PH300 Series Servo Drive

Operating Manual

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Preface

Thank you for purchasing the PH300 series multi-function high performance servo drive.

Before using PH300 series servo drive, please read this manual carefully to have a thoroughly understanding of product and ensure proper usage.

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

DANGER

It indicates a potentially dangerous which may cause the death or serious injury because of incorrect use.

WARNING

It indicates that failure to comply with the notice will result in moderate or minor personal injury and may damage to servo drive or cause equipment failures.

The drawings in this user manual are shown for description only, due to production upgrade, information contained in this user's manual may be subject to change, may not match the product you purchased, please in kind prevail.

Please keep this manual well and forward it to end users with the product.

In order to provide you with a continuously improved products & better services, please contact with our agent or customer service center if you have any problem during the use.

Contents

Safety Information & Precautions

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

DANGER

It indicates a potentially dangerous which may cause the death or serious injury.

WARNING

It indicates that failure to comply with the notice will result in moderate or minor personal injury and may damage to servo drive or cause equipment failures. According to the different situations, it may cause other serious consequences.

CAUTION

It indicates the necessary operation to ensure the device run properly.

Please follow these indications when using the servo drive.
Warning Marks are placed on the front cover of the servo drive.

DANGER
● Risk of Injury and electric shock. ● Read the manual and follow the safety instruction before use. ● Isolate from supply and wait 10 minutes before removing this cover. ● Ensure proper earth connection. ● Mount the inverter on a non-combustible surface.

Product Checking

WARNING
Never use the servo drive if you find components missing or damage upon unpacking. Failure to comply may result in personal injury.

Upon unpacking, please check:

- Whether the servo drive is damaged during transportation. If you find any omission or damage, please contact Phase or your supplier immediately.
- Whether the nameplate model and the drive ratings are consistent with your order.
- Whether the box contains the servo drive's user manual and warranty card.
- Whether the servo drive's accessories is your ordered, if you have ordered accessories.

Disassembly & Installation

DANGER

- For installation and commissioning of servo drive, must be qualified personnel which receive professional training, failure to comply may result serious injury or major property damage.
- Ensure power cable supply well, proper earth connection.
- Even if the servo drive is not at working, dangerous voltage may still present in terminals as below:
  - Power input terminal R, S, T
  - Power output terminal U, V, W

DANGER

- Disconnect all power line before opening front cover of unit. Wait at least 10 minutes until DC Bus capacitors discharge.
- Sectional area of grounding conductor, please refer to information as below, but the minimum sectional area of grounding conductor must be ≥ 10mm².

Sectional area of power line conductor S (mm²)	S≤16	16<S≤35	35<S
Sectional area of power line conductor S (mm²)	S	16	S/2

WARNING

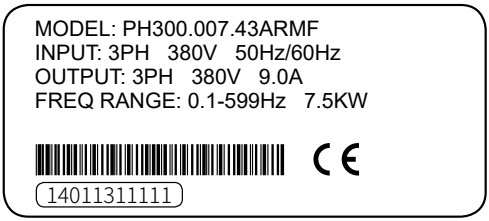
- When move servo drive, must hold on stand-off, don't carry the front cover. Failure to comply may make the servo drive's body fall, and result in personal injury.
- Install the servo drive on incombustible object such as metal, and keep it away from combustible materials. Failure to comply may result in a fire.
- When two servo drives are installed in the same cabinet, arrange the installation positions properly to ensure the cooling effect or install air-cooler and make the air temperature below 40 degrees. Failure to comply may result in a fire.

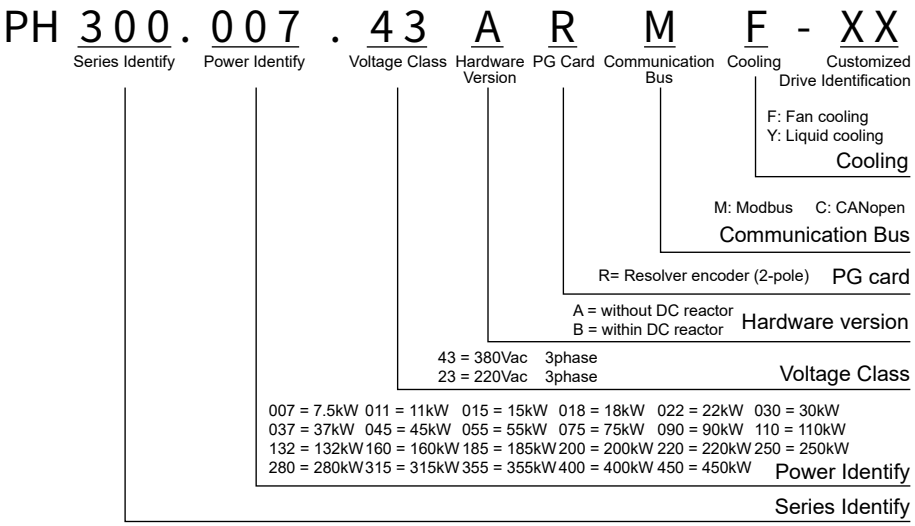
Chapter 1 Introduction

1.1 Technical Specifications

Item	PH300
Max. frequency	0-599Hz
PWM frequency	According to load characteristics, PWM frequency auto-adjustment 1KHz~12kHz
Input frequency resolution	Digital Setting : 0.01Hz
	Analog setting : Max frequency×0.025%
Control mode	Close-Loop Vector Control
Startup torque	0Hz / 180%
Speed range	1：1000(FVC)
Speed stability accuracy	±0.02%(FVC)
Torque control accuracy	±5%(FVC)
Overload capacity	60s for 150% of the rated current 3s for 180% of the rated current
Ramp curve	Straight-line or S-curve, 4 kinds of acceleration and deceleration time, acceleration & deceleration time range : 0.0s~6500.0s
Fast current limiting function	Minimizing overcurrent fault, protect drives' good running
PG card option	Differential input PG card, open collector input PG card, resolver PG card, etc.
Overvoltage /overcurrent stall torque	The current and voltage are limited automatically during the running process, avoiding frequent tripping due to overvoltage/ overcurrent.

1.2 Name Plate Description





1.3 PH300 Series Servo Drive Selection Guide

PH300 AC 380V

PH300XXX43ARMF PH300XXX43BRMF		007	011	015	018	022	030	037	045	055	075	090	110
Rated output power (kW)		7.5	11	15	18.5	22	30	37	45	55	75	90	110
Rated output current (A)		17	25	32	37	45	60	75	90	110	150	176	210
Version A	Rated input current (A)	20	30	37	42	51	67	82	99	115	157	183	214
	Rated input current (A)	4.5	4.5	5	5	5.2	9.9	10	20.5	21	29	29.5	30
	Dimension W*L*H (mm)	151x332x183					217x400x216		300x440x240		275x590x310		
	Size	B					C		D		E		
Version B	Rated input current (A)	/					/		89	106	139	164	196
	Net Weight (Kg)	/					/		29.5	30	33.5	48.5	49
	Dimension W*L*H (mm)	/					/		300x500x253		338x546x257	338x550x300	
	Size	/					/		C1		D1	E1	
DC reactor		without internal DC reactor							Version A without internal DC reactor Version B within internal DC reactor				
Brake Unit		internal brake											
Power Supply		380Vac~480Vac±10% 50Hz/60Hz											
Output Frequency		0~599 Hz											

Remarks: "/" indicates that here is no such servo drive type

PH300 AC 380V

PH300XXX43ARMF PH300XXX43BRMF		132	160	185	200	220	250	280	315	355	400	450
Rated output power (kW)		132	160	185	200	220	250	280	315	355	400	450
Rated output current (A)		253	300	340	380	420	470	520	600	640	690	790
Version A	Rated input current (A)	256	307	350	385	430	468	525	610	665	700	800
	Rated input current (A)	55	56.5	/	/	/	/	/	/	/	/	/
	Dimension W*L*H (mm)	400x675x310		/	/	/	/	/	/	/	/	/
	Size	F		/	/	/	/	/	/	/	/	/
Version B	Rated input current (A)	240	287	330	368	405	455	505	580	620	670	765
	Net Weight (Kg)	96.5	97	118	118.5	118.5	148	125	127.5	173.5	175.5	178.5
	Dimension W*L*H (mm)	400x872x310		300x1445x500			330x1595x545	325x1495x545		335x1720x545		
	Size	F1		G1			H1	I1		J1		
DC reactor		Version A without internal DC reactor Version B within internal DC reactor										
Brake Unit		Without Internal brake， needs to be purchased separately										
Power Supply		380Vac~480Vac±10% 50Hz/60Hz										
Output Frequency		0~599 Hz										

Remarks：“/” indicates that here is no such servo drive type

PH300 AC 220V

PH300XXX23ARMF PH300XXX23BRMF		007	011	015	018	022	030	037	045	055	075	090
Rated output power(kW)		7.5	11	15	18.5	22	30	37	45	55	75	90
Rated output current (A)		32	45	60	75	90	110	150	176	210	300	340
Version A	Rated input current (A)	37	51	67	82	99	115	157	183	214	307	/
	Net Weight (kg)	4.5	4.7	5	5	20	20.5	28	28.5	29	55	/
	Dimension W*L*H (mm)	151x332x183		217x400x216		300x440x240		275x590x310			400x675x310	/
	Size	B		C		D		E			F	/
Version B	Rated input current (A)	/										350
	Net Weight (kg)	/										91
	Dimension W*L*H (mm)	/										300x1445x500
	Size	/										G1
DC reactor		without internal DC reactor										within internal DC reactor
Brake Unit		internal brake										Without Internal brake
Power Supply		380Vac~480Vac±10% 50Hz/60Hz										
Output Frequency		0~599 Hz										

Remarks："/" indicates that here is no such servo drive type

1.4 Installation

Installation environment has direct influence on the service life and the normal function of servo drive, please using servo according to environment conditions allowed in this manual, failure to comply may result in drive protection or faults.

PH300 series servo drive is wall-mounted or cabinet-mounted, please use the vertical installation, so that the air convection and the heat dissipation effect can be better.

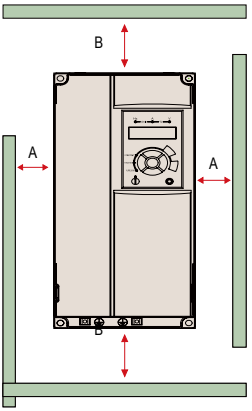
Servo drive's installation environment, please comply with the followings:

Item	Requirements
Ambient temperature	-10℃ to 40 ℃
Ambient humidity	0% to 95% and no condensation
Heat dissipation	Install the servo drive on an incombustible supporting surface.
	Use strong screws or bolts to secure the enclosure on the supporting surface. Away from heating elements (such as brake resistor, etc).
	Please notice the mounting location for sevral servo dirves mounted, make sure there is sufficient space around the enclosure to allow for efficient heat dissipation, and cooling fan should be installed to make sure ambient temperature lower below 40℃ .
Mounting location	Make sure the mounting location is.
	Away from direct sunlight.
	Protected against corrosive, combustible or explosive gases and vapours.
	Free from oil, dirt, dust, cotton fibre or metallic powders.
	Away from radioactive substance and electromagnetic interference source (such as electric welding machine, large power machine, etc).
	In place 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.
Vibration	Make sure the mounting location is not affected by levels of vibrition that exceed 0.6g.
	Make sure the mounting location is not affected by levels of vibrition that exceed 0.6g.

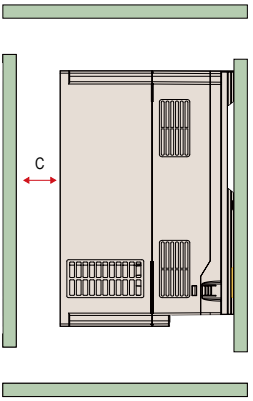
Mounting Orientations and Clearance

The mechanical clearance requirements for PH300 vary with power classes of the servo drive.

◆ Single servo drive installation:



Front view

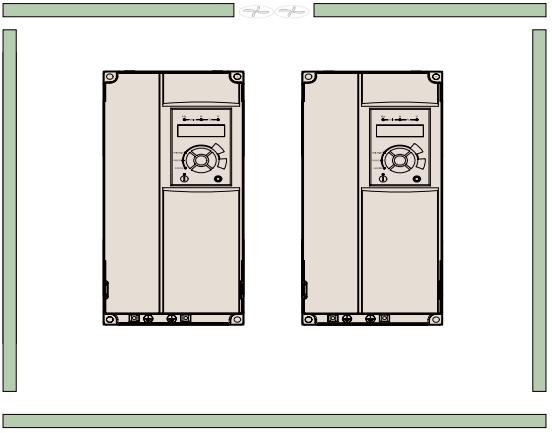


Side view

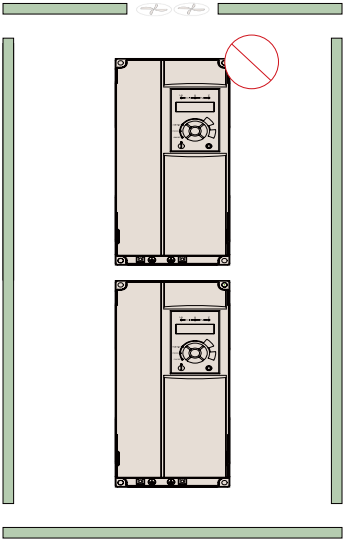
Space size	
A	≥50mm
B	≥150mm
C	≥50mm

◆ Multiple servo drives installed in one control cabinet:

Need to mount servo drives side by side

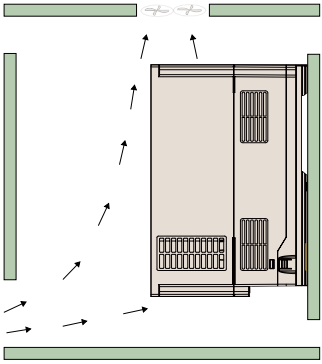


Correct installation

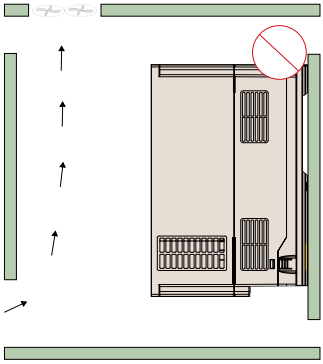


Incorrect installation

Make sure there is enough clearances around the enclosure to allow for efficient heat dissipation, and cooling fan should be installed.



