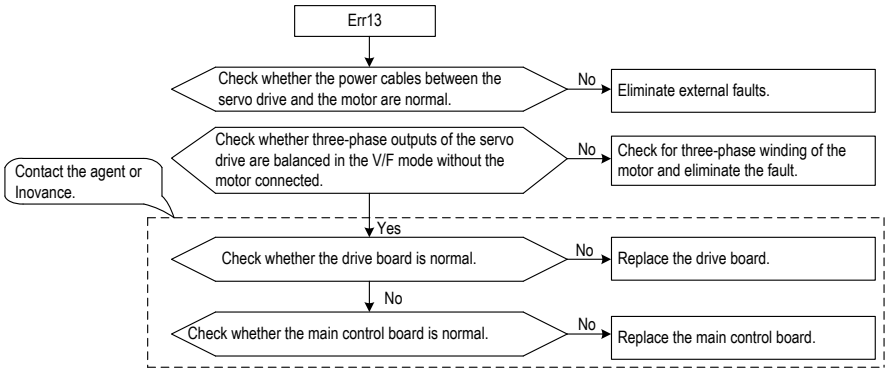


Figure 5-11 Err14 (Module overheat)

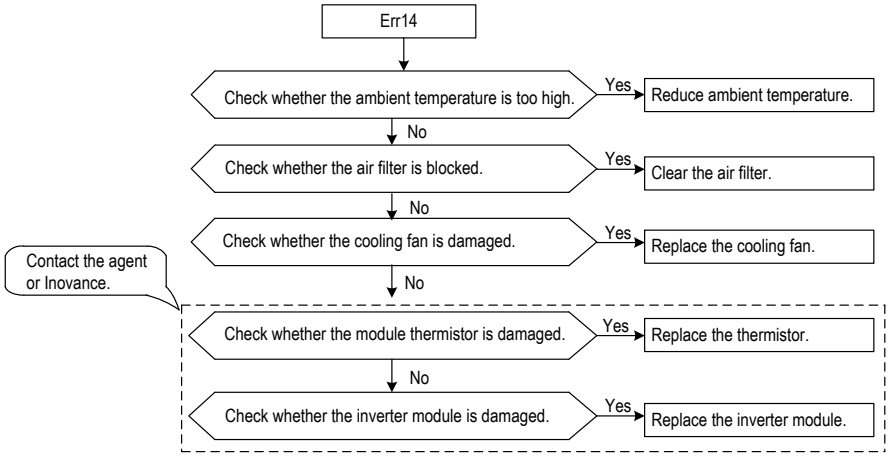


Figure 5-12 Err15 (External device fault)

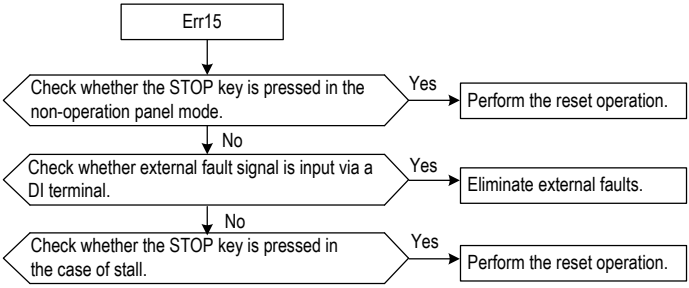


Figure 5-13 Err16 (Communication fault)

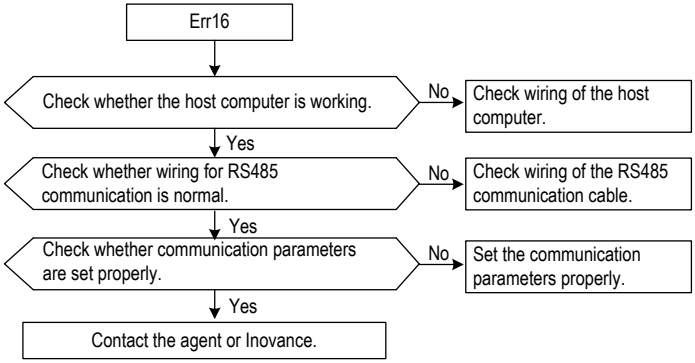


Figure 5-14 Err17 (Contactor fault)

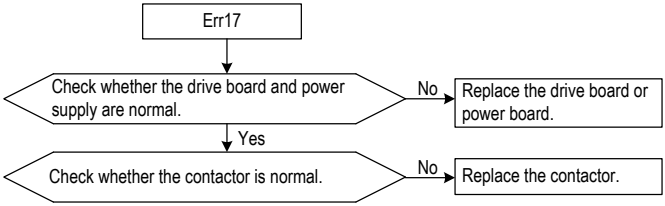


Figure 5-15 Err18 (Current detection fault)

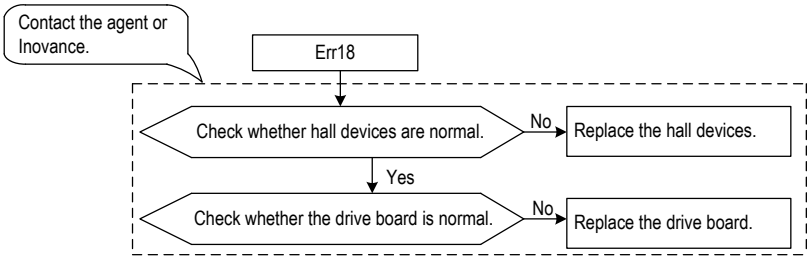


Figure 5-16 Err19 (Motor auto-tuning fault)

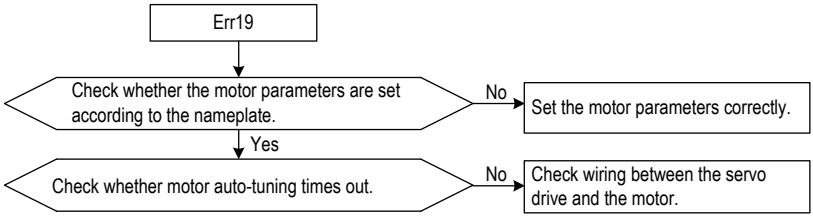


Figure 5-17 Err20 (Encoder fault)

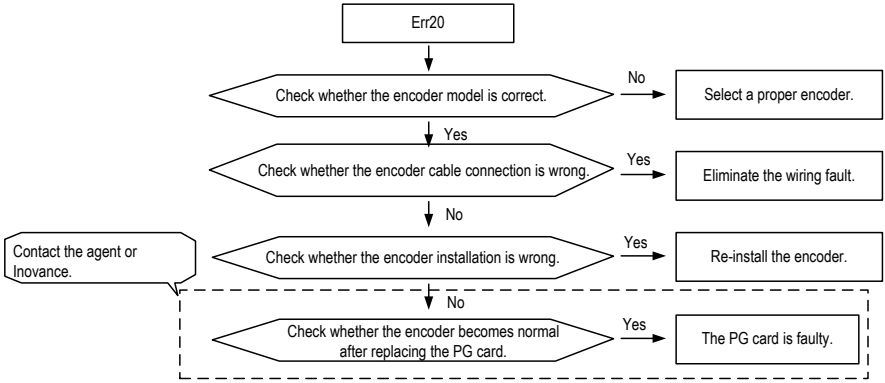


Figure 5-18 Err21 (EEPROM fault)

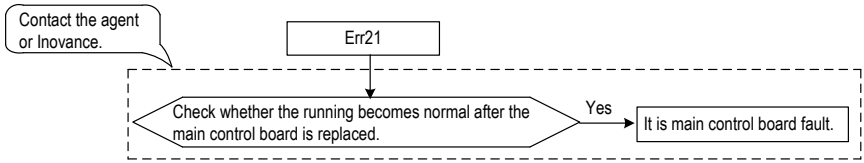


Figure 5-19 Err23 (Short circuit to ground)

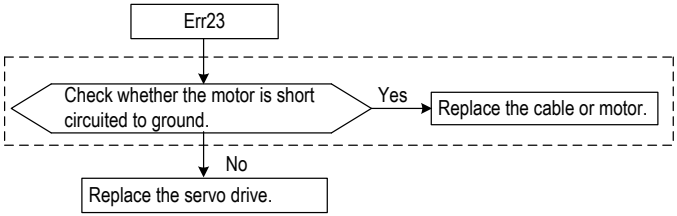


Figure 5-20 Err26 (Accumulative running time reached)

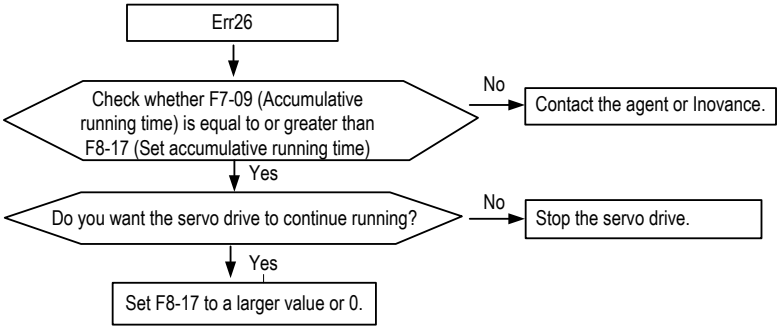


Figure 5-21 Err27 (Accumulative business running time reached)

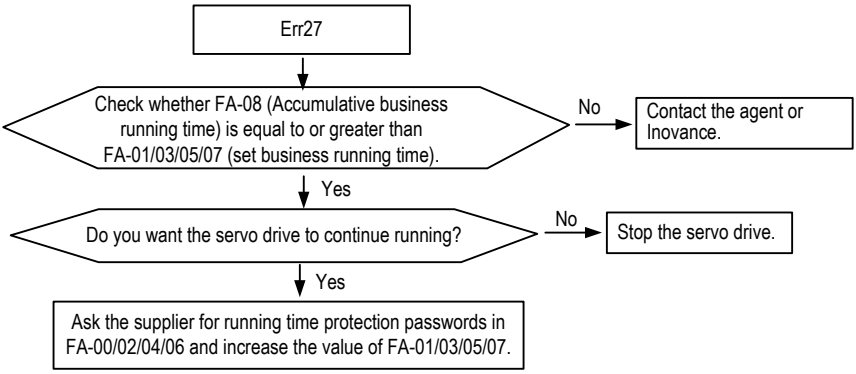


Figure 5-22 Err40 (Wave-chasing current limit fault)

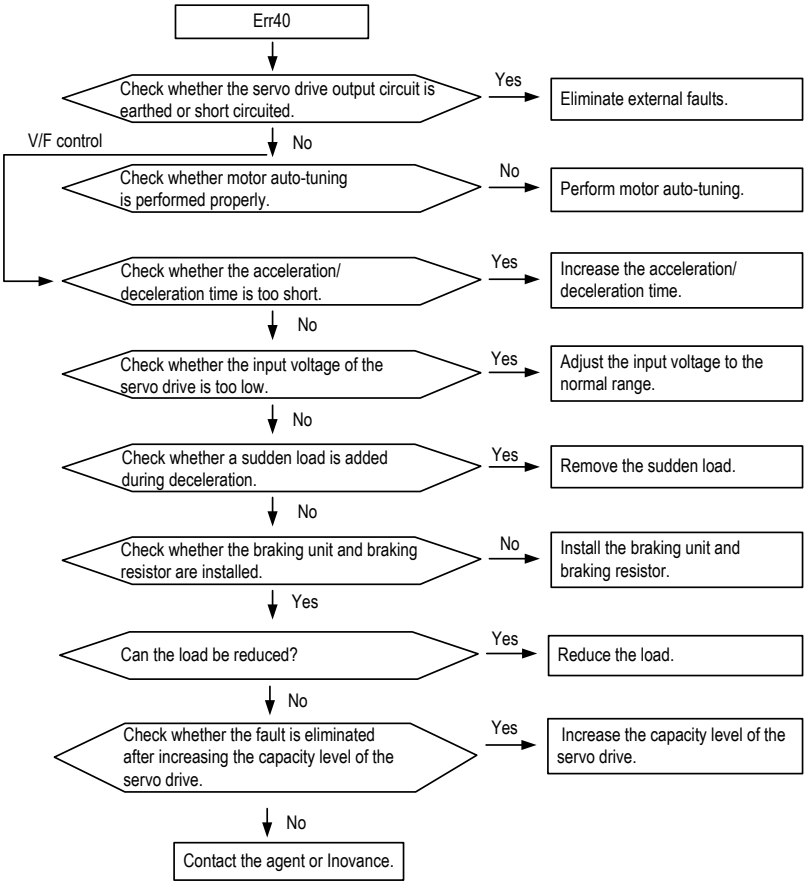


Figure 5-23 Err42 (CAN communication interrupted)

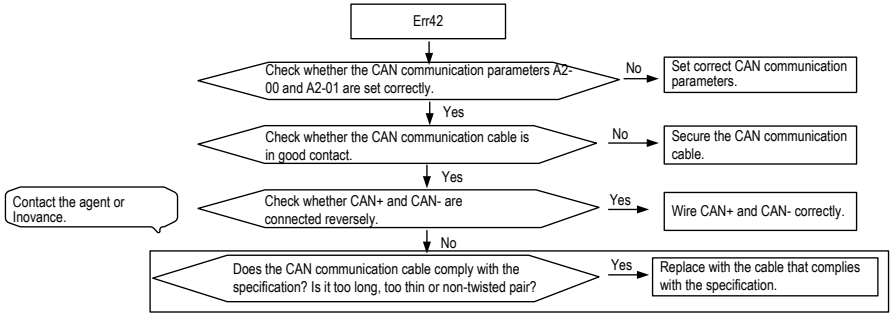


Figure 5-24 Err43 (Encoder fault during motor auto-tuning)

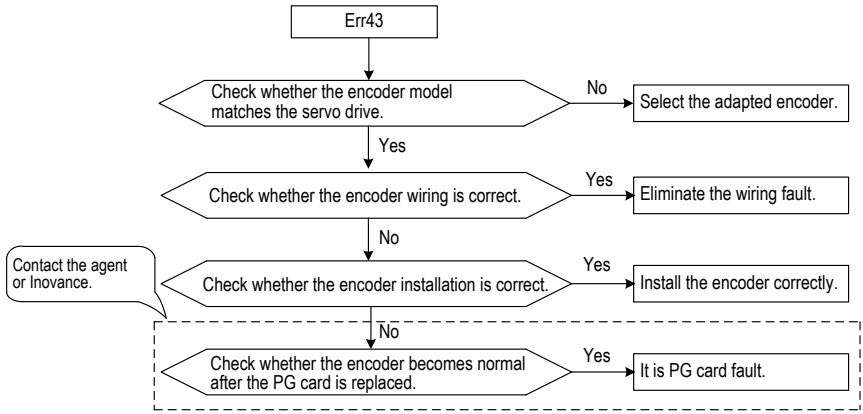


Figure 5-25 Err44 (Speed deviation too large)

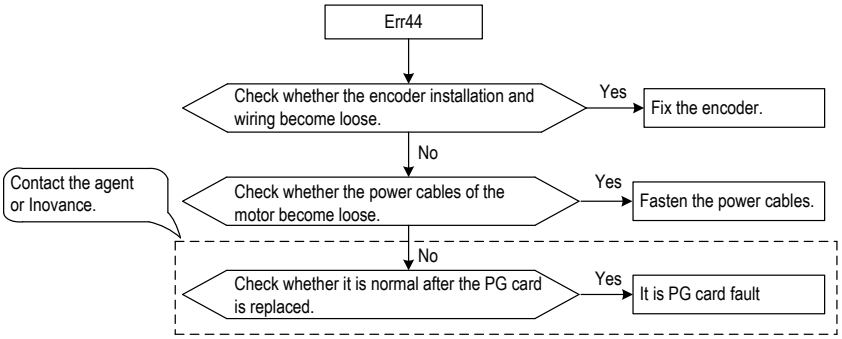


Figure 5-26 Err45 (Motor overheat)

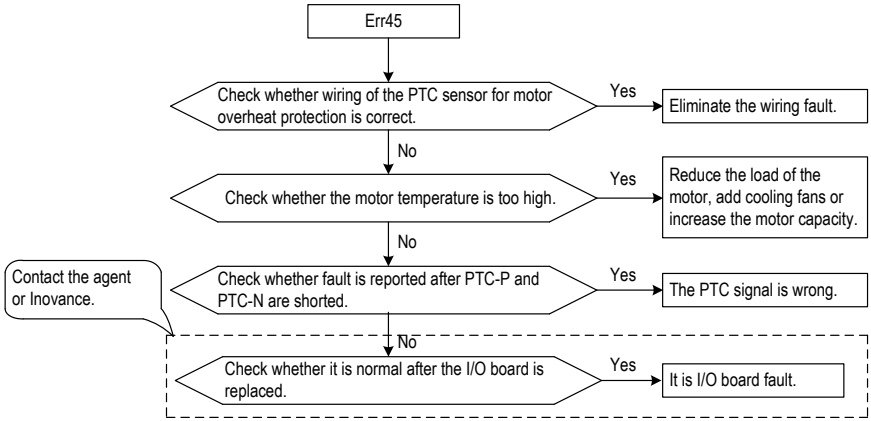


Figure 5-27 Err46 (Pressure sensor fault)

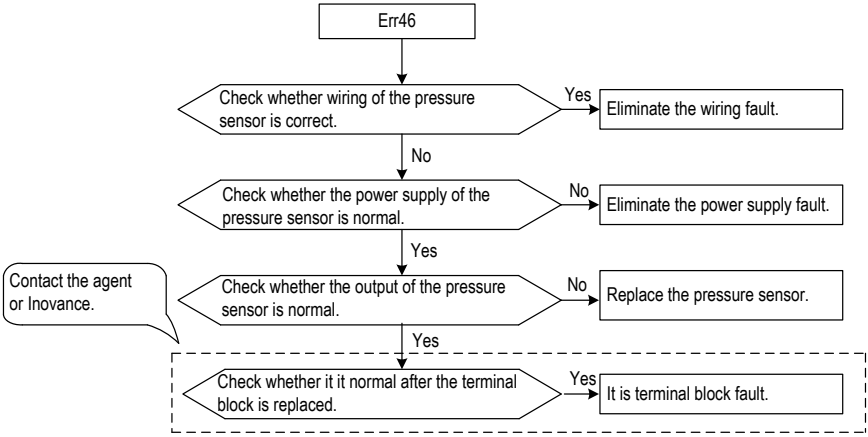


Figure 5-28 Err49 (Resolver signal fault)

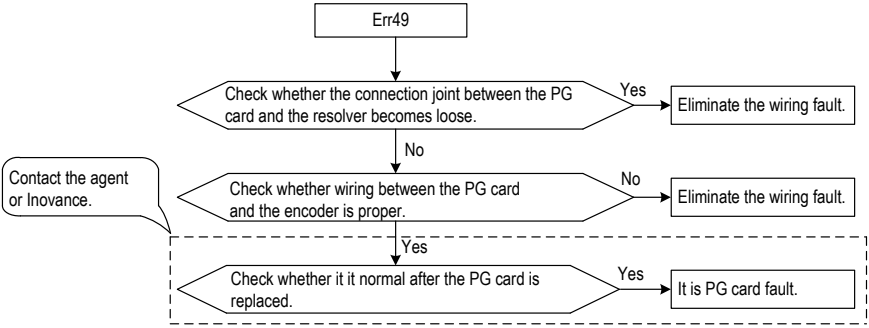


Figure 5-29 Err58 (Parameter restoration fault)

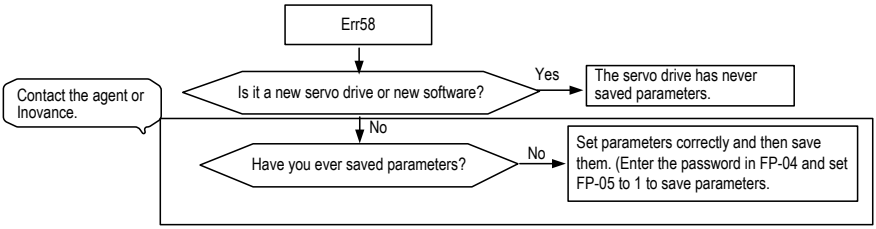


Figure 5-30 Err59 (Back EMF auto-tuning fault)

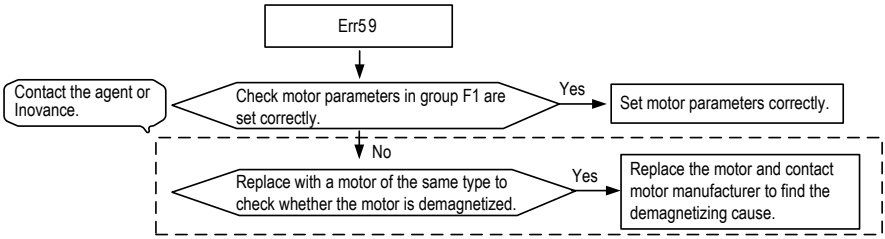


Figure 5-31 Err61 (Brake pipe in braking protection state for long time)

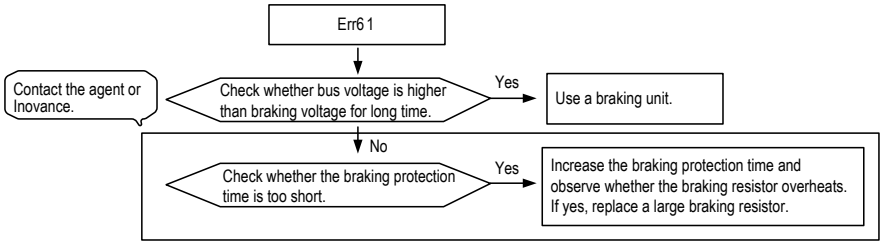
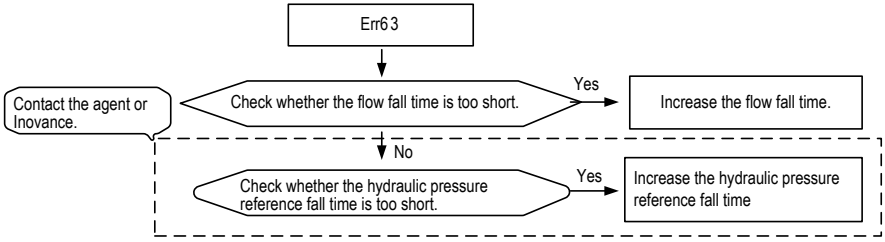


Figure 5-32 Err63 (Reverse running time reached)



Note

- Err47 and Err48 are related to the multi-pump convergent flow solution.
- If only one pump is controlled, disable DI5. If the multi-pump convergent flow solution is used, refer to descriptions in Appendix C.

