NIETZ

AT10 series

User Manual

Servo Drive for Electro Hydraulic Control System

NIETZ ELECTRIC CO.,LTD

• Thank you very much for your buying AT10 series multi-function high performance servo drive.

• Before use, please read this manual thoroughly to ensure proper usage. Keep this manual at an easily accessible place so that can refer anytime as necessary.

Safety Precautions

Please read this operation manual carefully before installation, operation, maintenance or inspection In this manual, the safety precautions were sorted to "WARNING" or "CAUTION".

⚠ WARNING Indicates a potentially dangerous situation which, if can not avoid will result in death or serious injury.

⚠ CAUTION Indicates a potentially dangerous situation which, if can not avoid will cause minor or moderate injury and damage the device. This Symbol is also used for warning any un-safety operation.

In some cases, even the contents of "CAUTION" still can cause serious accident. Please follow these important precautions in any situation.

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★ NOTE indicate the necessary operation to ensure the device run properly.

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

WARNING
• May cause injury or electric shock. • Please follow the instructions in the manual before installation or operation. • Disconnect all power line before opening front cover of unit. Wait at least 10 minutes until DC Bus capacitors discharge. • Use proper grounding techniques. • Never connect AC power to output UVW terminals.

Contents

Chapter 1 Safety Cautions

1.1 Confirmation on receiving

⚠ Warning

The servo drive has been strictly and well packed before ex-work. Inconsideration of various factors during the transportation special attention should be paid to the following points before the assembly and installation. If there is anything abnormal please notify the dealer or the relevant people of our company.

- Check if the servo drive has got any damage or deformation during the transportation and handling.
- Check if there is one piece of AT10 series servo drive and one copy of the instruction manual available when unpacking it.
- Check the information on the nameplate to see if the specifications meet your order (Operating voltage and KVA value).
- Check if there is something wrong with the inner parts, wiring and circuit board.
- Check if each terminal is tightly locked and if there is any foreign article inside the servo drive.
- Check if the operator buttons are all right.
- Check if the optional components you ordered are contained.
- Check if there is a certificate of qualification and a warranty card.

1.2 Transportion and installation

⚠ Warning

- When carrying products, use correct lifting gear to prevent injury.
- Do not stack the servo drive boxes higher than the number recommended.

- Ensure that installation position and material can withstand the weight of the servo drive. Install according to the information in the instruction manual.
- Do not install or operate the servo drive if it is damaged or has parts missing.
- When carring the servo drive, do not hold it by the front cover or setting dial. It may fall or fail.
- Do not stand or rest heavy objects on the product.
- Check the servo drive mounting orientation is correct.
- Prevent other conductive bodies such as screws and metal fragments or other flammable substance such as oil from entering the servo drive.
- As the servo drive is a precision instrument, do not drop or subject it to impact.
- Use the servo drive under the following enviromental conditions. Otherwise, the servo drive may be damaged.

Ambient temperature: －10℃~40℃〈non-freezing〉.
Ambient humidity: 95% RH or less〈non-condensing〉
Ambient environment: indoors〈free from corrosive gas, flammable gas, oil mist, dust and dirt, free from direct sunlight〉
Vibration: max. 0.5G

- Please make sure that the screws are fixed, fastened firmly in accordance with the stipulations of the instruction manual, to prevent the servo drive falling.
- If two or more servo drives are installed in a control cabinet, please install them according to the information in the instruction manual, and it is required to keep enough space and install extra cooling fans to keep the air in the cabinet flowing freely to keep the temperature inside the cabinet lower than 40℃. Overheating may cause servo drive fault, fire or other accidents.
- Due to the servo drive of akind of electrical and electronic product it must be installed, tested and adjusted with parameters by specialized engineering persons of motors.

1.3 Wiring and Junction

⚠ Warning

- Please do not damage the wires. Let the wires bear weight or be clamped may damage the wires and cause an electric shock.
- Do not install a power factor correction capacitor or surge suppressor/radio noise filter (capacitor type filter) on the servo drive output side.
- Do not install switch devices such as the air switch and contactor on the servo drive output side, if it is for technologic demand, please ensure that the servo drive is switching without output.
- Wrong wiring might lead to damage of the servo drive.The control signal lines must be kept fully away from the main circuit to protect them from noise.

Danger

- Please ensure that the power is off before junction.
- The wiring work shall be done by qualified electricians.
- Please wire the wires in accordance with the specifications stipulated in the instruction manual.
- The grounding connection shall be done correctly and in accordance with relative regulations in the instruction manual, otherwise it may cause an electric shock or fire.
- Please use independent power supply for the servo drive, never use the same power supply with strong interference equipment like electric welder.
- Please do not touch the bottom plate with wet hand, otherwise you may get an electric shock.
- Please do not touch the terminals directly, do not connect the servo drive's input or output terminals to the servo drive's shell, otherwise you may get an electric shock.
- Please make sure that the voltage of the power supply and the voltage of the servo drive are same, otherwise it may cause the

servo drive fault or personnel injury.

- The power supply cables must be connected to R,S,T. Never connect the power cable to the U,V,W of the servo drive.Doing so will damage the servo drive.
- Please do not conduct pressure resistance test to the servo drive, otherwise it may cause the servo drive's internal fault.
- Please install accessories such as brake units, brake resistors in accordance with the regulations of the instruction manual, otherwise it may cause the servo drive fault or fire.
- Please ensure that the screws of the terminals are firmly locked, otherwise it may cause the servo drive fault.

1.4 Power-on, Test operation

⚠ Warning

- While power is on or when the servo drive is running, do not open the front cover.Otherwise you may get an electric shock.
- Do not run the servo drive with the front cover or wiring cover removed. Otherwise, you may access the exposed high-voltage terminals or the charging part of the circuitry and get an electric shock.
- Before starting operation, confirm and adjust the parameters. A failure to do so may cause some machines to make unexpected motions.
- It is recommended to undertake test runs with no load.
- Please provide an emergency stop switch when the "stop" function setting is unavailable.
- Do not use the servo drive input side magnetic contactor to start/ stop the servo drive, otherwise it may affect the life of the servo drive.

Danger

- When fault restart function is set, please do not approach the

equipment because the equipment may automatically restart after the running stop.

- Make sure that the specification and rating match the system requirements. Exceeding their use range can cause motor and machine fault.
- Please do not change the parameter settings of servo drive casually during running.
- While power is on or for some time after power-off, do not touch the servo drive as it is hot and you may get burnt.
- Perform setting dial and key operations with dry hands to prevent an electric shock. Otherwise you may get an electric shock.
- Please do not link or withdraw motors during the servo drive running, otherwise it may cause servo drive protection or fault.

1.5 Inspection and Maintenance

⚠ Warning

- Please ensure that the power supply and the power indicating light is off before inspecting and maintaining. Otherwise you may get an electric shock.
- For prevent damage due to static electricity,touch nearby metal before touching this product to eliminate static electricity from your body.
- Do not carry out a megger (insulation resistance) test on the control circuit of the servo drive.

Danger

- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Please do check, maintenance and replacement of the components according to the appointed methods in the instruction manual, strictly prohibit modifying by yourself. If you do so, you may get an electric shock and injury or the servo drive may get damaged.

1.6 Emergency stop

Danger

- Provide a safty backup such as an emergency brake which will prevent the machine and equipment from hazardous conditions if the servo drive fails.
- When the braker on the servo drive input side trips, check for the wiring fault (short circuit), damage to internal parts of the servo drive, etc. Identify the cause of the trip, then remove the cause and power on the breaker.
- When the protective function is activated, take the corresponding corrective action, then reset the servo drive, and resume operation.

1.7 Disposing of the servo drive

Warning

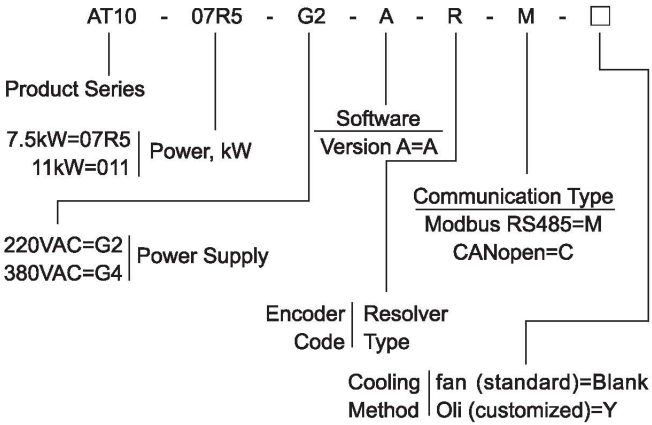
Treat as industrial waste. Do not burn it up!