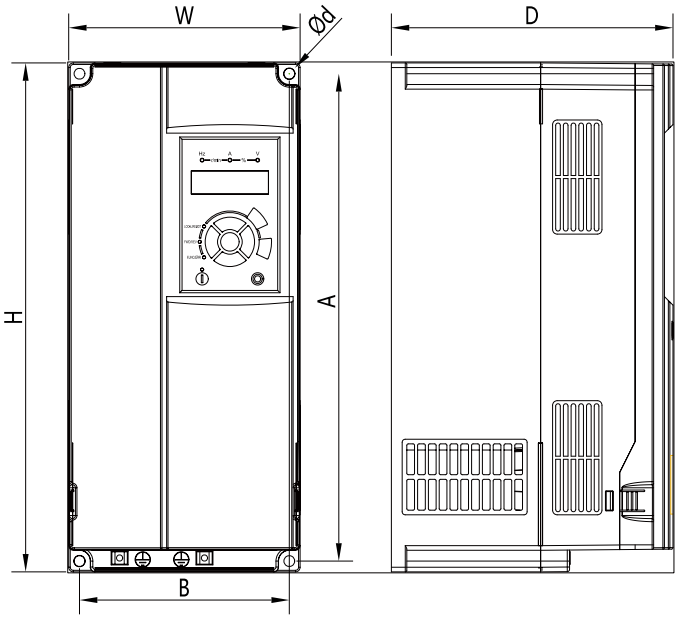
Correct installation position of cooling fan



Incorrect installation position of cooling fan

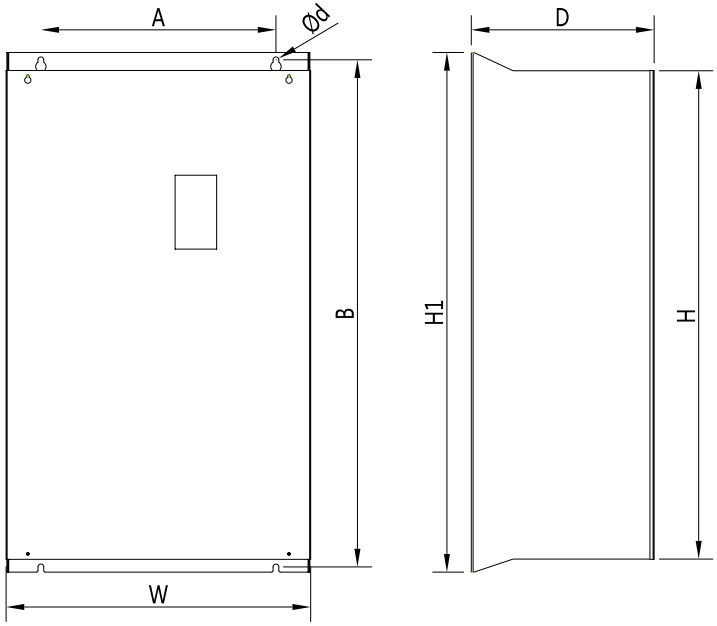
◆ Dimensions of Servo Drives

■ 380Vac/7.5kW~37kW&220Vac/7.5kW~18.5kW



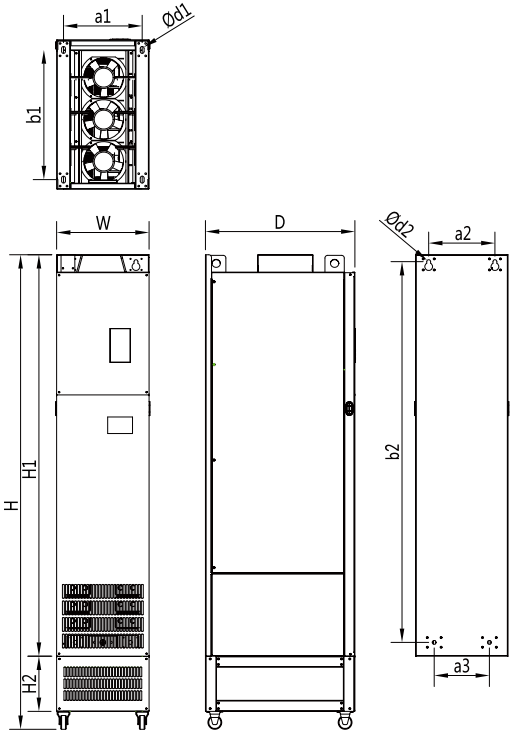
Version	Size	Drive Code	W	H	D	A	B	Ød
Version A	B	PH300.007.43ARMF PH300.011.43ARMF PH300.015.43ARMF PH300.018.43ARMF PH300.022.43ARMF PH300.007.23ARMF PH300.011.23ARMF	151	332	183	318	137	7
	C	PH300.030.43ARMF PH300.037.43ARMF PH300.015.23ARMF PH300.018.23ARMF	217	400	216	385	202	7

■ 380Vac/45kW~160kW&220Vac/22kW~75kW



Version	Size	Drive Code	W	H	D	A	B	Ød	H1
Version A	D	PH300.045.43ARMF PH300.055.43ARMF PH300.022.23ARMF PH300.030.23ARMF	300	440	240	200	455	9	470
	E	PH300.075.43ARMF PH300.090.43ARMF PH300.110.43ARMF PH300.037.23ARMF PH300.045.23ARMF PH300.055.23ARMF	275	590	310	200	612	9	630
	F	PH300.132.43ARMF PH300.160.43ARMF PH300.075.23ARMF	400	675	310	320	695	11	715
Version B	C1	PH300.045.43BRMF PH300.055.43BRMF	300	500	253	200	522	9	540
	D1	PH300.075.43BRMF	338	546	257	270	560	9	576
	E1	PH300.090.43BRMF PH300.110.43BRMF	338	550	300	270	564	9	580
	F1	PH300.132.43BRMF PH300.160.43BRMF	400	872	310	320	895	11	915

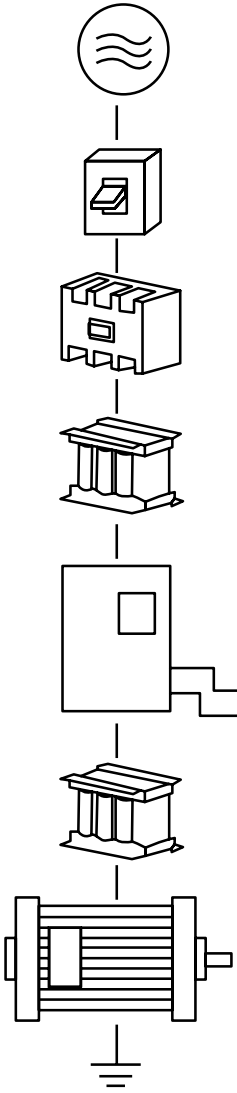
■ 380Vac/185kW~450kW&220Vac/90kW



Version	Size	Drive Code	Dimension					Foot-mounted dimension			Wall-mounted dimension			
			W	H	H1	H2	D	a1	b1	d1	a2	a3	b2	d2
Version B	G1	PH300.090.23ARMF PH300.185.43BRMF PH300.200.43BRMF PH300.220.43BRMF	300	1445	1180	200	500	250	430	14	220	150	1135	13
	H1	PH300.250.43BRMF	330	1595	1330	200	545	280	475	14	220	185	1275	13
	I1	PH300.280.43BRMF PH300.315.43BRMF	325	1495	1230	200	545	275	470	14	225	185	1175	14
	J1	PH300.350.43BRMF PH300.400.43BRMF PH300.450.43BRMF	335	1720	1455	200	545	285	470	14	240	200	1380	14

Chapter 2 Wiring

2.1 Wiring Mode of Main Parts



Three – phase AC power suppy：Use within the allowable power suppy specifications of the servo drive.

Moulded 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 contractor (MC)：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.

AC input reactor：Suppress the high order harmonic to improve the power factor. (Optional parts)

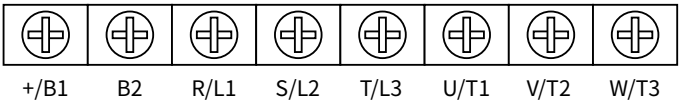
Brake resistor：Avoid DC bus high voltage of the servo drive, and improve the braking ability of the internal brake unit.

AC output reactor：Suppress the high order harmonic to improve the power factor. (Optional parts)

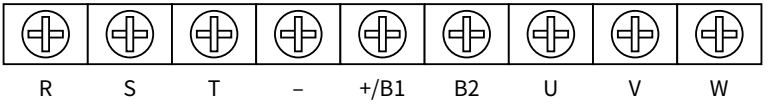
2.2 Main Circuit Wiring

Main Circuit Terminals

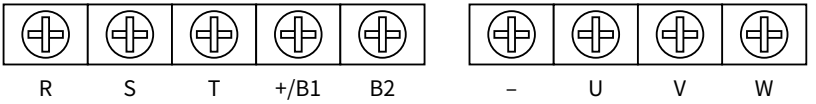
Type B: 3PH 380V 7.5-37KW & 3PH 220V 7.5-18.5KW



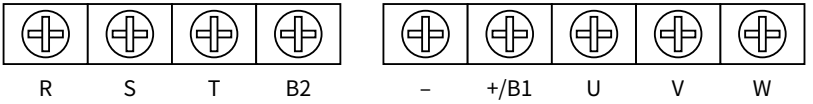
Type C: 3PH 380V 45-55KW & 3PH 220V 22-30KW



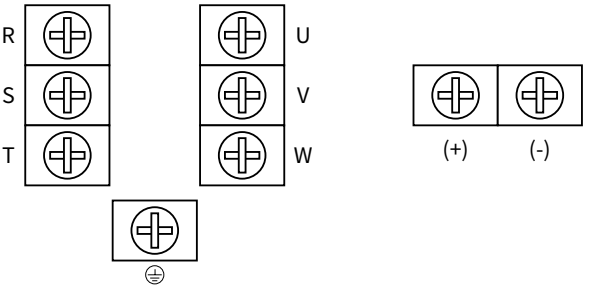
Type D: 3PH 380V 75-110KW & 3PH 220V 37-55KW



Type E: 3PH 380V 132-160KW & 3PH 220V 75KW



Type F: 3PH 380V 185-450KW & 3PH 220V 90KW



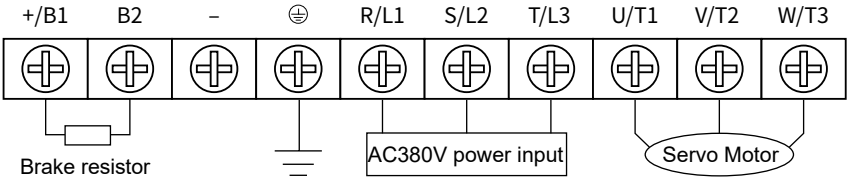
*Remarks： R/S/T, U/V/W wiring terminals at the bottom of servo drive; (+) / (-) wiring terminals at the top of servo drive

*Remarks： The above diagram data are for reference only

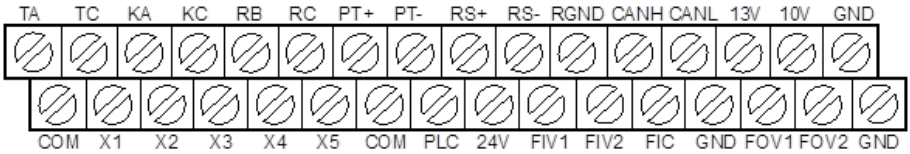
Main Circuit Terminals Description

Terminal Symbol	Describe
R/L1、S/L2、T/L3	Three-phase power input terminals
U/T1、V/T2、W/T3	Servo drive output terminals,Connect to a three-phase motor
+/B1、-	Positive and negative terminals of DC bus,Connect to the external braking unit
+/B1、B2	Terminals for connecting braking resistor
(+) / (-)	Terminals for braking unit
⏚	Grounding Terminal

2.3 Main Circuit Terminals Arrangement



2.4 Control Circuit Terminals and Wiring



Description of Control Circuit Terminals

Type	Terminal	Name	Description
Power	+10V-GND	+10V power supply	Provide 10V±10% power supply externally. Generally, it provides power supply to the external potentiometer with resistance range: 1kΩ~5kΩ. Maximum output current: 10mA
	+13V-GND	Pressure Sensor Power Supply	Provide 13V±10% power supply externally. Generally, it provides power supply to the pressure sensor. Maximum output current: 10mA
	+24V-COM	+24V power supply	Provide +24V power supply to an external unit. Generally used to supply the DI/DO terminals and external sensors. 24V±10%, no-load virtual voltage of 30V or less . Maximum output current: 200mA, internally isolated from GND.
	PLC	Input terminal of external power	Internally isolated from COM and 24V, shorted with +24V by using jumper by default. When X1 to X5 need to be driven by external signals. PLC must be disconnected from the +24V and connected to an external power supply terminal. (This is determined by the jumper J8).
Analog Input	FIV1-GND	Analog input terminal 1	Input voltage range: ±10V, 12-bit resolution, correction accuracy 0.5%; Input impedance: 100kΩ.
	FIV2-GND	Analog input terminal 2	Input voltage range: ±10V, 12-bit resolution, correction accuracy 0.5%; Input impedance: 100kΩ.
	FIC-GND	Analog input terminal 3	Input voltage range: ±10V or 0~20mA (This is determined by the jumper J9 on the control board), 12-bit resolution, correction accuracy 0.5%. Input impedance: 100kΩ (voltage input), 500Ω (current input).
Digital Input	X1-COM	Digital input 1	Isolated sink/source input programmable terminals, input frequency <100Hz; Input impedance: 3.3kΩ; Voltage range at level input: 9V ~ 30V.
	X2-COM	Digital input 2	
	X3-COM	Digital input 3	
	X4-COM	Digital input 4	
	X5-COM	Digital input 5	

Type	Terminal	Name	Description
Digital Input	PT+---PT-	Motor overheat protection input	The motor overheat PTC sensor, supporting PTC130 and PTC150, etc.
Communication	CANH/ CANL/ RGND	CAN communication terminal	CAN communication terminal
	RS+/RS-	485 communication terminal	Max. baud rate: 230Kbps , isolation. Whether to connect the terminal resistor is determined by the jumper J5 on the control board.
Analog Output	FOV1-GND	Analog output 1	Voltage or current output is determined by jumper J10 on the control board. Output range: 0 ~ 10V / 0 ~ 20mA 12-bit resolution, correction accuracy 1%, maximum load resistance value ≤ 500Ω.
	FOV2-GND	Analog output 2	Voltage or current output is determined by jumper J11 on the control board. Output range: 0 ~ 10V / 0 ~ 20mA 12-bit resolution, correction accuracy 1%, maximum load resistance value ≤ 500Ω.
Relay Output	RB-RC	NC terminal	Contact driving capability: 250Vac/3A; 30Vdc/1A
	TA-TC	NO terminal	
	KA-KC	External operation panel interface	Connect to the external operation panel.

Servo Drive Recommended specifications

Drive Code	Rated output power(kW)	Main Circuit Cable(mm)	Breaker Selection(A)	Input Side Magnetic contractor(A)
3PH AC220V±15%	7.5	6	50	38
	11	10	63	50
	15	16	100	65
	18.5	25	100	80
	22	35	125	95
	30	50	160	115
	37	70	225	170
	45	95	250	205
	55	120	315	245
	75	150	400	300
	90	185	500	410
3PH AC380V±15%	7.5	4	32	25
	11	4	40	32
	15	6	50	38
	18.5	10	50	40
	22	10	63	50
	30	16	100	65
	37	25	100	80
	45	35	125	95
	55	50	160	115
	75	70	225	150
	90	95	250	170
	110	120	315	205
	132	150	350	245
	160	185	400	300
	185	185	500	410
	200	185	500	410
	220	240	630	410
	250	240	630	475
	280	150*2	700	620
	315	185*2	800	620
	350	185*2	800	620
	400	240*2	1000	800
	450	240*2	1000	800

2.5 Wiring Main Circuits

Wiring at input side of main circuit

◆ Circuit breaker

It is necessary to connect a circuit breaker which is compatible with the capacity of servo drive between 3ph AC power supply and power input terminals (R, S, T). The capacity of breaker is 1.5-2 times to the rated current of servo drive. For details see < Specifications of Breaker Cable and Contactor>.

◆ Contactor

In order to cut off the input power effectively when something is wrong in the system, contactor should be installed at the input side to control the ON-OFF of the main circuit power supply.

◆ AC reactor

In order to prevent the rectifier damage result from the large current, AC reactor should be installed at the input side. It can also prevent rectifier from sudden variation of power voltage or harmonic generated by phase-control load.

Wiring at servo drive side of main circuit

◆ Braking unit and braking resistor

Servo drive of 160KW and below have built-in braking unit. In order to dissipate the regenerative energy generated by dynamic braking, the braking resistor should be installed at B1/+ and B2 terminals. The wire length of the braking resistor should be less than 5m.

Servo drive of 160KW and below have built-in braking unit. In order to dissipate the regenerative energy generated by dynamic braking, the braking resistor should be installed at B1/+ and B2 terminals. The wire length of the braking resistor should be less than 5m.

The temperature of braking resistor will increase because the regenerative energy will be transformed to heat. Safety protection and good ventilation is recommended.

◆ Wiring at motor side of main circuit

Output reator must be installed in the following condition. When the distance between servo drive and motor is more than 50m servo drive may be tripped by over-current protection frequently because of the large leakage current resulted from the parasitic capacitance with ground. And the same time to avoid the damage of motor insulation, the output reactor should be installed.