5.4 Symptoms and Diagnostics

The following symptoms may occur during use of the servo drive. When these symptoms occur, perform simple analysis based on the following table.

No.	Symptom	Possible Causes	Solutions
1	No display upon power-on	1. There is no power supply to the servo drive. 2. The 8-core cable connecting the drive board and the control board is in poor contact. 3. Components inside the servo drive are damaged.	1. Check the power input. 2. Connect the 8-core cable again. 3. Contact the agent or Inovance.
2	"HC" is displayed upon power-on.	1. The 4-core cable connecting the drive board and the control board is in poor contact. 2. Other components of the servo drive are broken.	1. Connect the 4-core cable again. 2. Contact the agent or Inovance.
3	"Err23" is displayed upon power-on.	1. The motor or the motor output cable is short circuited to the ground. 2. The servo drive is damaged.	1. Check the insulation status of the motor and the output cable with a megger. 2. Contact the agent or Inovance.
4	The servo drive display is normal upon power-on, but displays "HC" after running and stops immediately.	The cooling fan is damaged or does not rotate.	Replace the cooling fan.
5	Err14 (module overheat) is reported frequently.	1. The carrier frequency is set too high. 2. The cooling fan is damaged, or the air filter is blocked. 3. Components (thermal coupler or others) inside the servo drive are damaged.	1. Reduce the carrier frequency (F0-15). 2. Replace the cooling fan and clean the air filter. 3. Contact the agent or Inovance.
6	The motor does not rotate after the servo drive runs.	1. The motor is damaged or locked-rotor occurs. 2. The motor parameters in group F1 are set improperly.	1. Replace the motor or rectify mechanical faults. 2. Check and set the motor parameters again.
7	DI terminals are disabled.	1. The related parameters are set incorrectly. 2. The jumper across OP and +24V becomes loose. 3. The control board is faulty.	1. Check and set the parameters in group F4 again. 2. Re-connect the cable. 3. Contact the agent or Inovance.
8	In CLVC control mode, the motor speed cannot be rise.	1. The encoder is damaged or the encoder wiring is incorrect. 2. Components inside the servo drive are damaged.	1. Replace the encoder and correct the wiring. 2. Contact the agent or Inovance.

No.	Symptom	Possible Causes	Solutions
9	The servo drive reports overcurrent and overvoltage faults frequently.	1. The motor parameters in group F1 are set improperly. 2. The acceleration/deceleration time is improper. 3. The load fluctuates.	1. Set the motor parameters or perform motor auto-tuning again. 2. Set proper acceleration/deceleration time.3. Contact the agent or Inovance.
10	Err17 is reported upon power-on or running.	The soft startup contactor is not closed.	1. Check: Whether the contactor cable is loose Whether the contactor is faulty Whether the contactor 24 V power supply is faulty. 2. Contact the agent or Inovance.

6

ISMG Servo Motor

Chapter 6 ISMG Servo Motor (Voltage Class: 400 V)

6.1 Designation Rules of the ISMG Servo Motor

ISM G1- 30D 15C D- R1 3 1 F

Mark	Series No.
ISM	ISM Series servo motor

Mark	Features
G1	200 x 200 base
G2	266 x 266 base

Mark	Rated Power
1 digit + 1 letter	
A	x 1
B	x 10
C	x 100
D	x 1000
E	x 10000

Example:
15C: 1500 W
30D: 30000 W

Mark	Rated Speed
2 digits + 1 letter	
A	x 1
B	x 10
C	x 100
D	x 1000
E	x 10000

Example:
15C: 1500 RPM
20C: 2000 RPM

Mark	Customized Requirement
X	Natural cooling
Y	Forced air cooling

Mark	Brake, Reducer & Oil Seal
1	Oil seal

Mark	Shaft Connection Mode
1	Optical shaft
3	Solid, with key and threaded hole
8	Hollow spline

Mark	Encoder Type
1 digit + 1 letter	
R1	Resolver with one pair of poles
U1	2500 PPR wire-saving incremental encoder

Mark	Voltage Class
D	400 V

Note

Motor duty types indicate the load that the motor drives, with sequential operations, involving startup, electric braking, no-load running, power-off and stop.

- S1: Continuous duty

  The operation of a motor at a rated load may take an unspecified time period to reach thermal equilibrium.

- S4: Intermittent periodic duty with start

  This is a sequence of identical duty cycles, each consisting load for a period, an operation at constant load period, followed by a stationary and de-energized period. This cycle has a great impact on temperature rise.

6.2 ISMG Servo Motor Specification Parameters

6.2.1 ISMG1 Servo Motor (200 x 200 Base/Forced Air Cooling)

Specifications of the ISMG1 motor with forced air cooling											
Servo Motor Model	Rated Torque (Nm)		Rated Motor Speed (RPM)	Back EMF (V)	Rated Voltage (V)		Rated Current (A)		No-load Current (A)	Rated Power (kW)	
	S1	S4			S1	S4	S1	S4		S1	S4
ISMG1-95C15CD-R131F	50	60	1500	305	333	340	15	19	0.6	7.9	9.5
ISMG1-11D17CD-R131F	50	60	1700	296	332	338	19	23	0.8	8.9	11
ISMG1-12D20CD-R131F	50	60	2000	291	325	331	21	26	0.8	10.5	12.6
ISMG1-14D15CD-R131F	75	90	1500	291	325	332	25	30	0.7	13	14.1
ISMG1-16D17CD-R131F	75	90	1700	296	328	333	29	34	0.8	14.5	16
ISMG1-18D20CD-R131F	75	90	2000	310	335	340	31	36	0.8	17	18.8
ISMG1-17D15CD-R131F	92	110	1500	291	321	326	31	37	1.0	14.4	17.3
ISMG1-20D17CD-R131F	92	110	1700	288	318	323	35	42	1.0	16.4	19.6
ISMG1-23D20CD-R131F	92	110	2000	291	322	326	40	49	1.0	19.3	23.0
ISMG1-22D15CD-R131F	115	135	1500	305	342	348	36	41	0.8	19	22
ISMG1-24D17CD-R131F	115	135	1700	296	332	338	43	50	0.9	21.5	24
ISMG1-28D20CD-R131F	115	135	2000	291	322	328	47	54	0.9	25.5	28.3
ISMG1-30D15CD-R131F	150	195	1500	291	324	333	48	61	0.9	25	30.6
ISMG1-34D17CD-R131F	150	195	1700	301	330	340	56	72	1.3	27	34.7
ISMG1-41D20CD-R131F	150	195	2000	310	334	343	60	76	1	33	41

Specifications of the ISMG1 motor with forced air cooling								
Servo Motor Model	Torque Constant (Nm/A)	Back EMF Constant (V/RPM)	380-V Max. Torque (Nm)	Limit Torque (Nm)	Max. Motor Speed	Rotor Inertia ($kg \cdot m^2$ 10-3)	PTC Normal-Temp Resistance (Ω)	Number of Poles
ISMG1-95C15CD-R131F	3.24	0.203	105	160	1800	7.5	300	8
ISMG1-11D17CD-R131F	2.68	0.174	105	160	2040	7.5	300	8
ISMG1-12D20CD-R131F	2.387	0.1455	105	160	2400	7.5	300	8
ISMG1-14D15CD-R131F	3.01	0.194	145	230	1800	9	300	8
ISMG1-16D17CD-R131F	2.753	0.174	145	230	2040	9	300	8
ISMG1-18D20CD-R131F	2.554	0.155	145	230	2400	9	300	8
ISMG1-17D15CD-R131F	3.139	0.194	165	230	1800	10.5	300	8
ISMG1-20D17CD-R131F	2.746	0.169	165	230	2040	10.5	300	8
ISMG1-23D20CD-R131F	2.354	0.146	165	230	2400	10.5	300	8
ISMG1-22D15CD-R131F	3.306	0.203	210	340	1800	12	300	8
ISMG1-24D17CD-R131F	2.755	0.1741	210	340	2040	12	300	8
ISMG1-28D20CD-R131F	2.531	0.1455	210	340	2400	12	300	8
ISMG1-30D15CD-R131F	3.2	0.194	265	450	1800	15	300	8
ISMG1-34D17CD-R131F	2.68	0.177	265	450	2040	15	300	8
ISMG1-41D20CD-R131F	2.58	0.155	265	450	2400	15	300	8

6.2.2 ISMG2 Servo Motor (266 x 266 Base/Forced Air Cooling)

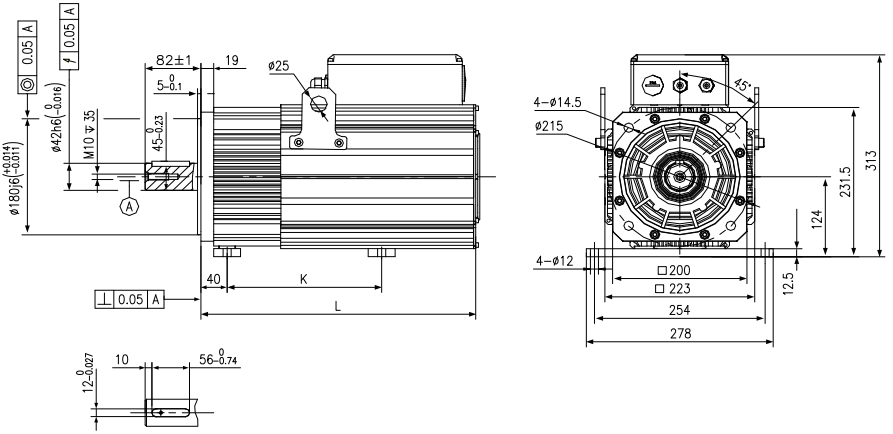
Specifications of the ISMG1 motor with forced air cooling											
Servo Motor Model	Rated Torque (Nm)		Rated Motor Speed (RPM)	Back EMF (V)	Rated Voltage (V)		Rated Current (A)		No-load Current (A)	Rated Power (kW)	
	S1	S4			S1	S4	S1	S4		S1	S4
ISMG2-20D15CD-R131F	116	130	1500	291	346	353	41	45	0.9	18.2	20.4
ISMG2-23D17CD-R131F	116	130	1700	296	351	358	45	50	0.9	20.6	23.1
ISMG2-27D20CD-R131F	116	130	2000	310	365	372	51	57	0.9	24.3	27.2
ISMG2-31D15CD-R131F	170	200	1500	305	358	364	56	65	1	26.7	31.4
ISMG2-36D17CD-R131F	170	200	1700	296	349	355	65	76	1	30.3	35.6
ISMG2-42D20CD-R131F	170	200	2000	291	344	350	78	92	1	35.6	41.9
ISMG2-42D15CD-R131F	230	270	1500	291	341	348	79	92	1	36.1	42.4
ISMG2-48D17CD-R131F	230	270	1700	296	346	353	88	102	1	40.9	48.1
ISMG2-57D20CD-R131F	230	270	2000	310	360	367	99	115	1	48.2	56.5
ISMG2-60D15CD-R131F	340	385	1500	305	353	360	110	125	1.1	53.4	60.5
ISMG2-68D17CD-R131F	340	385	1700	296	344	351	129	145	1.1	60.5	68.5
ISMG2-80D20CD-R131F	340	385	2000	291	339	346	154	174	1.1	71.2	80.6
ISMG2-80D15CD-R131F	440	510	1500	291	334	341	149	173	1.1	69.1	80.1
ISMG2-91D17CD-R131F	440	510	1700	329	372	379	149	173	1.1	78.3	90.8
ISMG2-11E20CD-R131F	440	510	2000	310	353	360	187	216	1.1	92.1	106.8

Specifications of the ISMG1 motor with forced air cooling								
Servo Motor Model	Torque Constant (Nm/A)	Back EMF Constant (V/RPM)	380-V Max. Torque (Nm)	Limit Torque (Nm)	Max. Motor Speed	Rotor Inertia ($kg \cdot m^2$ 10-3)	PTC Normal-Temp Resistance (Ω)	Number of Poles
ISMG2-20D15CD-R131F	2.981	0.194	240	325	1800	22.1	300	8
ISMG2-23D17CD-R131F	2.683	0.174	240	325	2040	22.1	300	8
ISMG2-27D20CD-R131F	2.385	0.155	240	325	2400	22.1	300	8
ISMG2-31D15CD-R131F	3.13	0.203	345	488	1800	29.6	300	8
ISMG2-36D17CD-R131F	2.683	0.174	345	488	2040	29.6	300	8
ISMG2-42D20CD-R131F	2.236	0.145	345	488	2400	29.6	300	8
ISMG2-42D15CD-R131F	2.981	0.194	465	650	1800	36.8	300	8
ISMG2-48D17CD-R131F	2.683	0.174	465	650	2040	36.8	300	8
ISMG2-57D20CD-R131F	2.385	0.155	465	650	2400	36.8	300	8
ISMG2-60D15CD-R131F	3.13	0.203	660	975	1800	50	300	8
ISMG2-68D17CD-R131F	2.683	0.174	660	975	2040	50	300	8
ISMG2-80D20CD-R131F	2.236	0.145	660	975	2400	50	300	8
ISMG2-80D15CD-R131F	2.981	0.194	825	1300	1800	64	300	8
ISMG2-91D17CD-R131F	2.981	0.194	825	1300	2040	64	300	8
ISMG2-11E20CD-R131F	2.385	0.155	825	1300	2400	64	300	8

6.3 Physical Appearance and Mounting Dimensions of ISMG Servo Motor

6.3.1 ISMG1 Servo Motor (200 x 200 Base/Forced Air Cooling)

Figure 6-1 Physical appearance and mounting dimensions of the ISMG1 servo motor (200 x 200 base/forced air cooling)



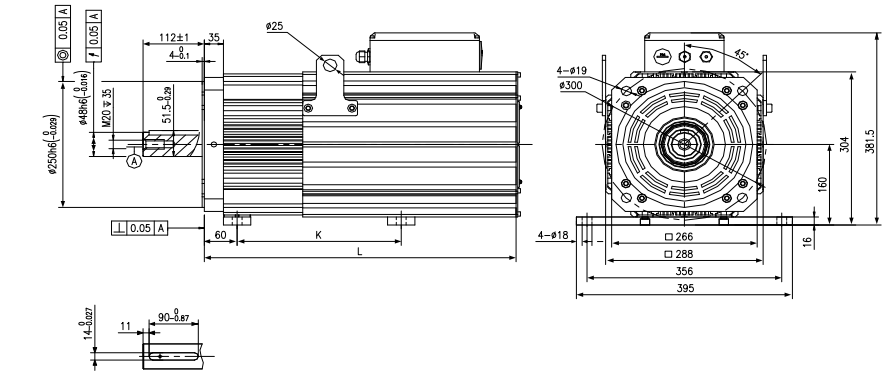
Standard configuration: A-type round-end parallel key 12 x 8 x 56
Refer to GB/T 1096

Table 6-1 Mounting dimensions of the ISMG1 servo motor (200 x 200 base/forced air cooling)

Servo Motor Model	ISMG1-95C15CD-R131F	ISMG1-14D15CD-R131F	ISMG1-17D15CD-R131F	ISMG1-22D15CD-R131F	ISMG1-30D15CD-R131F
	ISMG1-11D17CD-R131F	ISMG1-16D17CD-R131F	ISMG1-20D17CD-R131F	ISMG1-24D17CD-R131F	ISMG1-34D17CD-R131
	ISMG1-12D20CD-R131F	ISMG1-18D20CD-R131F	ISMG1-23D20CD-R131F	ISMG1-28D20CD-R131F	ISMG1-41D20CD-R131F
K	190	230	270	305	380
L	375	410	445	480	550

6.3.2 ISMG2 Servo Motor (266 x 266 Base/Forced Air Cooling)

Figure 6-2 Physical appearance and mounting dimensions of the ISMG2 servo motor (266 x 266 base/forced air cooling)



Standard configuration: A-type round-end parallel key 14 x 9 x 90
Refer to GB/T1096

Table 6-2 Mounting dimensions of the ISMG2 servo motor (266 x 266 base/forced air cooling)

Servo Motor Model	ISMG2-20D15CD-R131F	ISMG2-31D15CD-R131F	ISMG2-42D15CD-R131F	ISMG2-60D15CD-R131F	ISMG2-80D15CD-R131F
	ISMG2-23D17CD-R131F	ISMG2-36D17CD-R131F	ISMG2-48D17CD-R131F	ISMG2-68D17CD-R131F	ISMG2-91D17CD-R131F
	ISMG2-27D20CD-R131F	ISMG2-42D20CD-R131F	ISMG2-57D20CD-R131F	ISMG2-80D20CD-R131F	ISMG2-11E20CD-R131F
K	200	250	300	400	500
L	475	525	575	675	780

6.4 Supporting Board of ISMG Servo Motor Base

Model	Description
ISMG1-B02	Supporting board: used for the ISMG1 servo motor cooling fan
ISMG2-B02	Supporting board: used for the ISMG2 servo motor cooling fan

6.5 Wiring of the ISMG Servo Motor

6.5.1 Terminals of PCB Board

The signal types of the terminals are defined on the PCB board. AC1 and AC2 are power supply (single-phase 220 V) to the cooling fan. AC1 and AC2 should be wired strictly according to the marks.

The matched signal lines of the IS580 servo drive are defined as below:

Signal Definition	REF-	REF+	COS+	COS-	SIN+	SIN-
Adapted Encoder Cable Color	Yellow-white	Red-white	Red	Black	Yellow	Blue
Corresponding IS580 PG Card Pin	1	2	3	4	5	9

6.5.2 Precautions on Power Terminals Matched with PCB Board

When wiring the main circuit, ensure that the phase sequence conform to the marks. Connect PE terminal to the fixed screw with a special mark in the connection box.

Note

- PTC, KTY, and resolver signal cable cannot connect to the 220 V power supply. Otherwise, the motor will be damaged.
- The motor has passed the IP54 experiment. At wiring, protection measures must still be taken at the cabling holes to prevent foreign matters from falling into the motor.
- Sticky dust in the working environment will weaken heat dissipation of the motor. Refer to section 6.6 to clan the cooling fan.

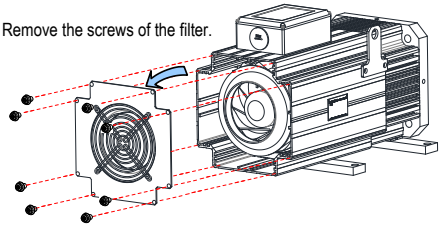
6.6 Cleaning the Cooling Fan of the Servo Motor

The estimated service life of the cooling fan of the servo motor is 40000 hours. On the condition that the cooling fan runs continuously at full speed, rated voltage and 40°C ambient temperature, after the cooling fan is jammed with foreign matters, the performance of the cooling fan degrades and the air volume reduces.

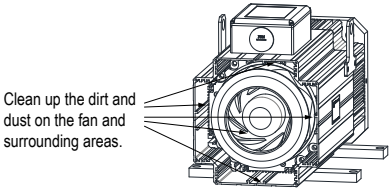
After the air filter is blocked, the air resistance increases and the air volume reduces, thus influencing the motor dissipation. Once the motor winding temperature exceeds the motor protection temperature, the servo drive reports Err45.

The procedure of cleaning the cooling fan is as follows:

1. Remove the eight screws that fix the filter at the tail of the motor (G1 is the M4 hex socket, G2 is the M5 hex socket) and then remove the cover.



2. Clean up the dirt and dust on the surface of the fan and in the air filter using a small flathead screwdriver and then use airgun to blow off the remaining dirt and dust.



3. Attach the cover to the drive and fix the screws.
4. Determine how often you clean the fan according to the actual working condition.