Chapter 2 Introduction

2.1 Technology Features

Item		AT10
Standard functions	Control mode	Closed-loop vector control, V/F control
	Maximum frequency	0–599Hz
	Carrier frequency	1–12 kHz The carrier frequency is automatically adjusted based on the load features.
	Input frequency esolution	Dgital setting: 0.01 Hz Analog setting: maximum frequency x 0.025%
	Startup torque	0Hz/180%
	Speed range	1:1000
	Speed stability accuracy	± 0.02%
	Overload capacity	60s for 150% of the rated current, 3s for 180% of the rated current.
	Overvoltage/ Overcurrent stall control	The current and voltage are limited automatically during the running process so as to avoid frequent tripping due to overvoltage/over current.
	Torque limit and control	It can limit the torque automatically and prevent frequent over current tripping during the running process.
	Torque control accuracy	±5%
	Support for multiple PG card	Support for rotating transformer PG card,differential input PG card,resolver PG card …

2.2 Description of Name Plate



2.3 Selection Guide

1.3PH AC380V±15%

Model	Rated Output Power (KW)	Rated Input current (A)	Rated Output Current (A)	Motor Power (kW)
3PH AC220V±15%				
AT10-07R5G2	7.5	35	32	7.5
AT10-011G2	11	46.5	45	11
AT10-015G2	15	62	60	15
AT10-018.5G2	18.5	76	75	18.5
AT10-022G2	22	92	90	22
AT10-030G2	30	113	110	30

Model	Rated Output Power (KW)	Rated Input current (A)	Rated Output Current (A)	Motor Power (kW)
AT10-037G2	37	157	152	37
AT10-045G2	45	180	176	45
AT10-055G2	55	214	210	55
AT10-075G2	75	307	304	75
AT10-090G2	90	345	340	90
3PH AC380V±15%				
AT10-07R5G4	7.5	20.0	17.0	7.5
AT10-011G4	11	26.0	25.0	11
AT10-015G4	15	35.0	32.0	15
AT10-018.5G4	18.5	38.0	37.0	18.5
AT10-022G4	22	46.0	45.0	22
AT10-030G4	30	62.0	60.0	30
AT10-037G4	37	76.0	75.0	37
AT10-045G4	45	92	90.0	45
AT10-055G4	55	113	110.0	55
AT10-075G4	75	157	150.0	75
AT10-090G4	90	180	176.0	90
AT10-110G4	110	214	210.0	110
AT10-132G4	132	256	253.0	132
AT10-160G4	160	307	300	160
AT10-185G4	185	355	340	185
AT10-200G4	200	385	380	200
AT10-220G4	220	430	420	220
AT10-250G4	250	468	470	250
AT10-280G4	280	525	520	280
AT10-315G4	315	610	600	315
AT10-350G4	350	665	640	350
AT10-400G4	400	700	690	400
AT10-450G4	450	800	790	450

2.4 Installation

2.4.1 Environment and installation requirements

servo drive's installation environment on the service life of servo

drive, and has direct influence on the normal function, servo drive can't satisfy the specification of environment , protection or fault could lead to the servo drive.

AT10 series servo drive of wall hung servo drive, please use the vertical installation so that the air convection and the heat dissipation effect can be better.

servo drive's installation environment, please make sure must comply with

(01) - 10°C to + 40°C ambient temperature

(02) Environment humidity 0 ~ 95% and no condensation

(03) Avoid direct sunlight

(04) Environment does not contain corrosive gas and liquid

(05) Environment without dust, floating fiber, cotton and metal particles

(06) Away from the radioactive material and fuel

(07) Away from electromagnetic interference source (such as electric welding machine, big power machine)

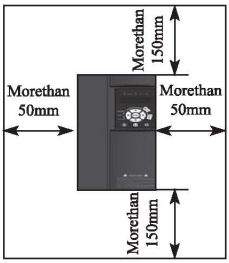
(08) Installed planar solid, no vibration, if it cannot avoid vibration, please add antivibration pads to reduce the vibration

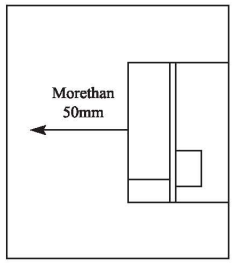
(09) Please install the servo drive in the well ventilated place, easy to check and maintain, and install on the solid non-combustible material, away from the heating element (such as braking resistance, etc.)

(10) servo drive installation please reserve enough space, especially many servo drives' installation, please pay attention to the placement of the frequency servo drive, and configure cooling fans, make the environment temperature lower than 45°C.

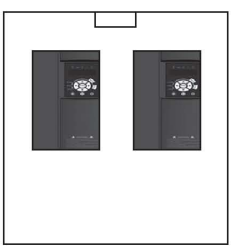
(11) servo drive can output the rated power when installed with altitude of lower than 1000m. It will be derated when the altitude is higher than 1000m.

(1) single servo drive installation

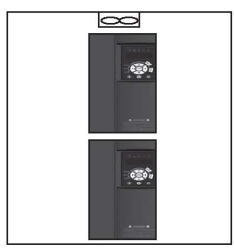




(2) Multiple servo drives installed in one control cabinet.
Please pay attetion:
① when encasing the multiple servo drives,install them in paralled as a cooling measure.

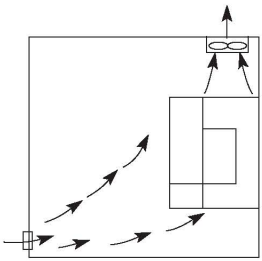


Favorable placing

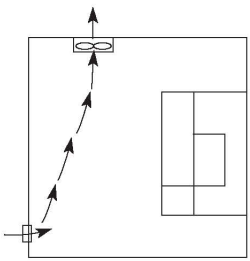


Unfavorable placing

② If multiple servo drives are installed in one control cabinet,please leave enough clearances and take cooling measure.



Incorrect installation position of the fan

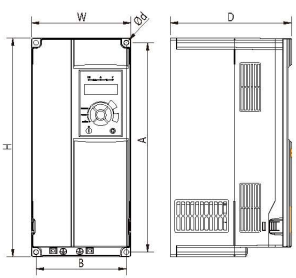


Correct installation position of the fan

the servo drive's outside shape and the installation dimensions

2.4.2 Outline dimension drawings

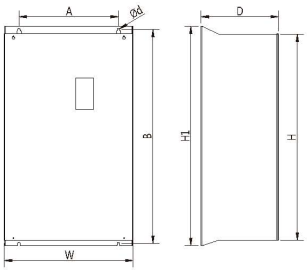
(1) 380V/7.5-37kW&220V/7.5-18.5kW



Model	W	H	D	A	B	Φd
AT10-07R5G2 AT10-011G2 AT10-07R5G4 AT10-011G4 AT10-015G4 AT10-018.5G4 AT10-022G4	151	332	183	318	137	7

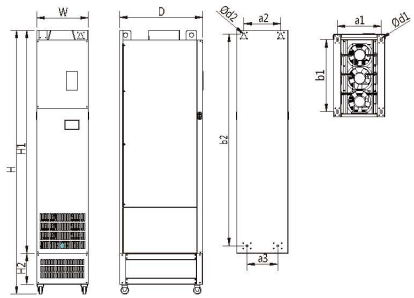
Model	W	H	D	A	B	Φd
AT10-015G2 AT10-018.5G2 AT10-030G4 AT10-037G4	217	400	216	385	202	7

(2) 380V/45-160kW&220V/22-75kW



Model	W	H	D	A	B	Φd	H1
AT10-022G2 AT10-030G2 AT10-045G4 AT10-055G4	300	440	240	200	455	9	470
AT10-037G2 AT10-045G2 AT10-055G2 AT10-075G4 AT10-090G4 AT10-110G4	275	590	310	200	612	9	630
AT10-075G2 AT10-132G4 AT10-160G4	400	675	310	320	695	11	715

(3) 380V/185-450kW&220V/90kW



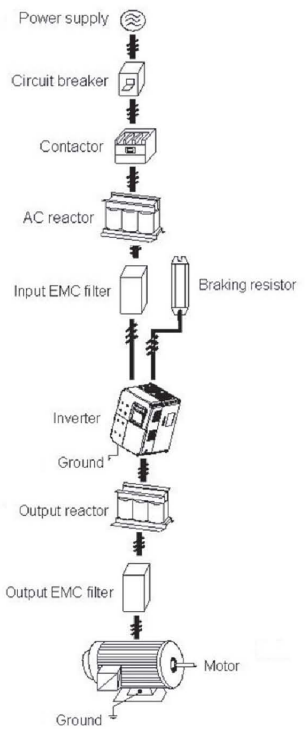
Unit: mm

Model	Dimensions					Floor mounting size			Wall mount dimensions			
	W	H	H1	H2	D	a1	b1	d1	a2	a3	b2	d2
AT10-090G2 AT10-185G4 AT10-200G4 AT10-220G4	300	1445	1180	200	500	250	430	14	220	150	1135	13
AT10-250G4	330	1595	1330	200	545	280	475	14	220	185	1275	13
AT10-280G4 AT10-315G4	325	1495	1230	200	545	275	470	14	225	185	1175	14
AT10-350G4 AT10-400G4 AT10-450G4	335	1720	1455	200	545	285	470	14	240	200	1380	14

Chapter 3 Wiring

the servo drive wiring of the main part and the control part

3.1 The servo drive wiring of the main part



3.1.1 the descriptions of peripheral devices

(1)AC power suppy

Use with in the permissible power suppy specifications of the servo drive.

(2)Moulded case circuit breaker:(MCCB)

When the power supply voltage is low or the input terminal

short circuit occurs,the breaker can provide protection,during inspection,maintenance or the servo drive is not running,you can cut off the breaker to separate the servo drive from the power supply.
(3)Magnetic contractor(MC)
The contractor can turn on and turn off the power of the servo drive to ensure safety.
(4)AC current reactor
a suppress high harmonic to protect the servo drive to ensure safety.
(5)Brake resistor
When the motor is braking, the resistor can avoid DC bus high voltage of the servo drive ,and improve the braking ability of the internal brake unit.

3.1.2 Precautions main circuit wiring
(1) circuit wiring ,refer to requirements of electrical codes.
(2)Application of supply power to output terminals(U,V,W)of the invert will damage it,so never perform such wiring.
(3)Power supply's wiring ,please use isolated wire and wire pipe if possible,and make isolated wire and wire pipe link to the earth.
(4)The servo drive and welding device, high-power motor,high-power load can't use a earth cable.
(5) The ground terminal E,ground impedance is lower than 100Ω
(6)Use the shortest earth cable possible.
(7)Many servo drives are earthed, pay attention not to cause ground loops.
(8)the power cables and the control cables must be separated in the main circuit. keep the power cables more than 10 cm away from the parallelled control cables,when the power cables and the control cables are crossed,make them vertical.Don't make the power cables and the control cables together, or the interference will cause.
(9)Under normal circumstances,the diatance between the servo drives and the motors is less than 30m,the current produced by the parasitic capacitance may cause over-current protection, mis-action,servo drive's fault and equipment operating faults .The maximum distance is 100m,when the distance is long, please select the output side filter,and reduce the carrier frequency.
(10)Don't install an absorbing capacitor or other capacitance-resistance absorbing devices.
(11)Ensure the terminals are all locked tightly,the cables are

connected well with the terminals,present the looseness due to an action of shaking,cause sparks and the short circuit

To minimize the interference,it is recommended that the contactor and relay should be connected to the surge absorber.