◆ Ground Wiring (PE)

In order to ensure safety and prevent electrical shock and fire terminal PE must be grounded with ground resistance. The ground wire should be big and short and it is better to use copper wire (>3.5mm2). When multiple servo drives need to be grounded, don't loop the ground wire.

2.6 Wiring-Control circuit

Note

Please connect the control terminal with multi-core shielded cable or twisted pair shielded cable. When using the shielded cable (driver side), connect the shield to the ground terminal of the driver.⏚。 When wiring, the control cable should be more than 20cm away from the power line (including power line, motor line, relay, contactor line, etc.), parallel wiring should be avoided and vertical wiring is recommended, thus to prevent the driver from misoperation caused by external interference.

Control board switch instructions

switch	describe
J9	Voltage (0 ~ 10V)/current (0 ~ 20mA) input switch:V, GND short connection for voltage input; I, GND short connection for current input
J10、J11	Voltage (0 ~ 10V)/current (0 ~ 20mA) input switch: J10: 500Ω Input impedance J11: 250Ω Input impedance

External resistance is greater than 3 kΩ, power≥1/4W, recommend 5 ~ 10 kΩ.

2.7 EMC

Definition of EMC

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

EMC includes two aspects: Electromagnetic interference and electromagnetic immunity. According to the transmission mode, electromagnetic interference is divided into two types: conducted interference and radiated interference. Conducted interference is propagated by conductor, therefore any conductors (such as wire transmission line inductor capacitor and so on) are the transmission channels of the interference.

Radiated interference is the interference transmitted in electromagnetic wave and the energy is inverse proportional to the square of distance.

Three necessary conditions or essentials of electromagnetic interference are: interference source transmission channel and sensitive receiver. For customers, the solution of EMC problem is mainly in transmission channel because of the device attribute of disturbance source and receiver can't be changed.

EMC features of servo drive

Like other electric or electronic devices servo drive is not only an electromagnetic interference source but also an electromagnetic receiver. The operating principle of servo drive determines that it can produce certain electromagnetic interference noise. At the same time servo drive should be designed with certain anti-jamming ability to ensure the smooth working in certain electromagnetic environment. Following is its EMC features:

◆ Input current is non-sine wave. The input current includes large amount of high-harmonic waves that can cause electromagnetic interference decrease the grid power factor and increase the line loss.

◆ Output voltage is high frequency PMW wave which can increase the temperature rise and shorten the life of motor. And the leakage current will also increase which can lead to the leakage protection device malfunction and generate strong electromagnetic interference to influence the reliability of other electric devices.

◆ As the electromagnetic receiver, too strong interference will damage the servo drive and influence the normal using of customers.

◆ In the system EMS and EMI of servo drive coexist. Decrease the EMI of servo drive increase its EMS ability.

EMC Installation Guideline

In order to ensure all electric devices in the same system to work smoothly this section based on EMC features of servo drive introduces EMC installation process in several aspects of application (noise control site wiring grounding leakage current and power supply filter). The good effective of EMC will depend on the good effective of all of these five aspects.

◆ Noise control

AII the connections to the control terminals must use shielded wire And the shield layer of the wire must ground near the wire entrance of servo drive. The ground mode is 360 degree annular connection formed by cable clips. It is strictly prohibitive to connect the twisted shielding layer to the ground of servo drive which greatly decreases or loses the shielding effect.

Connect servo drive and motor with the shielded wire or the separated cable tray. One side of shield layer of shielded wire or metal cover of separated cable tray should connect to ground, and the other side should connect to the motor cover. Installing an EMC filter can reduce the electromagnetic noise greatly.

◆ Site wiring

Power supply wiring:

The power should be separated supplied from electrical transformer. Normally it is 5 core wires three of which are fire wires, one of which is the neutral wire and one of which is the ground wire. It is strictly prohibitive to use the same line to be both the neutral wire and the ground wire.

Device categorization:

There are different electric devices contained in one control cabinet such as servo drive, filter, PLC, and instrument etc, which have different ability of emitting and withstanding electromagnetic noise. Therefore, it needs to categorize these devices into strong noise device and noise sensitive device. The same kinds of device should be placed in the same area and the distance between devices of different category should be more than 20cm.

Wire Arrangement inside the control cabinet:

There a signal wire (light current) and power cable (strong current) in one cabinet. For the servo drive the power cables are categorized into input cable and output cable.

Signal wiresn be easily disturbed by powercables to make the equipment malfunction. Therefore when wiring signal cables and power cables should be arranged in different area. It is strictly prohibitive to arrange them in parallel or interlacement at a close distance (less than 20cm) or tie them together. If the signal wires have to cross the power cables they should be arranged in 90 angles. Power input and output cables should not either be arranged in interlacement or tied together especially when installed the EMC filter. Otherwise the distributed capacitances of its input and output power cable can be coupling each other to make the EMC filter out of function.

◆ Ground

Servo drive must be ground safely when in operation. Grounding enjoys priority in all EMC methods because it does not only ensure the safety of equipment and persons but also is the simplest most effective and lowest cost solution for EMC problems.

Grounding has three categories: special pole grounding common pole grounding and series-wound grounding. Different control system should use special pole grounding and different devices in the same control system should use common pole grounding and different devices connected by same power cable should use series-wound grounding.

◆ Leakage Current

Leakage current includes line-to-line leakage current and over¬ ground leakage current. Its value depends on distributed capacitances carrier frequency of servo drive. The over-ground leakage current which is the current passing through the common ground wire can not only flow into servo drive system but also other devices. It also can make leakage current circuit breaker relay or other devices malfunction. The value of line-to-line leakage current, which means the leakage current passing through distributed capacitors of input output wire, depends on the carrier frequency of servo drive, the length and section areas of motor cables. The higher carrier frequency of servo drive, the longer of the motor cable and/or the bigger cable section area, the larger leakage current will occur.

Countermeasure: Decreasing the carrier frequency can effectively decrease the leakage current. In the case of motor cable is relatively long (longer than 50m), it is necessary to install AC reactor or sinusoidal wave filter at the output side and when it is even longer it is necessary to install one reactor at every certain distance.

EMC Filter

EMC filter has a great effect of electromagnetic decoupling, so it is preferred for customer to install it.

For servo drive noise filter has following categories:

- Noise filter installed at the input side of servo drive;
- Install noise isolation for other equipment by means of isolation transformer or power filter.

Chapter 3 Operation

3.1 Operation Panel

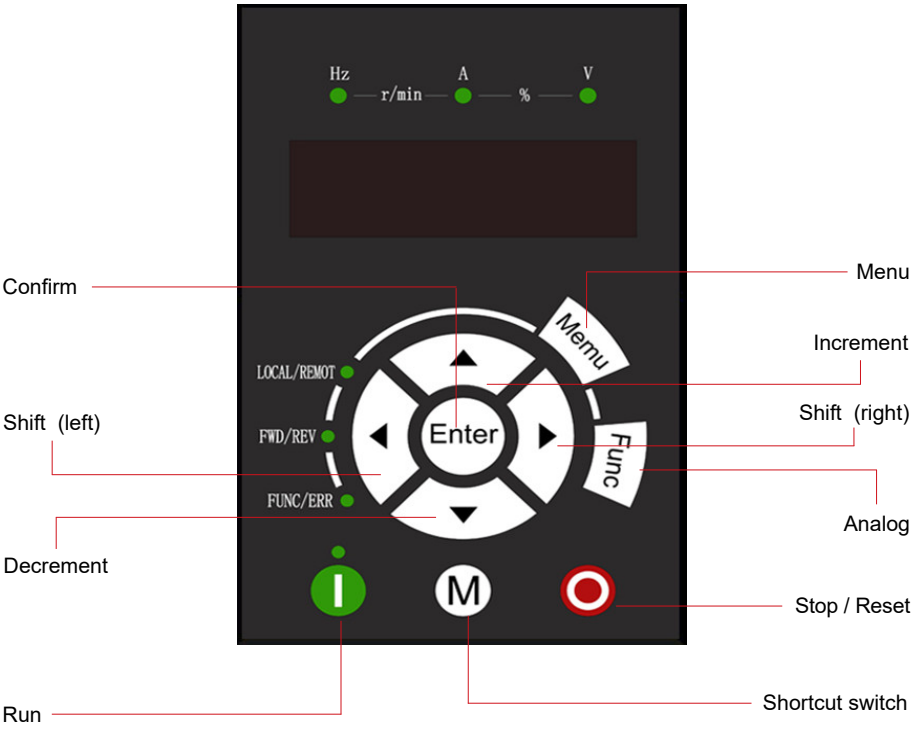


Figure 3-1 Panel diagram

Description of Operation Panel

Key	Name	Description
	Menu	Enter or exit level I, parameters delete quick menu.
	Confirm	Enter the menu interfaces level by level, and confirm the parameters setting.
	Increment	Increase data or function code.
	Decrement	Decrease data or function code.
	Shift (left)	Select the displayed parameters in turn in the stop or running state, and select the dijit to be modified when modifying parameters.
	Shift (right)	
	Run	Start the servo drive in the operation panel control mode.
	Stop / Reset	Stop the servo drive when it is running state and restrained by function code P7.02; Perform the reset operation when it is in the fault state.
	Shortcut switch	Self - definition function
	Analog	Enter to PA.00 analog set

Description of Indicators

Unit / Symbol	Description
Hz	Unit of frequency
A	Unit of current
V	Unit of voltage
r/min	Unit of rotational speed
%	Percentage
LOCAL/REMOT	ON：Terminal control OFF：Operation panel control
FWD/REV	ON: Reverse rotation OFF: Forward rotation
FUNC/ERR	Function / Error information

3.2 Operation Procedure

Viewing and Modifying Function Codes

The operation panel of the PH300 series servo drive adopts three-level menu:

- Function code (Level I)
- Function code (Level II)
- Function code (Level II)

Note: You can return to Level II menu from Level III by pressing Menu 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 Menu, 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 P2.04 to 10.00Hz.

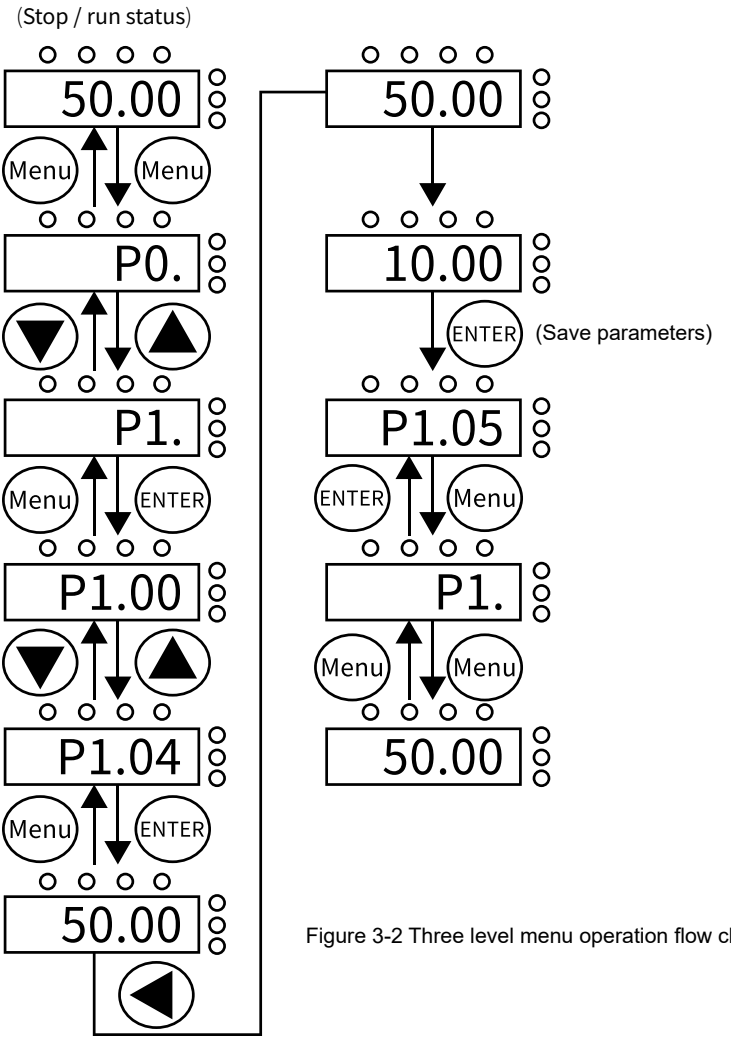


Figure 3-2 Three level menu operation flow chart

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

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

Motor auto-tuning

When selecting the vector control mode, the nameplate parameters of the motor must be input accurately, then the driver will match out the standard motor parameters according to the nameplate parameters. In order to obtain better control performance, motor auto-tuning is recommended to set. The operation steps are as follows:

First select “command source selection (P0.02)” as “operation panel control”. Then please set the following parameters according to the actual parameters of the motor:

P0.01	Control mode selection	P2.02	Motor rated voltage	P2.27	Encoder line counts per turn
P0.10	Preset frequency	P2.03	Motor rated current	P2.28	Encoder type
P0.12	Maximum frequency	P2.04	Motor rated frequency	P2.37	Motor auto-tuning mode
P2.01	Motor rated power	P2.05	Motor rated speed		

* note1: when you choose Closed-loop vector control (CLVC), the following parameters should be set: P2.27- encoder line counts per turn, P2.28- encoder type. During the motor auto-tuning process, the keyboard will display “Study”. When the keyboard displays the frequency, the process of motor auto-tuning is finished.

* note2: during the motor auto-tuning process, the motor should be disconnected with the load; otherwise, the motor parameters obtained by auto-tuning may not be correct. Please refer to the instruction section of P2.37 for motor auto-tuning.

3.3 Running State

Power on initialization

When the driver is powered on, the system initializes first, the LED displays "PH300" and the 7 diode indicator lights are all on. After initialization, the driver is in ready state.

Running status display

In the running condition, a total of 14 state parameters can be choosed to display: running frequency, set frequency ,bus voltage, output voltage, output current, running speed, output power, output torque and PID setting, PID feedback, digital input status, open collector output status, analog input voltage FIV, analog input voltage FIC, multiple velocity segments, torque Setting value. Monitor parameters can be changed in sequence by the keys, you can select monitor parameters by shift key.

The fault

Driver provide a variety of fault information, please refer to PH300 fault trigger conditions and troubleshooting for details.

Fault reset: when the driver alarm, the driver will display the relevant fault information. The user can use the STOP key on the keyboard or the terminal function (P5 group) to reset driver. After fault reset, the driver is in ready state.

If the driver alarm, and the user does not reset it, the driver will be in an operating protection state and cannot run.

3.4 Motor Trial Running

Procedure of Motor Trial Running

Step	Parameter Setting	Parameter Description	Remarks
Set the control mode	PA.17=0	non-hydraulic control mode	Set the non-hydraulic control mode.
Set the command source	P0.02=0	non-hydraulic control mode	The “LOCAL/REMOT” indicator is OFF.
Perform motor auto-tuning	Group P2 parameters	Motor and encoder parameters	For details, see section P25 Auto-tuning of Motor Parameters.
Perform motor trial running	P0.10 = 5.00Hz	Trial running frequency	Start trial running in operation panel control and monitor whether the output current is normal.

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

Setting and Auto-tuning of Motor Parameters

◆ Parameter setting

The PH300 series drive controls servo pump in closed-loop vector control (CLVC) to 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
P2.00	Motor type	Reference parameters of motor nameplate
P2.01~P2.05	Rated motor power Rated motor voltage Rated motor current Rated motor frequency Rated motor rotational speed	
P2.34	Pole pairs of resolver	number of resolver's pole pairs
P2.20	Back EMF	Obtain the value directly from the manual provided by motor manufacturer.
		Obtain the value by means of dynamic auto-tuning, if the value can't be obtained from the motor manufacturer.
P2.37	Auto-tuning mode	Dynamic and static

◆ Motor Auto-tuning Setting

Auto-tuning Mode	Function code Setting	Application
No operation	P2.37=0	After motor auto-tuning is completed, the value of P2.37 will be restored to 0 automatically.
Static auto-tuning1	P2.37=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	P2.37=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 P2.37=2, the motor rotating direction is clockwise when you face the motor shaft. When P2.37=5, the motor rotating direction is counter clockwise when you face the motor shaft.
Static auto-tuning2	P2.37=3	The motor 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 " PG " is reported during static auto-tuning1 or dynamic auto-tuning, use this mode.