7

Selection

Chapter 7 Selection

7.1 Technical Data of the IS580

Model	Power Capacity (kVA)	Input Current (A)	Output Current (A)	Adaptable Motor (kW, HP)		Thermal Power Consumption (kW)
Three-phase 440 V, 50/60 Hz						
IS580T020-R1-1	30	36.3	25	11	15	0.445
IS580T030-R1-1	39	45.1	32	15	20	0.553
IS580T035-R1-1	45	49.5	37	18.5	25	0.651
IS580T040-R1-1	54	59	45	22	30	0.807
IS580T050-R1-1	52	57	60	30	40	1.01
IS580T070-R1-1	63	69	75	37	50	1.20
IS580T080-R1-1	81	89	91	45	60	1.51
IS580T080-R1-H-1						
IS580T100-R1-1	97	106	112	55	75	1.80
IS580T100-R1-H-1						
IS580T140-R1-1	127	139	150	75	100	1.84
IS580T140-R1-H-1						
IS580T170-R1-1	150	164	176	90	125	2.08
IS580T170-R1-H-1						
IS580T210-R1-1	179	196	210	110	150	2.55
IS580T210-R1-H-1						

7.2 Selection of Braking Unit and Braking Resistor

Servo drive Model	Recommended Power of Braking Resistor	Recommended Resistance of Braking Resistor	Braking Unit	Remark
Three-phase 380 to 480 V				
IS580T020-R1-1	800 W	≥ 43 Ω	Built-in	-
IS580T030-R1-1	1000 W	≥ 32 Ω		
IS580T035-R1-1	1300 W	≥ 25 Ω		
IS580T040-R1-1	1500 W	≥ 25 Ω		
IS580T050-R1-1	2500 W	≥ 20 Ω		
IS580T070-R1-1	3.7 kW	≥ 16 Ω		
IS580T080-R1-1	4.5 kW	≥ 16 Ω		
IS580T080-R1-H-1				
IS580T100-R1-1	5.5 kW	≥ 16 Ω		
IS580T100-R1-H-1				
IS580T140-R1-1	7.5 kW	≥ 12 Ω		
IS580T140-R1-H-1				
IS580T170-R1-1	4.5 kW x 2	≥ 12 Ω × 2	External	MDBUN-60-T × 2 (< 440 V) MDBUN-60-5T × 2 (> 440 V)
IS580T170-R1-H-1				
IS580T210-R1-1	5.5 kW × 2	≥ 12 Ω × 2	External	MDBUN-60-T × 2 (< 440 V) MDBUN-60-5T × 2 (> 440 V)
IS580T210-R1-H-1				

Note

" x 2" indicates that two braking units with their respective braking resistor connected in parallel.

7.3 Selection of Peripheral Electrical Devices

Servo drive Model	Servo drive Rated Input Current	MCCB (A)	Contactor (A)	Cable of Input Side Main Circuit (mm^2)	Cable of Output Side Main Circuit (mm^2)	Cable of Control Circuit (mm^2)	Main Circuit Grounding Cable (mm^2)
Three-phase 440 V, 50/60 Hz							
IS580T020-R1-1	36.30	40	38	6	6	0.75	6
IS580T030-R1-1	45.10	50	50	10	10	0.75	10
IS580T035-R1-1	49.50	80	65	10	10	0.75	10
IS580T040-R1-1	59.00	80	65	16	16	0.75	16
IS580T050-R1-1	57.00	80	65	16	16	0.75	16
IS580T070-R1-1	69.00	100	80	25	25	0.75	16
IS580T080-R1-1	89.00	160	95	25	25	0.75	16
IS580T080-R1-H-1							

Servo drive Model	Servo drive Rated Input Current	MCCB (A)	Contactor (A)	Cable of Input Side Main Circuit (mm^2)	Cable of Output Side Main Circuit (mm^2)	Cable of Control Circuit (mm^2)	Main Circuit Grounding Cable (mm^2)
IS580T100-R1-1	106.00	160	115	35	35	0.75	16
IS580T100-R1-H-1							
IS580T140-R1-1	139.00	250	150	50	50	0.75	25
IS580T140-R1-H-1							
IS580T170-R1-1	164.00	250	170	70	70	0.75	35
IS580T170-R1-H-1							
IS580T210-R1-1	196.00	400	205	95	95	0.75	50
IS580T210-R1-H-1							

7.4 Mounting Dimensions of the IS580

Figure 7-1 Mounting dimensions of the IS580 of plastic housing

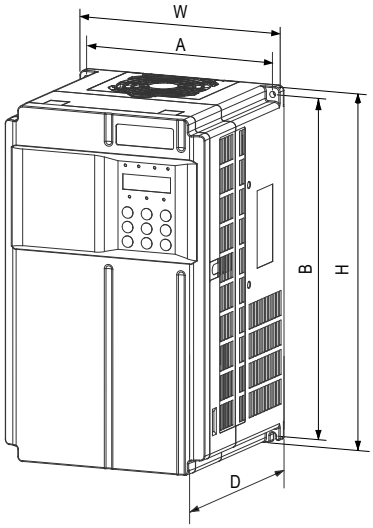


Figure 7-2 Mounting dimensions of IS580 sheet metal housing (IS580T080-R1-1 to IS580T210-R1-1)

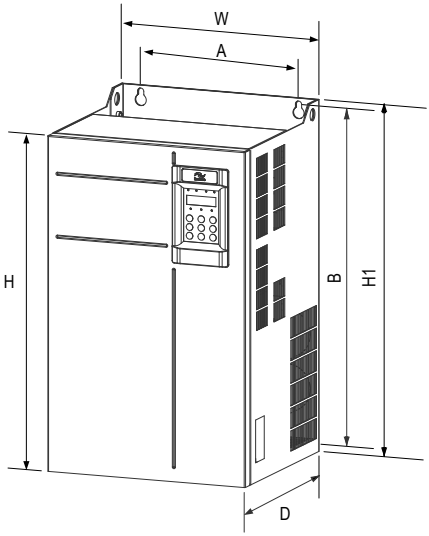
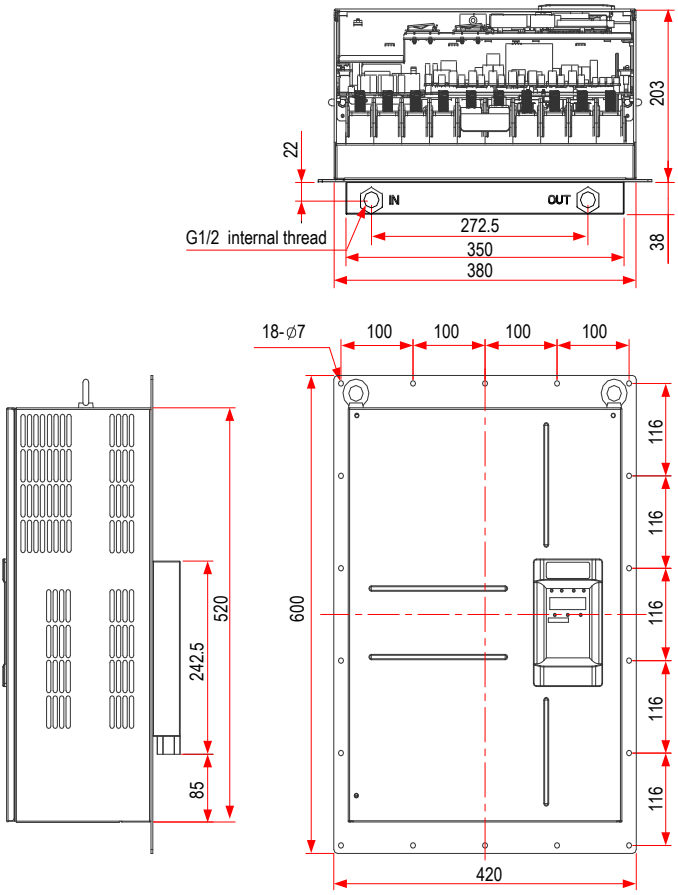


Table 7-1 Mounting dimensions of IS580 sheet metal housing (IS580T080-R1-1 to IS580T210-R1-1)

Servo drive Model	Mounting Hole (mm)		Overall Dimensions (mm)				Mounting Hole Diameter (mm)	Weight (kg)
	A	B	H	H1	W	D		
Three-phase 380 to 480 V								
IS580T020-R1-1	195	335	350	/	210	192	Ø6	9.1
IS580T030-R1-1								
IS580T035-R1-1	195	335	350	/	210	192	Ø6	9.1
IS580T040-R1-1								
IS580T050-R1-1	230	380	400	/	250	220	Ø7	17
IS580T070-R1-1								
IS580T080-R1-1	245	523	523	540	300	275	Ø10	35
IS580T100-R1-1								
IS580T140-R1-1	270	560	550	576	315	338	Ø10	51.5
IS580T170-R1-1								
IS580T210-R1-1								

Figure 7-3 Mounting dimensions of IS580 sheet metal housing (IS580T080-R1-H-1 to IS580T210-R1-H-1)



7.5 Mounting Dimensions of Power Terminals and Recommended Cable Diameter

Note

- The data and models recommended in the table are for reference only. The diameter of the cable the use selects must not exceed the terminal dimensions in the figure.
- The prerequisite of cable selection is the recommended value of PVC insulated cooper wire or cable diameter at the ambient temperature of 40°C in the steady state. For details, refer to section 12.4 in the IEC 60204-1-2005.

Figure 7-4 Terminal dimensions of the IS580T020/030/035/040

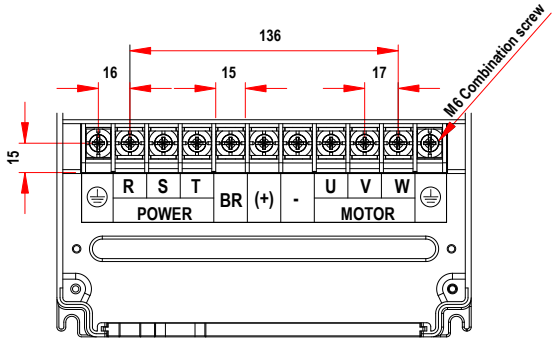


Table 7-2 Cable dimensions and tightening torque of the IS580T020/030/035/040

Servo drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm^2)	Tightening Torque (N·m)	Recommended Cable Lug Model
IS580T020-R1-1	36.3	6	4.0	GTNR6-5
IS580T030-R1-1	45.1	10	4.0	GTNR10-6
IS580T035-R1-1	49.5	10	4.0	GTNR10-6
IS580T040-R1-1	59	16	4.0	GTNR16-6

Figure 7-5 Terminal dimensions of IS580T050/070

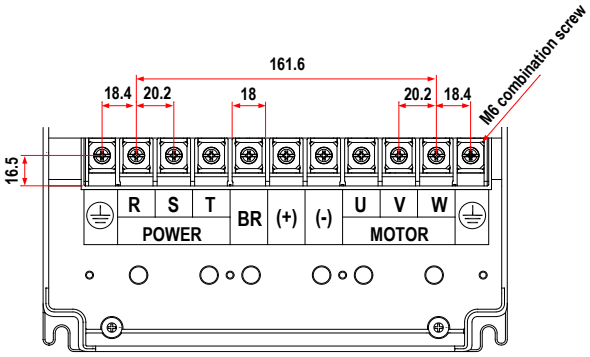


Table 7-3 Cable dimensions and tightening torque of IS580T050/070

Servo drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm^2)	Tightening Torque (N·m)	Recommended Cable Lug Model
IS580T050-R1-1	57	16	4.0	GTNR16-6
IS580T070-R1-1	69	25	4.0	GTNR25-6

Figure 7-6 Terminal dimensions of IS580T080/100

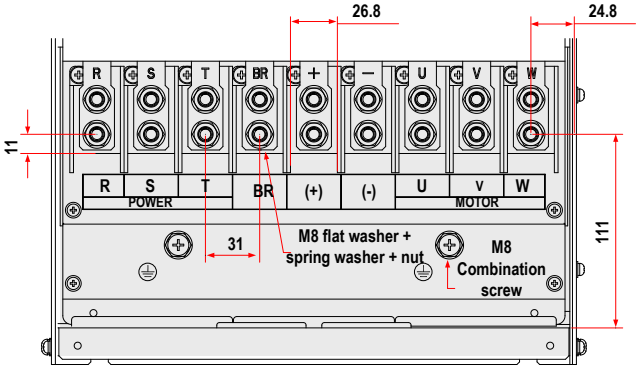


Table 7-4 Cable dimensions and tightening torque of IS580T080/100

Servo drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm2)	Tightening Torque (N·m)	Recommended Cable Lug Model
IS580T080-R1-1	89	25	10.5	GTNR25-8
IS580T080-R1-H-1				
IS580T100-R1-1	106	35	10.5	GTNR35-8
IS580T100-R1-H-1				

Figure 7-7 Terminal dimensions of IS580T140/170/210

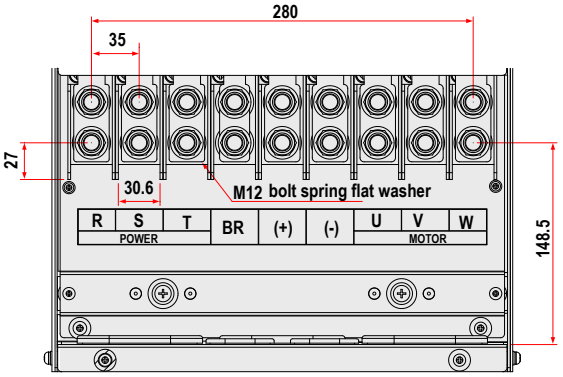


Table 7-5 Cable dimensions and tightening torque of IS580T140/170/210

Servo drive Model	Rated Input Current (A)	Recommended Cable Diameter (mm2)	Tightening Torque (N·m)	Recommended Cable Lug Model
IS580T140-R1-1	139	50	35.0	GTNR70-12
IS580T140-R1-H-1				
IS580T170-R1-1	164	70	35.0	GTNR70-12
IS580T170-R1-H-1				
IS580T210-R1-1	196	95	35.0	GTNR95-12
IS580T210-R1-H-1				

■ Cable Lug Specification

The recommended cable lug is manufactured by Suzhou Yuanli Metal Enterprise.

Figure 7-8 Appearance of recommended cable lugs

Figure 7-9 Dimensions of recommended TNR series cable lugs

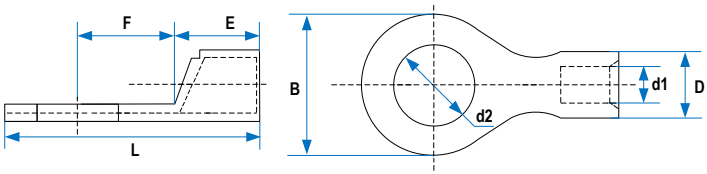


Table 7-6 Models and dimensions of the TNR series cable lugs

Cable Lug Model	Cable Range		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
TNR1.25-4	22-16	0.25-1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	19	AK-1M

Figure 7-10 Dimensions of recommended GTNR series cable lugs

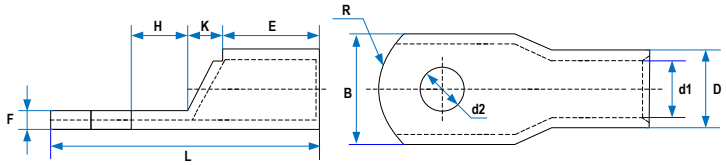


Table 7-7 Models and dimensions of the GTNR series cable lugs

Cable Lug 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
GTNR2.5-4	4.5	2.9	7.0	5.0	2.0	8.0	4.3	1.0	18.0		YYT-8
GTNR2.5-5				6.0			5.3		20.0	7	RYO-14
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
GTNR16-8							8.4				CT-100
GTNR25-6	9.5	7.5	12.0	8.0	4.5	14.0	6.4	2.0	32.0	10	
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				
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	60.0	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				

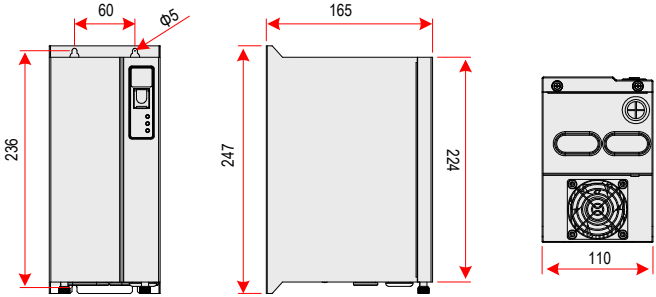
7.6 Mounting Dimensions of Optional Parts

7.6.1 Mounting Dimensions of the External Braking Unit

Note

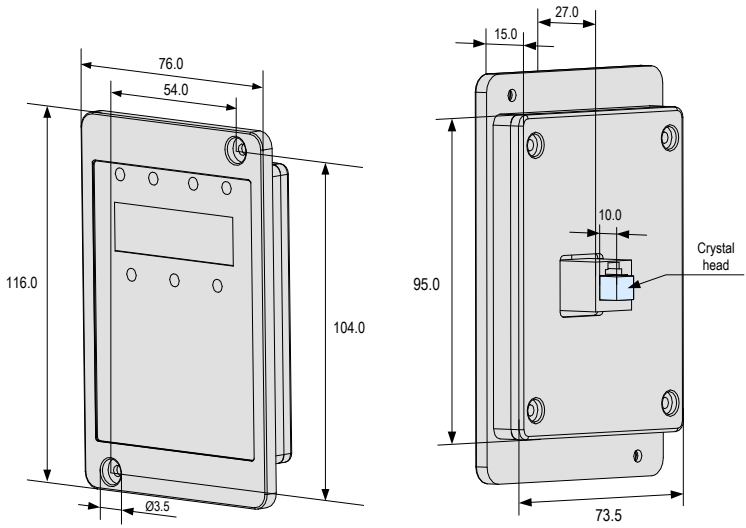
The servo drive of IS580T170-R1-1 and above has the built-in DC reactor.

Figure 7-11 Physical appearance and mounting dimensions of the MDBUN series braking unit



7.6.2 Physical Dimensions of External Operation Panel

Figure 7-12 Physical dimensions of external operation panel



8

EMC

Chapter 8 EMC

8.1 Definition of Terms

■ EMC

Electromagnetic compatibility (EMC) describes the ability of electronic and electrical devices or systems to work properly in the electromagnetic environment and not to generate electromagnetic interference that influences other local devices or systems.

In other words, EMC includes two aspects: The electromagnetic interference generated by a device or system must be restricted within a certain limit; the device or system must have sufficient immunity to the electromagnetic interference in the environment.

■ First environment

Environment that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network 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 Servo drive

Power Drive System (PDS) of rated voltage less than 1000 V, intended for use in the first environment

■ Category C2 Servo drive

PDS of rated voltage less 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 a professional

■ Category C3 Servo drive

PDS of rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment

■ Category C4 Servo drive

PDS of 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

8.2 Introduction to EMC Standard

8.2.1 CE Mark

The CE mark on the IS580 declares that the AC drive complies with the European low voltage directive (LVD) and EMC directive.

8.2.2 EMC Standard

The IS580 series AC drive complies with the international standards listed in the following table.

Directive	Directive Code	Standard
EMC directive	2004/108/EC	EN 61800-3 EN 55011 EN 61000-6-2
LVD directive	2006/95/EC 93/68/EEC	EN 61800-5-1

The IS580 series servo drive satisfies the requirements of standard EN 61800-3. 2004 Category C2. The Servo drives are applied to both the first environment and the second environment.

8.2.3 Installation Environment

The system manufacturer using the servo drive is responsible for compliance of the system with the European EMC directive. Based on the application of the system, the integrator must ensure that the system complies with standard EN 61800-3. 2004 Category C2, C3 or C4.

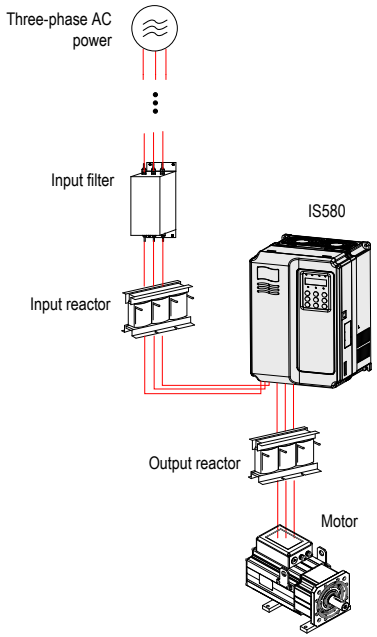
The system (machinery or appliance) installed with the servo drive must also have the CE mark. The system integrator is responsible for compliance of the system with the EMC directive and standard EN 61800-3. 2004 Category C2.

⚠WARNING

If applied in the first environment, the servo drive may generate radio interference. Besides the CE compliance described in this chapter, users must take measures to avoid such interference, if necessary.

8.3 Selection of Peripheral EMC Devices

Figure 8-1 Peripheral EMC devices of the IS580



8.3.1 Installation of EMC Input Filter on Power Input Side

An EMC filter installed between the servo drive and the power supply can not only restrict the interference of electromagnetic noise in the surrounding environment on the servo drive, but also prevents the interference from the servo drive on the surrounding equipment.

The IS580 series servo drive satisfies the requirements of category C2 only with an EMC filter installed on the power input side. The installation precautions are as follows:

- Strictly comply with the ratings when using the EMC filter. The EMC filter is category I electric apparatus, and therefore, the metal housing ground of the filter should be in good contact with the metal ground of the installation cabinet on a large area, and requires good conductive continuity. Otherwise, it will result in electric shock or poor EMC effect.
- The ground of the EMC filter and the PE conductor of the servo drive must be tied to the same common ground. Otherwise, the EMC effect will be affected seriously.
- The EMC filter should be installed as close as possible to the power input side of the servo drive.

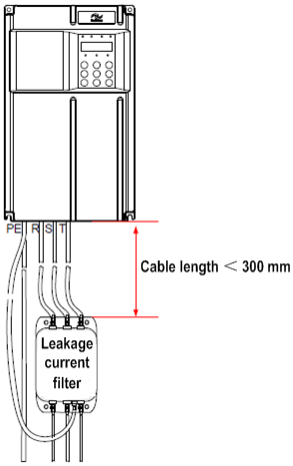
The following table lists the recommended manufacturers and models of EMC filters for the IS580 series servo drive. Select a proper one based on actual requirements.