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

3.2 Device recommended specifications

Model	Motor Output (kW)	Main Circuit Cable Type (mm^2)	Breaker Selection (A)	Input Side Magnetic contractor (A)
3PH AC220V±15%				
AT10-07R5G2	7.5	6	50	38
AT10-011G2	11	10	63	50
AT10-015G2	15	16	100	65
AT10-018.5G2	18.5	25	100	80
AT10-022G2	22	35	125	95
AT10-030G2	30	50	160	115
AT10-037G2	37	70	225	170
AT10-045G2	45	95	250	205
AT10-055G2	55	120	315	245
AT10-075G2	75	150	400	300
AT10-090G2	90	185	500	410
3PH AC380V±15%				
AT10-07R5G4	7.5	4	32	25
AT10-011G4	11	4	40	32
AT10-015G4	15	6	50	38
AT10-018.5G4	18.5	10	50	40
AT10-022G4	22	10	63	50
AT10-030G4	30	16	100	65
AT10-037G4	37	25	100	80
AT10-045G4	45	35	125	95
AT10-055G4	55	50	160	115
AT10-075G4	75	70	225	150
AT10-090G4	90	95	250	170
AT10-110G4	110	120	315	205
AT10-132G4	132	150	350	245
AT10-160G4	160	185	400	300
AT10-185G4	185	185	500	410
AT10-200G4	200	185	500	410

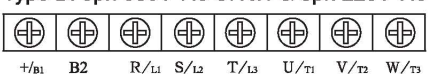
Model	Motor Output (kW)	Main Circuit Cable Type (mm^2)	Breaker Selection (A)	Input Side Magnetic contractor (A)
AT10-220G4	220	240	630	410
AT10-250G4	250	240	630	475
AT10-280G4	280	150*2	700	620
AT10-315G4	315	185*2	800	620
AT10-350G4	350	185*2	800	620
AT10-400G4	400	240*2	1000	800
AT10-450G4	450	240*2	1000	800

*The above data are for reference only.

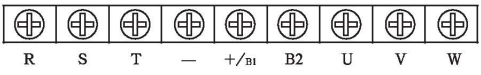
3.3 Terminal Configuration

3.3.1 Main Circuit Terminals

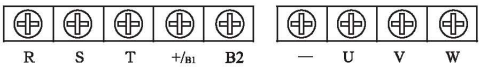
Type B: 3ph 380V 7.5-37KW & 3ph 220V 7.5-18.5kW



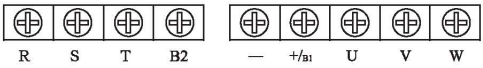
Type C: 3ph 380V 45-55KW & 3ph 220V 22-30kW



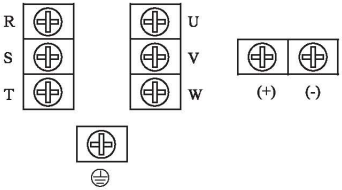
Type D: 3ph 380V 75-110KW & 3ph 220V 37-55kW



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

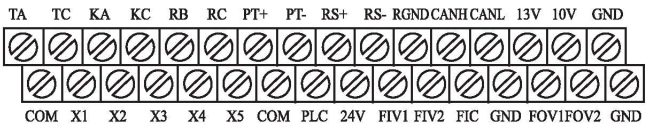


Type F: 3ph 380V 185-450KW & 3ph 220V 90kW



Terminal Symbol	Description
R/L1, S/L2, T/L3	Terminals of 3 phase AC input
+/B1, (-)	Spare terminals of external braking unit
+B1, B2	Spare terminals of external braking resistor
(-)	Terminal of negative DC bus
U/T1, V/T2, W/T3	Terminals of 3 phase AC output
⏚	Terminal of ground

3.3.2 Control Circuit Terminals

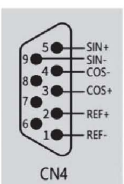


Category	Terminal Symbol	Terminal Name	Function Description
Power	+10V-GND	External +10V power supply	10V±10% power supply, maximum output current: 10mA is generally used as external potentiometer working power supply, potentiometer resistance range: 1kΩ~5kΩ.
	+13V-GND	Pressure Sensor Power Supply	13V±10% power supply to the outside, maximum output current: 10mA is generally used as the pressure sensor power supply.
	+24V-COM	External +24V power supply	+24V power supply, generally used as digital input and output terminal working power; 24V±10%, no-load virtual voltage does not exceed 30V, maximum output current is 200mA, internal is isolated from GND
	PLC	The PLC external power input terminal	The PLC external power input terminal is internally isolated from COM and 24V. The factory is short-circuited with +24V through the jumper. When external signals are used to drive X1 ~ X5, the PLC needs to be connected to the external power supply and disconnected from the +24V power supply terminal. The J8 jumper selection on the board is determined).

Category	Terminal Symbol	Terminal Name	Function Description
Analog input	FIV1-GND	Analog input terminal 1	1. Input range: ±10V, 12-bit resolution, calibration accuracy 0.5%; 2. Input impedance: 100kΩ.
	FIV2-GND	Analog input terminal 2	1. Input range: ±10V, 12-bit resolution, calibration accuracy 0.5%; 2. Input impedance: 100kΩ.
	FIC-GND	Analog input terminal 3	1. Input range: ±10V/0 to 20mA, 12-bit resolution, correction accuracy 0.5%, ±10V or 0~20mA input is determined by J9 jumper selection on the control panel; 2. Input impedance: 100kΩ for voltage input and 500Ω for current input.
digital input	X1-COM	digital input 1	1. Isolated drain-source input programmable terminal, input frequency <100Hz; 2. Input impedance: 3.3kΩ; 3. Voltage range when level input: 9V ~ 30V.
	X2-COM	digital input 2	
	X3-COM	digital input 3	
	X4-COM	digital input 4	
	X5-COM	digital input 5	
	PT+---PT-	Motor Overheat Protection Input	Motor temperature overheat protection PTC sensor. Support: PTC130, PTC150, etc.
communication Terminal	CANH/ CANL/ RGND	CAN communication terminal	Maximum communication speed 1Mbps
	RS+/RS-	485 communication terminal	The maximum communication speed is 230Kbps with isolation. Select whether to connect the terminating resistor by the J5 jumper on the control board.
Analog output	FOV1-GND	Analog Output 1	The voltage or current output is determined by the J10 jumper selection on the control board. Output range: 0 ~ 10V / 0 ~ 20mA, 12-bit resolution, 1% correction accuracy, maximum load resistance value ≤ 500Ω.
	FOV2-GND	Analog Output 2	The voltage or current output is determined by the J11 jumper selection on the control board. Output range: 0 ~ 10V / 0 ~ 20mA, 12-bit resolution, 1% correction accuracy, maximum load resistance value ≤ 500Ω.

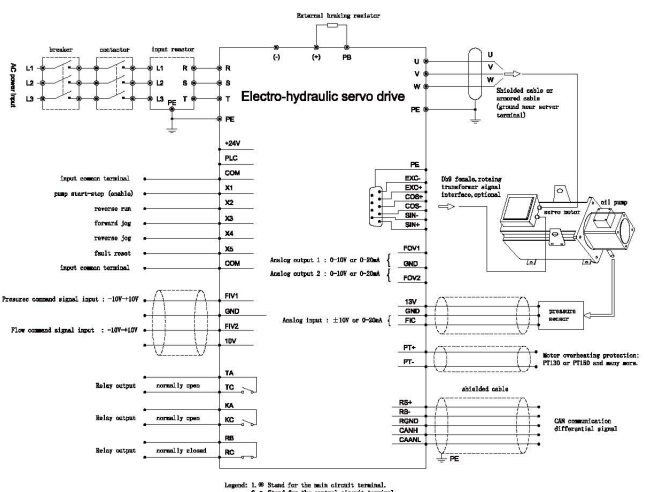
Category	Terminal Symbol	Terminal Name	Function Description
Relay Output	RB-RC	Normally Closed	Terminal Contact Drive Capability: 250Vac/3A; 30Vdc/1A
	TA-TC	normally open terminal	
	KA-KC	normally open terminal	

3.3.3 Resolver Encoder Terminal Arragement and Definition



1	REF-	Resolver excitation " -"
2	REF+	Resolver excitation "+"
3	COS+	Resolver feedback COS "+"
4	COS-	Resolver feedback COS "-"
5	SIN+	Resolver Feedback SIN "+"
6	/	/
7	/	/
8	/	/
9	SIN-	Resolver feedback SIN "-"

3.3.4



3.4 Wiring Main Circuits

3.4.1 Wiring at input side of main circuit

3.4.1.1 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>.

3.4.1.2 Contactor

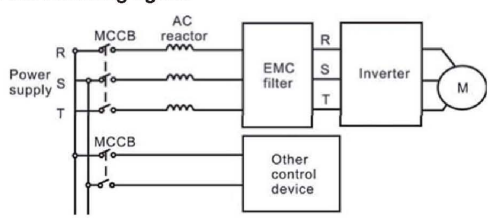
In order to cut off the input power effectively when something is wrong in the system, contactor should be installed at the input side to control the ON-OFF of the main circuit power supply.

3.4.1.3 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.

3.4.1.4 Input EMC filter

The surrounding device may be disturbed by the cables when the servo drive is working. EMC filter can minimize the interference. Just like the following figure.



Wiring at input side.

3.4.2 Wiring at servo drive side of main circuit

3.4.2.1 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 185KW and above need connect external braking unit which should be installed at (+) and (-) terminals. The cable

between servo drive and braking unit should be less than 5m. The cable between braking unit and braking resistor should be less than 10m.

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

Notice: Be sure that the electric polarity of (+) (-) terminals is right; it is not allowed to connect (+) with (-) terminals directly, Otherwise damage or fire may occur.