Auto-tuning Mode	Function code Setting	Application
Dynamic auto-tuning	P2.37=4 or 6	This mode enables you to obtain parameters such as back EMF and the encoder installation angel 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 calve must be opened. When P2.37=4, the motor rotating direction is clockwise when you face the motor shaft. When P2.37=6, the motor rotating direction is counter clockwise when you face the motor shaft.

◆ Trial Running Check

● After auto-tuning is completed, set P0.10=5.00Hz to make the motor carry out the low-speed trial running and check whether the running current of servo drive is small and stable.

● If the running current is large, please check whether the setting of motor parameters in group P2 and pole pairs of resolver in P2.34 are set correctly or not. If there is any modification, perform motor auto-tuning again and perform low speed running to check whether the servo drive becomes normal.

● After ensuring that motor running is normal, check whether the rotating direction is correct or not, if not, exchange any two phase of motor UVW cables and perform motor auto-tuning again.

● If the motor oscillates or generates low noise during running, weaken the speed loop and current loop properly, for example, decreasing the values of P3.00, P3.03, P3.13, P3.14, P3.15, and P3.16, and increasing the values of P3.01 and P3.04.

● If the motor speed is unstable during running, strengthen the speed loop and current loop properly, for example, increasing the values of P3.00, P3.03, P3.13, P3.14, P3.15, and P3.16, and decreasing the values of P3.01 and P3.04.

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 P3.
- The speed loop and current loop response directly affect the pressure stability. Set strong speed loop and current loop response if allowed.

3.5 Application Commisioning of Servo Pump

FI Zero Drift Correction

◆ FI Zero Drift Auto Correction

Step	Function Code Setting	Description	Remarks
Set the command source	P0.02=0	Operation panel control mode is used.	The “LOCAL/REMOT” indicator is OFF.
Set the command source	PA.00=1	FI zero drift auto correction function is enabled.	After the operation panel display "-FI-", press RUN button, FI zero drift auto correction is carried out.

◆ FI Zero Drift Correction Manually

When PA.00=0 (that is, FI zero drift auto correction is disabled), check the values of three analog channels in D1.04, D1.05, and D1.06, add 10mA to each of the values and then enter the results in P5.13. , P5.18, and P5.23.

Selection and Parameter Setting of Hydraulic Control Mode

Hydraulic Mode Selection	Function Code Setting	Description
Non-oil pressure control mode	PA.17=0	The speed mode is used.
Oil pressure control mode	PA.17=2	FIV1 provides the oil pressure reference, FIV2 provides flow reference, FIC provides oil pressure feedback, the servo drive conducts oil pressure control.

When the non-oil pressure control mode (PA.17=0) is switched over to the oil pressure control mode (PA.17≠0), the related parameters will be set automatically, as listed in the following table.

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.

Function code	Parameter Name	Setting
P0.01	Control mode	1(Closed – loop vector control)
P0.02	Command source selection	1(Terminal)
P0.04	Main frequency source X selection	If PA.17=2, set P0.04=3 (FIC) If PA.17=1 or 3, set P0.04=9 (Communication)
P0.08	Deceleration time	0.0s
P0.09	Deceleration time	0.0s
P2.00	Motor type	2 : Synchronous motor)
P5.00	X1 terminal function selection	1 : Forward RUN (FWD enabled)
P5.01	X2 terminal function selection	48: Servo pump PID selection terminal 1
P5.02	X3 terminal function selection	53: Slave pump address selection terminal 1
P5.03	X4 terminal function selection	9: Fault reset (RESET)
P5.04	X5 terminal function selection	5 : CAN communication enabled
P6.01	Control board relay RB RC function selection	2 : Fault output
P6.02	Control board relay KA KC function selection	23: Double-discharge plunger pump sloping switchover (NO)
P6.03	Control board relay KA KC function selection	24: Oil pressure control output (NC)

Oil pump function parameter setting

Oil pump function parameter setting

◆ System flow and pressure settings

Function code	Description	Remarks
PA.18	Full load oil pressure corresponding speed	Set the maximum speed of motor operation, that is, the motor speed corresponding to 100% of the flow command
PA.20	Oil pressure setting value	Set the maximum pressure of the system, 0~maximum oil pressure range (PA.21)
PA.21	Maximum oil pressure range	Set the pressure range of the pressure sensor, corresponding to the voltage 0~10VDC output type pressure sensor

◆ FIV1 Oil pressure command corresponding setting

Function code	Description	Remarks
P5.13	FIV1 minimum input	Oil pressure command minimum voltage input, corresponding to FIV1 zero drift
P5.14	FIV1 minimum input corresponding setting	Oil pressure minimum command, default 0.0%, is zero pressure
P5.15	FIV1 maximum input	Oil pressure command maximum voltage input, generally maximum 10V input
P5.16	FIV1 maximum input corresponding setting	Oil pressure maximum command, 100.0% corresponding oil pressure setting value (PA.20)

Used to set the corresponding relationship between 0~10V (or other range) of FIV1 hydraulic pressure command corresponding to 0kg/cm²~ oil pressure setting value (PA.20).

◆ FIV2 flow command corresponding setting

Function code	Description	Remarks
P5.18	FIV2 minimum input	Flow command minimum voltage input, corresponding to FIC zero drift
P5.19	FIV2 minimum input corresponding setting	Flow minimum command, default 0.0%, ie zero flow
P5.20	FIV2 maximum input	Flow command maximum voltage input, generally maximum 10V input
P5.21	FIV2 maximum input corresponding setting	Flow maximum command, default 100.0% corresponds to full load oil pressure corresponding speed (PA.18)

It is used to set the corresponding relationship between 0~10V (or other range) of FIV2 flow command corresponding to 0rpm~ full load oil pressure corresponding speed (PA.18).

◆ FIC oil pressure feedback corresponding setting

Function code	Description	Remarks
P5.23	FIC minimum input	Oil pressure feedback minimum voltage input, corresponding to FIC zero drift
P5.24	FIC minimum input corresponding setting	Oil pressure feedback minimum value, default 0.0%, ie zero pressure
P5.25	FIC maximum input	Oil pressure feedback maximum voltage input, generally maximum 10V input
P5.26	FIC maximum input corresponding setting	Hydraulic feedback maximum value, default 100.0% corresponds to maximum oil pressure range (PA.21)

It is used to set the corresponding relationship between the FIC hydraulic feedback 0~10V (or other range) corresponding pressure sensor range 0kg/cm²~maximum oil pressure range (PA.21).

◆ Pressure relief setting (parameter number: PA.19)

Function code	Description	Remarks
PA.19	Pressure relief speed	The pressure relief speed at the time of pressure relief is set according to the percentage of the full load oil pressure corresponding speed (PA.18). Used to set the maximum reverse running speed of the motor. The larger the set value, the faster the pressure relief, but too large will cause the oil pump to reverse the noise; the smaller the set value, the slower the pressure relief.

◆ Minimum flow rate without command/minimum pressure setting without command (parameter number: PA.22, PA.23)

Due to the internal leakage of the oil pump, when the system does not give the flow and pressure setting, the hydraulic oil in the oil circuit will flow back to the oil tank, causing the air to enter the oil circuit, causing the system to operate noise and instability, so it is necessary to give a certain minimum flow. And minimum pressure.

Function code	Description	Remarks
PA.22	Minimum flow rate without command Setting range	0.0%~50.0%, corresponding to the percentage setting of the full load hydraulic pressure corresponding speed (PA.18)
PA.23	Minimum pressure without command Setting range	0.0kg/cm²~50.0kg/cm²

◆ Oil pressure FIV filter time setting

Function code	Description	Setting range	Factory value
P5.17	FIV1 sampling filter time	0~10.000s	
PA.24	Oil pressure command acceleration time	0~2.000s	0.020s
PA.25	Given oil pressure rises filter time	0~2.000s	0.030s
PA.26	Given oil pressure drop s filter time	0~2.000s	0.030s
PB.22	Injection action curves curve rise time (terminal 48=1, 49=0 valid)	0~2.000s	0.030s
PB.23	Injection action curves curve fall time (terminal 48=1, 49=0 valid)	0~2.000s	0.030s
PB.26	Injection given oil pressure rise time	0~2.000s	0.020s
PB.27	Injection given oil pressure drop time	0~2.000s	0.020s

◆ Flow rate FIV2 filter time setting

Function code	Description	Setting range	Factory value
P5.22	FIV2 sampling filter time	0~10.000s	0.020s
PB.19	Flow rise filter time	0~2.000s	0.030s
PB.20	Flow reduction filter time	0~2.000s	0.030s
PB.24	Injection action flow rising slope (terminal 48=1, 49=0 valid)	0~2.000s	0.100S
PB.25	Injection action flow drop slope (terminal 48=1, 49=0 valid)	0~2.000s	0.100S

◆ Oil Pressure PID Mode: Determined by terminal 48 and terminal 49

The servo drive provides 4 groups of PID parameters, which are selected according to the combination of the input terminals 48 and the input terminals 49, the following table describes the relationship between PID group selection.

49	48	PID Group
0	0	Group 1: PA.03~PA.05
0	1	Group 2: PA.06~PA.08
1	0	Group 3: PA.09~PA.11
1	1	Group 4: PA.12~PA.14

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

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

◆ Oil Pressure PID Proportional Gain (PA.03, PA.06, PA.09, PA0.12)

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

◆ Oil Pressure PID Integral Time (PA.04, PA.07, PA.10, PA0.13)

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

◆ Oil Pressure Overshoot Suppression (PB.06/PB.28, PB.07/PB.29)

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

Overshoot suppression detection level (PB.06/PB.28):

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 (PB.07/PB.29):

The larger the value of 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.

◆ Oil Pressure Loop PID Response Gain (PB.08)

It is used to adjust the response of the entire hydraulic loop. The lager 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 lager or the oil pipe is slim.

◆ 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 P3.00 and decrease the value of P3.01. Note that two parameter must be modified properly to avoid motor oscillation.

Chapter 4
Function Code Table

Group P and Group C are standard function parameters. Group D includes the monitoring function parameters.

The symbols in the function code table are described as follows:

"☆": The parameter can be modified when the Servo drive is in either stop or running state.
"★": The parameter cannot be modified when the Servo drive is in the running state.
"●" The parameter is the actually measured value and can't be modified.

"*": The parameter is factory parameter can be set only by the manufacturer.

Function Code	Name	Setting Range	Default	Property
Group P0 : Standard Parameters				
P0.00	Model display	1: G type (heavy load)	1	●
P0.01	Control mode	1:Closed-loop vector control (CLVC) 2: V/F Control	1	★
P0.02	Command source selection	0: Operation panel control (LED OFF) 1: Terminal control (LED ON) 2: Communication setting (LED blinking)	0	☆
P0.04	Main frequency source X selection	0:Digital setting (P0.08 preset, UP/ DOWN modification, non-retentive) 1: Digital setting (P0.08 preset UP/ DOWN modification, retentive) 2: FIV1 3: FIV2 4: FIC 6: Multi-speed 9: Communication setting	0	★
P0.08	Acceleration time 1	0.0s ～ 6500.0s	20.0s	☆
P0.09	Deceleration time 1	0.0s ～ 6500.0s	20.0s	☆

Function Code	Name	Setting Range	Default	Property
Group P0 : Standard Parameters				
P0.10	Preset frequency	0.00Hz ~ maximum frequency (P0.12)	50.00Hz	☆
P0.11	Rotating direction	0: Same direction 1: Reverse direction	0	☆
P0.12	Maximum frequency	0.00Hz ～ 599.00Hz	200.00Hz	★
P0.13	Source of frequency upper limit	0: Set by P0.14 1: FIV 1 2: FIV2 3: FIC 5: Communication settings	0	★
P0.14	Frequency upper limit	Frequency lower limit (P0.16) to maximum frequency (P0.12)	200.00Hz	☆
P0.15	Upper limit offset	0.00Hz to maximum frequency (P0.12)	0.00Hz	☆
P0.16	Frequency lower limit	0.00Hz to frequency upper limit (P0.14)	0.00Hz	☆
P0.17	Carrier frequency	1.0kHz ～ 12.0kHz	Model dependent	☆
Group P2: Motor Parameters				
P2.00	Motor type	2: Servo motor	2	★
P2.01	Motor rated power	0.4kW ～ 450.0kW	Model dependent	★
P2.02	Motor rated voltage	0V ～ 600V	Model dependent	★
P2.03	Motor rated current	0.01A ～ 6500.0A	Model dependent	★
P2.04	Motor rated frequency	0.00Hz to maximum frequency (P0.12)	Model dependent	★
P2.05	Motor rated speed	1rpm ～ 30000rpm	Model dependent	★
P2.06	Motor type selection	0 ～ 65535	0	★
P2.16	Stator resistance (servo motor)	0.001Ω to 65.535Ω (Servo drive power<=55kW) 0.0001Ω to 6.5535Ω (Servo drive power>55kW)	Auto tuning parameter	★

Function Code	Name	Setting Range	Default	Property
Group P2: Motor Parameters				
P2.17	Shaft D inductance (servo motor)	0.01mH to 655.35mH (Servo drive power<=55kW) 0.001mH to 65.535mH (Servo drive power>55kW)	Auto tuning parameter	★
P2.18	Shaft Q inductance (servo motor)	0.01mH to 655.35mH (Servo drive power<=55kW) 0.001mH to 65.535mH (Servo drive power>55kW)	Auto tuning parameter	★
P2.20	Back EMF (servo motor)	0 ～ 65535	Auto tuning parameter	★
P2.21	Reserved			★
P2.27	Pulses per revolution of encoder	1 ～ 65535	1024	★
P2.28	Encoder type	0: ABZ incremental encoder 1: UVW incremental encoder 2: Resolver	2	★
P2.30	Inversion of feedback speed	0: Consistent 1: Reverse	0	★
P2.31	Encoder installation angle	0.0° ～ 359.9°	0.0°	★
P2.34	Number of pole pairs of resolver	1 ～ 50	1	★
P2.36	Encoder signal fault detection time	0.000: Detection invalid 0.001s ～ 60.000s	2s	★

Function Code	Name	Setting Range	Default	Property
Group P2: Motor Parameters				
P2.37	Motor auto-tuning mode	0: No operation 1: No-load static auto-tuning 2: No-load dynamic auto- tuning, rotating at high-speed in the reverse direction 3: With-load static auto-tuning 4: No-load fast dynamic auto- tuning, rotating at high-speed in the reverse direction 5: No-load dynamic auto-tuning, rotating at high-speed in the forward direction 6: No-load fast dynamic auto-tuning, rotating at high-speed in the forward direction	0	★
Group P3: Vector Control Parameters				
P3.00	Speed loop proportional gain 1	1 ～ 400	60	☆
P3.01	Speed loop integration time 1	0.01s ～ 10.00s	0.30s	☆
P3.02	Switchover frequency 1	0.00 ～ P3.05	5.00Hz	☆
P3.03	Switchover frequency 1	1 ～ 400	60	☆
P3.04	Speed loop integration time 2	0.01s ～ 10.00s	0.30s	☆
P3.05	Switchover frequency 2	P3.02 to maximum frequency	10.00Hz	☆
P3.06	Slip compensation coefficient	50% ～ 200%	100%	☆
P3.07	Speed feedback filter time	0.5ms ～ 10.0ms	1.0ms	☆
P3.08	Torque control	0: Invalid 1: Valid	0	☆