Table 8-1 Recommended manufacturers and models of EMC filters

Servo drive Model	AC Input Filter Model (Changzhou Jianli)	AC Input Filter Model (Schaffner)
IS580T020-R1-1	DL-50EBK5	FN 3258-42-33
IS580T030-R1-1	DL-50EBK5	FN 3258-55-34
IS580T035-R1-1	DL-50EBK5	FN 3258-55-34
IS580T040-R1-1	DL-65EBK5	FN 3258-75-34
IS580T050-R1-1	DL-65EBK5	FN 3258-75-34
IS580T070-R1-1	DL-80EBK5	FN 3258-100-35
IS580T080-R1-1	DL-100EBK5	FN 3258-100-35
IS580T080-R1-H-1		
IS580T100-R1-1	DL-130EBK5	FN 3258-130-35
IS580T100-R1-H-1		
IS580T140-R1-1	DL-160EBK5	FN 3258-180-40
IS580T140-R1-H-1		
IS580T170-R1-1	DL-200EBK5	FN 3258-180-40
IS580T170-R1-H-1		
IS580T210-R1-1	DL-250EBK5	FN 3270H-250-99
IS580T210-R1-H-1		

8.3.2 Simple EMC Filter

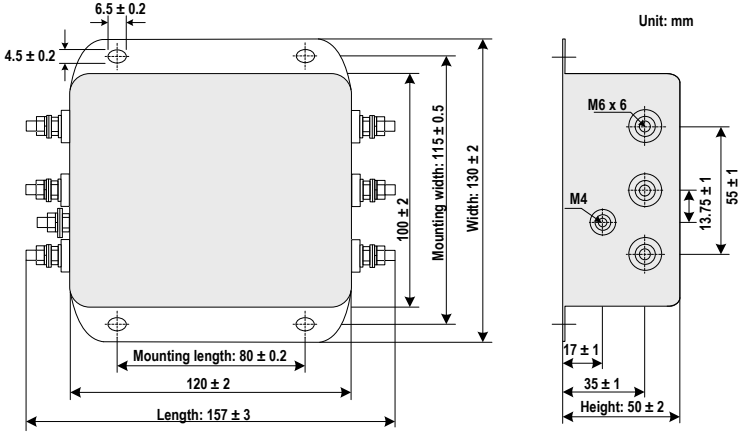
Figure 8-2 Installation of the simple EMC filter



- Selection of the simple EMC filter

Servo Drive Model	Simple EMC Filter Model	Filter Rated Current (A)	Overall Dimensions (Length x Width x Height)	Mounting Dimensions (Mounting Length x Mounting Width)
IS580T020-R1-1	DL65EB1/10	65	218 x 140 x 80	184 x 112
IS580T030-R1-1				
IS580T035-R1-1				
IS580T040-R1-1				
IS580T050-R1-1				
IS580T070-R1-1	DL-120EB1/10	120	334 x 185 x 90	304 x 155
IS580T080-R1-1				
IS580T080-R1-H-1				
IS580T100-R1-1				
IS580T100-R1-H-1				
IS580T140-R1-1	DL-180EB1/10	180	388 x 220 x 100	354 x 190
IS580T140-R1-H-1				
IS580T170-R1-1				
IS580T170-R1-H-1				
IS580T210-R1-1	Unavailable			
IS580T210-R1-H-1				

- Mounting dimensions



8.3.3 Magnetic Ring

Add the magnetic ring to the R, S, T input cables or the U, V, W output cables to improve the EMC performance.

- Selection of the magnetic ring

Magnetic Ring Model	Dimensions (Outer Diameter x Inner Diameter x Thickness: mm)
DY644020H	64 x 40 x 20
DY805020H	80 x 50 x 20
DY1207030H	120 x 70 x 30

8.3.4 Installation of AC Reactor on Power Input Side

An AC input reactor is installed to eliminate the harmonics of the input current. As an optional device, the reactor can be installed externally to meet strict requirements of an application environment for harmonics. The following table lists the recommended manufacturers and models of input reactors.

Table 8-2 Recommended manufacturers and models of AC input reactors

Servo drive Model	AC Input Reactor Model (Inovance)	Reactor Rated Current (A)
IS580T020-R1-1	MD-ACL-40-4T-153-2%	40
IS580T030-R1-1	MD-ACL-50-4T-183-2%	50
IS580T035-R1-1	MD-ACL-50-4T-183-2%	50
IS580T040-R1-1	MD-ACL-80-4T-303-2%	80
IS580T050-R1-1	MD-ACL-80-4T-303-2%	80
IS580T070-R1-1	MD-ACL-80-4T-303-2%	80
IS580T080-R1-1	MD-ACL-120-4T-453-2%	120
IS580T080-R1-H-1		
IS580T100-R1-1	MD-ACL-120-4T-453-2%	120
IS580T100-R1-H-1		
IS580T140-R1-1	MD-ACL-200-4T-753-2%	200
IS580T140-R1-H-1		
IS580T170-R1-1	MD-ACL-200-4T-753-2%	200
IS580T170-R1-H-1		
IS580T210-R1-1	MD-ACL-250-4T-114-2%	250
IS580T210-R1-H-1		

8.3.5 Installation of AC Reactor on Power Output Side

Whether to install an AC output reactor on the power output side is dependent on the actual situation. The cable connecting the servo drive and the motor should not be too long; capacitance enlarges when an over-long cable is used and thus high-harmonics current may be easily generated.

If the length of the output cable is equal to or greater than the value in the following table, install an AC output reactor on the power output side of the servo drive.

Table 8-3 Cable length threshold when an AC output reactor is installed

Servo drive Model	Rated Voltage (V)	Min. Cable Length When Selecting Output Reactor (m)
IS580T020-R1-1	200 to 500	110
IS580T030-R1-1	200 to 500	125
IS580T035-R1-1	200 to 500	135
IS580T040-R1-1	200 to 500	150
≥ IS580T050-R1-1	280 to 690	150

The following table lists the recommended manufacturer and models of AC output reactors.

Table 8-4 Recommended manufacturer and models of AC output reactors

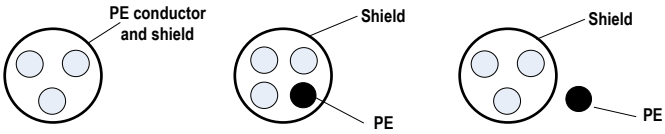
Servo drive Model	AC Output Reactor Model (Inovance)	Reactor Rated Current (A)
IS580T020-R1-1	MD-OCL-30-4T-113-1%	30
IS580T030-R1-1	MD-OCL-40-4T-153-1%	40
IS580T035-R1-1	MD-OCL-50-4T-183-1%	50
IS580T040-R1-1	MD-OCL-60-4T-223-1%	60
IS580T050-R1-1	MD-OCL-80-4T-303-1%	80
IS580T070-R1-1	MD-OCL-90-4T-373-1%	90
IS580T080-R1-1	MD-OCL-120-4T-453-1%	120
IS580T080-R1-H-1		
IS580T100-R1-1	MD-OCL-150-4T-553-1%	150
IS580T100-R1-H-1		
IS580T140-R1-1	MD-OCL-200-4T-753-1%	200
IS580T140-R1-H-1		
IS580T170-R1-1	MD-OCL-250-4T-114-1%	250
IS580T170-R1-H-1		
IS580T210-R1-1	MD-OCL-250-4T-114-1%	250
IS580T210-R1-H-1		

8.4 Shielded Cable

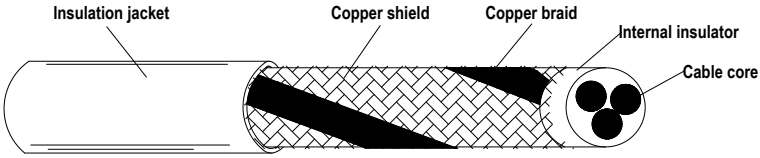
8.4.1 Requirements for Shielded Cable

The shielded cable must be used to satisfy the EMC requirements of CE marking. Shielded cables are classified into three-conductor cable and four-conductor cable. If conductivity of the cable shield is not sufficient, add an independent PE cable, or use a four-conductor cable, of which one phase conductor is PE cable.

The three-conductor cable and four-conductor cable are shown in the following figure.

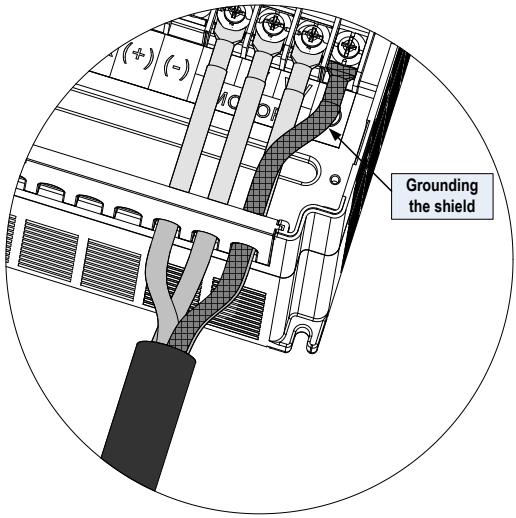


To suppress emission and conduction of the radio frequency interference effectively, the shield of the shielded cable is cooper braid. The braided density of the cooper braid should be greater than 90% to enhance the shielding efficiency and conductivity, as shown in the following figure.



The following figure shows the grounding method of the shielded cable.

Figure 8-3 Grounding of the shielded cable



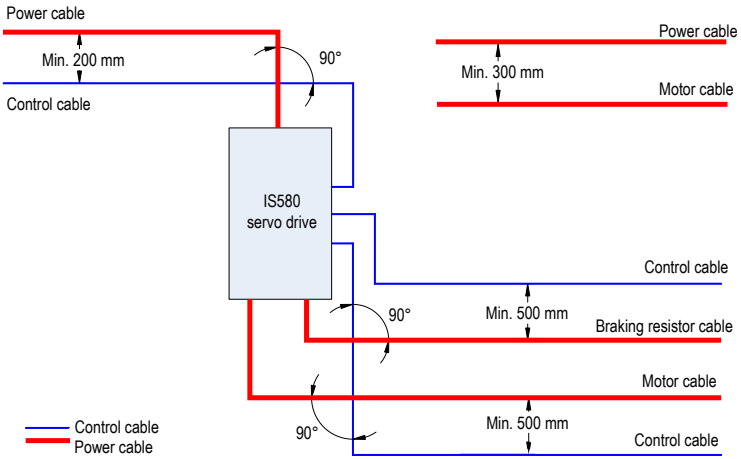
The installation precautions are as follows:

1. Symmetrical shielded cable is recommended. The four-conductor shielded cable can also be used as an input cable.
2. The motor cable and PE shielded conducting wire (twisted shielded) should be as short as possible to reduce electromagnetic radiation and external stray current and capacitive current of the cable. If the motor cable is over 100 meters long, an output filter or reactor is required.
3. It is recommended that all control cables be shielded.
4. It is recommended that shielded cables or shielded steel tube armored cables be used for the drive power output, and the shield must be well grounded. For devices suffering from interference, shielded twisted pair (STP) cable is recommended and the cable shield must be well grounded.

8.4.2 Cabling Requirements

1. The motor cables must be laid far away from other cables. The motor cables of several Servo drives can be laid side by side.
2. It is recommended that the motor cables, power input cables and control cables be laid in different ducts. To avoid electromagnetic interference caused by rapid change of the output voltage of the Servo drive, the motor cables and other cables must not be laid side by side for a long distance.
3. If the control cable must run across the power cable, make sure they are arranged at an angle of close to 90°. Other cables must not run across the Servo drive.
4. The power input and output cables of the Servo drive and weak-current signal cables (such as control cable) should be laid vertically (if possible) rather than in parallel.
5. The cable ducts must be in good connection and well grounded. Aluminium ducts can be used to improve electric potential.
6. The filter, servo drive and motor should be connected to the system (machinery or appliance) properly, with spraying protection at the installation part and conductive metal in full contact.

Figure 8-4 Cabling diagram



8.5 Solutions to Common EMC Interference Problems

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

Interference Type	Solution
Leakage protection switch tripping	• Connect the motor housing to the PE of the servo drive. • Connect the PE of the Servo drive to the PE of the line voltage. • Add a safety capacitor to the power input cable. • Add magnetic rings to the input drive cable.
Servo drive interference during running	• Connect the motor housing to the PE of the servo drive. • Connect the PE of the Servo drive to the PE of the line voltage. • Add a safety capacitor to the power input cable and wind the cable with magnetic rings. • Add a safety capacitor to the interfered signal port or wind the signal cable with magnetic rings. • Connect the equipment to the common ground.
Communication interference	• Connect the motor housing to the PE of the servo drive. • Connect the PE of the servo drive to the PE of the line voltage. • Add a safety capacitor to the power input cable and wind the cable with magnetic rings. • Add a matching resistor between the communication cable source and the load side. • Add a common grounding cable besides the communication cable. • Use a shielded cable as the communication cable and connect the cable shield to the common grounding point.
I/O interference	• Enlarge the capacitance at the low-speed DI. A maximum of 0.1 uF capacitance is suggested. • Enlarge the capacitance at the AI. A maximum of 0.22 uF is suggested.

9

Function Code Table

Chapter 9 Function Code Table

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
Group U0: View Servo Drive Parameters						
U0-00	Running frequency	Running frequency	0.00 Hz to maximum frequency (F0-10)	-	-	●
U0-01	Set frequency	Set frequency	0.00 Hz to maximum frequency (F0-10)	-	-	●
U0-02	Bus voltage	Bus voltage	0 to 830 V	-	-	●
U0-03	Output voltage	Output voltage	0 V to rated motor voltage (F1-02)	-	-	●
U0-04	Output current	Output current	0.1 to 6553.5 A	-	-	●
U0-05	Output power	Output power	0.4 to 1000.0 kW	-	-	●
U0-06	Output torque	Output torque	0.0% to 500.0%	-	-	●
U0-07	Local DI/output relay state	Local DI/output relay state	-	-	-	●
U0-08	Extended DI/output relay state	Extended DI/output relay state	-	-	-	●
U0-09	AI1 voltage (after correction)	AI1 voltage (after correction)	-10.00 to 10.000 V	-	-	●
U0-10	AI2 voltage (after correction)	AI2 voltage (after correction)	-10.00 to 10.000 V	-	-	●
U0-11	AI3 voltage (after correction)	AI3 voltage (after correction)	-10.00 to 10.000 V	-	-	●
U0-12 to U0-29	Reserved	-	-	-	-	●
U0-30	AI1 voltage (before correction)	AI1 voltage (before correction)	-10.00 to 10.000 V	-	-	●
U0-31	AI2 voltage (before correction)	AI2 voltage (before correction)	-10.00 to 10.000 V	-	-	●
U0-32	AI3 voltage (before correction)	AI3 voltage (before correction)	-10.00 to 10.000 V	-	-	●
U0-33	Reserved	-	-	-	-	●
U0-34	AO1 output voltage	AO1 output voltage	0.000 to 10.000 V	-	-	●
U0-35	AO2 output voltage	AO2 output voltage	0.000 to 10.000 V	-	-	●
Group U1: View Servo Pump Parameters						
U1-00	Real-time angle	Real-time angle	0.0° to 359.9°	-	-	●
U1-01	Set oil pressure	Set oil pressure	0.0 kg to system oil pressure (A3-02)	-	-	●
U1-02	Feedback oil pressure	Feedback oil pressure	0.0 kg to maximum oil pressure (A3-03)	-	-	●

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
U1-03	Motor speed	Motor speed	-9999 to 30000 RPM	-	-	●
U1-04	AI1 voltage	AI1 voltage	-10.00 to 10.000 V	-	-	●
U1-05	AI2 voltage	AI2 voltage	-10.00 to 10.000 V	-	-	●
U1-06	AI3 voltage	AI3 voltage	-10.00 to 10.000 V	-	-	●
U1-07	AI1 zero drift	AI1 zero drift	-10.00 to 10.000 V	-	-	●
U1-08	AI2 zero drift	AI2 zero drift	-10.00 to 10.000 V	-	-	●
U1-09	AI3 zero drift	AI3 zero drift	-10.00 to 10.000 V	-	-	●
U1-10	Reference flow	Reference flow	0.00 Hz to maximum frequency (F0-10)	-	-	●
U1-11	Resolver signal interference degree	Resolver signal interference degree	0 to 1000 (resolver wire breaking)	-	-	●
U1-12	Oil pressure reference of host computer	Oil pressure reference of host computer	0.0 kg to system oil pressure (A3-02)	-	-	●
U1-13	CAN communication interference status	CAN communication interference status	0 to 128 (disconnected)	-	-	●
U1-14	Number of CAN messages sent	Number of CAN messages sent	0 to 65535	-	-	●
U1-15	Number of CAN messages received	Number of CAN messages received	0 to 65535	-	-	●
U1-16	CAN buffer use ratio	CAN buffer use ratio	0% to 1.00%	-	-	●
Group A0: Field Weakening and SVC Control Parameters						
A0-00	Field weakening control mode		0: Direct calculation 1: Automatic adjustment 2: Automatic adjustment + calculation	1	1	★
A0-01	Field weakening current coefficient		0 to 500	1	5	★
A0-02	Field weakening depth of PMSM		0% to 50%	1%	5%	★
A0-03	Max. power output adjustment gain of PMSM		20% to 300%	1%	100%	★
A0-04	Excitation current adjustment gain calculated by PMSM		40% to 200%	1%	4%	★
Group A1: PG Card Parameters						
A1-00	PG card type	PG card type	0: Resolver 1: Reserved 2: Common ABZ encoder	1	0	★
A1-01	Reserved	-	-	-	-	★

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
A1-02	Encoder installation angle	Encoder installation angle	0.0° to 359.9°	0.1°	0.0°	☆
A1-03	Inversion of feedback speed	Inversion of feedback speed	0: Consistent 1: Reverse	1	0	★
A1-04	Number of pole pairs of resolver	Number of pole pairs of resolver	1 to 50	1	1	★
A1-05	Resolver signal fault detection time	Resolver signal fault detection time	0.000: Detection invalid 0.001s to 60.000s	0.001s	0.000	☆
A1-06	Pulses per revolution of the encoder	Pulses per revolution of the encoder	0 to 65535	1	1024	★
Group A2: CAN Communication Parameters						
A2-00	Baud rate	Baud rate	0: 20 K 1: 50 K 2: 125 K 3: 250 K 4: 500 K 5: 1 M	1	5	☆
A2-01	CAN communication address	CAN communication address	1 to 255	1	1	☆
A2-02	CAN continuous communication time	CAN continuous communication time	0.0s: Invalid 0.1s to 600.0s	0.1s	0.3s	☆
A2-03	CAN multi-pump mode	CAN multi-pump mode	0: Broadcast mode 1: Multi-master mode	1	0	☆
A2-04	CAN slave address 1	CAN slave address 1	0 to 65535	1	32766	☆
A2-05	CAN slave address 2	CAN slave address 2	0 to 65535	1	0	☆
A2-06	CAN slave address 3	CAN slave address 3	0 to 65535	1	0	☆
A2-07	CAN slave address 4	CAN slave address 4	0 to 65535	1	0	☆
Group A3: Servo Pump Control Parameters						
A3-00	Oil pressure control mode	Oil pressure control mode	0: Non-oil pressure control mode 1: Oil pressure control mode 1 (CAN setting) 2: Oil pressure control mode 2 (AI setting) 3: CAN oil pressure control mode (for special use) 4: Reserved	0	0	★
A3-01	Max. motor speed	Max. motor speed	Motor speed corresponding to max. frequency lower limit to 30000 RPM	1 RPM	2000 RPM	★