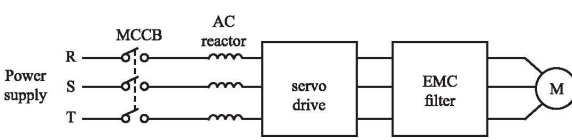
3.4.3 Wiring at motor side of main circuit

3.4.3.1 Output Reactor

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.

3.4.3.2 Output EMC filter

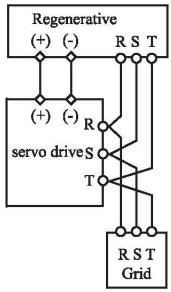
EMC filter should be installed to minimize the leakage current caused by the cable and minimize the radio noise caused by the cables between the servo drive and cable. Just see the following figure.



Wiring at motor side.

3.4.4 Wiring of regenerative unit

Regenerative unit is used for putting the electricity generated by braking of motor to the grid. Compared with traditional 3 phase inverse parallel bridge type rectifier unit, regenerative unit uses IGBT so that the total harmonic distortion (THD) is less than 4%. Regenerative unit is widely used for centrifugal and hoisting equipment.



Wiring of regenerative unit.

3.4.5 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, do not loop the ground wire.

3.5 Installation Guidline to EMC Compliance

3.5.1 General knowledge of EMC

EMC is the abbreviation of electromagnetic compatibility, which means the device or system has the ability to work normally in the electromagnetic environment and will not generate any electromagnetic interference to other equipments.

EMC includes two subjects: electromagnetic interference and electromagnetic anti-jamming.

According to the transmission mode, Electromagnetic interference can be divided into two categories: conducted interference and radiated interference. Conducted interference is the interference transmitted 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 not be changed.

3.5.2 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:

3.5.2.1 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.

3.5.2.2 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.

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

3.5.2.4 In the system, EMS and EMI of servo drive coexist. Decrease the EMI of servo drive can increase its EMS ability.

3.5.3 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.

3.5.3.1 Noise control

All 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.

3.5.3.2 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 are 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 wires can be easily disturbed by power cables 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.

3.5.3.3 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.

3.5.3.4 Leakage Current

Leakage current includes line-to-line leakage current and over-ground leakage current. Its value depends on distributed capacitances and 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.

3.5.3.5 EMC Filter

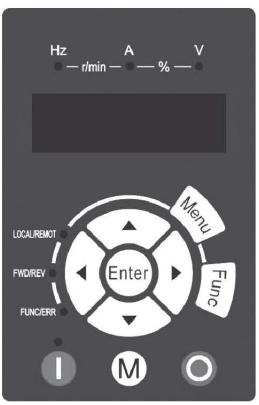
EMC filter has a great effect of electromagnetic decoupling, so it is preferred for customer to install it.

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 4 Operation

4.1 Keypad Description



4.2 Function key description

Key	Name	Description
Menu	Menu key	One - level menu to enter or exit, shortcut parameters delete
Enter	Data enter key	Progressively enter menu and confirm parameters.
▲	UP Increment Key	Progressively increase data or function codes.
▼	DOWN Decrement Key	Progressive decrease data or function codes.

Key	Name	Description
	shift key (left)	In parameter setting mode, press this button to select the bit to be modified. In other modes, cyclically displays parameters by right shift
	shift key (right)	In the stop display interface and the running display interface, the display parameters can be selected cyclically; when the parameters are modified, the modified bits of the parameters can be selected.
	Run key	Start to run the servo drive in keypad control mode.
	Stop key/Fault reset key	In running status, restricted by P7.02, can be used to stop the servo drive. W hen fault alarm, can be used to reset the servo drive without any restriction.
	Shortcut Key	You can define functions
	Analog calibration key	Direct access to PA.00 analog calibration

4.3 Indicator light description

1) Unit Indicator Light Description

Symbol	Description
Hz	Frequency unit
A	Current unit
V	Voltage unit
r/min	Speed unit
%	percentage
LOCAL/ REMOT	Command source indicator: When the light is off, it means it is in the keyboard control; when it is on, it means it is in the terminal control.

FWD/REV	Positive and negative indicator: When the light is off, it indicates that it is in the forward rotation state; when the light is on, it indicates that it is in the reverse state.
FUNC/ERR	Function/error message indication

4.4 Motor Trial Runing

4.4.1 Procedure of Motor Trial Running

Step	Setting parameters	Parameter description	Remarks
1. Set control mode	PA.17=0	non-hydraulic control mode	Set the drive to non-hydraulic control mode. PA.17=0.
2. Set command source	P0.02=0	Command source selection	The "LOCAL/REMOT" light on the panel is off.
3. auto-tuning of motor parameters	P2 group	Motor and encoder parameters	For details, see section auto-tuning of motor parameters.
4. Perform motor trial running	P0.10 = 5.00Hz	Trial running frequency	Use the operation panel to run, and monitor whether the output current is normal and the motor runs smoothly.

Be sure to fully open the relief valve to ensure no load during commissioning.

4.4.2 Setting and Auto-tuning of Motor Parameters

(1) Parameter setting

The AT10 series drive adopts closed-loop vector control to drive the servo oil pump. The vector control mode operation has strong dependence on accurate motor parameters. To make the drive have good driving performance and operating efficiency, please adapt the motor nameplate parameters in strict accordance with the driver standard.

Function Code	Description	Remarks
P2.00	Motor type selection	Reference motor nameplate
P2.01~P2.05	Motor rated power / voltage / current / frequency / speed	
P2.34	resolver pole pairs	number of resolver pole pairs

P2.20	Synchronous motor back EMF	1. Available directly from the motor manufacturer's manual 2. If the motor manufacturer cannot obtain it, it must be obtained by dynamic auto-tuning
P2.37	auto-tuning mode	Dynamic and static

(2)Motor Auto-tuning Setting

Auto-tuning Mode	Function code Setting	Description
No operation	P2.37=0	After motor auto-tuning is completed, the P2.37 parameter value will automatically return to "0".
Static auto-tuning1	P2.37=1	Used when the motor back electromotive force is known; During the auto-tuning process, the motor will run at a low speed and can be carried out without opening the relief valve;
Dynamic auto-tuning	P2.37=2or5	Used when the motor back electromotive force is unknown; During the auto-tuning process, the motor must run at high speed, and the overflow valve must be opened. The auto-tuning with load will affect the accuracy of self-learning of the motor parameters and affect the system control effect. When set to 2, the high-speed rotation direction of the motor is clockwise toward the motor shaft. When set to 5, the high-speed rotation direction of the motor is counterclockwise toward the motor shaft.
Static auto-tuning2	P2.37=3	The motor back electromotive force is known and used under heavy load conditions; During the auto-tuning process, the motor will run at a low speed and can be carried out without opening the relief valve; Remarks: If you check the correct connection between the resolver encoder and the motor, static auto-tuning 1 or the drive alarm "PG" during dynamic auto-tuning, please use this mode to learn.

Dynamic auto-tuning	P2.37=4or6	Learning the motor back electromotive force, encoder angle and other parameters in a short time, the learning accuracy is slightly poor, only used to verify whether the motor is used for degaussing; During the auto-tuning process, the motor must run at high speed and the relief valve must be opened. When set to 4, the motor's high-speed rotation direction is clockwise toward the motor shaft. When set to 6, the motor's high-speed rotation direction is counterclockwise toward the motor shaft.

4.4.3 Trial Running check

(1) After auto-tuning is completed, set P0.10=5.00Hz low-speed test run to observe whether the drive running current is small and stable.

(2) If the running current is large, please check whether the motor parameters (P2 group) and rotary encoder pole pairs (P2.34) are set correctly. If there is any change, it is normal to re-learn and run at low speed.

(3) After the auto-tuning operation is normal, check whether the drive is running in the correct direction. If it is not correct, please wire any two phases of the UVW of the motor and perform the auto-tuning of the motor parameters again.

(4) If the motor runs during oscillation or emits a low sound, please weaken the speed loop and current loop appropriately. If the values of P3.00, P3.03, P3.13, P3.14, P3.15, and P3.16 are reduced, the values of P3.01 and P3.04 are increased.

(5) If the motor speed is not stable during operation, please increase the speed loop and current loop appropriately. For example, increase the values of P3.00, P3.03, P3.13, P3.14, P3.15, and P3.16, and decrease the values of P3.01 and P3.04.

Remarks:

◆ Be sure to fully open the relief valve to ensure no load during commissioning.

◆ For the speed loop and current loop parameters, see the P3 group function code;

◆ The speed loop and current loop response will directly affect the pressure stability. If conditions permit, please set a strong speed loop and current loop response.

4.5 Application Commisioning of Servo Pump

4.5.1 FI zero drift correction

Auto Correction:

Correction step	Function code Setting	Description	Remarks
1. Set the command source mode	P0.02=0	Operation panel control mode	The "LOCAL/REMOT" light on the panel is off.
2.FI zero drift automatic correction	PA.00=1	FI zero drift automatic correction	Keyboard display "-FI-", press RUN button, FI zero drift will automatically complete the correction;

Manual correction: When the drive is not enabled, check the values of the three analog channels D1.04, D1.05, and D1.06, and add the maximum value of the view to the margin of 10mV and write them to P5.13. , P5.18, P5.23 function code;

4.5.2 Oil pressure mode selection and parameter setting

Auto-tuning Mode	Function code Setting	Description
Non-oil pressure control model	PA.17=0	speed mode
oil pressure control mode	PA.17=2	PA.17=2 FIV1 analog channel provides oil pressure command, FIV2 analog channel provides flow command, FIC analog channel provides oil pressure feedback command, drive performs oil pressure control

When switching from Non-oil pressure mode (PA.17=0) to hydraulic mode (PA.17≠0), the relevant parameters will be automatically set, as shown in the table below.