Function Code	Name	Setting Range	Default	Property
Group P3: Vector Control Parameters				
P3.09	Torque upper limit source	0: P3.10 1: FIV 1 2: FIV2 3: FIC 5: Communication setting Analog input range corresponding to P3.10	0	☆
P3.10	Torque upper limit	0.0% ～ 250.0%	200.00%	☆
P3.11	Torque filter bandwidth	0Hz ～ 1500Hz	500Hz	☆
P3.13	Current loop low-speed proportional gain	0.2 ～ 5.0	1.0	★
P3.14	Current loop low-speed integral gain	0.2 ～ 5.0	1.0	★
P3.15	Current loop high-speed proportional gain	0.2 ～ 5.0	1.0	★
P3.16	Current loop high-speed integral gain	0.2 ～ 5.0	1.0	★
P3.18	Field weakening control mode	0: Direct calculation 1: Automatic adjustment 2: Automatic adjustment + calculation	0	★
P3.19	Field weakening depth of servo motor	0% ～ 50%	5%	★
P3.20	Field weakening current coefficient	0 ～ 500	5	★
P3.21	Maximum power output adjustment gain of servo motor	20% ～ 300%	100%	★
P3.22	Excitation current adjustment gain calculated by servo motor	40% ～ 200%	120%	★

Function Code	Name	Setting Range	Default	Property
Group P3: Vector Control Parameters				
P3.23	Overvoltage modulation coefficient	100% ～ 120%	110%	☆
P3.24	Bus voltage filter	0.000 ～ 0.100	0.000	☆
P3.25	Selection of Back EMF compensation	0: Disabled 1: Enabled	0	★
Group P5: Input Terminals				
P5.00	X1 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) 8: Coast to stop 9: Fault reset (RESET) 11: External fault NO input 33: External fault NC input 48: Servo pump PID selection terminal 1 49: Servo pump PID selection terminal 2 50: CAN communication enabled 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)	1	★
P5.01	X2 function selection		0	★
P5.02	X3 function selection		0	★
P5.03	X4 function selection		9	★
P5.04	X5 function selection		0	★
P5.10	X filter time	1 ～ 10	4	☆
P5.11	Terminal command mode	0: Two-line 1 1: Two-line 2 2: Three-line 1 3: Three-line 2	0	★
P5.13	FIV1 minimum input	10.00V ～ P5.15	0.02V	☆

Function Code	Name	Setting Range	Default	Property
Group P5: Input Terminals				
P5.14	Corresponding setting of FIV1 minimum input	-100.0% ～ +100.0%	0.0%	☆
P5.15	FIV1 maximum input	P5.13 ～ +10.00V	10.00V	☆
P5.16	Corresponding setting of FIV1 maximum input	P5.13 ～ +10.00V	100.0%	☆
P5.17	FIV1 filter time	0.000s ～ 10.000s	0.010s	☆
P5.18	FIV2 minimum input	-10.00V ～ P5.20	0.02V	☆
P5.19	Corresponding setting of FIV2 minimum input	-100.0% ～ +100.0%	0.0%	☆
P5.20	FIV2 maximum input	P5.18 ～ +10.00V	10.00V	☆
P5.21	Corresponding setting of FIV2 maximum input	-100.0% ～ +100.0%	100.0%	☆
P5.22	FIV2 filter time	0.000s ～ 10.000s	0.005s	☆
P5.23	FIC minimum input	-10.00V ～ P5.25	0.02V	☆
P5.24	Corresponding setting of FIC minimum input	-100.0% ～ +100.0%	0.0%	☆
P5.25	FIC maximum input	P5.23 ～ +10.00V	10.00V	☆
P5.26	Corresponding setting of FIC maximum input	-100.0% ～ +100.0%	100.0%	☆
P5.27	FIC filter time	0.000s ～ 100.00s	0.000s	☆

Function Code	Name	Setting Range	Default	Property
Group P6: Output Terminals				
P6.01	Control board relay (RB / RC) function selection	0: No output 1: Servo drive running 2: Fault output 6: Servo motor overload pending 7: Servo drive overload pending 12: Accumulative running time reached 15: Ready 20: Communication setting 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: Output of Maximum reverse rotational speed	2	☆
P6.02	Control board relay (TA / TC) function selection		1	☆
P6.03	Control board relay (KA / KC) function selection		0	☆
P6.04	reserved			
P6.05	reserved			
P6.07	FOV1 output selection	0: Running frequency 1: Set frequency 2: Output current 3: Output torque 4: Output power 5: Output voltage 7: FIV1 8: FIV2 9: FIC 10: Feedback rotational speed (oil pressure control mode) 11: Feedback pressure (oil pressure control mode) 12 ~ 16: Reserved	10	☆
P6.08	FOV2 output selection		11	☆
P6.10	FOV1 offset coefficient	-100.0% ～ +100.0%	0.00%	☆
P6.11	FOV1 gain	-10.00 ～ +10.00	1.00	☆
P6.12	FOV2 offset coefficient	-100.0% ～ +100.0%	0.0%	☆
P6.13	FOV1 gain	-10.00 ～ +10.00	1.00	☆

Function Code	Name	Setting Range	Default	Property
Group P7: Operation Panel and Display				
P7.02	STOP/RESET 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	2	☆
P7.06	Load speed display coefficient	0.0001 ～ 6.5000	1.0000	☆
P7.07	Heatsink temperature 1	0.0℃～ 120.0℃	-	●
P7.09	Accumulative running time	0h ～ 65535h	-	●
P7.11	Software version	-	-	●
P7.12	Set running time	0h ～ 65535h	0	☆
P7.13	Action selection upon set running time reached	0: Continue to run 1: Stop and report "END2"	0	
Group P8: Manufacture Factory Setting Parameter				
Group P9: Fault and Protection				
P9.00	Motor overload protection selection	0: Disabled 1: Enabled	0	☆
P9.01	Motor overload protection gain	0.20 ～ 10.00	2.00	☆
P9.02	Motor temperature protection	0: Disabled 1: Enabled	1	☆
P9.03	Runaway speed deviation	0.50Hz ～ 50.00Hz	10.00Hz	☆
P9.04	Detection time of runaway fault	0.1s ～ 20.0s	10.0s	☆
P9.05	Startup protection selection	0: Disabled 1: Enabled	0	☆

Function Code	Name	Setting Range	Default	Property
Group P9: Fault and Protection				
P9.06	Software undervoltage threshold	120.0V ～ 400.0V	Model dependent	☆
P9.07	Delection of short-circuit to groung uopn power-on	0: Disabled 1: Enabled	1	☆
P9.08	Braking voltage	650.0V ～ 820.0V	Model dependent	☆
P9.09	Allowed braking unit running time	0.1s ～ 3600.0s	5.0s	☆
P9.12	Power input phase loss protection selection	Bits: Power input phase loss protection selection 0: Disabled 1: Enabled	1	☆
P9.13	Power output phase loss protection selection	0: Disabled 1: Enabled	1	☆
P9.14	1st Fault type	0: No fault 1: Reserved 2: Overcurrent during acceleration 3: Overcurrent during deceleration 4: Overcurrent at constant speed 5: Overvoltage during acceleration 6: Overvoltage during deceleration 7: Overvoltage at constant speed 9: Under voltage 10: Servo drive overload 12:Power input phase loss 13: Power output phase loss 14: Heatsink overheat 15: External device fault 16: Communication fault 17: Contactor fault 18: Current detection fault 19: Motor auto-tuning fault 21: EEPROM read-write fault 23: Short circuit to ground 24: Reserved 25: Reserved 26:Accumulative running time reached 27: Business running time reached 40: Wave-chasing current limiting fault 42: CAN communication interrupted	-	●
P9.15	2nd Fault type		-	●

Function Code	Name	Setting Range	Default	Property
Group P9: Fault and Protection				
P9.16	3rd (latest) Fault type	43: Resolver fault during motor auto-tuning 44: Speed deviation protection fault 45: Motor overheat 46: Servo pump sensor fault 47: Slave fault spending 48: CAN address conflicted 49: Cable between resolver and PG card disconnected 52: Multi-master fault in multi-pump convergent flow 58: Parameter restoration fault 59: Back EMF abnormal fault 61: Brake pipe in braking protection state for long time 63: Reverse running time reached	-	●
P9.17	Frequency @ 3rd (latest) fault	-	-	●
P9.18	Current @ 3rd (latest) fault	-	-	●
P9.19	Bus Voltage @ 3rd (latest) fault	-	-	●
P9.20	Input terminal state @ 3rd (latest) fault	-	-	●
P9.21	Input terminal state @ 3rd (latest) fault	-	-	●
Group PA: Servo Pump PID Control Parameters				
PA.00	FI zero drift auto correction	0: Disabled 1: Enabled	0	☆
PA.02	Oil pressure PID algorithm selection	0 ～ 2	0	★

Function Code	Name	Setting Range	Default	Property
Group PA: Servo Pump PID Control Parameters				
PA.03	Oil pressure control Kp1	0.0 ～ 800.0	210.0	☆
PA.04	Oil pressure control Ti 1	0.001s ～ 10.000s	0.100s	☆
PA.05	Oil pressure control Td 1	0.000s ～ 1.000s	0.000s	☆
PA.06	Oil pressure control Kp 2	0.0 ～ 800.0	210.0	☆
PA.07	Oil pressure control Ti 2	0.001s ～ 10.000s	0.100s	☆
PA.08	Oil pressure control Td 2	0.000s ～ 1.000s	0.000s	☆
PA.09	Oil pressure control Kp 3	0.0 ～ 800.0	210.0	☆
PA.10	Oil pressure control Ti 3	0.001s ～ 10.000s	0.100s	☆
PA.11	Oil pressure control Td 3	0.000s ～ 1.000s	0.000s	☆
PA.12	Oil pressure control Kp 4	0.0 ～ 800.0	210.0	☆
PA.13	Oil pressure control Ti 4	0.001s ～ 10.000s	0.100s	☆
PA.14	Oil pressure control Td 4	0.000s ～ 1.000s	0.000s	☆
PA.15	Max. value of Integral limit deviation	0.0kg/cm² ～ PA.20	45.0kg/ cm2	☆
PA.16	Integral limit mode selection	0 ～ 1	0	☆
PA.17	Oil pressure control mode	0: Non-oil pressure control mode 1: Oil pressure control mode 1 (CAN setting) 2: Oil pressure control mode (AI Setti ng) 3: CAN oil pressure control mode 2 4: Reserved	0	★

Function Code	Name	Setting Range	Default	Property
Group PA: Servo Pump PID Control Parameters				
PA.18	Max. motor speed	Motor speed corresponding to max. frequency lower limit to 30000 rpm	2000 rpm	☆
PA.19	Reverse pressure relief speed	0.0% ～ 100.0%	10.0%	☆
PA.20	System oil pressure	0.0kg/cm² to Maximum oil pressure (PA.21)	175kg/cm²	☆
PA.21	Max. oil pressure	System oil pressure (PA.20) to 500.0kg/ cm²	250kg/cm²	☆
PA.22	Minimum flow	0.0% ～ 50.0%	0.50%	☆
PA.23	Minimum pressure	0.0 kg/cm² ～ 50.0 kg/cm²	0.5kg/ cm²	☆
PA.24	Oil pressure reference ramp time	0.000s ～ 2.000s	0.020s	☆
PA.25	S-curve rise filter time of set oil pressure	0.001s ～ 10.000s	0.030s	☆
PA.26	S-curve fall filter time of set oil pressure	0.001s ～ 1.000s	0.030s	☆
PA.27	Min. pressure of reverse pressure relief	0.0kg/cm² ～ PA.20	0	☆
PA.28	Long-time running protective time of reverse pressure relief	0.001s ～ 5.000s	0.000s	☆
Group PB: Servo Pump Control Auxiliary Parameters				
PB.00	Pressure sensor fault detection current lower limit	0% ～ 300%(P2.03)	100%	☆
PB.01	Pressure sensor fault detection speed upper limit	0% ～ 100%（PA.18）	50%	☆

Function Code	Name	Setting Range	Default	Property
Group PB: Servo Pump Control Auxiliary Parameters				
PB.02	Fault detection time of oil pressure sensor	0.000s: Detection invalid 0.001s ～ 60.000s	0.500s	☆
PB.03	Setting of max. speed in pressure control	0.0% ～ 100.0%	10.0%	☆
PB.04	Setting of min. oil pressure in pressure control	0.0% ～ 100.0%	60.0%	☆
PB.05	Delay of pressure control state output	0.000s ～ 10.000s	0.100s	☆
PB.06	Overshoot suppression detection level	0 ～ 2000	200	☆
PB.07	Overshoot suppression coefficient	0 ～ 3.000	0.200	☆
PB.08	Oil pressure loop gain coefficient	0.20 ～ 5.00	1.00	☆
PB.09	Oil pressure deviation of oil pressure suppression disabled	0.0kg/cm² ～ PA.20	10.0kg/cm²	☆
PB.10	Pressure loop output upper limit	0 ～ 50.0	2.0	☆
PB.11	Pressure loop output upper limit	50.0% ～ 250.0%	160.0%	☆
PB.12	Injection valve opening delay time	0.000s ～ 0.500s	0.00s	☆
PB.13	Start valve pressure relief delay	0.001 ～ 5.000s	0.100s	☆
PB.14	Exit valve pressure relief delay	0.001 ～ 5.000s	0.100s	☆
PB.15	Pressure deviation lower limit of start valve pressure relief	0.0 ～ PA.20(system oil pressure)	0.0kg	☆

Function Code	Name	Setting Range	Default	Property
Injection Overshoot Suppression Coefficient				
PB.16	Pressure lower limit of start valve pressure relief	0.0 ～ PA.20(system oil pressure)	0.0kg	☆
PB.17	Rotational speed filter time	0s ～ 5.000s	0.005s	☆
PB.18	Current filtering time	0s ～ 5.000s	0.010s	☆
PB.19	Flow rise filtering time	0s ～ 1.000s	0.100s	☆
PB.20	Flow fall filter time	0s ～ 1.000s	0.100s	☆
PB.21	Flow leakage compensation	0.0% ～ 50.0%	0.0%	☆
PB.22	Injection S-curve rise time	0.001s ～ 1.000s	0.030s	☆
PB.23	Injection S-curve fall time	0.001s ～ 1.000s	0.030s	☆
PB.24	Injection flow rise slope	0.001s ～ 5.000s	0.100s	☆
PB.25	Injection flow fall slope	0.001s ～ 5.000s	0.100s	☆
PB.26	Oil pressure reference rise time	0.000s ～ 2.000s	0.020s	☆
PB.27	Oil pressure reference fall time	0.000s ～ 2.000s	0.020s	☆
PB.28	Injection overshoot suppression detection level	0 ～ 2000	200	☆
PB.29	Injection overshoot suppression coefficient	0.000s ～ 3.000s	0.200s	☆
Group PC: Multi-pump Oil Pressure Control Parameters				
PC.01	Master judges whether to send slave speed enabled in multi-pump	0: Forbid enabling the slave speed 1: Allow enabling the slave speed	0	★

Function Code	Name	Setting Range	Default	Property
Group PC: Multi-pump Oil Pressure Control Parameters				
PC.02	Pressure holding control gain in multi-pump convergent flow	20 ～ 800	100	☆
PC.03	Pressure deviation for decreasing PI to de-twitter in multi-pump injection mode	0.0 ～ 50.0kg	5.0kg	☆
PC.04	Flow lower limit for decreasing PI to de-twitter in multi-pump injection mode	0 ～ 30000rpm	0rpm	☆
PC.05	Flow detection time for decreasing PI to de-twitter in multi-pump injection mode	0.200s ～ 2.000s	0.400s	☆
PC.06	Pressure deviation of slave pump not working in the CAN multi-pump mode	0 ～ 50.0kg	5.0kg	☆
PC.07	Flow lower limit of slave pump not working in the CAN multi-pump mode	-100.0% ～ 100.0%	0	☆
PC.08	Judgment delay of slave pump to stop without speed reference	0.010s ～ 5.000s	1.000s	☆
PC.09	Deceleration time of slave pump to stop without speed reference	0.001s ～ 5.000s	0.200s	☆