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
A3-02	System oil pressure	System oil pressure	0.0 kg/cm^2 to maximum oil pressure (A3-03)	0.0 kg/cm^2	175.0 kg/cm^2	☆
A3-03	Max. oil pressure	Max. oil pressure	System oil pressure (A3-02) to 500.0 kg/cm^2	0.0 kg/cm^2	250.0 kg/cm^2	☆
A3-04	Oil pressure reference ramp time	Oil pressure reference ramp time	0s to 2s	0.001s	0.020s	☆
A3-05	Oil pressure control Kp1	Oil pressure control Kp1	0.0 to 800.0	0.1	210.0	☆
A3-06	Oil pressure control Ti1	Oil pressure control Ti1	0.001s to 10.000s	0.001s	0.100s	☆
A3-07	Oil pressure control Td1	Oil pressure control Td1	0.000s to 1.000s	0.001s	0.000s	☆
A3-08	Max. reverse rotational speed	Max. reverse rotational speed	0.0% to 100.0%	0.1%	20.0%	☆
A3-09	Min. flow	Min. flow	0.0% to 50.0%	0.1%	0.5%	☆
A3-10	Min. pressure	Min. pressure	0.0 to 50.0 kg/cm^2	0.1 kg/cm^2	0.5 kg/cm^2	☆
A3-11	Oil pressure control Kp2	Oil pressure control Kp2	0.0 to 800.0	0.1	210.0	☆
A3-12	Oil pressure control Ti2	Oil pressure control Ti2	0.001s to 10.000s	0.001s	0.100s	☆
A3-13	Oil pressure control Td2	Oil pressure control Td2	0.000s to 1.000s	0.001s	0.000s	☆
A3-14	Oil pressure control Kp3	Oil pressure control Kp3	0.0 to 800.0	0.1	210.0	☆
A3-15	Oil pressure control Ti3	Oil pressure control Ti3	0.001s to 10.000s	0.001s	0.100s	☆
A3-16	Oil pressure control Td3	Oil pressure control Td3	0.000s to 1.000s	0.001s	0.000s	☆
A3-17	Oil pressure control Kp4	Oil pressure control Kp4	0.0 to 800.0	0.1	210.0	☆
A3-18	Oil pressure control Ti4	Oil pressure control Ti4	0.001s to 10.000s	0.001s	0.100s	☆
A3-19	Oil pressure control Td4	Oil pressure control Td4	0.000s to 1.000s	0.001s	0.000s	☆
A3-20	AI zero drift auto correction	AI zero drift auto correction	0: Disabled 1: Enabled	0	0	☆
A3-21	Fault detection time of oil pressure sensor	Fault detection time of oil pressure sensor	0.000s: Detection invalid 0.001s to 60.000s	0.001s	0.500s	☆
A3-22	Setting of max. speed in pressure control	Setting of maximum speed in pressure control	0.0%–100.0%	0.1%	10.0%	☆
A3-23	Setting of min. oil pressure in pressure control	Setting of min. oil pressure in pressure control	0.0% to 100.0%	0.1%	60.0%	☆
A3-24	Delay of pressure control state output	Delay of pressure control state output	0.000s to 10.000s	0.001s	0.100s	☆
A3-25	S-curve rise filter time of set oil pressure	S-curve rise filter time of set oil pressure	0.000s to 1.000s	0.001s	0.040s	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
A3-26	S-curve fall filter time of set oil pressure	S-curve fall filter time of set oil pressure	0.000s to 1.000s	0.001s	0.020s	☆
A3-27	Overshoot suppression detection level	Overshoot suppression detection	0 to 2000	1	200	☆
A3-28	Overshoot suppression coefficient	Overshoot suppression coefficient	0 to 3.000	0.001	0.200	☆
A3-29	Oil pressure loop gain coefficient	Oil pressure loop gain coefficient	0.20 to 5.00	0.01	1.00	☆
A3-30	Torque upper limit for switchover from pressure mode to speed mode	Torque upper limit for switchover from pressure mode to speed mode	50.0%–250.0%	0.1%	160.0%	☆
A3-31	Injection valve opening delay	Injection valve opening delay	0.020s to 0.500s	0.001s	0.100s	☆
A3-32	Slave min. input	Slave min. input	0.0% to A3-34	0.1%	0.0%	☆
A3-33	Corresponding setting of slave min. input	Corresponding setting of slave min. input	-100.0% to 100.0%	0.1%	0.0%	☆
A3-34	Slave medium input	Slave medium input	A3-32 to A3-36	0.1%	0.0%	☆
A3-35	Corresponding setting of slave medium input	Corresponding setting of slave medium input	-100.0% to 100.0%	0.1%	0.0%	☆
A3-36	Slave max. input	Slave max. input	A3-34 to 100.0%	0.1%	100.0%	☆
A3-37	Corresponding setting of slave max. input	Corresponding setting of slave max. input	-100.0% to 100.0%	0.1%	100.0%	☆
A3-38	Master judges whether to send slave speed enabled in multi-pump mode	Master judges whether to send slave speed enabled in multi-pump mode	0: Forbid enabling the slave speed 1: Allow enabling the slave speed	1	0	★
A3-39	Pressure holding control gain in multi-pump convergent flow	Pressure holding control gain in multi-pump convergent flow	20 to 800	1	100	☆
A3-40	Pressure deviation for decreasing PI to de-twitter in multi-pump injection mode	Pressure deviation for decreasing PI to de-twitter in multi-pump injection mode	0.0 to 50.0 kg	0.1 kg	5.0 kg	☆
A3-41	Flow lower limit for decreasing PI to de-twitter in multi-pump injection mode	Flow lower limit for decreasing PI to de-twitter in multi-pump injection mode	0 to 30000 rpm	1 rpm	0 rpm	☆
A3-42	Flow detection time for decreasing PI to de-twitter in multi-pump injection mode	Flow detection time for decreasing PI to de-twitter in multi-pump injection mode	0.200s to 2.000s	0.001s	0.400s	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
A3-43	Pressure deviation of slave pump not working in the CAN multi-pump mode	Pressure deviation of slave pump not working in the CAN multi-pump mode	0 to 50.0 kg	0.1 kg	5.0 kg	☆
A3-44	Flow lower limit of slave pump not working	Flow lower limit of slave pump not working in the CAN multi-pump mode	-100.0% to 100.0%	0.0%	0	☆
A3-45	Judgment delay of slave pump to stop without speed reference	Judgment delay of slave pump to stop without speed reference	0.100s to 5.000s	0.001s	1.000s	☆
A3-46	Deceleration time of slave pump to stop without speed reference	Deceleration time of slave pump to stop without speed reference	0.001s to 5.000s	0.001s	0.200s	☆
A3-47	Start valve pressure relief delay	Start valve pressure relief delay	0.001s to 5.000s	0.001s	0.100s	☆
A3-48	Exit valve pressure relief delay	Exit valve pressure relief delay	0.001s to 5.000s	0.001s	0.100s	☆
A3-49	Pressure deviation lower limit of start valve pressure relief	Pressure deviation lower limit of start valve pressure relief	0.0 kg to A3-02 (System oil pressure)	0.1 kg	0.0 kg	☆
A3-50	Pressure lower limit of start valve pressure relief	Pressure lower limit of start valve pressure relief	0.0 kg to A3-02 (System oil pressure)	0.1 kg	0.0 kg	☆
A3-51	Pressure sensor fault detection current lower limit	Pressure sensor fault detection current lower limit	0% to 300% (rated motor current F1-03)	1%	100%	☆
A3-52	Pressure sensor fault detection speed upper limit	Pressure sensor fault detection speed upper limit	0% to 100% (max. motor speed A3-01)	1%	50%	☆
Group A4: Oil Pressure Control Optimization Parameters						
A4-00	Rotational speed filter time	Rotational speed filter time	0s to 5.000s	0.001s	0.005s	☆
A4-01	Current filter time	Current filter time	0s to 5.000s	0.001s	0.010s	☆
A4-02	Reserved	-	-	-	-	☆
A4-03	Flow rise filter time	Flow rise filter time	0s to 1.000s	0.001s	0.100s	☆
A4-04	Flow fall filter time	Flow fall filter time	0s to 1.000s	0.001s	0.100s	☆
A4-05	Reserved	-	-	-	-	☆
A4-06	Flow leakage compensation	Flow leakage compensation	0.0% to 50.0%	0.1%	0.0%	☆
A4-07	Reserved	-	-	-	-	☆
A4-08	Min. pressure of reverse pressure relief	Min. pressure of reverse pressure relief	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2	0.0 kg/cm^2	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
A4-09	Long-time running protective time of reverse pressure relief	Long-time running protective time of reverse pressure relief	0.001s to 5.000s	0.001s	0.000s	☆
A4-10	Injection S-curve rise time	Injection S-curve rise time	0.001s to 1.000s	0.001s	0.030s	☆
A4-11	Injection S-curve fall time	Injection S-curve fall time	0.001s to 1.000s	0.001s	0.030s	☆
A4-12	Injection flow rise slope	Injection flow rise slope	0s to 5.000s	0.001s	0.100s	☆
A4-13	Injection flow fall slope	Injection flow fall slope	0s to 5.000s	0.001s	0.100s	☆
A4-14	Oil pressure reference rise time	Oil pressure reference rise time	0s to 2.000s	0.001s	0.020s	☆
A4-15	Oil pressure reference fall time	Oil pressure reference fall time	0s to 2.000s	0.001s	0.020s	☆
A4-16	Injection overshoot suppression detection level	Injection overshoot suppression detection level	0 to 2000	1	200	☆
A4-17	Injection overshoot suppression coefficient	Injection overshoot suppression coefficient	0s to 3.000s	0.001s	0.050s	☆
A4-18	Reserved	-	-	-	-	☆
A4-19	Reserved	-	-	-	-	☆
A4-20	Reserved	-	-	-	-	☆
A4-21	Reserved	-	-	-	-	☆
A4-22	Oil pressure deviation of oil pressure suppression disabled	Oil pressure deviation of oil pressure suppression disabled	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2	10.0 kg/cm^2	☆
A4-23	Max. value of integral limit deviation	Max. value of integral limit deviation	0.0 kg/cm^2 to A3-02	0.1 kg/cm^2	25.0 kg/cm^2	☆
A4-24	Integral limit mode selection	Integral limit mode selection	0, 1	1	0	☆
A4-25	Pressure loop output upper limit	Pressure loop output upper limit	0 to 50.0	0.1s	2.0	☆
A4-26	Oil pressure PID algorithm selection	Oil pressure PID algorithm selection	0 to 2	1	0	★
A4-27	Reserved	-	-	-	-	☆
Group F0: Standard Parameters						
F0-00	Model display	Model display	1: G type (heavy load) 2: Reserved	1	Model dependent	●
F0-01	Control mode	Control mode	0: Reserved 1: Closed-loop vector control (CLVC) 2: V/F control	1	1	★

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F0-02	Command source selection	Command source selection	0: Operation panel (LED OFF) 1: Terminal (LED ON) 2: Communication setting (LED blinking)	1	0	☆
F0-03	Main frequency source X selection	Main frequency source X selection	0: Digital setting (UP/DOWN modification, non-retentive) 1: Digital setting (UP/DOWN modification, retentive) 2: AI1 3: AI2 4: AI3 5: Reserved 6: Multi-speed 7: Reserved 8: Reserved 9: Communication setting	1	1	★
F0-04 to F0-07	Reserved	-	-	-	-	☆
F0-08	Preset frequency	Preset frequency	0.00 Hz to max. frequency (F0-10)	0.01 Hz	50.00 Hz	☆
F0-09	Rotating direction	Rotating direction	0: Same direction 1: Reverse direction	1	0	☆
F0-10	Max. frequency	Max. frequency	50.00 to 300.00 Hz	1	200.00 Hz	★
F0-11	Source of frequency upper limit	Source of frequency upper limit	0: Set by F0-12 1: AI1 2: AI2 3: AI3 4: Reserved 5: Communication setting	1	0	★
F0-12	Frequency upper limit	Frequency upper limit	Frequency lower limit (F0-14) to max. frequency (F0-10)	0.01 Hz	200.00 Hz	☆
F0-13	Upper limit offset	Upper limit offset	0.00 Hz to maximum frequency (F0-10)	0.01 Hz	0.00 Hz	☆
F0-14	Frequency lower limit	Frequency lower limit	0.00 Hz to frequency upper limit (F0-12)	0.01 Hz	0.00 Hz	☆
F0-15	Carrier frequency	Carrier frequency	0.5 to 8.0 kHz	0.1 kHz	Model dependent	☆
F0-16	Carrier frequency adjustment selection	Carrier frequency adjustment selection				☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F0-17	Acceleration time 1	Acceleration time 1	0.0s to 6500.0s	0.1s	20.0s	☆
F0-18	Deceleration time 1	Deceleration time 1	0.0s to 6500.0s	0.1s	20.0s	☆
Group F1: Motor Parameters						
F1-00	Motor type selection	Motor type selection	0: Common asynchronous motor 1: Variable frequency asynchronous motor 2: PMSM	1	2	★
F1-01	Rated motor power	Rated motor power	0.4 to 1000.0 kW	0.1 kW	Model dependent	★
F1-02	Rated motor voltage	Rated motor voltage	0 to 480 V	1 V	Model dependent	★
F1-03	Rated motor current	Rated motor current	0.01 to 650.00 A	0.01 A	Model dependent	★
F1-04	Rated motor frequency	Rated motor frequency	0.00 Hz to max. frequency (F0-10)	0.01 Hz	Model dependent	★
F1-05	Rated motor speed	Rated motor speed	0 to 30000 rpm	1 rpm	Model dependent	★
F1-06 to F1-10	Reserved	-	-	-	-	☆
F1-11	Shaft D inductance	Shaft D inductance	0–65535	1	Model dependent	★
F1-12	Shaft Q inductance	Shaft Q inductance	0–65535	1	Model dependent	★
F1-13	Stator resistance	Stator resistance	0–65535	1	Model dependent	★
F1-14	Unit	Unit	0–65535	1	Model dependent	★
F1-15	Back EMF	Back EMF	0–65535 V	1	Model dependent	★

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F1-16	Motor auto-tuning mode	Motor auto-tuning mode	0: No operation 1: No-load static auto-tuning 2: No-load dynamic auto-tuning, rotating at high speed in reverse direction 3: With-load static auto-tuning 4: No-load fast dynamic auto-tuning, rotating at high speed in reverse direction 5: No-load dynamic auto-tuning, rotating at high speed in forward direction 6: No-load fast dynamic auto-tuning, rotating at high speed in forward direction	1	0	★
Group F2: Vector Control Parameters						
F2-00	Speed loop proportional gain 1	Speed loop proportional gain 1	0 to 400	1	60	☆
F2-01	Speed loop integration time 1	Speed loop integration time 1	0.01s to 10.00s	0.01s	0.30s	☆
F2-02	Switchover frequency 1	Switchover frequency 1	0.00 to F2-05	0.01 Hz	5.00 Hz	☆
F2-03	Speed loop proportional gain 2	Speed loop proportional gain 2	0 to 400	1	60	☆
F2-04	Speed loop integration time 2	Speed loop integration time 2	0.01s to 10.00s	0.01s	0.30s	☆
F2-05	Switchover frequency 2	Switchover frequency 2	F2-02 to max. frequency	0.01 Hz	10.00 Hz	☆
F2-06	Slip compensation coefficient	Slip compensation coefficient	50% to 200%	1%	100%	☆
F2-07	Speed feedback filter time	Speed feedback filter time	0.5 to 10.0 ms	0.1 ms	1.0 ms	☆
F2-08	Torque control	Torque control	0: Invalid 1: Valid	1	0	☆
F2-09	Torque upper limit source	Torque upper limit source	0: F2-10 1: AI1 2: AI2 3: AI3 4: Reserved 5: Communication setting Analog input range corresponding to F2-10	1	0	☆
F2-10	Torque upper limit	Torque upper limit	0.0% to 250.0%	0.1%	200.0%	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F2-11	Torque filter bandwidth	Torque filter bandwidth	0 to 1500 Hz	1 Hz	500 Hz	☆
F2-12	Reserved	-	-	-	-	★
F2-13	Current loop low-speed proportional gain	Current loop low-speed proportional gain	0.2 to 5.0	0.1	1.0	★
F2-14	Current loop low-speed integral gain	Current loop low-speed integral gain	0.2 to 5.0	0.1	1.0	★
F2-15	Current loop high-speed proportional gain	Current loop high-speed proportional gain	0.2 to 5.0	0.1	1.0	★
F2-16	Current loop high-speed integral gain	Current loop high-speed integral gain	0.2 to 5.0	0.1	1.0	★
F2-25	Overvoltage modulation coefficient	Overvoltage modulation coefficient	100% to 120%	1%	115%	☆
F2-26	Bus voltage filter	Bus voltage filter	0.000 to 0.100	0.001	0.000	☆
F2-27	Reserved	-	-	-	-	★
F2-29	Selection of back EMF compensation	Selection of back EMF compensation	0: Disabled 1: Enabled	1	0	★
Group F3: Reserved						
Group F4: Input Terminals						
F4-00	DI1 function selection	DI1 function selection	0: No function 1: Forward RUN (FWD) 2: Reverse RUN (REV) 3: Three-wire control mode 4: Forward JOG (FJOG) 5: Reverse JOG (RJOG) 6/7: Reserved 8: Coast to stop 9: Fault reset (RESET) 10: Reserved 11: External fault NO input 12 to 32: Reserved 33: External fault NC input 34 to 47: Reserved 48: Servo pump PID selection terminal 1 49: Servo pump PID selection terminal 2 50: CAN communication enabled	1	1	★
F4-01	DI2 function selection	DI2 function selection		1	0	★
F4-02	DI3 function selection	DI3 function selection		1	9	★
F4-03	DI4 function selection	DI4 function selection		1	0	★
F4-04	DI5 function selection	DI5 function selection		1	0	★

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F4-05 to F4-14	Reserved	-	51: Slave pump enabled as master pump 52: Switchover from pressure mode to speed mode 53: Slave pump address selection terminal 1 54: Slave pump address selection terminal 2 55: Switchover from injection to pressure holding 56: Fault reset(not allowed at overcurrent)	-	-	★
F4-15	DI filter time		1 to 10	1	4	☆
F4-16	Terminal command mode	Terminal command mode	0: Two-line 1 1: Two-line 2 2: Three-line 1 3: Three-line 2	1	0	★
F4-17	Reserved	-	-	-	-	☆
F4-18	AI1 min. input	AI1 min. input	-11.00 to 11.00 V	0.01 V	0.02 V	☆
F4-19	Corresponding setting of AI1 min. input	Corresponding setting of AI1 min. input	-100.0% to 100.0%	0.1%	0.0%	☆
F4-20	AI1 max. input	AI1 max. input	-11.00 to 11.00 V	0.01 V	10.00 V	☆
F4-21	Corresponding setting of AI1 max. input	Corresponding setting of AI1 max. input	-100.0% to 100.0%	0.1%	100.0%	☆
F4-22	AI1 filter time	AI1 filter time	0.000s to 10.000s	0.001s	0.010s	☆
F4-23	AI2 min. input	AI2 min. input	-11.00 to 11.00 V	0.01 V	0.02 V	☆
F4-24	Corresponding setting of AI2 min. input	Corresponding setting of AI2 min. input	-100.0% to 100.0%	0.1%	0.0%	☆
F4-25	AI2 max. input	AI2 max. input	-11.00 to 11.00 V	0.01 V	10.00 V	☆
F4-26	Corresponding setting of AI2 max. input	Corresponding setting of AI2 max. input	-100.0% to 100.0%	0.1%	100.0 V	☆
F4-27	AI2 filter time	AI2 filter time	0.000s to 10.000s	0.001s	0.005s	☆
F4-28	AI3 min. input	AI3 min. input	-11.00 to 11.00 V	0.01 V	0.02 V	☆
F4-29	Corresponding setting of AI3 min. input	Corresponding setting of AI3 min. input	-100.0% to 100.0%	0.1%	0.0%	☆
F4-30	AI3 max. input	AI3 max. input	-11.00 to 11.00 V	0.01 V	10.00 V	☆
F4-31	Corresponding setting of AI3 max. input	Corresponding setting of AI3 max. input	-100.0% to 100.0%	0.1%	100.0%	☆
F4-32	AI3 filter time	AI3 filter time	0.000s to 10.000s	0.001s	0.000s	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F4-33 to F4-58	Reserved	-	-	-	-	☆
Group F5: Output Terminals						
F5-00	Reserved	-	-	-	-	☆
F5-01	Control board relay (T/A1-T/B1-T/C1) function selection	Control board relay (T/A1-T/B1-T/C1) function selection	0: No output 1: Servo drive running 2: Fault output 3 to 5: Reserved 6: Motor overload pending 7: Servo drive overload pending 8 to 11: Reserved 12: Accumulative running time reached 13 and 14: Reserved 15: Ready 16 to 19: Reserved 20: Communication setting 21 and 22: Reserved 23: Double-discharge plunger pump sloping switchover 1 24: Pressure control state output 25: Slave pump alarm 26: Double-discharge plunger pump sloping switchover 2 27: Bus voltage establishment 28: Business running time reached 29: Business running time not reaching 24 hours 30: DO output of max. reverse rotational speed	1	2	☆
F5-02	Control board relay (T/A2-T/C2) function selection	Control board relay (T/A2-T/C2) function selection		1	1	☆
F5-03	Control board relay (T/A3-T/C3) function selection	Control board relay (T/A3-T/C3) function selection		1	0	☆
F5-04 to F5-09	Reserved	-	-	-	-	☆
F5-10	AO1 output selection	AO1 output selection	0: Running frequency 1: Set frequency	1	10	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F5-11	AO2 output selection	AO2 output selection	2: Output current 3: Output torque 4: Output power 5: Output voltage 6: Reserved 7: AI1 8: AI2 9: AI3 10: Feedback rotational speed (oil pressure control mode) 11: Feedback pressure (oil pressure control mode) 12–16: Reserved	1	11	☆
F5-12 and F5-13	Reserved	-	-	-	-	☆
F5-14	AO1 offset coefficient	AO1 offset coefficient				
F5-15	AO1 gain	AO1 gain				
F5-16	AO2 offset coefficient	AO2 offset coefficient				
F5-17	AO2 gain	AO2 gain				
F5-18 to F5-22	Reserved	-	-	-	-	☆
Group F6: Reserved						
Group F7: Operation Panel and Display						
F7-00 and F7-01	Reserved	-	-	-	-	☆
F7-02	STOP/RESET key function	STOP key function	0: Valid only in operation panel control 1: Stop function of the STOP key valid in terminal control 2: Reset function of the STOP key valid in terminal control 3: Both stop and reset functions of the STOP key valid in terminal control	1	2	☆
F7-03 to F7-05	Reserved	-	-	-	-	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F7-06	Load speed display coefficient	Load speed display coefficient	0.0001 to 6.5000	0.0001	1.0000	☆
F7-07	Heatsink temperature 1	Heatsink temperature 1	0.0°C to 100°C	1°C	-	●
F7-08	Reserved	-	-	-	-	●
F7-09	Accumulative running time	Accumulative running time	0 to 65535 h	1	-	●
F7-10	Software version 1	Software version 1	-	-	-	●
F7-11	Software version 2	Software version 1	-	-	-	●
F7-12	Software temporary version 1	Software temporary version 1	-	-	-	●
F7-13	Software temporary version 2	Software temporary version 2	-	-	-	●
Group F8: Auxiliary Functions						
F8-17	Set running time	Set running time	0 to 65000 h	1 h	0	☆
F8-18	Startup protection selection	Startup protection selection	0: Disabled 1: Enabled	1	0	☆
F8-22	Detection of short-circuit to ground upon power-on	Detection of short-circuit to ground upon power-on	0: Disabled 1: Enabled	1	1	☆
F8-23	Action selection upon set running time reached	Action selection upon set running time reached	0: Continue to run 1: Stop and report Err26	1	0	☆
F8-24	Software undervoltage threshold	Software undervoltage threshold	148.5 to 321.7 VAC (AC voltage input, multiplied by $\sqrt{2}$ when converted to bus voltage)	0.1 V	247.5 V	☆
F8-25	Allowed braking unit running time	Allowed braking unit running time	0.1s to 3600.0s	0.1s	5.0s	☆
Group F9: Fault and Protection						
F9-00	Motor overload protection selection	Motor overload protection selection	0: Disabled 1: Enabled	1	0	☆
F9-01	Motor overload protection gain	Motor overload protection gain	0.20 to 10.00	0.01	2.00	☆
F9-08	Brake pipe applied voltage	Brake pipe applied voltage	650.0 to 800.0 V	0.1 V	780.0 V	☆
F9-12	Power input phase loss protection selection	Power input phase loss protection selection	0: Disabled 1: Enabled	1	1	☆
F9-13	Power output phase loss protection selection	Power output phase loss protection selection	0: Disabled 1: Enabled	1	1	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F9-14	Runaway speed deviation	Runaway speed deviation	0.50 to 50.00 Hz	0.01 Hz	10.00 Hz	☆
F9-15	Detection time of runaway fault	Detection time of runaway fault	0.1s to 20.0s	0.1s	10.0s	☆
F9-16	Motor temperature protection	Motor temperature protection	0: Disabled 1: Enabled	1	1	☆
F9-18	1st fault type	1st fault type	0: No fault 1: Reserved 2: Overcurrent during acceleration (Err02) 3: Overcurrent during deceleration (Err03) 4: Overcurrent at constant speed (Err04) 5: Overvoltage during acceleration (Err05) 6: Overvoltage during deceleration (Err06) 7: Overvoltage at constant speed (Err07) 8: Reserved 9: Undervoltage (Err09) 10: Servo drive overload (Err10) 11: Reserved 12: Power input phase loss (Err12) 13: Power output phase loss (Err13) 14: Heatsink overheat (Err14) 15: External device fault (Err15) 16: Communication fault (Err16) 17: Contactor fault (Err17) 18: Current detection fault (Err18) 19: Motor auto-tuning fault (Err19) 20: Reserved (Err20) 21: EEPROM read-write fault (Err21)	1	0	☆
F9-19	2nd fault type	2nd fault type		1	0	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F9-20	Latest fault type	Latest fault type	22: Reserved (Err22) 23: : Short circuit to ground (Err23) 24 and 25: Reserved 26: Accumulative running time reached 27: Business running time reached 28 to 39: Reserved 40: Wave-chasing current limit fault 41: Reserved 42: CAN communication interrupted (Err42) 43: Resolver fault during motor auto-tuning (Err43) 44: Speed deviation too large (Err44) 45: Motor overheat (Err45) 46: Servo pump sensor fault (Err46) 47: Slave fault pending (Err47) 48: CAN address conflicted (Err48) 49: Cable between resolver and PG card disconnected (Err49) 52: Multi-master fault in multi-pump convergent flow (Err52) 58: Parameter restoration fault (Err58) Err59: Back EMF abnormal (Err59) 60: Reserved (Err60) 61: Brake pipe in braking protection state for long time (Err61) 62: Reserved 63: Reverse running time reached (Err63)	1	0	☆
F9-21	Frequency at fault occurrence	Frequency at fault occurrence	-	0.01 Hz	-	●