When the following parameters are modified in the oil pressure control mode, the power-down memory will be restored (the automatic setting value will be restored when the drive is powered back on). If the oil pressure control mode is switched to the non-oil pump control mode, the following parameters will automatically return to the oil pressure control mode. The previous value.

Function code	Description	Function code setting
P0.01	Control mode	1 (vector control mode)
P0.02	command source	1 (terminal command source)

P0.04	frequency source	If PA.17=2, then P0.04=3 (FIC is the frequency source); If PA.17=1 or 3, then P0.04=9 (communication is given as frequency source)
P0.08	acceleration time	0.0s
P0.09	Deceleration time	0.0s
P2.00	Motor type selection	2 (synchronous motor)
P5.00	X1 terminal function selection	1 (run enable)
P5.01	X2 terminal function selection	48 (servo oil pump PID selection terminal 1)
P5.02	X3 terminal function selection	53 (select terminal 1 from pump address)
P5.03	X4 terminal function selection	9 (fault reset)
P5.04	X5 terminal function selection	5 (CAN communication enable)
P6.01	Relay output selection RB RC(normally closed)	2 (fault output)
P6.02	relay output selection TA TC (normally open)	23 (double displacement switching)
P6.03	relay output selection KA KC (normally open)	24 (pressure control status output)

4.5.3 Oil pump function parameter setting

System oil pressure and flow corresponding settings

(1) 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

(2)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);

(3) 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);

(4) 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);

(5) 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.

(6) 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/cm^2~50.0kg/cm^2

(7) 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 rise s 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 curve s curve rise time (terminal 48=1, 49=0 valid)	0~2.000s	0.030S
PB.23	Injection action curve s 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

(8) Flow rate FIV2 filter time setting

Function code	Description	Setting range	Factory value
P5.22	FIV2 sampling filter time	0~10.000s	0.020
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

(9) Oil pressure PID mode: terminal 48, 49 selection

The driver provides 4 sets of PIDs, which are selected according to the combination of the input terminals 48 and 49 functions, corresponding to the following:

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

The larger the proportional gain and the smaller the integration time, the larger the differentiation time, the faster the response, the faster the response is too fast, causing overshoot, causing the system to oscillate and unstable; otherwise, the smaller the proportional gain, the larger the integration time, and the smaller the differential time. The slower the response, the slower the response, the lower the efficiency and the instability of the product.

(10) Hydraulic pressure PID proportional gain (parameter numbers: PA.03, PA.06, PA.09, PA0.12)

The larger the proportional gain, the faster the pressure response, but too large will cause the system to oscillate, otherwise the pressure response will be slower.

(11) Hydraulic PID integration time (parameter numbers: PA.04, PA.07, PA.10, PA0.13)

The smaller the integration time, the faster the pressure response, but it is easy to cause overshoot. Too strong will cause the system to oscillate; otherwise, the slower the pressure response, too weak will lead to pressure instability.

(12) Oil pressure overshoot suppression (parameter number: PB.06/ PB.28, PB.07/PB.29)

Suitable for starting overshoot suppression at higher speeds:

Overshoot suppression detection level (PB.06/PB.28): The larger the value, the later the pressure suppression overshoot is effective, the overshoot suppression effect is worse, the overshoot will become larger, and the inhibition is faster, the inhibition effect Ok, the overshoot is smaller;

Overshoot suppression coefficient (PB.07/PB.29): The larger the value, the better the pressure overshoot suppression effect. If the pressure curve is too large, the pressure curve will be unbalanced and will be discounted. On the contrary, the worse the suppression effect, the larger the overshoot.

(13) Oil pressure PID response gain (parameter number: PB.08)

Due to the adjustment of the response of the entire oil pressure ring control, the greater the oil pressure loop gain, the stronger the response of the entire oil pressure ring, but too strong will cause the system to oscillate; otherwise, the smaller the oil pressure ring gain,

the slower the response of the entire oil pressure ring.
When the hydraulic system inertia is relatively large, or the oil pressure is relatively slender, it is generally necessary to reduce the gain.
(14) Pressure holding stability debugging
If the pressure during the commissioning process is large, please increase the low speed speed loop response to improve the pressure stability, that is, increase the P3.00 parameter value and decrease the P3.01 parameter value. Pay attention to the adjustment range. Otherwise, the motor control will be oscillation.

Chapter 5
List of Function Parameters

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.

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 AC drive is in either stop or running state.

" ★ ": The parameter cannot be modified when the AC drive is in the running state.

" ● ": The parameter is the actually measured value and cannot be modified.

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

Standard Function Parameters

Function Code	Parameter Name	Setting Range	Default	Property
Group P0: Standard Function Parameters				
P0.00	type display	1: Constant torque load	1	★
P0.01	Control mode selection	1:Closed-loop vector control 2: V/F Control	1	★
P0.02	Command source selection	0: Operation panel control (LED off) 1: Terminal control (LED on) 2: Communication control (LED linking)	0	☆

Function Code	Parameter Name	Setting Range	Default	Property
P0.04	Main frequency source X selection	0: Digital setting (P0.10 preset frequency, can modify the UP/DOWN, power lost don't memory) 1: Digital setting (P0.10 preset frequency, can modify the UP/DOWN, power lost memory) 2: FIV 1 3: FIV 2 4: FIC 6: Multistage instruction 9: Communication setting	0	★
P0.08	Acceleration time 1	0.00s~6500.0s	20.0s	☆
P0.09	Deceleration time 1	0.00s~6500.0s	20.0s	☆
P0.10	Frequency preset	0.00Hz~maximum frequency	50.00Hz	☆
P0.11	Rotation direction	0: Same direction 1: Reverse direction	0	☆
P0.12	Maximum frequency	0.00Hz~599.00Hz	200.00Hz	★
P0.13	Upper limit frequency source	0: P0.14 1: FIV 1 2: FIV 2 3: FIC 4: PULSE settings 5: communication settings	0	★
P0.14	Upper limit frequency	Frequency lower limit P0.16~Maximum frequency P0.12	200.00Hz	☆
P0.15	Upper limit frequency offset	0.00Hz~Maximum frequency P0.12	0.00Hz	☆
P0.16	Frequency lower limit	0.00Hz~Upper limit frequency P0.14	0.00Hz	☆
P0.17	Carrier frequency	1.0kHz~12.0kHz	Model dependent	☆
Group P2: Motor Parameters				
P2.00	Motor type selection	2: Permanent magnetic synchronous motor	2	★
P2.01	Rated motor power	0.1kW~450kW	Model dependent	★
P2.02	Rated motor voltage	1V~600V	Model dependent	★

Function Code	Parameter Name	Setting Range	Default	Property
P2.03	Rated motor current	0.01A~655.35A (AC drive power<=55kW) 0.1A~6553.5A (AC drive power>55kW)	Model dependent	★
P2.04	Rated motor frequency	0.01Hz~maximum frequency	Model dependent	★
P2.05	Rated motor rotational speed	1rpm~20000rpm	Model dependent	★
P2.06	motor model selection	0~65535	Model dependent	★
P2.16	stator resistance (synchronous motor)	0.001Ω~65.535Ω (AC drive power<=55kW) 0.0001Ω~6.5535Ω (AC drive power>55kW)	Model dependent	★
P2.17	Shaft D inductance (synchronous motor)	0.01mH~655.35mH (AC drive power<=55kW) 0.001mH~65.535mH (AC drive power>55kW)	Model dependent	★
P2.18	Shaft Q inductance (synchronous motor)	0.01mH~655.35mH (AC drive power<=55kW) 0.001mH~65.535mH (AC drive power>55kW)	Model dependent	★
P2.20	Back EMF (synchronous motor)	0.1V~6553.5V	Model dependent	★
P2.27	Encoder pulses per revolution	1~65535	1024	★
P2.28	Encoder type	0: ABZ incremental encoder 1: UVW incremental encoder 2: Resolver	2	★
P2.30	Speed feedback inversion	0: Consistent 1: Opposite	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 wire-break fault detection time	0.0: No action 0.01~60.000	2s	★

Function Code	Parameter Name	Setting Range	Default	Property
P2.37	Auto-tuning selection	0: no operation 1: no-load static auto-tuning 2: No-load dynamic auto-tuning, high-speed rotation in the opposite direction 3: Loaded static auto-tuning 4: No-load fast dynamic auto-tuning, high-speed rotation in the opposite direction 5: No-load dynamic auto-tuning, high-speed rotation in the positive direction 6: No-load fast dynamic auto-tuning, high-speed rotation in the positive direction	0	★
Group P3: Vector Control Parameters				
P3.00	Speed loop proportional gain 1	1~400	60	☆
P3.01	Speed loop integral time 1	0.01s~10.00s	030	☆
P3.02	Switchover frequency 1	0.00~P3.05	5.00Hz	☆
P3.03	Speed loop proportional gain 2	1~400	60	☆
P3.04	Speed loop integral time 2	0.01s~10.00s	0.30	☆
P3.05	Switchover frequency 2	P3.02~maximum output frequency	10.00Hz	☆
P3.06	Vector control slip gain	50%~200%	100%	☆
P3.07	Time constant of speed loop filter	0.5ms~10.0ms	1.0ms	☆
P3.08	Torque Control	0: Invalid 1: valid	0	☆
P3.09	Torque upper limit source in speed control mode	0: P3.10 1: FIV 1 2: FIV 2 3: FIC 5: Communication setting	0	☆
P3.10	digital setting of torque upper limit in speed control mode	0.0%~250.0%	200.0%	☆

Function Code	Parameter Name	Setting Range	Default	Property
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 1: automatic adjustment 2: automatic adjustment + calculation	0	★
P3.19	Synchronous machine weak field depth	0~50%	5%	★
P3.20	Weak magnetic current coefficient	0~500	5	★
P3.21	Synchronous machine maximum output adjustment gain	20%~300%	100%	★
P3.22	Synchronous machine calculates excitation current adjustment gain	40%~200%	120%	★
P3.23	Overvoltage modulation factor	100%~120%	110%	☆
P3.24	Bus voltage filtering	0.000~0.100	0.000	☆
P3.25	Back EMF compensation enable	0: Invalid 1: enable	0	★