Function Code	Name	Setting Range	Default	Property
Group PC: Multi-pump Oil Pressure Control Parameters				
PC.10	Slave min. input	-100.0% ～ PC.12	0.0%	☆
PC.11	Corresponding setting of slave min. input	-100.0% ～ 100.0%	0.0%	☆
PC.12	Slave medium input	PC.10 ～ PC.14	10.0%	☆
PC.13	Slave medium input	-100.0% ～ 100.0%	0.0%	☆
PC.14	Slave max. input	PC.12 ～ 100.0%	100.0%	☆
PC.15	Corresponding setting of slave max. input	-100.0% ～ 100.0%	100.0%	☆
Group PD: Communication Parameters				
PD.00	Baud rate	0：300BPS 1：600BPS 2：1200BPS 3：2400BPS 4：4800BPS 5：9600BPS 6：19200BPS 7：38400BPS 8：57600BPS 9：115200BPS	5	☆
PD.01	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,1> 3: No check data format <8, N, 1> Valid for Modbus	0	☆
PD.02	PD.01	1 ～ 200 0: Broadcast address	1	☆
PD.03	Response delay	0ms ～ 20ms	2	☆

Function Code	Name	Name	Default	Property
Group PD: Communication Parameters				
PD.04	Timeout duration	0.0：Invalid 0.1s ～ 60.0s	0.0	☆
PD.05	Communication protocol	0:Standard Modbus protocol	0	☆
PD.06	CAN baud rate	0：20k 1：50k 2：125k 3：250k 4：500k 5：1M	4	☆
PD.07	CAN communication address	1 ～ 30	1	☆
PD.08	CAN continuous communication time	0.0s（invalid） 0.1s ～ 600.0s	0.3S	☆
PD.09	CAN multi-pump mode	0: Broadcast mode 1: Multi- master mode	0	☆
PD.10	CAN slave address 1	0 ～ 65535	0	☆
PD.11	CAN slave address 2	0 ～ 65535	0	☆
PD.12	CAN slave address 2	0 ～ 65535	0	☆
PD.13	CAN slave address 4	0 ～ 65535	0	☆
Group PP: User Function Code				
PP.00	User Password	0 ～ 65535	0	☆
PP.01	Parameter initialization	0: No operation 01: Restore default setting (excluding servo motor parameters) 02: Clear fault records	0	★
PP.02	Password for user storage operation	0 ～ 65535	0	☆
PP.03	User storage mode	0: No operation 1: Store user parameters	0	☆

If PP.00 is set to a non-zero number parameter protection is enabled. You must enter the correct user password to enter the menu. To cancel the password protection function enter with password and set PP.00 to 0.

Function Code	Name	Min. Unit
Group D0: View Servo Drive Parameters		
D0.00	Running frequency (Hz)	0.01Hz
D0.01	Set frequency (Hz)	0.01Hz
D0.02	Bus voltage (V)	0.1V
D0.03	Output voltage (V)	1V
D0.04	Output current (A)	0.01A
D0.05	Output power (kW)	0.1kW
D0.06	Output torque (%)	0.1%
D0.07	X input state	-
D0.08	X input state	-
D0.09	FIV1 voltage (after correction)	-10.00V ～ 10.000V
D0.10	FIV2 voltage (after correction)	-10.00V ～ 10.000V
D0.11	FIC voltage (after correction)	-10.00V ～ 10.000V
D0.30	FIV1 voltage (before correction)	-10.00V ～ 10.000V
D0.31	FIV2 voltage (before correction)	-10.00V ～ 10.000V
D0.32	FIC voltage (before correction)	-10.00V ～ 10.000V
D0.34	FIC voltage (before correction)	0.000V ～ 10.000V
D0.35	FOV2 output voltage	0.000V ～ 10.000V

Function Code	Name	Min. Unit
Group D01: View Servo Pump Parameters		
D1.00	Real-time angle	0.0° ～ 359.9°
D1.01	Set oil pressure	0.0kg to system oil pressure
D1.02	Feedback oil pressure	0.0kg to maximum oil pressure
D1.03	Motor speed	-9999rpm ～ 30000rpm
D1.04	FIV1 analog voltage	-10.00V ～ 10.000V
D1.05	FIV2 analog voltage	-10.00V ～ 10.000V
D1.06	FIC analog voltage	-10.00V ～ 10.000V
D1.07	FIC analog voltage	-10.00V ～ 10.000V
D1.08	FIV2 zero drift	-10.00V ～ 10.000V
D1.09	FIC zero drift	-10.00V ～ 10.000V
D1.10	Reference flow	0.00Hz ～ maximum frequency
D1.11	Resolver signal interference degree	0 ～ 1000
D1.12	Oil pressure reference of host computer	0.0kg ～ system oil pressure
D1.13	CAN communication interference status	0 ～ 128
D1.14	Number of CAN messages sent	0 ～ 65535
D1.15	Number of CAN messages received	0 ～ 65535
D1.16	CAN buffer use ratio	0 ～ 1.00%

Chapter 5
Fault Checking & Troubleshooting

5.1 Fault Alarm & Troubleshooting

The PH300 series servo drive provides alarm information and protective functions. When a fault occurs, PH300 serie servo drives implement the protective function, stop output, makes the fault relay act, and displays the fault code on the operation panel. Before contacting Physis 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 can't be rectified, please contact the agent or Physis.

The OUOC in the warning message is a hardware overcurrent or overvoltage signal. In most cases, the hardware overvoltage fault causes the OUOC alarm.

Symptom	Fault Display	Possible Causes	Solutions
Overcurrent during acceleration	OC1	The servo drive output circuit is earthed or short circuited.	Eliminate external faults.
		Motor auto-tuning is not performed properly.	Perform motor auto-tuning.
		The acceleration time is too short.	Increase the acceleration time.
		The customized torque boost or V/F curve is not proper.	Adjust the customized torque boost or V/F curve properly.
		The input voltage of the servo drive is too low.	Adjust the input voltage to the normal range.
		The rotating motor is restarted.	Remove the sudden load.
		The rotating motor is restarted.	Remove the sudden load.
		The capacity level of the servo drive is too low.	Increase the capacity level of the servo drive.

Symptom	Fault Display	Possible Causes	Solutions
Overcurrent during deceleration	OC2	The servo drive output circuit is earthed or short circuited.	Eliminate external faults.
		Motor auto-tuning is not performed properly.	Perform motor auto-tuning.
		The deceleration time is too short.	Increase the deceleration time.
		The input voltage of the servo drive is too low.	Adjust the input voltage to the normal range.
		A sudden load is added during deceleration.	Remove the sudden load.
		The braking unit and braking resistor are not installed.	Eliminate external faults. Install an output reactor if the cable is too long.
Overcurrent at constant speed	OC3	The servo drive output circuit is earthed or has leakage current.	Eliminate external faults. Install an output reactor if the cable is too long.
		Motor auto-tuning is not performed properly.	Perform motor auto-tuning.
		The input voltage of the servo drive is too low.	Adjust the input voltage to the normal range.
		A sudden load is added during deceleration.	Increase the capacity level of the servo drive.
		The capacity level of the servo drive is too low.	Increase the capacity level of the servo drive.
Overvoltage during acceleration	OU1	The input voltage of servo drive is too high.	Adjust the input voltage to the normal range.
		An external force drives the motor during acceleration.	Remove the external force or install a braking resistor.
		The acceleration time is too short.	Increase the acceleration time .
		The braking unit and braking resistor are not installed.	Install the braking unit and braking resistor.
Overvoltage during deceleration	OU2	The input voltage of servo drive is too high.	Adjust the input voltage to the normal range.
		An external force drives the motor during deceleration.	Remove the external force or install a braking resistor.
		The deceleration time is too short.	Increase the deceleration time .
		The braking unit and braking resistor are not installed.	Install the braking unit and braking resistor.

Symptom	Fault Display	Possible Causes	Solutions
Overvoltage at constant speed	OU3	The input voltage of servo drive is too high.	Adjust the input voltage to the normal range.
		An external force drives the motor during acceleration.	Remove the external force or install a braking resistor.
Control power supply fault	POF	The input voltage of the servo drive is not in the allowable range.	The input voltage of the servo drive is not in the allowable range.
Undervoltage	LU	Instantaneous power failure occurs	Perform the reset operation.
		The input voltage of the servo drive is not in the allowable range.	Adjust the input voltage to the normal range.
		The DC bus voltage is abnormal.	Contact the agent or Physis.
		The rectifier bridge and snubber resistor are abnormal.	
		The drive board is abnormal.	
		The main control board is abnormal.	
Servo drive overload	OL2	The load is too heavy or the motor is blocked.	The capacity level of the servo drive is too low.
		The capacity level of the servo drive is too low.	Increase the capacity level of the servo drive.
Motor overload	OL1	The load is too heavy or the motor is blocked.	Set the motor parameters correctly. Reduce the load and check the motor and connected machine.
		The capacity level of the servo drive is too low.	Increase the capacity level of the servo drive.
Phase loss on input side	LI	The three-phase power supply is abnormal.	Eliminate external faults.
		The drive board is abnormal.	Contact the agent or Physis.
		The anti-thunder board is abnormal.	
		The main control board is abnormal.	

Symptom	Fault Display	Possible Causes	Solutions
Phase loss on output side	Lo	The power cables between the servo drive and the servo motor are abnormal.	Eliminate external faults.
		Three phase outputs of the servo drive are unbalanced in the V/F mode without the motor connected.	Three-phase winding of the motor is abnormal and eliminate the fault.
		The drive board is abnormal.	Contact the agent or Physis.
		The main control board is abnormal.	
Module overheat	OH	The ambient temperature is too temperature.	Reduce ambient temperature.
		The air filter is blocked.	Clean the air filter.
		The cooling fan is damaged.	Replace the cooling fan.
		The module thermistor is damaged.	Replace the thermistor.
		The inverter module is damaged.	Replace the inverter module.
Motor overheat	OH2	Wiring of the PTC sensor for motor overheat protection is incorrect.	Eliminate the wiring fault.
		The motor temperature is too high.	Reduce the load of the motor, add cooling fans or increase the motor capacity.
		Motor demagnetization	Contact the agent or Physis.
External device fault	EF	External fault signal is input via a X terminal.	Eliminate external faults.
		External fault signal is input via a virtual IO function.	Perform the reset operation.
Communication fault	EF	The host computer is not working.	Check wiring of the host computer.
		The wiring for communication is abnormal.	Check wiring of the communication cable.
		The communication parameters in group PD are set improperly.	Set the communication parameters properly.

Symptom	Fault Display	Possible causes	Solutions
Contactor fault	RAy	The drive board and power supply are abnormal.	Replace the drive board or power board.
		The contactor is abnormal.	Replace the contactor.
Current detection fault	IE	The HALL device is abnormal.	Replace the HALL devices.
		The drive board is abnormal.	Replace the drive board.
Current detection fault	TE	The motor parameters are not set according to the nameplate.	Set the motor parameters correctly.
		The motor auto-tuning times out.	Check wiring between the servo drive and the servo motor.
Encoder fault	PG	The encoder model don't match the servo drive.	Select the adapted encoder.
		The encoder wiring is incorrect.	Eliminate the wiring fault.
		The encoder is damaged.	Replace the encoder.
		The PG card is faulty.	Replace the PG card.
EEPROM fault	EEP	The Chip of EEPROM is damaged.	Replace the main control board.
Servo drive hardware fault	OUOC	Overvoltage	Deal with overvoltage fault
		Overcurrent	Deal with overcurrent fault
Short circuit to ground	GND	The motor is short circuited to the ground	Replace the cable or motor
Accumulative running time reached	END1	The accumulative running time is equal to or greater than set accumulative running time	Clear the record through the parameter initialization function
Accumulative business running time reached	END2	Accumulative business running time is equal to or greater than set business running time.	Clear the record through the parameter initialization function
PID feedback lost during running	PIDE	PID feedback lost during running	Contact the agent or Physis.
Wave-chasing current limit fault	CBC	The load is too heavy or the motor is blocked.	Reduce the load and check the motor and connected machine.
		Reduce the load and check the motor and connected machine.	Increase the capacity level of the servo drive.

Symptom	Fault Display	Possible causes	Solutions
Too large speed deviation	ESP	The encoder parameters are set incorrectly.	The encoder parameters are set incorrectly.
		The motor auto-tuning is not performed.	Reduce the load and check the motor and connected machine.
		P9.03 and P9.04 are set incorrectly.	Set P9.03 and P9.04 correctly according to the actual situation.
Motor over-speed fault	oSP	Incorrect encoder parameter setting.	Set the encoder parameter correctly.
		The motor auto-tuning is not performed.	Set parameters correctly according to the actual situation.
Initial position fault	INI	The motor parameter are not set based on the actual situation.	Check that the motor parameters are set correctly and whether the setting of rated current is too small.
Pressure sensor fault	AL. 46	Wiring of the pressure sensor is incorrect.	Eliminate the wiring fault.
		The power supply of pressure sensor is abnormal.	Eliminate the power supply fault.
		Output of pressure sensor is abnormal.	Replace the pressure sensor.
CAN communication interrupted	CAN	CAN communication parameters are set incorrectly.	Set correct CAN communication parameters.
		The wiring of CAN communication is incorrect.	Eliminate the wiring fault.

5.2 Eliminate Wiring Fault

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

Table 5-1 Symptoms and Diagnostics

SN	Fault	Possible Causes	Solutions
01	No display upon power-on.	There is no power supply to the servo drive or the power input to the servo drive is too low.	Check the power input.
		The switch of power supply on the drive board is Faulty.	Check the power input.
		Components inside the servo drive are damaged.	Contact the agent or Physis.
02	"PH300" is displayed at power-on.	The cable connecting the control board and the drive board is in poor contact.	Contact the agent or Physis.
		Components on the control board are damaged.	
		The motor or the motor cable is short circuited to the ground.	
		The HALL device is faulty.	
		The power input to the servo drive is too low.	
03	"GND" is displayed at power-on.	The motor or the motor output cable is short circuited to the ground.	Check the insulation status of the motor and the output cable with a megger.
		The servo drive is damaged.	Contact the agent or Physis.
04	The servo drive display is normal upon power- on, but displays "PH300" after running and stops immediately.	The external control terminal cable is short circuited.	Eliminate external fault
		The cooling fan is damaged or does not rotate.	Replace the cooling fan.

SN	Fault	Possible Causes	Solutions
05	OH (IGBT overheat) fault is reported frequently.	The carrier frequency is set too high.	Reduce the carrier frequency (P017).
		The cooling fan is damaged, or the air filter is blocked.	Replace the cooling fan and clean the air filter.
		Components (thermal coupler or others) inside the servo drive are damaged.	Contact the agent or Physis.
06	The motor does not rotate after the servo drive runs.	Check the cable between the servo drive and the servo motor	Ensure the cable between the servo drive and the motor is normal.
		The motor is damaged or locked rotor occurs.	Replace the motor or rectify mechanical fault.
		The motor is damaged or locked rotor occurs.	Check and set the motor parameters again.
		The control board is faulty.	Contact the agent or Physis.
07	X terminals are disabled.	The related parameters are set incorrectly.	Check and set the parameters in group P5 again.
		The jumper across OP and +24 V becomes loose.	Re-connect the cables.
		The jumper across OP and +24 V becomes loose.	Contact the agent or Physis.
08	In CLVC mode, the motor speed can't be rise.	The encoder is damaged or the encoder wiring is incorrect.	Replace the encoder and correct the wiring.
		The PG card is faulty.	Replace the PG card.
		The drive board is faulty.	Contact the agent or Physis.
09	The servo drive reports overcurrent and overvoltage fault frequently.	The motor parameters are set impro perly.	Set the motor parameters or perform motor auto-tuning again.
		The acceleration / deceleration time is improper.	Set proper acceleration / deceleration time .
		The load fluctuates.	Contact the agent or Physis.
10	rAy is reported upon power- on or running.	The soft startup contactor is not closed.	Check whether the contactor cable is loose; Check whether the contactor is faulty; Check whether the contactor 24V power supply is faulty; Contact the agent or Physis;

Chapter 6 Maintenance

Warning

- Maintenance must be performed according to designated maintenance methods.
- Maintenance inspection and replacement of parts must be performed only by qualified professionals.
- Must shut off power supply and wait for 10 minutes before maintenance or inspection.
- Do not touch components directly of PCB board, otherwise servo drive can be damaged by static electricity
- Ensure all screws must be tightened after maintenance.