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
F9-22	Current at fault occurrence	Current at fault occurrence	-	0.1 A	-	●
F9-23	Bus voltage at fault occurrence	Bus voltage at fault occurrence	-	0.1 V	-	●
F9-24	Input terminal state at fault occurrence	Input terminal state at fault occurrence	-	1	-	●
F9-25	Output terminal state at fault occurrence	Output terminal state at fault occurrence	-	1	-	●
Group FA: Business Timing Function						
FA-00	1st running time protection password	1st running time protection password	0 to 65535	1	0	☆
FA-01	1st timed running time	1st timed running time	0 h to FA-03	1 h	0	☆
FA-02	2nd running time protection password	2nd running time protection password	0 to 65535	1	0	☆
FA-03	2nd timed running time	2nd timed running time	FA-01 to FA-05	1 h	0	☆
FA-04	3rd running time protection password	3rd running time protection password	0 to 65535	1	0	☆
FA-05	3rd timed running time	3rd timed running time	FA-03 to FA-07	1 h	0	☆
FA-06	4th running time protection password	4th running time protection password	0 to 65535	1	0	●
FA-07	4th timed running time	4th timed running time	FA-05 to 65535 h	1 h	0	●
FA-08	Accumulative business running time (hour)	Accumulative business running time (hour)	0 to 65535 h	1 h	0	☆
FA-09	Accumulative business running time (second)	Accumulative business running time (second)	0s to 65535s	1s	0	☆
A maximum of 4-segment timed running is supported. The relationship among these segments of timed running is: FC-01 < FC-03 < FC-05 < FC-07. Each segment has a protection password. If the timed running time is set to 0, the timing function is disabled. After the timed running time of all segments is reached, the servo drive reports Err28, indicating that the business timing is reached. In this case, you need to disable the timing function or increase the timing time. The set timed running time can be viewed in FA-08 without a password.						
Group FB: Reserved						
Group FC: Reserved						
Group FD: Modbus Communication Parameters						
FD-00	Baud rate	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	1	5	☆

Function Code	Name	LED Display	Setting Range	Min. Unit	Default	Property
FD-01	Data format	Data format	0: No check, data format <8,N,2> 1: Even parity check, data format <8,E,1> 2: Odd Parity check, data format <8,O,0>	1	0	☆
FD-02	Local address	Local address	0: Broadcast address 1 to 247	1	1	☆
FD-03	Response delay	Response delay	0 to 20 ms	1	2 ms	☆
FD-04	Timeout duration	Timeout duration	0.0s: Invalid 0.1s to 60.0s	0.1s	0.0s	☆
FD-05	Communication protocol	Communication protocol	0: Standard Modbus protocol, used for host computer parameter reading/writing and running control 1: Inovance private protocol, used for communication with background oscilloscope	1	1	☆
Group FP: User Password						
FP-00	User password	User password	0–65535	1	0	☆
FP-01	Parameter initialization	Parameter initialization	0: No operation 1: Restore default settings 2: Clear fault records 3: Restore user parameters 4: Restore system factory parameters except A2-01 5: Restore default settings of all parameters (except groups FF, FP and FA, remember to back up the parameters)	1	0	☆
FP-02	Motor model	Motor model	0 to 65535	1	0	☆
FP-03	Reserved	-	-	-	-	-
FP-04	Password for user storage operation	Password for user storage operation	0 to 65535	1	0	☆
FP-05	User storage mode	User storage mode	0: No operation 1: Store user parameters	1	0	☆
FP-06	Equipment specifications displayed on operation panel	Equipment specifications displayed on operation panel in both Chinese and English	0 to 65535	1	0	☆

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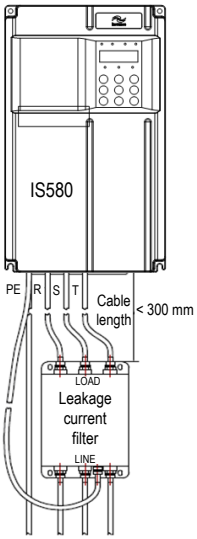
Appendix

Appendix A Leakage Current Suppression Solution and Leakage Protector Selection

Note

In the following tables,

- "-" indicates that the leakage current suppression solution does not cover the power.
- The residual current circuit breaker (RCCB), RCD and leakage protector indicate the same concept.

<table>
<tr><td rowspan="2">Servo Drive Model</td><td colspan="5">Solution 1: Require Leakage Current During Running < 30 mA (Use Leakage Current Filter).</td></tr>
<tr><td>Leakage Protector Selection With Leakage Current Suppression Solution</td><td>Leakage Protector Selection Without Leakage Current Suppression Solution</td><td>Leakage Current Filter</td><td>Installation Wiring Diagram</td><td>Leakage Protector Selection</td></tr>
<tr><td>Reserved</td><td rowspan="15">CHINT Electric DZ series,
CHINT Electric NM1LE series, Changshu MCCBCM3L series, ABB F200 series, Schneider i1D leakage protector</td><td rowspan="8">Action current I△n ≥ 100 mA</td><td>DL-15EB1/10</td><td rowspan="15">Note: The leakage current filter has the direction. Therefore, connect the servo drive to the LOAD side of the filter.
 
</td><td rowspan="13">Action current I△n ≥ 100 mA</td></tr>
<tr><td>DL-35EB1/10</td></tr>
<tr><td>IS580T035-R1-1</td><td>DL65EB1/10</td></tr>
<tr><td>IS580T040-R1-1</td></tr>
<tr><td>IS580T050-R1-1</td><td rowspan="7">Action current I△n ≥ 300 mA</td></tr>
<tr><td>IS580T070-R1-1</td><td rowspan="6">DL-120EB1/10</td></tr>
<tr><td>IS580T080-R1-1</td></tr>
<tr><td>IS580T080-R1-H-1</td></tr>
<tr><td>IS580T100-R1-1</td></tr>
<tr><td>IS580T100-R1-H-1</td></tr>
<tr><td>IS580T140-R1-1</td><td rowspan="3">DL-180EB1/10</td></tr>
<tr><td>IS580T140-R1-H-1</td></tr>
<tr><td>IS580T170-R1-1</td></tr>
<tr><td>IS580T170-R1-H-1</td><td></td><td></td><td></td></tr>
<tr><td>IS580T210-R1-1</td><td></td><td>-</td><td>-</td><td>Action current I△n ≥ 300 mA</td></tr>
<tr><td>IS580T210-R1-H-1</td><td></td><td></td><td></td><td></td></tr>
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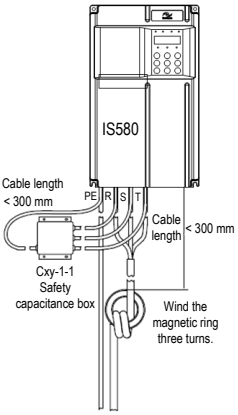
<table>
<tr><td rowspan="2">Servo Drive Model</td><td colspan="6">Solution 1: Require Leakage Current During Running < 100 mA (Use Wind the Magnetic Ring Three Turns and Use the Safety Capacitance Box).</td></tr>
<tr><td>Leakage Protector Selection With Leakage Current Suppression Solution</td><td>Leakage Protector Selection Without Leakage Current Suppression Solution</td><td>Magnetic Ring Model</td><td>Safety Capacitance Box Model</td><td>Installation Wiring Diagram</td><td>Leakage Protector Selection</td></tr>
<tr><td>Reserved</td><td rowspan="15">CHINT Electric DZ series, CHINT Electric NM1LE series, Changshu MCCBCM3L series, ABB F200 series, Schneider i1D leakage protector</td><td rowspan="2">Action current I△n ≥ 100 mA</td><td>DY644020</td><td rowspan="15">Cxy-1-1
Note: If the drive has the built-in 1 uF safety capacitance, ignore this option and select the corresponding jumper.</td><td rowspan="11">Note: Never run the PE cable around the magentic ring together with the RST cable.
 
</td><td rowspan="11">Action current I△n ≥ 100 mA</td></tr>
<tr><td>IS580T035-R1-1</td><td>DY805020H</td></tr>
<tr><td>IS580T040-R1-1</td><td rowspan="2">Action current I△n ≥ 300 mA</td><td rowspan="2"></td></tr>
<tr><td>IS580T050-R1-1</td></tr>
<tr><td>IS580T070-R1-1</td><td rowspan="9"></td><td rowspan="9"></td></tr>
<tr><td>IS580T080-R1-1</td><td>DY1207030H</td></tr>
<tr><td>IS580T080-R1-H-1</td></tr>
<tr><td>IS580T100-R1-1</td></tr>
<tr><td>IS580T100-R1-H-1</td></tr>
<tr><td>IS580T140-R1-1</td></tr>
<tr><td>IS580T140-R1-H-1</td></tr>
<tr><td>IS580T170-R1-1</td><td rowspan="4"></td><td>-</td><td>-</td><td rowspan="4">Action current I△n ≥ 300 mA</td></tr>
<tr><td>IS580T170-R1-H-1</td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>IS580T210-R1-1</td><td>-</td><td>-</td></tr>
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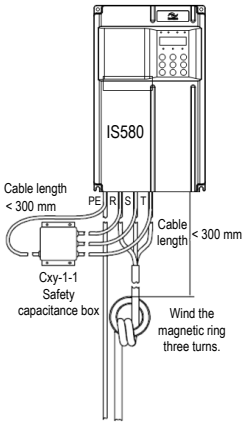
<table>
<tr><td rowspan="2">Servo Drive Model</td><td colspan="3">Solution 3: Require Leakage Current During Running < 200 mA (Wind the Magnetic Ring One Turn and Use the Safety Capacitance Box).</td></tr>
<tr><td>Magnetic Ring Model</td><td>Installation Wiring Diagram</td><td>Leakage Protector Selection</td></tr>
<tr><td>Reserved</td><td>DY644020H</td><td rowspan="19">For selection of the safety capacitance box, refer to the solution 2.
Note: Never run the PE cable around the magnetic ring together with the RST cable.
 
</td><td rowspan="19">Action current $I_{\triangle n}$ ≥ 100 mA</td></tr>
<tr><td>IS580T035-R1-1</td><td rowspan="4">DY805020H</td></tr>
<tr><td>IS580T040-R1-1</td></tr>
<tr><td>IS580T050-R1-1</td></tr>
<tr><td>IS580T070-R1-1</td></tr>
<tr><td>IS580T080-R1-1</td><td rowspan="6">DY1207030H</td></tr>
<tr><td>IS580T080-R1-H-1</td></tr>
<tr><td>IS580T100-R1-1</td></tr>
<tr><td>IS580T100-R1-H-1</td></tr>
<tr><td>IS580T140-R1-1</td></tr>
<tr><td>IS580T140-R1-H-1</td></tr>
<tr><td>IS580T170-R1-1</td><td rowspan="4">DY1207030H</td></tr>
<tr><td>IS580T170-R1-H-1</td></tr>
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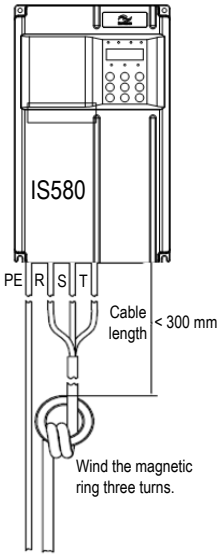
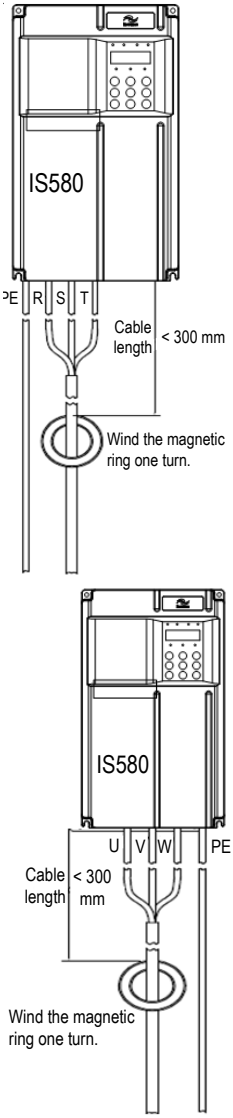
</table>

<table>
<tr><td rowspan="2">Servo Drive Model</td><td colspan="3">Solution 4: Require Leakage Current During Running Reducing 50% (Wind the Input or Output Magnetic Ring Three Turns).</td></tr>
<tr><td>Magnetic Ring Model</td><td>Installation Wiring Diagram</td><td>Leakage Protector Selection</td></tr>
<tr><td>Reserved</td><td>DY644020H</td><td rowspan="10">For the wiring diagram of winding the output UVW cable three turns, for the wiring diagram in solution 5.
Note: Never run the PE cable around the magnetic ring together with the RST cable.
 
</td><td rowspan="10">Action current
I△n ≥ 100 mA</td></tr>
<tr><td>IS580T035-R1-1</td><td rowspan="4">DY805020H</td></tr>
<tr><td>IS580T040-R1-1</td></tr>
<tr><td>IS580T050-R1-1</td></tr>
<tr><td>IS580T070-R1-1</td></tr>
<tr><td>IS580T080-R1-1</td><td rowspan="6">DY1207030H</td></tr>
<tr><td>IS580T080-R1-H-1</td></tr>
<tr><td>IS580T100-R1-1</td></tr>
<tr><td>IS580T100-R1-H-1</td></tr>
<tr><td>IS580T140-R1-1</td></tr>
<tr><td>IS580T140-R1-H-1</td></tr>
<tr><td>IS580T170-R1-1</td><td rowspan="2">-</td><td rowspan="2">-</td><td rowspan="4">Action current
I△n ≥ 300 mA</td></tr>
<tr><td>IS580T170-R1-H-1</td></tr>
<tr><td>IS580T210-R1-1</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td>IS580T210-R1-H-1</td></tr>
</table>

<table>
<tr><td rowspan="2">Servo Drive Model</td><td colspan="3">Solution 5: Require Leakage Current During Running Reducing 25% (Wind the Input or Output Magnetic Ring One Turn).</td></tr>
<tr><td>Magnetic Ring Model</td><td>Installation Wiring Diagram</td><td>Leakage Protector Selection</td></tr>
<tr><td>Reserved</td><td>DY644020H</td><td rowspan="15"> 
</td><td rowspan="8">Action current $I_{\triangle n}$ ≥ 100 mA</td></tr>
<tr><td>IS580T035-R1-1</td><td rowspan="4">DY805020H</td></tr>
<tr><td>IS580T040-R1-1</td></tr>
<tr><td>IS580T050-R1-1</td></tr>
<tr><td>IS580T070-R1-1</td></tr>
<tr><td>IS580T080-R1-1</td><td rowspan="6">DY1207030H</td></tr>
<tr><td>IS580T080-R1-H-1</td></tr>
<tr><td>IS580T100-R1-1</td></tr>
<tr><td>IS580T100-R1-H-1</td></tr>
<tr><td>IS580T140-R1-1</td></tr>
<tr><td>IS580T140-R1-H-1</td></tr>
<tr><td>IS580T170-R1-1</td><td rowspan="2">DY1207030H</td><td rowspan="7">Action current $I_{\triangle n}$ ≥ 300 mA</td></tr>
<tr><td>IS580T170-R1-H-1</td></tr>
<tr><td>IS580T210-R1-1</td><td rowspan="2"></td></tr>
<tr><td>IS580T210-R1-H-1</td></tr>
</table>

Appendix B Multi-pump Control of IMM

B.1 Parallel Pump Control

The parallel pump control is classified into multi-pump convergent flow and multi-pump distributed flow.

- The multi-pump convergent flow

  A servo drive is used as the master drive, and the other drives are used as slave drives connected in parallel. The host computer outputs a set of flow and pressure analog signals.

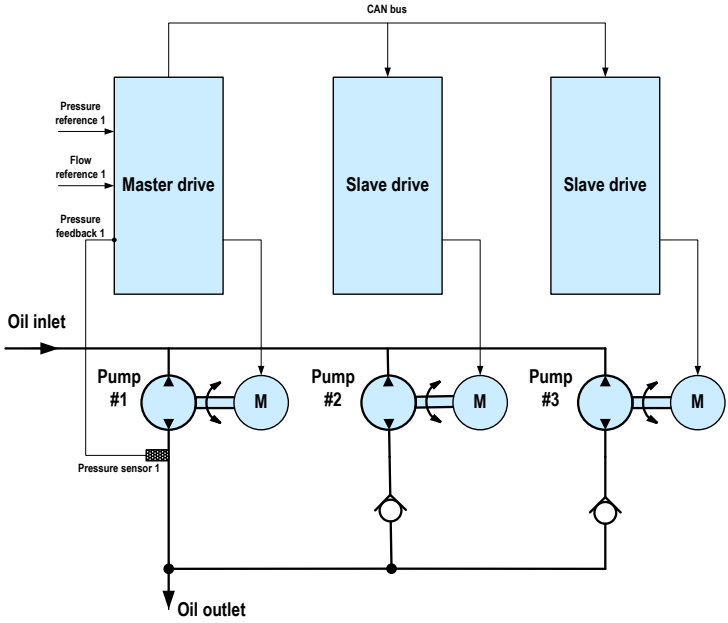
  - In flow control state (the feedback pressure is less than the reference pressure), the master drive and the slave drives rotate at the same speed.
  - In pressure control state (the feedback pressure is greater than or equal to the reference pressure), the slave drives are shut down, and the master drive independently controls the pumps.

- The multi-pump distributed flow

  Multiple servo drives may work in multi-pump convergent flow mode or multi-pump distributed flow mode (distributed PID control based on the oil pressure). The host computer outputs multiple sets of flow and pressure analog signals

The following figure shows the multi-pump convergent flow structure chart.