Function Code	Parameter Name	Setting Range	Default	Property
Group P5: Input Terminals				
P5.00	X1 function selection	0: No function 1: Forward RUN (FWD) 2: Reverse RUN (REV) 3: Three-line control 4: Forward JOG (FJOG) 5: Reverse JOG (RJOG) 8: Coast to stop 9: Fault reset (RESET) 10: RUN pause 11: Normally open (NO) input of external fault	1	★
P5.01	X2 function selection		0	★
P5.02	X3 function selection		0	★
P5.03	X4 function selection		9	★
P5.04	X5 function selection	33: Normally closed (NC) input of external fault 48: PID switching selection terminal 1 49: PID switching selection terminal 2 50: CAN communication enable 51: Slave as host enable 52: Pressure switched to speed mode terminal 53: Select terminal 1 from the pump address 54: Select terminal 2 from the pump address 55: Transfer pressure terminal 56: Fault reset terminal 2	0	★
P5.10	X filter time	0~10	4	☆
P5.11	Terminal command mode	0: Two-line mode 1 1: Two-line mode 2 2: Three-line mode 1 3: Three-line mode 2	0	★
P5.13	FIV1 curve minimum input	0.00V~P5.15	0.02V	☆
P5.14	Corresponding setting of FIV1 curve minimum input	-100.0%~+100.0%	0.0%	☆
P5.15	FIV1 curve maximum input	P5.13~+10.00V	10.00V	☆
P5.16	Corresponding setting of FIV1 curve maximum input	-100.0%~+100.0%	100.0%	☆

Function Code	Parameter Name	Setting Range	Default	Property
P5.17	FIV1 curve filter time	0.00s~10.00s	0.01s	☆
P5.18	FIV2 curve minimum input	0.00V~P5.20	0.02V	☆
P5.19	Corresponding setting of FIV2 curve minimum input	-100.0%~+100.0%	0.0%	☆
P5.20	FIV2 curve maximum input	P5.18~+10.00V	10.00V	☆
P5.21	Corresponding setting of FIV2 curve maximum input	-100.0%~+100.0%	100.0%	☆
P5.22	FIV2 curve filter time	0.00s~10.00s	0.005s	☆
P5.23	FIC curve minimum input	-10.00V~P5.25	0.02V	☆
P5.24	Corresponding setting of FIC curve minimum input	-100.0%~+100.0%	0.0%	☆
P5.25	FIC curve maximum input	P5.23~+10.00V	10.00V	☆
P5.26	Corresponding setting of FIC curve maximum input	-100.0%~+100.0%	100.0%	☆
P5.27	FIC curve filter time	0.00s~10.00s	0.10s	☆
Group P6: Output Terminals				
P6.01	Replay output function (RB/RC)	0: No output 1: AC drive running 2: Fault output (stop) 6: Motor overload pre-warning 7: AC drive overload pre-warning 12: Accumulative running time reached 15: Ready for RUN 20: Communication setting	2	☆
P6.02	Relay output function (TA/TC)		1	☆
P6.03	Relay output function (KA/KC)		0	☆

Function Code	Parameter Name	Setting Range	Default	Property
P6.04	reserved	23:Piston pump Switch 1 24: Pressure control status output 25: Slave alarm output 26: Piston pump Switch 2 27: Bus voltage establishment 28: Timed running time arrives 29: Scheduled running time is less than 24 hours 30: Maximum reverse speed output		
P6.05	reserved			
P6.07	FOV1 function selection	0: Running frequency 1: Set frequency 2: Output current 3: Output torque 4: Output power 5: Output voltage 7: FIV 1 8: FIV 2 9: FIC 10: Feedback speed (oil pressure mode) 11: Feedback pressure (oil pressure mode)	0	☆
P6.08	FOV2 function selection		1	☆
P6.10	FOV1 offset coeffcient	-100.0%~+100.0%	0.0%	☆
P6.11	FOV1 gain	-10.00~+10.00	1.00	☆
P6.12	FOV2 offset coeffcient	-100.0%~+100.0%	0.0%	☆
P6.13	FOV2 gain	-10.00~+10.00	1.00	☆
Group P7: Keyboard and Accessibility				

Function Code	Parameter Name	Setting Range	Default	Property
P7.02	STOP/RESET key function	0: Only valid during keyboard control 1: STOP key stop function is valid when terminal is controlled 2: STOP key fault reset function is valid during terminal control 3: When the terminal is controlled, the STOP key stop function and the fault reset function are valid	2	☆
P7.06	Load speed display coefficient	0.0001~6.5000	1.0000	☆
P7.07	servo drive Module Heatsink Temperature	0.0°C~120.0°C	-	●
P7.09	Cumulative running time	0h~65535h	-	●
P7.11	Software version	-	-	●
P7.12	Set the running arrival time	0~65535h	0	☆
P7.13	Set the running time to arrive Action selection	0: continue to run 1: Stop and report "END2"	0	☆
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	☆
P9.02	Motor temperature protection enable	0: Disabled 1: enabled	1	☆
P9.03	Speed deviation setting of flying speed	0.50Hz ~ 50.00Hz	10.00Hz	☆
P9.04	Speed determination time of flying speed	0.1s ~ 20.0S	10.0S	☆

Function Code	Parameter Name	Setting Range	Default	Property
P9.05	Startup protection selection	0: Startup is not protected 1: Start protection	0	☆
P9.06	Software undervoltage point	120.0V ~ 400.0V	350.0V	☆
P9.07	Short-circuit to groung uopn power-on	0: Disabled 1: enabled	1	☆
P9.08	Brake voltage	650.0V ~ 820.0V	780.0V	☆
P9.09	Brake unit is allowed to open time	0.1s ~ 3600.0s	5.0s	☆
P9.12	Input phase loss protection selection	0: Disabled 1: Enabled	11	☆
P9.13	Output phase loss protection selection	0: Disabled 1: Enabled	1	☆

Function Code	Parameter Name	Setting Range	Default	Property
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 8: Buffer resistance overload 9: Undervoltage 10: AC drive overload 12:Power input phase loss 13: Power output phase loss 14: Module overheat 15: External equipment fault		●
P9.15	2nd fault type	16: Communication fault 17: Contactor fault 18: Current detection fault 19: Motor auto-tuning fault 20: Encoder/PG card fault 21: EEPROM read-write fault 23: Short circuit to ground 24: Reserved 25: Reserved 26: Accumulative running time reached 27: Business running time arrives 40: Wave-by-wave current limiting fault 42: CAN communication fault 43: Rotational tuning fault 44: Speed deviation protection fault 45: Motor temperature is too high 46: Oil pump sensor fault 47: Slave failure warning 48: CAN address conflict 49: Rotating PG disconnection fault	-	●

Function Code	Parameter Name	Setting Range	Default	Property
P9.16	3rd (latest) fault type	52: Multi-pump converging multi-master fault 58: User parameter recovery fault 59: Back EMF abnormal fault 61: Brake pipe braking time is too long to protect 63: Reverse running time arrives	-	●
P9.17	Frequency upon 3rd fault	-	-	●
P9.18	Current upon 3rd fault	-	-	●
P9.19	Bus voltage upon 3rd fault	-	-	●
P9.20	Input terminal status upon 3rd fault	-	-	●
P9.21	Output terminal status upon 3rd fault	-	-	●
Group PA: Process Control PID Function				
PA.00	PID feedback zero drift automatic correction	0: disabled; 1: enabled	0	☆
PA.02	Oil pressure PID algorithm selection	0~2	0	☆
PA.03	Oil pressure control gain 1	0.0-800.0	210	☆
PA.04	Oil pressure control integral 1	0.001s-10.00s	0.100s	☆
PA.05	Oil pressure control differential 1	0.000s-1.000s	0.000s	☆
PA.06	Oil pressure control gain 2	0.0-800.0	210	☆
PA.07	Oil pressure control integral 2	0.001s-10.00s	0.100s	☆
PA.08	Oil pressure control differential 2	0.000s-1.000s	0.000s	☆

Function Code	Parameter Name	Setting Range	Default	Property
PA.09	Oil pressure control gain 3	0.0-800.0	210	☆
PA.10	Oil pressure control integral 3	0.001s-10.00s	0.100s	☆
PA.11	Oil pressure control differential 3	0.000s-1.000s	0.000s	☆
PA.12	Oil pressure control gain 4	0.0-800.0	210	☆
PA.13	Oil pressure control integral 4	0.001s-10.00s	0.100s	☆
PA.14	Oil pressure control differential 4	0.000s-1.000s	0.000s	☆
PA.15	integral limit deviation maximum Value	0.0kg/cm2 ~ PA.20	25.0kg/ Cm2	☆
PA.16	integral limit mode selection	0~1	0	☆
PA.17	Oil pressure control mode	0: Non-oil pressure control mode 1: CAN reference oil pressure control 1 2: Analog channel given oil pressure control 3: CAN oil pressure setting mode 2 4: Reserved	0	☆
PA.18	Full load oil pressure corresponding speed	The speed corresponding to the lower frequency limit--30000rpm	2000rpm	★
PA.19	Pressure relief speed	0.0% ~ 100.0%	10.00%	☆
PA.20	Oil pressure setting value	0.0kg/cm2 ~ Maximum oil pressure (PA.21)	175Kg/ cm2	☆
PA.21	Maximum oil pressure range Oil pressure setting value	(PA.20) ~ 500.0kg/cm2	250Kg/ cm2	☆
PA.22	Minimum flow without command	0.0% ~ 50.0%	0.50%	☆