6.1 Daily Maintenance

In order to avoid the potential faults and ensure servo drive proper operation, prolong service life of the servo drive, it's necessary to carry out routine and periodic maintenance. Check the following items of daily maintenance:

Inspection Items	Inspection Points
Temperature / Humidity	Ambient temperature : 0℃ to 40 ℃ Humidity：0% to 95% and no condensation
Oil stain / Dust	Ensure no oil stain, dust in servo drive.
Servo drive	Check whether the servo drive is overheat or vibration.
	Check whether the servo drive is overheat or vibration.
	Ensure voltage input and frequency is in correct range.
Motor	Check whether the servo motor whether is overheat or vibration, whether abnormal noise and phase loss.

6.2 Periodic Inspection

Customer should perform period inspection within 6 months as followings.

Inspection Items	Inspection content	Methods
Screws of control terminals	Whether the screws are loose.	Tighten the screws
PCB board	Dust and smudginess	Clean the dust and smudginess with compressed air drying
Fan	Dust and smudginess	Debris removal; Replace the cooling fan
Electrolytic capacitor	Discoloration or odor	Replace the electrolytic capacitor
Radiator	Dust and smudginess	Clean the dust and smudginess with compressed air drying
Components and parts	Dust and smudginess	Clean the dust and smudginess with compressed air drying

6.3 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 operation environment and maintenance status. Generally, the service life is shown as follows:

- Fan: Must be replaced when using up to 20,000 hours.
- Electrolytic Capacitor: Must be replaced when using up to 30,000-40,000 hours.

6.4 Warranty Agreement

Physis will provide 12-month warranty from date of manufacturing for the failure or damage under normal use conditions.

Chapter 7 Selection of Peripheral Electrical Devices

Name	Description
Moulded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB)	Protect the wiring of servo drives, and to be beneficial to installation and maintenance.
Electromagnetic contractor (MC)	It's convenient for servo drives' power on and off, to ensure safety.
Surge absorber	Absorbing electromagnetic and control surge current of relays
Isolation transformer	Decrease interference
AC Reactor	Protect servo drive, prevent the high harmonics and surge voltage.
Absorb regenerated energy.	Absorb regenerated energy.
Decrease of electromagnetic interference which is caused by servo drive.	Decrease of electromagnetic interference which is caused by servo drive.
Ferrite ring	Decrease of electromagnetic interference which is caused by servo drive.

7.1 AC Input Reactor

Voltage Level	Motor Output (kW)	Parameters of AC Input Reactor		Remark
		Rated Currency (A)	Inductance Value (mH)	
220Vac	7.5	40	0.3	Option
	11	60	0.2	
	15	80	0.14	
	18.5	90	0.12	
	22	120	0.1	
	30	150	0.07	
	37	200	0.06	
	45	250	0.05	
	55	250	0.04	
	75	330	0.03	
	90	400	0.025	

Voltage level	Motor Output (kW)	Parameters of AC Input Reactor		Remark
		Rated Currency (A)	Inductance Value (mH)	
380Vac	7.5	20	0.75	Option
	11	30	0.6	
	15	40	0.42	
	18.5	50	0.35	
	22	60	0.28	
	30	80	0.19	
	37	90	0.16	
	45	120	0.13	
	55	150	0.1	
	75	200	0.12	
	90	250	0.06	
	110	250	0.06	
	132	290	0.04	
	160	330	0.04	
	185	400	0.04	
	200	490	0.03	
	220	490	0.03	
	250	530	0.03	
	280	600	0.02	
	315	660	0.02	
	350	800	0.0175	
	400	800	0.0175	
	450	1000	0.014	

7.2 AC Output Reactor

Voltage level	Motor Output (kW)	Parameters of AC Output Reactor		Remark
		Rated Currency (A)	Inductance Value (mH)	
220Vac	7.5	40	0.15	Option
	11	60	0.1	
	15	80	0.07	
	18.5	90	0.06	
	22	120	0.05	
	30	150	0.035	
	37	200	0.03	
	45	250	0.025	
	55	250	0.02	
	75	330	0.015	
	90	400	0.013	
380Vac	7.5	20	0.13	
	11	30	0.087	
	15	40	0.066	
	18.5	50	0.052	
	22	60	0.045	
	30	80	0.032	
	37	90	0.03	
	45	120	0.023	
	55	150	0.019	
	75	200	0.014	
	90	250	0.011	
	110	250	0.011	
	132	290	0.008	

Voltage level	Motor Output (kW)	Parameters of AC Output Reactor		Remark
		Rated Currency (A)	Inductance Value (mH)	
380Vac	160	330	0.008	Option
	185	400	0.005	
	200	490	0.004	
	220	490	0.004	
	250	530	0.003	
	280	600	0.003	
	315	660	0.002	
	350	800	0.002	
	400	800	0.002	
	450	1000	0.0012	

7.3 Applied Braking Resistor Specification

Voltage Level	Motor Output (kW)	Brake Resistor		Brake Unit CDBR	Braking Torque (10%ED)	Motor Output (kW)
		Power (W)	Resistance Value(Ω)			
220Vac	7.5	1000W	16	Built-in	125	7.5
	11	1500W	11			11
	15	2500W	8			15
	18.5	3.7KW	6.7			18.5
	22	4.5KW	6.7			22
	30	5.5KW	5			30
	37	7.5KW	3.3			37
	45	4.5KW*2	5*2			45
	55	5.5KW*2	5*2			55

Voltage Level	Motor Output (kW)	Brake Resistor		Brake Unit CDBR	Braking Torque (10%ED)	Motor Output (kW)
		Power (W)	Resistance Value(Ω)			
220Vac	75	16KW	3.3	Built-in		75
	90	6.5KW*3	6.3*3	External		90
380Vac	7.5	1000W	65	Built-in		7.5
	11	1500W	43			11
	15	2000W	32			15
	18.5	4KW	24			18.5
	22	4.5KW	24			22
	30	6KW	19.2			30
	37	7KW	14.8			37
	45	9KW	12.8			45
	55	11KW	9.6			55
	75	15KW	6.8			75
	90	9KW*2	9.3*2		125	90
	110	11KW*2	9.3*2			110
	132	13KW*2	6.2*2			132
	160	16KW*2	6.2*2			160
	185	19KW*2	2.5*2	External		185
	200	19KW*2	2.5*2			200
	220	21KW*2	2.5*2			220
	250	24KW*2	2.5*2			250
	280	27KW*2	2.5*2			280
	315	20KW*3	2.5*3			315
	350	23KW*3	2.5*3			350
	400	26KW*3	2.5*3			400
	450	29KW*3	2.5*3			450

Note:The braking resistor value is related to the DC voltage when the servo drive is braking. For 380V power supply, DC voltage is 800V-820V and for 220V system, the DC voltage is 400V.

Calculate of Braking resistor value:

The braking resistor value is related to braking torque Mbr% , and for the different braking torque, the braking resistor values are different.

The calculation formula is as follows:

$$R = \frac{U_{dc}^2 \times 100}{P_{Motor} \times M_{br}\% \times \eta_{Driver} \times \eta_{Motor}}$$

U_{dc}——DC voltage of brake； P_{Motor}——Motor power； M_{br}——Braking torque；
η_{Motor}——Motor efficiency； η_{Driver}——Drive efficiency。

The braking power is related to braking torque and braking frequency, as the calculation formula above indicates the braking torque is 125% , the frequency is 10%. However, according to the different load, the values in the calculation formula are just for reference only.

Chapter 8
Multi-pump Control of IMM

Due to the limit of motor power and pump displacement, single pump can't meet the requirements of displacement, large tonnage injection molding machine needs multi-pump in parallel to converge maximum flow.

8.1 Parallel Pump Control

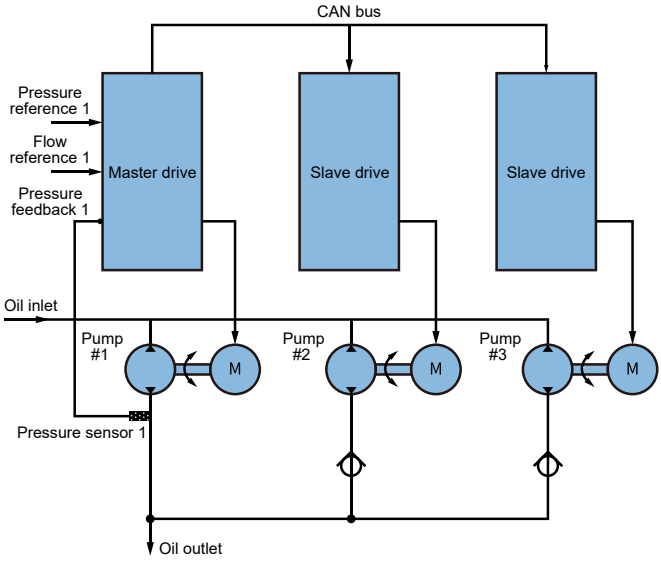
The parallel pump control is classified into multi-pump convergent flow and multi pump distributed flow.

Multi-pump convergent flow: A servo motor 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.

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.

◆ Structure diagram of multi pump combined flow

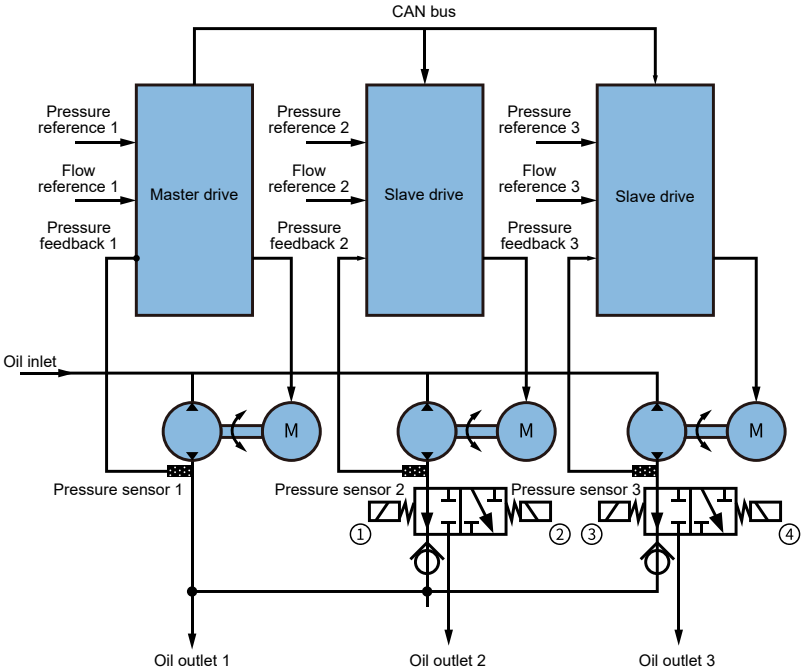
The following figure shows the multi-pump convergent flow structure chart.



Note: You can ensure the same motor speed through the communication.

◆ Multi pump shunt structure

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



Note: You can ensure the same motor speed through the communication.

The convergent flow and distributed flow of 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, the CAN communication command received by the drive are invalid.

8.2 Multi–pump Control Mode

PD.09	CAN multi-pump mode	0	Multi-pump 1 (broadcast mode)
		1	Multi-pump 2 (multi-master mode)

Multi-pump 1:

● This mode is broadcast mode and is applicable to simple multi-pump control.
● When the slave pump is switched over to the master pump, the slave pump can't be controlled.
● To enable the multi-pump mode, set the DI terminal for 50# function.
● After disconnecting the DI terminal set for 50# function of the slave pump, the slave pump is switched over to the master pump.

Multi-pump 2 :

This mode is the multi-master mode and can satisfy more complicated multi-pump convergent and distributed flow control. It supports a maximum of 4 multi-pump distributed flow control combinations.

◆ Wiring（Multi-pump convergent flow）

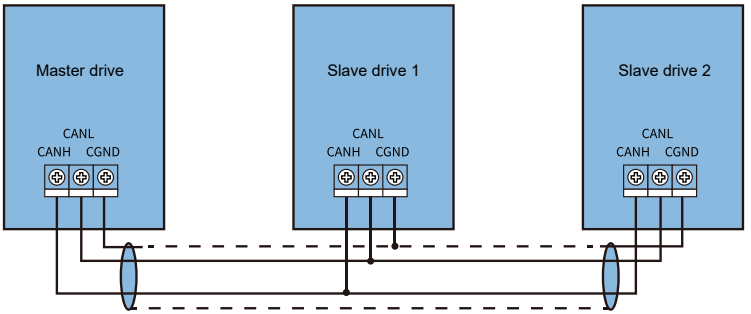
Set the corresponding parameter in group P6.02=25 (slave alarm output) and connect this signal to the system computer for alarm display.

Note: 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 t low-speed holding pressure. For detailed parameter setting, refer to the following "Parameter Setting for Slave Pump Response to Master Pump Reference" part.

Multi-pump distributed flow:
Set the corresponding parameter in group P6.02=25 (slave alarm output) and connect this signal to the system computer for alarm display.

◆ CAN Communication Wiring

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



Note:

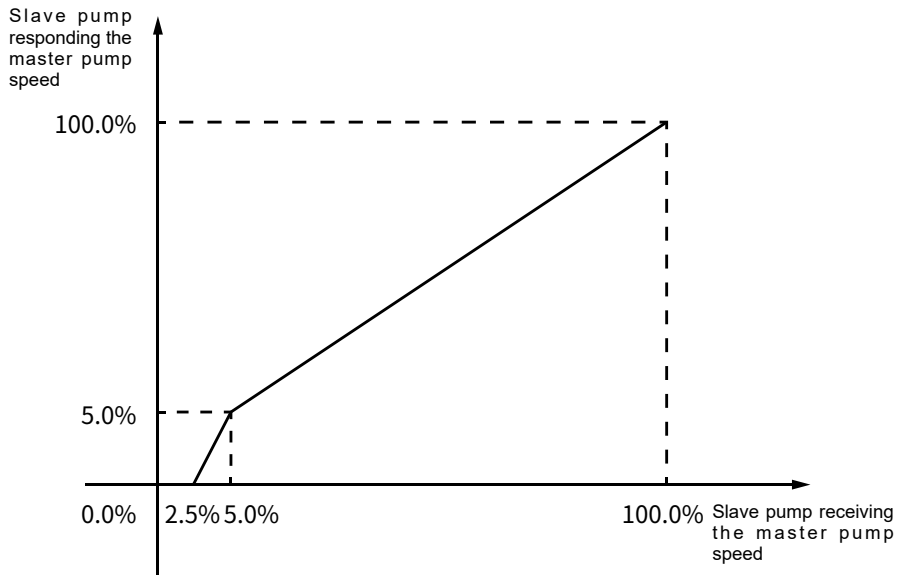
- Connect the CANH and CANL terminals on the boards of all drives together
- Connect the GND terminal together through the shield.
- The first drive and the end drive at the CAN bus must connect the CAN communication terminal resistor.

◆ Parameter Setting for Slave Pump Response to Master Pump Reference

Function Code	Parameter Name	Default	Description
PC.10	Slave min. input	0.0%	The slave pump drive setting
PC.11	Corresponding setting of slave min. input	0.0%	
PC.12	Slave medium input	0.0%	
PC.13	Corresponding setting of slave medium input	0.0%	
PC.14	Slave max. input	100.0%	
PC.15	Corresponding setting of slave max. input	100.0%	

The setting of PC.10 to PC.15 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.
Condition 2: At pressure holding, 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.
When the mater group 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 PC.10 to PC.15 to get the three-point curve to make the slave pump respond to the speed reference as follows:
(PC.10, PC11) = Slave pump input reference: 50 rpm/min., slave response reference: 0 rpm/min. = 2.5%, 0.0%
(PC.12, PC13) = Slave pump input reference: 100 rpm/min., slave response reference: 100 rpm/min. = 5.0%, 5.0%
(PC.14, PC15) = Slave pump input reference: 2000 rpm/min., slave response reference: 2000 rpm/min. = 100%, 100%
100%)



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

8.3 Parameter Setting on Master Drive

◆ Multi-pump mode1 (Pd.09=0)

The parameter setting is simple. For all servo drives, allocate a X terminal and set the parameter to 50.