Figure B-1 The multi-pump convergent flow structure chart

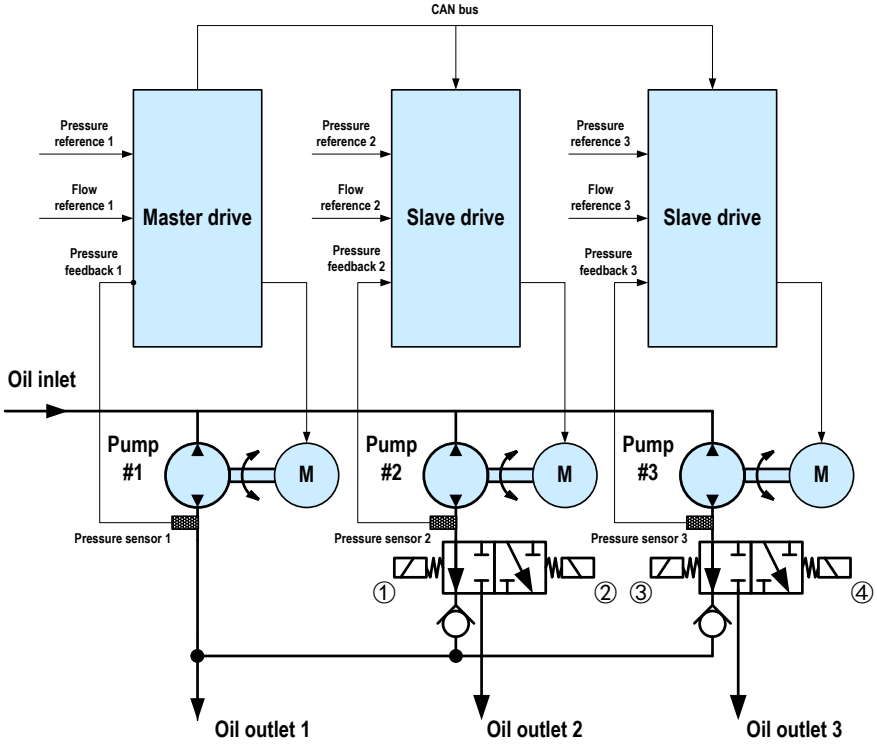


Note

- For detailed wiring and CAN communication wiring, refer to the foldouts at the end of this chapter.
- For the parameter setting, refer to the following related parameter setting part.
- You can ensure the same motor speed through the communication.

The following figure shows the multi-pump distributed flow structure chart.

Figure B-2 The multi-pump distributed flow structure chart



Note

- For detailed wiring and CAN communication wiring, refer to the foldouts at the end of this chapter.
- For the parameter setting, refer to the following related parameter setting part.
- You can ensure the same motor speed through the communication.
- The convergent flow and distributed flow of pump 2 and pump 3 can be controlled by energizing solenoid valves ① ② ③ ④. In the convergent flow control, the pressure reference, flow reference and pressure feedback signal received by the drive are invalid. In the distributed flow control, the CAN communication command received by the drive are invliad.

B.2 Multi-pump Control Mode

Function Code	Parameter Name	Setting Range
A2-03	CAN multi-pump mode	0: Multi-pump 1 (old mode) 1: Multi-pump 2 (new mode)

- Multi-pump 1

  This mode is the old mode and is applicable to simple multi-pump control.

  - When the slave pump is switched over to the master pump, the slave pump cannot be controlled.
  - To enable the multi-pump mode, set the DI terminal for the 50# function.
  - After disconnecting the DI terminal set for the 50# function of the slave pump, the slave pump is switched over to the master pump.

- Multi-pump 2

  This mode is the new mode and can satisfy more complicated multi-pump convergent and distributed flow control. It supports a maximum of four multi-pump distributed flow control combinations.

The two multi-pump modes have different wiring methods and applications.

■ Wiring

For the wiring of multi-pump convergent flow, see the foldout 1 and foldout 2 at the end of this chapter. In the multi-pump convergent flow control, Set the corresponding parameter in group F5 to 25 (slave alarm output) and connect this signal to the system computer for alarm display.

Note that high-pressure without cause occurs on the oil channel of the slave pump in the pressure control when leakage of the check valve is large while the inner discharge of the slave pump is small. To relieve the high-pressure state of the oil channel, do as follows:

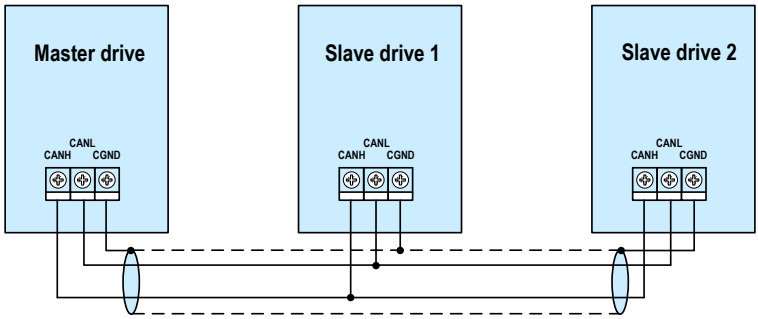
- Reduce the discharge of the slave pump to reasonable range.
- Decrease the torque upper limit of the slave drive to reasonable range.
- Set the speed response curve according to the max. discharge speed of the master pump, ensuring that the slave drive implements automatic pressure relief at low-speed holding pressure. For detailed parameter setting, refer to the following "Parameter Setting for Slave Pump Response to Master Pump Reference" part.

For the wiring of multi-pump distributed flow, see the foldout 3 and foldout 4 at the end of this chapter.

■ CAN Communication Wiring

The CAN bus connection of all pumps is shown in the following figure.

Figure B-3 CAN bus connection of all pumps



Note

- User shielded twisted pair (STP) cables for the CAN bus connection.
- Connet the CANH and CANL terminals on the control boards of all drives together, and connect the CGND terminal together through the shield.
- The first drive and the end drive at the CAN bus must connect the CAN communication terminal resistor through the jumper J4.

■ Parameter Settings for Slave Pump Response to Master Pump Reference

Function Code	Parameter Name	Default	Description
A3-32	Slave min. input	0.0%	The slave pump drive setting
A3-33	Corresponding setting of slave min. input	0.0%	
A3-34	Slave medium input	0.0%	
A3-35	Corresponding setting of slave medium input	0.0%	
A3-36	Slave max. input	100.0%	
A3-37	Corresponding setting of slave max. input	100.0%	

The setting of A3-32 to A3-37 can implement automatic pressure relief of the slave pump when the master pump is in the low-speed pressure holding state, avoid occurrence of holding high pressure on the slave pump and ensure the system flow linearity.

For example:

Condition 1: Suppose the max. pressure holding speed of the master is 50 rpm/min., the max. speed of the master is 2000 rpm/min., and the max. speed of the slave is 2000 rpm/min.

Condition 2: At pressure hoding, the master works and the slave stops.

Condition 3: To ensure flow linearity, The master is over 100 rpm/min. and the slave keeps the same speed.

That is, when the master pump is below 50 rpm/min., the slave pump stops running. When the master pump is above 100 rpm/min, the master pump and the slave pump keep the same speed.

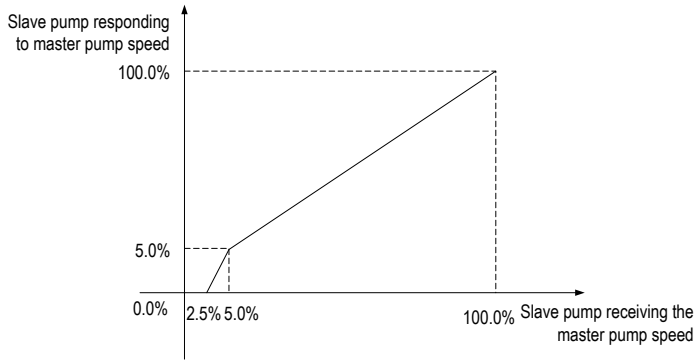
The speed reference of the master pump is 0% to 100%. You can set A3-32 to A3-37 to get the three-point curve to make the slave pump respond to the speed reference as follows:

A3-32, A3-33 = Slave pump input reference: 50 rpm/min., slave response reference: 0 rpm/min. = 2.5%, 0.0%

A3-34, A3-35 = Slave pump input reference: 100 rpm/min., slave response reference: 100 rpm/min. = 5.0%, 5.0%

A3-36, A3-37 = Slave pump input reference: 2000 rpm/min., slave response reference: 2000 rpm/min. = 100%, 100%

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



Note

The two multi-pump modes have the same parameter setting for the slave pump response to the master pump speed reference.

B.3 Parameter Setting on Master Drive

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

  The parameter setting is simple. For all servo drives, allocate a DI terminal for the 50# function and set it to ON.

Function Code	Parameter Name	Setting	Description
A2-01	CAN communication address	1	-
A2-03	Multi-pump mode 1	0	-
F4-**	Multi-pump control enabled	50	Short DI5 to COM directly.
F5-02	Relay on the control board (T/A2-T/C2) output selection	25	Slave alarm output (normally-open)

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

  The servo drive with address 1 must be the master pump. A maximum of four combined distributed flow control can be implemented. The related parameter settings are as follows:

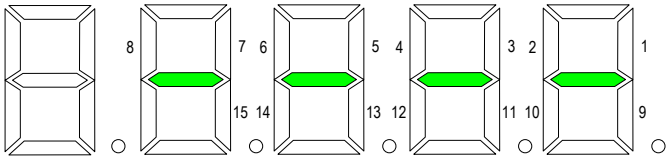
Function Code	Parameter Name	Setting	Description
F4-**	Slave pump address selection terminal 1	53	In multi-pump distributed flow control, these parameters are used to set which slave pumps the master pump selects for convergent flow.
F4-**	Slave pump address selection terminal 2	54	
F5-02	Relay on the control board (T/A2-T/C2) output selection	25	Slave alarm output (normally-open)
A2-01	CAN communication address	1	-
A2-03	Multi-pump mode 1	1	-
A2-04	CAN slave address 1	0	Together with the two DI terminals set for the 53# and 54# functions, the four combined distributed flow control can be implemented.
A2-05	CAN slave address 2	0	
A2-06	CAN slave address 3	0	
A2-07	CAN slave address 4	0	

- Slave pump address DI input selection

Setting of DI Set for 54# Function	Setting of DI Set for 54# Function	CAN Slave Address Selection
0	0	A2-04: CAN slave address 1
0	1	A2-05: CAN slave address 2
1	0	A2-06: CAN slave address 3
1	1	A2-07: CAN slave address 4

- Description of slave pump address setting

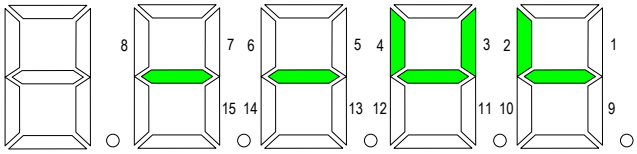
  The LED display of the slave pump address setting is as follows:



Note

- The numbers in the LED display correspond to the slave pump address station No.
- If the nixie tube of a number is ON, it indicates that the slave pump of the address station No.
- The IS580 supports the setting of a total of 15 slave pump addresses.

For example, 1# is the master pump. The setting of slave pump addresses in A2-04 is shown in the following figure, indicating that 1# is the master pump and works with slave pumps 2#, 3# and 4#.



The key operation of the slave pump address is described below:

- The address of slave pumps 1# to 8# is set by and .
- The address of slave pumps 9# to 15# is set by and .

B.4 Parameter Setting on Slave Drive

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

  The following table lists the parameter setting of the slave drive. Perform the same parameter setting as you do in the common servo pump mode.

Function Code	Parameter Name	Setting	Description
A2-01	CAN communication address	> 1	Slave drive
F4-**	Multi-pump control enabled	50	Slave pump may switch over to master pump control.

If the slave pump switches over to master pump, disconnect the DI terminal set for the 50# function of the slave pump.

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

  The following table lists the parameter setting of the slave drive. Perform the same parameter setting as you do in the common servo pump mode.

Function Code	Parameter Name	Setting	Description
A2-01	CAN communication address	> 1	Slave drive
F4-**	Slave pump address selection terminal 1	53	When the slave pump is used as the master pump, it need be triggered by the terminal. For the slave pump address setting, refer to section B.3 Parameter Setting on Master Drive.
F4-**	Slave pump address selection terminal 2	54	

B.5 Applications of Multi-pump Convergent and Distributed Flow Control

B.5.1 Multi-pump Mode 1 (A2-03 = 0)

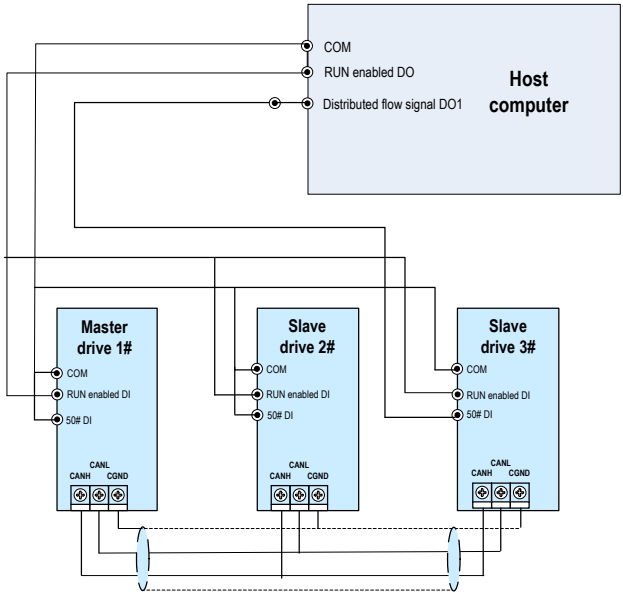
For example, the IMM servo pump system consists of three pumps with the address set as 1#, 2# and 3#. In the multi-pump mode 1, when a slave pump is used as the master pump, the slave pump does not follow its speed.

There are the follwoing two combinations:

- Combination 1: 3-pump convergent flow
- Combination 2: 2+1 combination for distributed flow control, the 1# master pump is followed by the 2# slave pump, and the 3# pump switches over to the master pump.

■ Combination 1: 3-pump Convergent Flow

Figure B-5 Wiring of 3-pump convergent flow

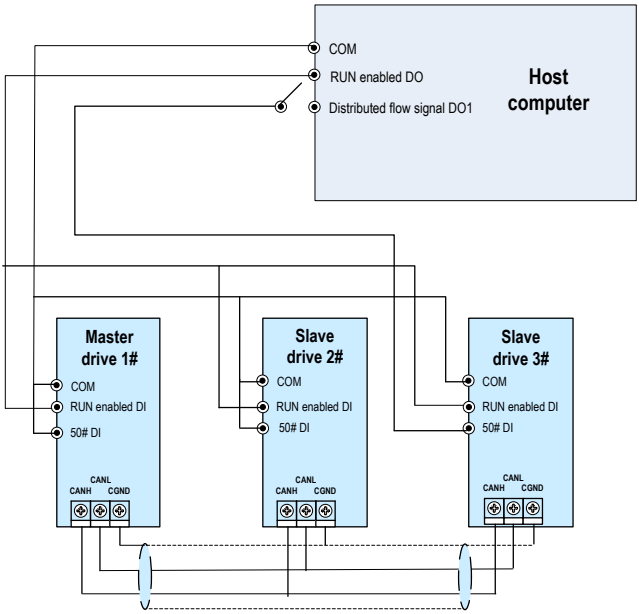


Note

- Because the 1# pump is always the master pump and the 2# pump alaways the slave pump, directly short the DI terminal set for the 50# function.
- The 3# pump switches over to the master pump in the following combination 2, which requires an external switchover signal. When the host computer sends the closing signal, the DI terminal set for the 50# function of the slave pump closes to process the multi-pump convergent flow.

■ Combination 2: 2+1 combination for distributed flow control

Figure B-6 2+1 combination for distributed flow control



Note

You can switch over the 3# pump to the master pump by disconnect the DI terminal set for the 50# function of the slave pump.

B.5.2 Multi-pump Mode 2 (A2-03 = 1)

For example, the IMM servo pump system consists of four pumps with the address set as 1#, 2#, 3# and 4#. There are the follwoing three combinations:

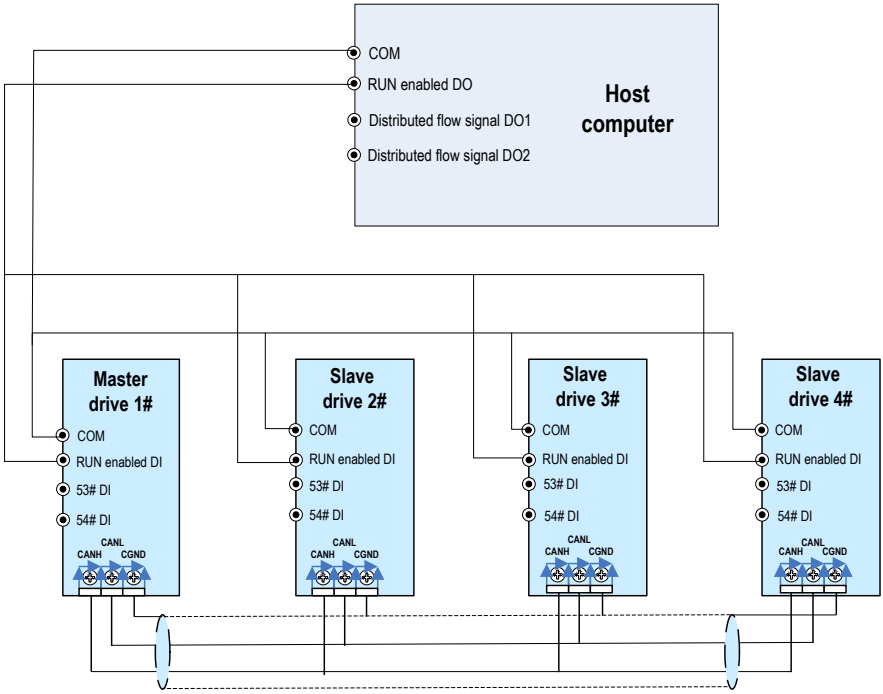
- Combination 1: 4-pump convergent flow
- Combination 2: 2+2 combination for distributed flow control

  The 1# pump is the master pump and is followed by the 2# slave pump. The 3# pump works as the master pump and is followed by the 4# slave pump.
- Combination 3: 3+1 combination for distributed flow control

  The 1# pump is the master pump and is followed by the 3# and 4# slave pumps. The 2# slave pump switches over to the master pump.

■ Combination 1: 4-pump Convergent Flow

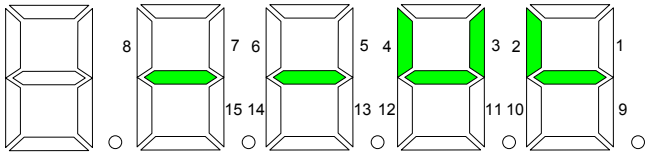
Figure B-7 Wiring of 4-pump convergent flow



Note

The convergent flow control requires very simple wiring including CAN bus and DI terminal wiring.

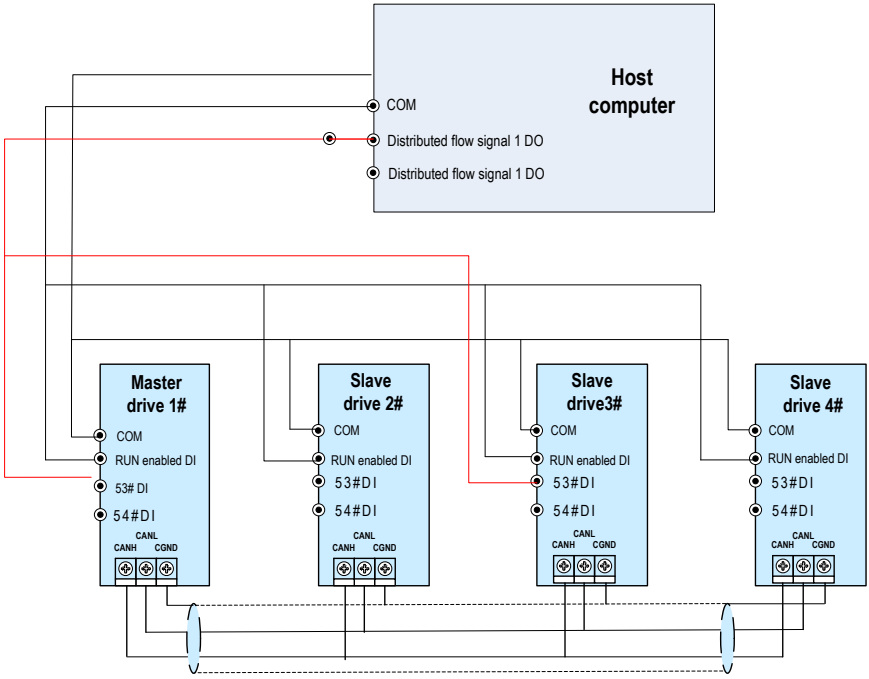
The 1# pump is the master pump, and the 2#, 3# and 4# pumps are slave pumps. The setting of address of corresponding slave pumps in A2-04 is as follows:



■ Combination 2: 2+2 combination for distributed flow control

The 1# pump is the master pump and is followed by the 2# slave pump. The 3# pump works as the master pump and is followed by the 4# slave pump.

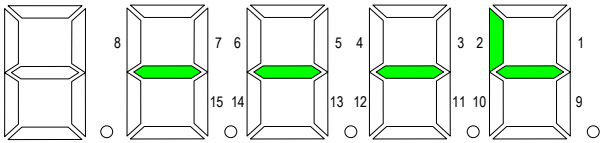
Figure B-8 Wiring of 4combination for distributed flow control



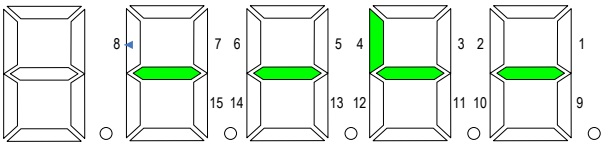
Note

The host computer provides the distributed flow signal. Connect the distributed flow signal to the DI terminal set for the 53# function of the master drive. The master pump identifies the slave pump address through the 53# DI signal. The slave pump switches over to the master pump and identifies the slave pump address by using the 53# DI signal.