Function Code	Parameter Name	Setting Range	Default	Property
PA.23	Minimum pressure without command	0.0 kg/cm2 ~ 50.0 kg/cm2	0.5kg/ Cm2	☆
PA.24	Oil pressure command acceleration time	0.000s ~ 2.000s	0.020s	☆
PA.25	given oil pressure rise S filter Wave time	0.001s ~ 10.000s	0.040s	☆
PA.26	given oil pressure drop S filter Wave time	0.001s ~ 1.000s	0.020s	☆
PA.27	Reverse pressure relief minimum pressure	0.0kg/cm2 ~ PA.20	0	☆
PA.28	Reverse pressure relief operation protection time	0.001s ~ 5.000s	0.000s	☆
Group PB: Oil pump control auxiliary parameters				
PB.00	pressure sensor troubleshooting Lower limit of current measurement	0%~300%(P2.03)	100%	☆
PB.01	pressure sensor troubleshooting Measuring speed upper limit	0%~100%(PA.18)	50%	☆
PB.02	Oil pressure sensor fault detection Measuring time	0.000s: invalid detection		
		0.001s to 60.000s	0.500s	☆
PB.03	Pressure control status output maximum speed setting	0.0% ~ 100.0%	10.00%	☆
PB.04	Pressure Control Status Output Minimum oil pressure setting	0.0% to 100.0%	60.00%	☆

Function Code	Parameter Name	Setting Range	Default	Property
PB.05	Pressure Control Status Output Delay time	0.000s ~ 10.000s	0.100s	☆
PB.06	Overshoot suppression detection level	0 ~ 2000	200	☆
PB.07	Overshoot suppression coefficient	0 ~ 3.000	0.2	☆
PB.08	Oil pressure loop gain coefficient	0.20~5.00	1	☆
PB.09	Oil pressure suppression cancels oil pressure deviation	0.0kg/cm2 ~ PA.20	10.0kg/ cm2	☆
PB.10	Pressure ring output upper limit increase width	0-50.0	2	☆
PB.11	Pressure mode switching speed mode torque upper limit	50.0%-250.0%	160.00%	☆
PB.12	Injection valve opening delay time	0.000s-0.500s	0.100s	☆
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	Start valve pressure relief Lower limit of deviation	0.0-PA.20	0.0kg	☆
PB.16	Start valve pressure relief lower limit of setting	0.0-PA.20	0.0kg	☆
PB.17	Speed filter time	0.0-5.000s	0.005s	☆
PB.18	Current filtering time	0.0-5.000s	0.010s	☆

Function Code	Parameter Name	Setting Range	Default	Property
PB.19	Flow rise filtering time	0-1.000s	0.100s	☆
PB.20	Flow reduction filter time	0-1.000s	0.100s	☆
PB.21	Flow leakage compensation value	0.0%-50.0%	0.00%	☆
PB.22	Injection action curve S song line rise time	0.001-1.000s	0.030s	☆
PB.23	Injection action curve S song line fall time	0.001-1.000s	0.030s	☆
PB.24	Injection movement flow rate rises slope	0.001-5.000s	0.100s	☆
PB.25	Injection action flow rate drop slope	0.001-5.000s	0.100s	☆
PB.26	Injection given oil pressure rise time	0.000-2.000s	0.020s	☆
PB.27	Injection given oil pressure drop time	0.000-2.000s	0.020s	☆
PB.28	Injection overshoot inhibition test level	0-2000	200	☆
PB.29	Injection overshoot inhibition coefficient	0.000-3.000s	0.050s	☆
Group PC: multi-pump oil pressure control parameters				
PC.01	Multi-pump master judges whether to send slave speed enable	0: disabled; 1: enabled	0	☆
PC.02	multi-pump confluence pressure control gain	20-80	100	☆

Function Code	Parameter Name	Setting Range	Default	Property
PC.03	multi-pump injection PI adjustment debounce pressure deviation	0.0-50.0kg	5.0kg	☆
PC.04	multi-pump injection PI adjustment debounce flow lower limit	0-30000rpm	0rpm	☆
PC.05	multi-pump injection PI adjustment debounce flow detection time	0.200-2.00s	0.400s	☆
PC.06	Multi-pump CAN communication mode The pressure deviation from the pump does not work	0-50kg	5.0kg	☆
PC.07	Multi-pump CAN communication mode The lower flow limit from the pump does not work	-100.0%~100.0%	0	☆
PC.08	Judgment time from pump no speed command stop	0.10-5.000s	1.000s	☆
PC.09	Deceleration time from pump no speed command stop	0.001-5.000s	0.200s	☆
PC.10	Slave minimum input	-100.0% ~ PC.12 0.0%	0.00%	☆
PC.11	Slave minimum input corresponding	-100.0%~100.0%	0.00%	☆
PC.12	Slave intermediate point input	PC.12-PC.14	0.00%	☆

Function Code	Parameter Name	Setting Range	Default	Property
PC.13	Slave intermediate point input corresponding	-100.0%~100.0%	0.00%	☆
PC.14	Slave maximum input	PC.12--100%	100.00%	☆
PC.15	Slave maximum input corresponding	-100.0%~100.0%	100.00%	☆
Group PD: Communication Parameters				
PD.00	Baud rate	Unit's digit: MODBUS 0: 300BPS 1: 600BPS 2: 1200BPS 3: 2400BPS 4: 4800BPS 5: 9600BPS 6: 19200BPS 7: 38400BPS 8: 57600BPS 9: 115200BPS Ten's digit : reserved Hundred's digit: reserved Thousand's digit: reserved	0005	☆
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	485 communication address	1~200, 0: Broadcast address	1	☆
PD.03	Response delay	0ms~20ms	2	☆
PD.04	Communication timeout	0.0 (invalid) , 0.1s~60.0s	0.0	☆
PD.05	Modbus protocol selection	0: Standard Modbus protocol Ten's digit: reserved	0	☆
PD.06	CAN baud rate selection	0:20K 1:50k 2:125k 3:250k 4:500k 5:1M	5	☆

Function Code	Parameter Name	Setting Range	Default	Property
PD.07	CAN 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 3	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 factory parameters, excluding motor parameters 02: Clear fault information	0	☆
PP.02	User Store Operation Password Setting	0-65535	0	☆
PP.03	User storage mode	0: No operation 1: Store user parameters	0	☆

Group D0: Basic parameters monitoring		
Function Code	Parameter Name	Unit
D0.00	Operating frequency(Hz)	0.01HZ
D0.01	Setting 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 (%)	0.10%
D0.07	X input status	-
D0.08	Y output status	-
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	FOV1 output voltage	0.000V ~ 10.000V
D0.35	FOV2 output voltage	0.000V ~ 10.000V
D1 Oil pump parameters monitoring		
D1.00	motor angle	0.0°~ 359.9°
D1.01	Oil pressure setting value	0.0kg ~ system oil pressure
D1.02	Oil pressure feedback value	0.0kg ~ system oil pressure
D1.03	motor running 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	FIV1 simulation zero drift	-10.00V ~ 10.000V
D1.08	FIV2 simulation zero drift	-10.00V ~ 10.000V
D1.09	FIC simulation zero drift	-10.00V ~ 10.000V
D1.10	Corresponding frequency of given flow	0.00Hz ~ maximum frequency
D1.11	Degree of disturbance of the resolver signal (the bigger the more serious)	0-1000
D1.12	Communication oil pressure command	0.0kg ~ system oil pressure
D1.13	CAN communication interference status	0-128
D1.14	CAN Sending Number	0~65535
D1.15	CAN receiving number	0~65535
D1.16	CAN buffer usage	0~1.00%

Chapter 6 Troubleshooting

6.1 Fault alarm and countermeasures

The drive has a number of warning messages and protection functions. Once the fault occurs, the protection function operates, the drive stops outputting, the drive fault relay contacts act, and the fault code is displayed on the drive display panel. Before seeking service, users can perform self-checking according to the tips in this section, analyze the cause of the fault, and find a solution. If it is the reason listed in the dotted box, please seek service, contact the agent of the drive you purchased or contact us directly.

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

Fault Name	Display	Possible Causes	Solutions
servo drive unit protection	OC	1: The output circuit is grounded or short circuited. 2: The connecting cable of the motor is too long. 3: The module overheats. 4: The internal connections become loose. 5:The main control board is faulty. 6: The drive board is faulty. 7: The servo drive module is faulty	1: Eliminate external faults. 2: Install a reactor or an output filter. 3: Check the air filter and the cooling fan. 4: Connect all cables Properly. 5, 6, 7: Looking for technical support

Fault Name	Display	Possible Causes	Solutions
Overcurrent during acceleration	OC1	1: The output circuit is grounded or short circuited. 2: Motor auto-tuning is not Performed. 3: The acceleration time is too Short. 4: Manual torque boost or V/F curve is not appropriate. 5: The voltage is too low. 6: The startup operation is performed on the rotating motor. 7: A sudden load is added during Acceleration. 8: The AC drive model is of too small power class.	1: Eliminate external faults. 2: Perform the motor auto-tuning. 3: Increase the acceleration time. 4: Adjust the manual torque boost or V/F curve. 5: Adjust the voltage to normal range. 6: Select rotational speed tracking restart or start the motor after it stops. 7: Remove the added load. 8: Select an AC drive of higher power class.
Overcurrent during acceleration	OC2	1: The output circuit is grounded or short circuited. 2: Motor auto-tuning is not performed. 3: The deceleration time is too Short. 4: The voltage is too low. 5: A sudden load is added during Deceleration. 6: The braking unit and braking resistor are not installed.	1: Eliminate external faults. 2: Perform the motor auto- tuning. 3: Increase the deceleration time. 4: Adjust the voltage to normal range. 5: Remove the added load. 6: Install the braking unit and braking resistor.
Overcurrent at constant speed	OC3	1: The output circuit is grounded or short circuited. 2: Motor auto-tuning is not performed. 3: The voltage is too low. 4: A sudden load is added during operation. 5: The AC drive model is of too small power class.	1: Eliminate external faults. 2: Perform the motor auto- tuning. 3: Adjust the voltage to normal range. 4: Remove the added load. 5: Select an AC drive of higher power class.