Function Code	Parameter Name	Setting	Description
Pd.07	CAN communication address	1	
Pd.09	Multi-pump mode 1	0	
P5.00~P5.04	Multi-pump control enabled	50	
P6.02	Relay on the control board output selection	25	Slave alarm output (normally – open)

◆ Multi-pump mode 2 (Pd.09=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
P5.00~P5.04	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.
P5.00~P5.04	Slave pump address selection terminal 2	54	
P6.02	Slave pump address selection terminal 2	25	Slave alarm output (normally-open)
Pd.07	CAN communication address	1	
Pd.09	Multi-pump mode 2	1	
Pd.10	CAN slave address 1	0	Together with the two X terminals set for the 53# and 54# functions, the four combined distributed flow control can be implemented.
Pd.11	CAN slave address 2	0	
Pd.12	CAN slave address 3	0	
Pd.13	CAN slave address 4	0	

◆ Slave pump address X terminal input selection

Setting of X Terminal for 54# Function	Setting of X Terminal for 54# Function	CAN Slave Address Selection
0	0	Pd.10 : CAN slave address 1
0	1	Pd.11 : CAN slave address 2
1	0	Pd.12 : CAN slave address 3
1	1	Pd.13 : CAN slave address 4

◆ Description of slave pump address setting

Pd.10~Pd.13	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5
Station No	1	2	3	4	5	6
Value Setting	2^0=1	2^1=2	2^2=4	2^3=8	2^4=16	2^5=32
Pd.10~Pd.13	Bit6	Bit7	Bit8	Bit9	Bit10	Bit11
Station No	7	8	9	10	11	12
Station No.	2^6=64	2^7=128	2^8=256	2^9=512	2^{10}=1024	2^{11}=2048
Pd.10~Pd.13	Bit12		Bit13		Bit14	
Station No	13		14		15	
Station No.	2^{12}=4096		2^{13}=8192		2^{14}=16384	

- Bit0 corresponds to the slave pump station No.1, Bit1 corresponds to station No.2, by that analogy, Bit14 corresponds to station No.15.
- When address station number is 1, it indicates that the slave pump of the address station No.
- The PH300 series servo drives support the setting of a total 15 slave pump addresses.

For example, 1# is the master pump, Pd.10=1x2^1+1x2^2+1x2^3=14, indicating that 1# is the master pump, and works with slave pumps 2#, 3# and 4#.

8.4 Parameter Setting on Slave Drive

◆ Multi – pump mode 1 (Pd.09 = 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
PD.07	CAN communication address	>1	Slave drive
P5.00~P5.04	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 X terminal set for the 50# function of slave pump.

◆ Multi – pump mode 2 （Pd.09 = 1）

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

Function Code	Parameter Name	Setting	Description
Pd.07	CAN communication address	>1	Slave drive
P5.00~P5.04	Slave pump address selection terminal 1	53	When the slave pump is used as the master pump, it need to be triggered by the terminal. For the slave pump address setting, refer to section 8.3 “Parameter Setting on Master Drive”
P5.00~P5.04	Slave pump address selection terminal 2	54	

8.5 Applications of Multi-pump Convergent and Distributed Flow Control

◆ Multi-pump Mode 1 (Pd.09 = 0)

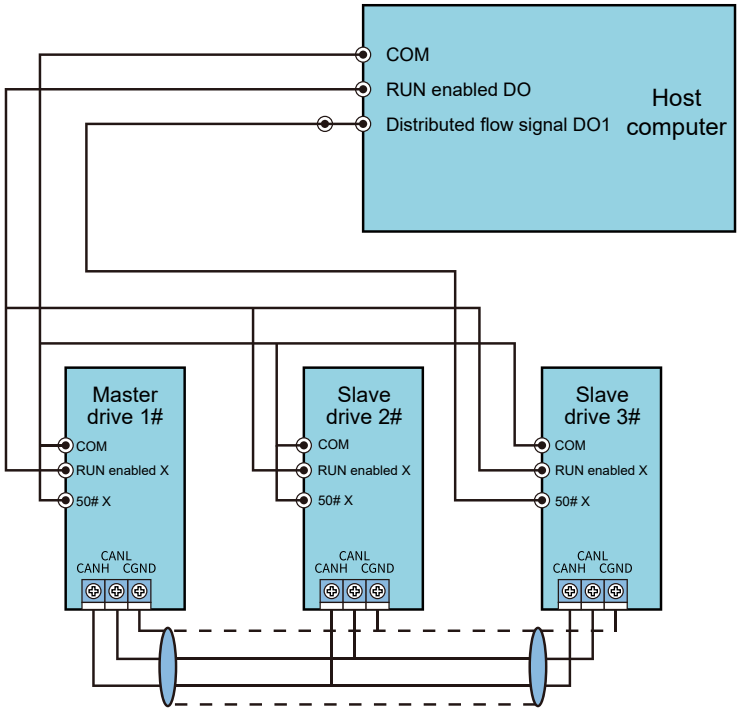
For example, the IMM servo pump system consists of the three pumps with the address set as 1#, 2# and 3#. In the multi-pump mode 1, when a slave pump is used as the master pump, the slave pump doesn't follow its speed.

And there are the following 2 combinations:

- Combination 1: 3-pump convergent flow
- Combination 2: 2+1 combination for distributed flow control

The following describes the wiring and setting of the above two combinations:

■ Combination 1: 3-pump convergent flow



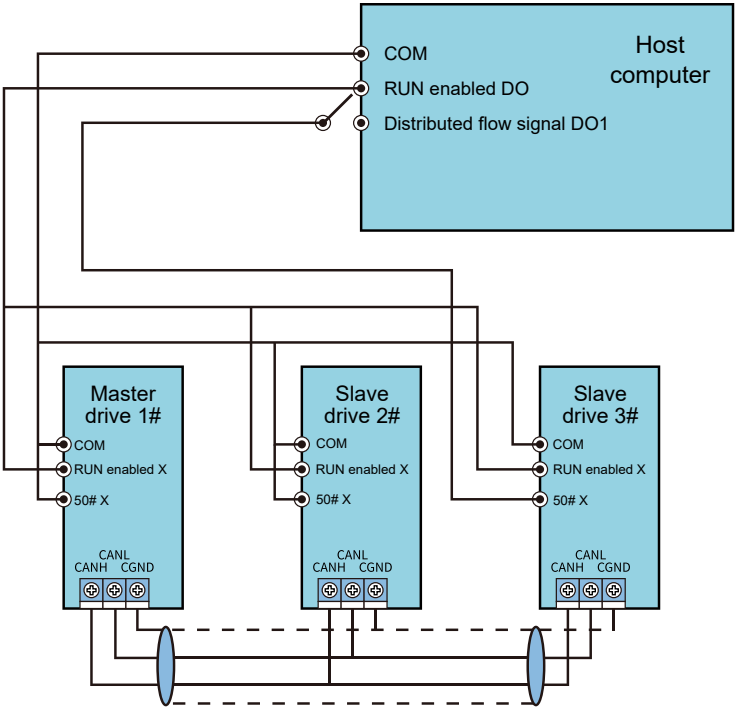
Note:

Because the 1# pump is always the master pump and the 2# pump always the slave pump, directly short the X terminal set for 50# function.

The 3# pump switches over to the master pump in the following combination 2, which requires an external switches signal. When the host computer sends the closing signal, the X 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

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



Note:

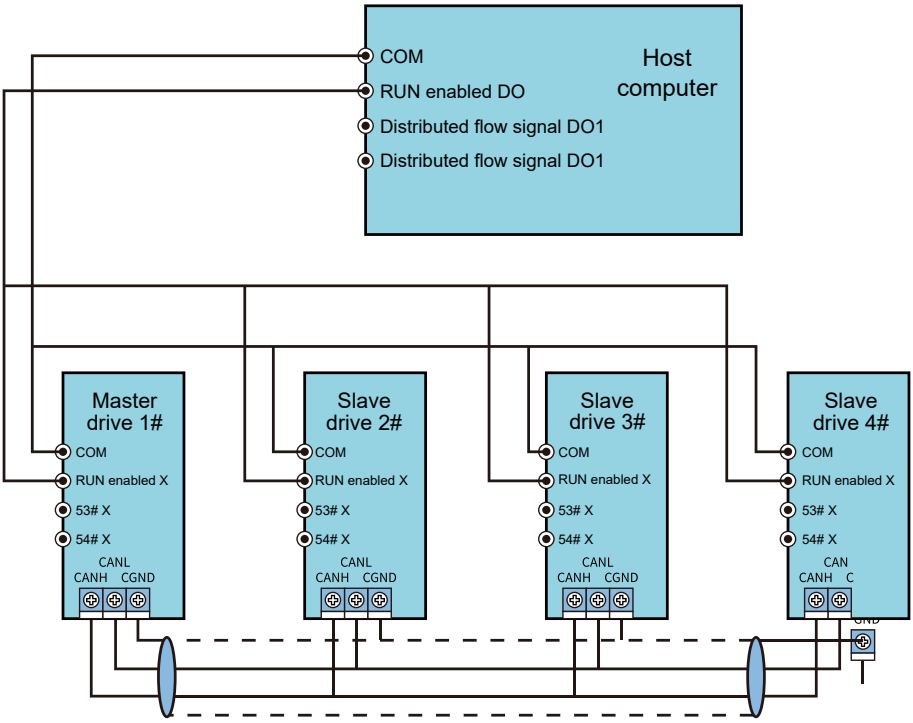
The 1# master pump is followed by the 2# slave pump, and you can switch over the 3# pump to the master pump by disconnect the X terminal set for the 50# function of the slave pump.

◆ Multi-pump Mode 2 (Pd.09 = 1)

For example, the IMM servo pump system consists of four pumps with the address set as 1#, 2#, 3# and 4#.

- Combination 1: 4-pump convergent flow
- Combination 2: 2+2 combination for distributed flow control
- Combination 3: 3+1 combination for distributed flow control

■ Combination 1: 4-pump convergent flow



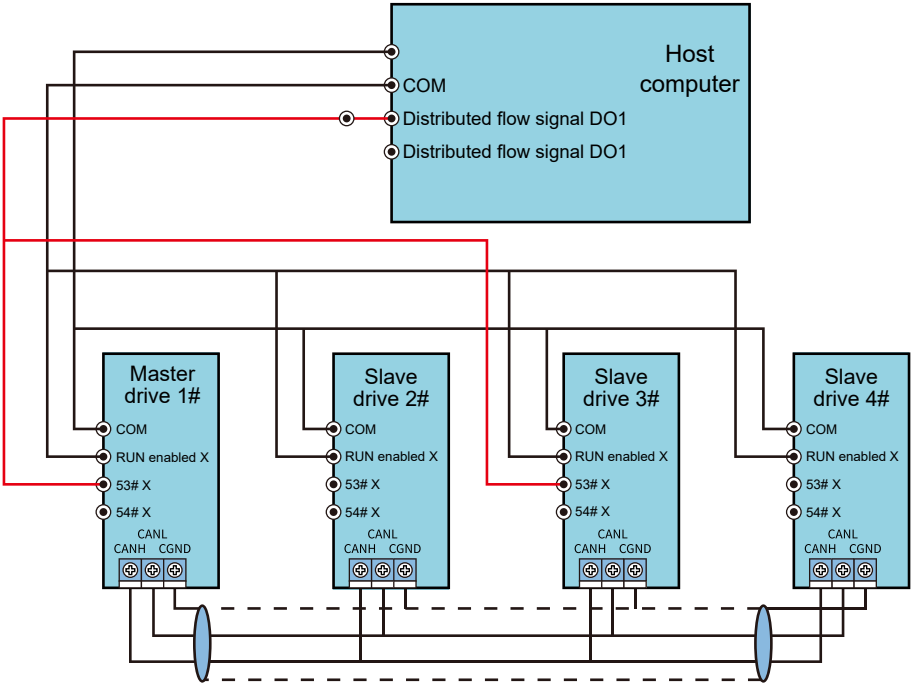
Note:

The convergent flow control requires very simple wiring including CAN bus and X 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 is Pd.10=1x2¹+1x2²+1x2³=14.

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

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



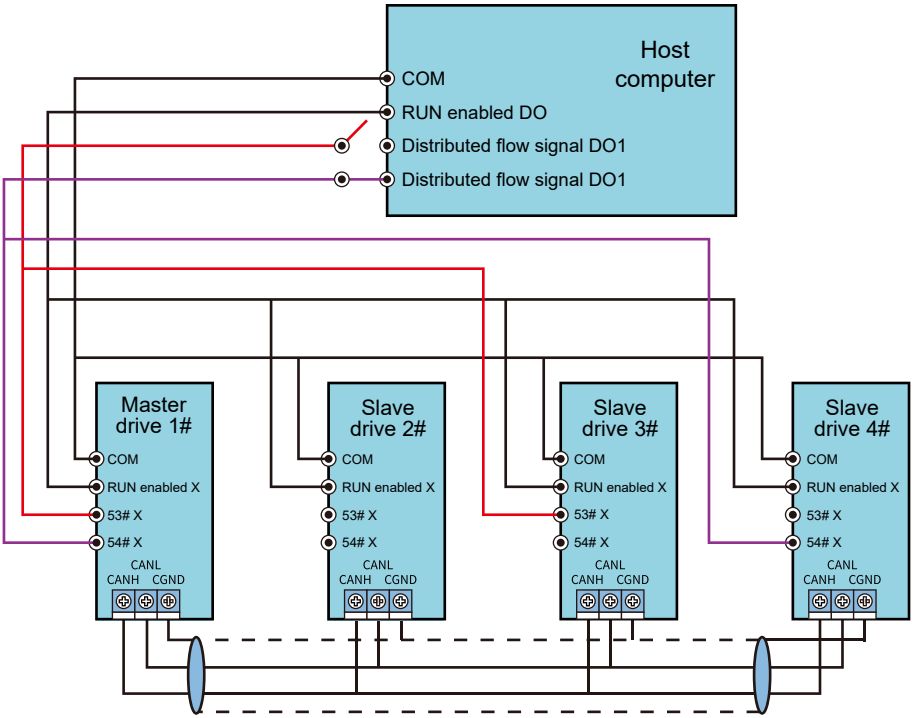
Note:

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

In this combination, the 1# pump and 3# pump are the master pump. The slave pump changes and the address of the salve pump needs to be set. The slave pump of the 1# master pump is 2# pump, the setting of address of 1# master pump is Pd.11=1x21=2. The slave pump of the 3# master pump is 4# pump, the setting of address of 3# master pump is Pd.11=1x23=8.

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

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



Note:

The host computer provides the distributed flow signal. Connect the distributed flow signal to the X terminal set for the 54# function of the master drive. The master pump identifies the salve pump address through the 54# X signal. The slave pump switches over to the master pump and identifies the slave pump address by using the 54# X signal.

Disconnect the X terminal set for the 53# function in the second combination.

In this combination, the 1# pump and 4# pump are the master pump. The slave pump changes and the address of the salve pump needs to be set. The slave pump of the 1# master pump are 2# pump and 3# pump, the setting of address of 1# master pump is Pd.12=1x21 +1x22=6. After the 4# slave pump switches over to the master pump, no slave pump follows it, therefore, Pd.11 doesn't need to be set, that is Pd.11=0.

Appendix
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Version Change Record

Date	Version	Update Content
2019-09	PHSDOM1909-V01	● First edition release
2020-04	PHSDOM2004-V02	● Content update ● Layout rearrangement
2020-07	PHSDOM2007-V03	● Logo update ● Content update

PERPETUAL MOTION

Version：PHSDOM2506-V05