In this combination, the 1# pump and 3# pump are the master pumps. The slave pump changes and the address of the slave pump needs to be set. The slave pump of the 1# master pump is 2# pump. The setting of the slave pump address in A2-05 is as follows:

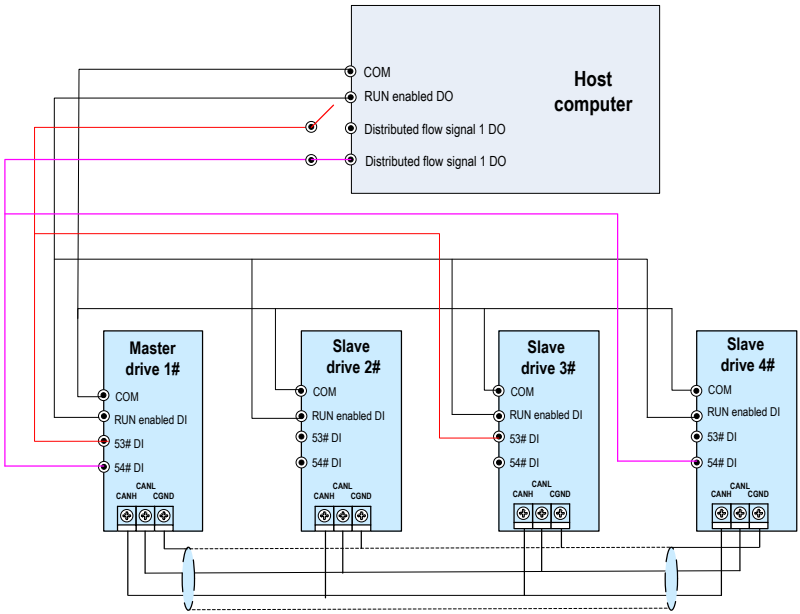


The slave pump of the 3# master pump is 4# pump. The setting of the slave pump address in A2-05 is as follows:



■ Combination 2: 3+1 combination for distributed flow control

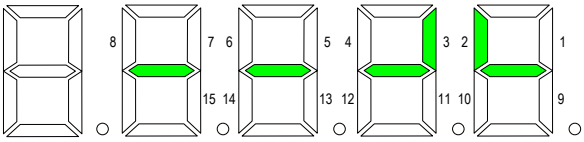
Figure B-9 Wiring of 3+1 combination for distributed flow control



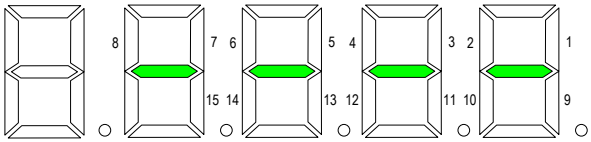
Note

- The host computer provides the distributed flow signal. Connect the distributed flow signal to the DI terminal set for the 54# function of the master drive. The master pump identifies the slave pump address through the 54# DI signal. The slave pump switches over to the master pump and identifies the slave pump address by using the 54# DI signal.
- Disconnect the DI terminal set for the 53# function in the second combination.

In this combination, the 1# pump and the 4# pump are the master pumps. The slave pump changes and the address of the slave pump needs to be set. The slave pumps of the 1# master pump are the 2# pump and 3# pump. The setting of the slave pump address in A2-06 is as follows:



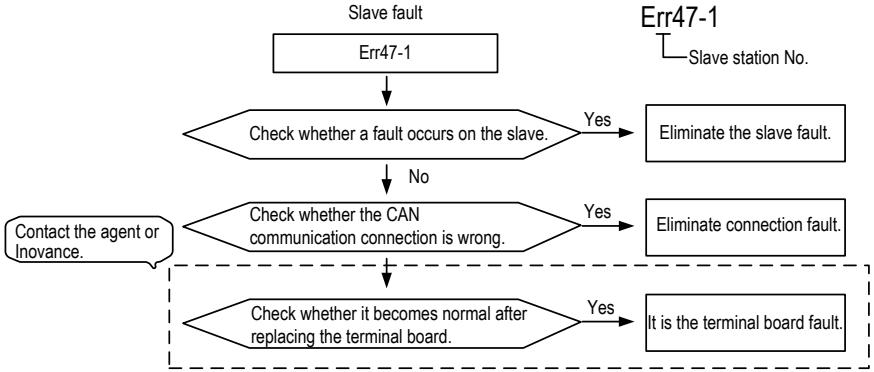
After the 4# slave pump switches over to the master pump, no slave follows it. Therefore, A2-06 does not need to be set.



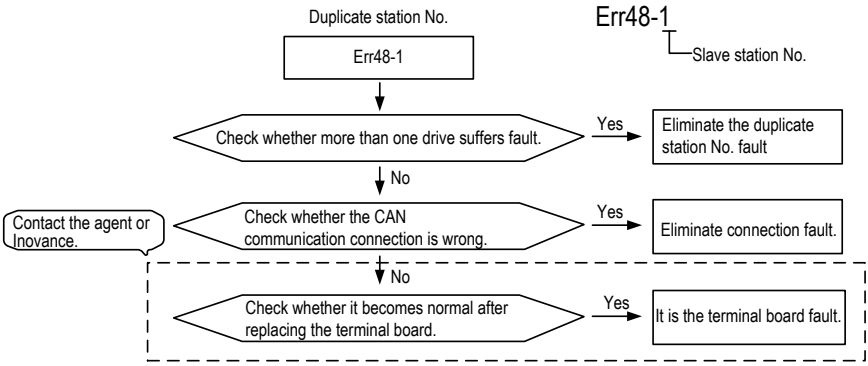
B.6 Fault Description

The fault occurring in the multi-pump control is described as follows:

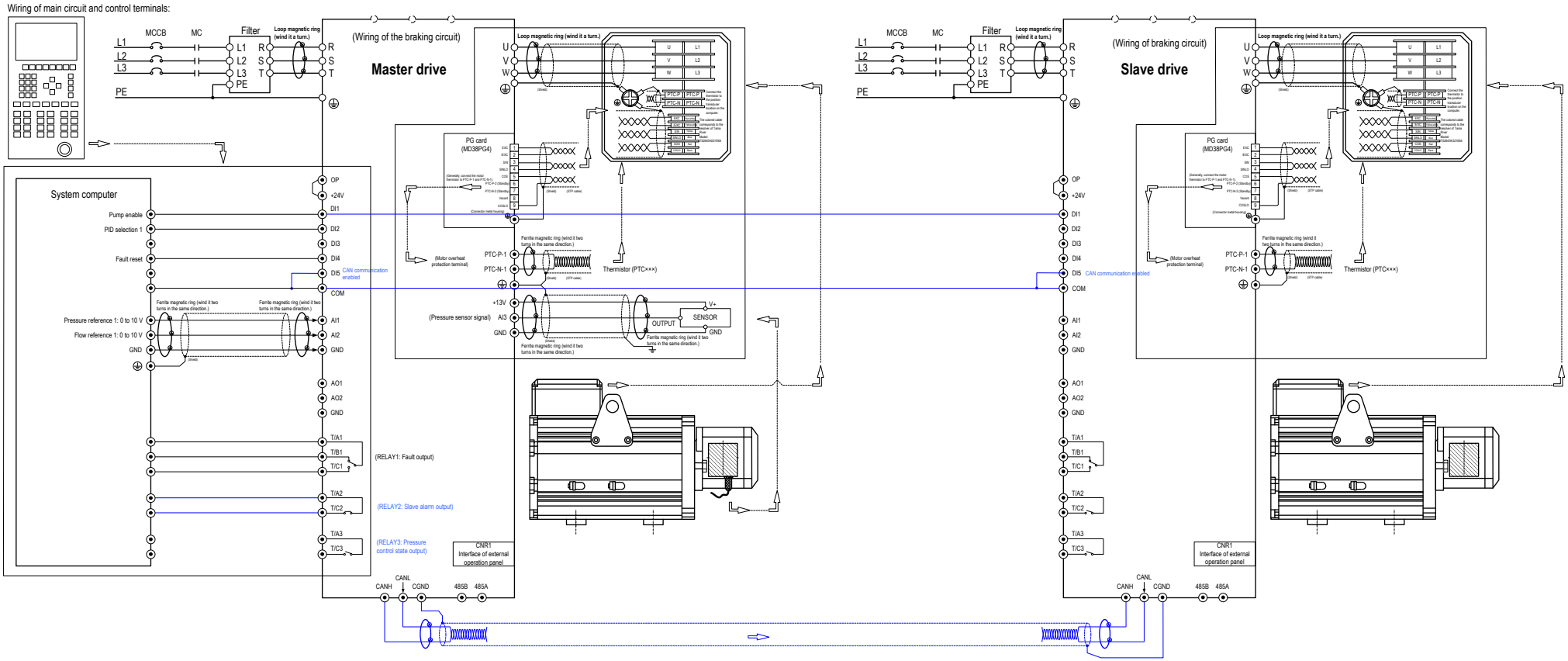
Err47 Oil pressure sensor fault



Err48 Oil pressure sensor fault



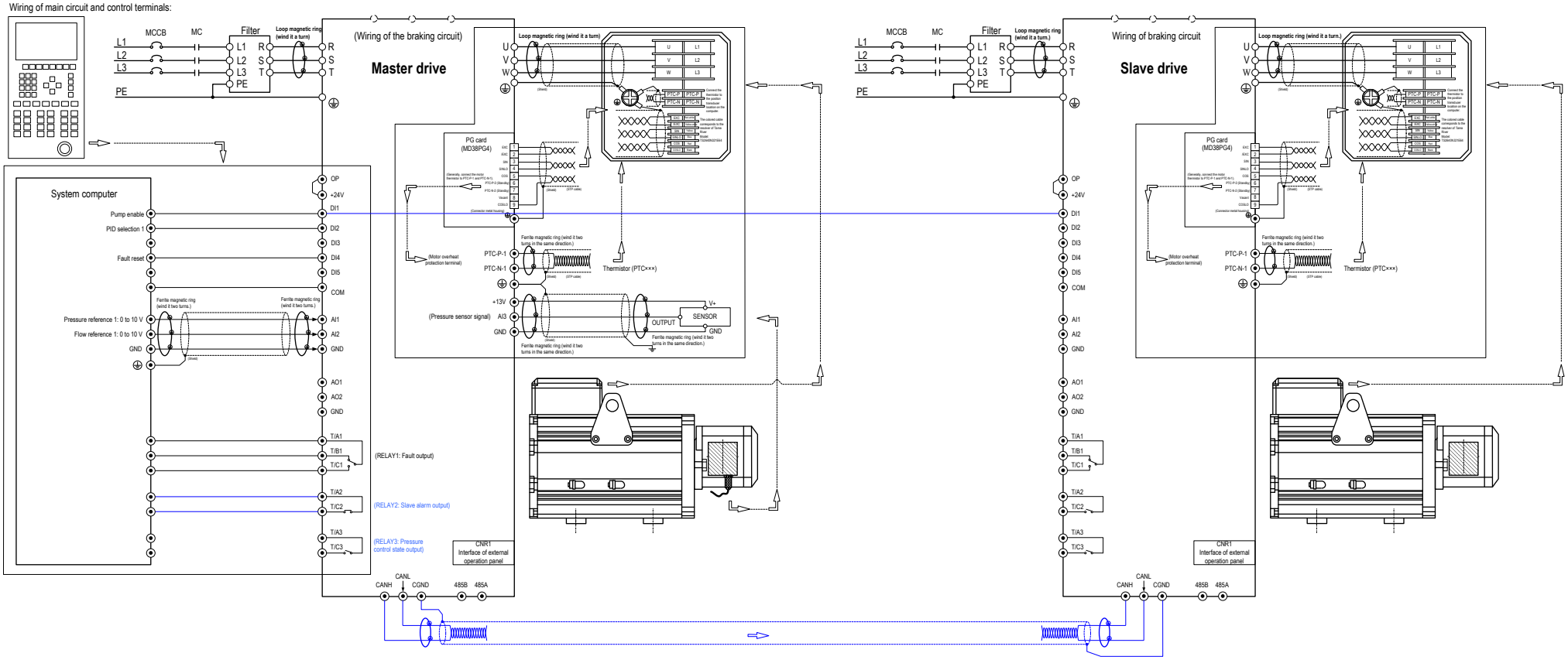
Wiring of main circuit and control terminals:



Note:

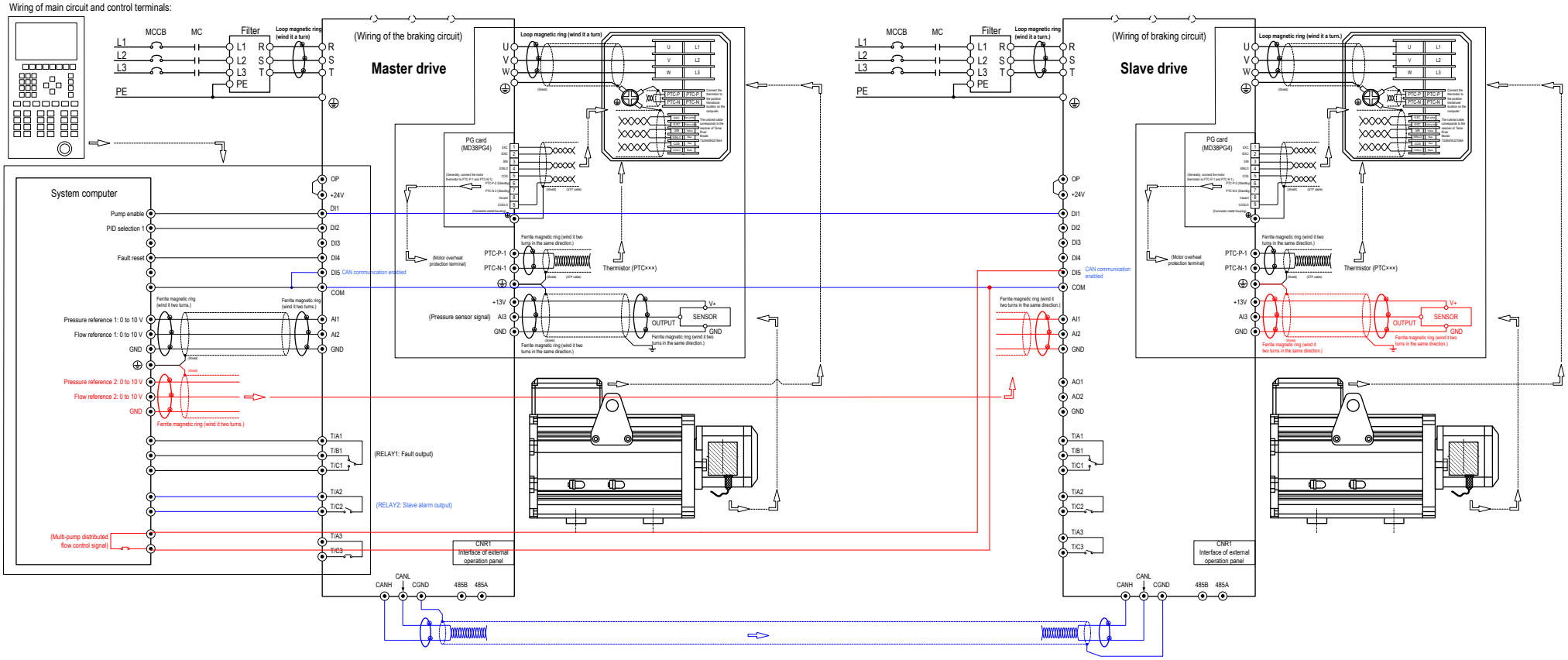
In the multi-pump mode 1, only when the DI terminal set for the 50# function of both master pump and slave pump close, the multi-pump convergent flow control can be enabled.

Wiring of main circuit and control terminals:



Note:

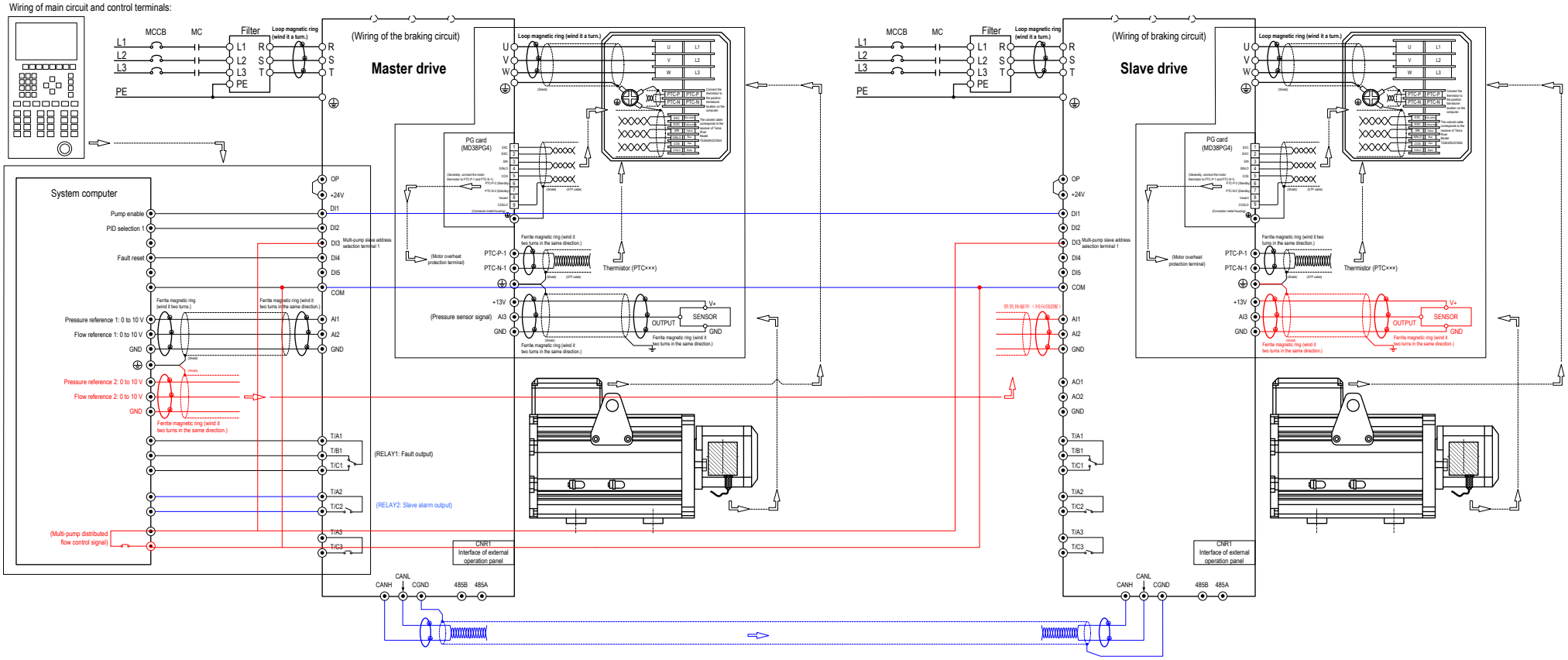
In the multi-pump mode 2, connect the CAN bus for the multi-pump convergent flow control and set the address of the slave pump that responds to the master pump flow reference.



Note:

The distributed flow signal sent by the computer board is used to open the DI terminal set for the 50# function of the slave. Then the drive receives the pressre, flow reference 2 and pressure feedback 2 and enters the oil pressure PID control.

Wiring of main circuit and control terminals:



Note:

Connect the slave alarm output signal to the system computer for alarm display.

In this control mode, the slave drive independently receives the pressure feedback 2 from the pressure sensor mounted on the oil channel of the slave pump. Therefore, high-pressure without cause will never occur on the oil channel of the slave pump in the pressure control.

Warranty Agreement

1. The warranty period of the product is 18 months from date of manufacturing. During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Inova will be responsible for free maintenance.
2. Within the warranty period, maintenance will be charged for the damages caused by the following reasons:

   a. Improper use or repair/modification without prior permission

   b. Fire, flood, abnormal voltage, other disasters and secondary disaster

   c. Hardware damage caused by dropping or transportation after procurement

   d. Improper operation

   e. Trouble out of the equipment (for example, external device)
3. If there is any failure or damage to the product, please correctly fill out the Product Warranty Card in detail.
4. The maintenance fee is charged according to the latest Maintenance Price List of Inovance.
5. The Product Warranty Card is not re-issued. Please keep the card and present it to the maintenance personnel when asking for maintenance.
6. If there is any problem during the service, contact Inova's agent or Inovance directly.
7. This agreement shall be interpreted by Inovance Technology..

Inovance Technology

Address: No.16, Youxiang Road, Yuexi Town, Wuzhong District, Suzhou 215104, P.R.China

Website: www.inovance.cn

Product Warranty Card

<table>
<tr><td rowspan="3">Customer information</td><td colspan="2">Address:</td></tr>
<tr><td rowspan="2">Company name:
Postcode:</td><td>Contact person:</td></tr>
<tr><td>Tel or Email:</td></tr>
<tr><td rowspan="3">Product information</td><td colspan="2">Product model:</td></tr>
<tr><td colspan="2">Serial No (Attach here):</td></tr>
<tr><td colspan="2">Name Supplier who supplied you the unit</td></tr>
<tr><td>Failure Description
(eg. Fault code)</td><td colspan="2">Maintenance personnel:</td></tr>
</table>

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