Fault Name	Display	Possible Causes	Solutions
Overvoltage during acceleration	OU1	1: The input voltage is too high. 2: An external force drives the motor during acceleration. 3: The acceleration time is too Short. 4: The braking unit and braking resistor are not installed.	1: Adjust the voltage to normal range. 2: Cancel the external force or install a braking resistor. 3: Increase the acceleration time. 4: Install the braking unit and braking resistor.
Overvoltage during deceleration	OU2	1: The input voltage is too high. 2: An external force drives the motor during deceleration. 3: The deceleration time is too Short. 4: The braking unit and braking resistor are not installed.	1: Adjust the voltage to normal range. 2: Cancel the external force or install the braking resistor. 4: Install the braking unit and braking resistor.
Overvoltage at constant speed	OU3	1: The input voltage is too high. 2: An external force drives the motor during deceleration.	1: Adjust the voltage to normal range. 2: Cancel the external force or install the braking resistor.
Control power supply fault	POF	1: The input voltage is too high. 2: An external force drives the motor during deceleration.	1: Adjust the voltage to normal range. 2: Cancel the external force or install the braking resistor.
Undervoltage	LU	1: Instantaneous power failure occurs on the input power supply. 2: The AC drive's input voltage is not within the allowable range. 3: The bus voltage is abnormal. 4: The rectifier bridge and buffer resistor are faulty. 5: The drive board is faulty. 6: The main control board is faulty.	1: Reset the fault. 2: Adjust the voltage to normal range. 3, 4, 5, 6: Looking for technical support

Fault Name	Display	Possible Causes	Solutions
AC drive overload	OL2	1: The load is too heavy or locked-rotor occurs on the motor. 2: The AC drive model is of too small power class.	1: Reduce the load and check the motor and mechanical condition. 2: Select an AC drive of higher power class
Motor overload	OL1	1: P9.01 is set improperly. 2: The load is too heavy or locked- rotor occurs on the motor. 3: The AC drive model is of too small power class.	1: Set P9.01 correctly. 2: Reduce the load and check the motor and the mechanical condition. 3: Select an AC drive of higher power class.
Power input phase loss	LI	1: The three-phase power input is abnormal. 2: The drive board is faulty. 3: The lightening board is faulty. 4: The main control board is faulty.	1: Eliminate external faults. 2, 3, 4: Looking for technical support
Power output phase loss	Lo	1: The cable connecting the AC drive and the motor is faulty. 2: The AC drive's three-phase outputs are unbalanced when the motor is running. 3: The drive board is faulty. 4: The module is faulty.	1: Eliminate external faults. 2: Check whether the motor three-phase winding is normal. 3:Looking for technical support .
Module overheat	OH	1: The ambient temperature is too temperature. 2: The air filter is blocked. 3: The fan is damaged. 4: The thermally sensitive resistor of the module is damaged. 5: The servo drive module is damaged.	1: Lower the ambient High. 2: Clean the air filter. 3: Replace the damaged fan 4: Replace the damaged thermally sensitive resistor. 5: Replace the servo drive module.
External equipment fault	EF	1: External fault signal is input via X. 2: External fault signal is input via virtual I/O.	Reset the operation.

Fault Name	Display	Possible Causes	Solutions
Communication fault	CE	1: The host computer is in abnormal state. 2: The communication cable is faulty. 3: P028 is set improperly. 4: The communication parameters in group PD are set improperly.	1: Check the cabling of host computer. 2: Check the communication cabling. 3: Set P028 correctly. 4:Set the communication parameters properly.
Contactor fault	rAy	1: The drive board and power supply are faulty. 2: The contactor is faulty.	1: Replace the faulty drive board or power supply board. 2: Replace the faulty Contactor.
Current detection fault	IE	1: The HALL device is faulty. 2: The drive board is faulty.	1: Replace the faulty HALL device. 2: Replace the faulty drive board.
Motor auto-tuning fault	TE	1: The motor parameters are not set according to the nameplate. 2: The motor auto-tuning times out.	1: Set the motor parameters according to the nameplate properly. 2: Check the cable connecting the AC drive and the motor.
Encoder fault	PG	1: The encoder type is incorrect. 2: The cable connection of the encoder is incorrect. 3: The encoder is damaged. 4: The PG card is faulty.	1: Set the encoder type correctly based on the actual situation. 2:Eliminate external faults. 3: Replace the damaged Encoder. 4: Replace the faulty PG card.
EEPROM read-write fault	EEP	The EEPROM chip is damaged.	Replace the main control board.
AC drive hardware fault	OUOC	1: Overvoltage exists. 2: Overcurrent exists.	1: Handle based on Overvoltage. 2: Handle based on overcurrent.
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 reaches the setting value.	Clear the record through The parameter initialization function.

Fault Name	Display	Possible Causes	Solutions
Accumulative power-on time reached	END2	The accumulative power-on timereaches the setting value.	Clear the record through The parameter initialization function.
Load becoming 0	LOAD	The AC drive running current is lower than P9.64.	Check that the load is disconnected or the setting of P9.64 and P9.65 is correct.
PID feedback lost during running	PIDE	The PID feedback is lower than the setting of PA.26.	Check the PID feedback signal or set PA.26 to a proper value.
Pulse-by-pulse current limit fault	CBC	1: The load is too heavy or locked-rotor occurs on the motor. 2: The AC drive model is of toosmall power class.	1: Reduce the load and check the motor and mechanical condition. 2: Select an AC drive of higher power class.
Too large speed deviation	ESP	1: The encoder parameters are set Incorrectly. 2: The motor auto-tuning is not Performed. 3: P9.69 and P9.70 are set incorrectly.	1: Set the encoder parameters properly. 2: Perform the motor auto- tuning. 3: Set P9.69 and P9.70 correctly based on the actual situation.
Motor over-speed	oSP	1: The encoder parameters are set Incorrectly. 2: The motor auto-tuning is not Performed. 3: P9.69 and P9.70 are set incorrectly.	1: Set the encoder parameters properly. 2: Perform the motor auto- tuning. 3: Set P9.69 and P9.70 correctly based on the actual situation.
Initial position fault	ini	The motor parameters 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.

6.2 Common Faults and Solutions

You may come across the following faults during the use of the AC drive. Refer to the following table for simple fault analysis.
Table 6-1 Troubleshooting to common faults of the AC drive

SN	Fault	Possible Causes	Solutions
1	There is no display at power-on.	1: There is no power supply to the AC drive or the power input to the AC drive is too low. 2: The power supply of the switch on the drive board of the AC drive is Faulty. 3: The rectifier bridge is damaged. 4: The control board or the operation panel is faulty. 5: The cable connecting the control board and the drive board and the operation panel breaks.	1: Check the power supply. 2: Check the bus voltage. 3:Looking for technical support
2	"AT10" is displayed at power-on.	1: The cable between the drive board and the control board is in poor contact. 2: Related components on the control board are damaged. 3: The motor or the motor cable is short circuited to the ground. 4: The HALL device is faulty. 5: The power input to the AC drive is too low.	Looking for technical support
3	"GND" is displayed at power-on.	1: The motor or the motor output cable is short-circuited to the ground. 2: The AC drive is damaged.	1: Measure the insulation of the motor and the output cable with a megger. 2: Looking for technical support
4	The AC drive display is normal upon power-on. But "AT10" is displayed after running and stops immediately.	1:The cooling fan is damaged or locked-rotor occurs. 2: The external control terminal cable is short circuited.	1: Replace the damaged fan. 2: Eliminate external fault.

SN	Fault	Possible Causes	Solutions
5	OH (module overheat) fault is reported frequently.	1: The setting of carrier frequency is too high. 2: The cooling fan is damaged, or the air filter is blocked. 3: Components inside the AC drive are damaged (thermal coupler or others).	1: Reduce the carrier frequency (P017). 2: Replace the fan and clean the air filter. 3: Looking for technical support
6	The motor does not rotate after the AC drive runs.	1: Check the motor and the motor Cables. 2: The AC drive parameters are set improperly (motor parameters). 3: The cable between the drive board and the control board is in poor contact. 4: The drive board is faulty.	1: Ensure the cable between the AC drive and the motor is normal. 2: Replace the motor or clear mechanical faults. 3: Check and re-set motor parameters.
7	The X terminals are disabled.	1: The parameters are set incorrectly. 2: The external signal is incorrect 3: The jumper bar across OP and +24 V becomes loose. 4: The control board is faulty.	1: Check and reset the parameters in group P5. 2: Re-connect the external signal cables. 3: Re-confirm the jumper bar across OP and +24 V. 4:Looking for technical support
8	The motor speed is always low in CLVC mode.	1: The encoder is faulty. 2: The encoder cable is connected incorrectly or in poor contact. 3: The PG card is faulty. 4: The drive board is faulty.	1: Replace the encoder and ensure the cabling is proper. 2: Replace the PG card. 3: Looking for technical support
9	The AC drive reports overcurrent and overvoltage frequently.	1: The motor parameters are set improperly. 2: The acceleration/ deceleration time is improper. 3: The load fluctuates.	1:Re-set motor parameters or re-perform the motor auto-tuning. 2: Set proper acceleration/ deceleration time. 3: Looking for technical support
10	rAy is reported upon power-on or running.	The soft startup contactor is not picked up.	1: Check whether the contactor cable is loose. 2: Check whether the contactor is faulty. 3: Check whether 24 V power supply of the contactor is faulty. 4: Looking for technical support

Chapter 7 Maintenance

⚠ WARNING

- Maintenance must be performed according to designated maintenance methods.
- Maintenance, inspection and replacement of parts must be performed only by certified person.
- After turning off the main circuit power supply, wait for 10 minutes before maintenance or inspection.
- DO NOT directly touch components or devices of PCB board. Otherwise servo drive can be damaged by electrostatic.
- After maintenance, all screws must be tightened.

7.1 Inspection

In order to prevent the fault of servo drive to make it operate smoothly in high-performance for a long time, user must inspect the servo drive periodically (within half year). The following table indicates the inspection content.

Items to be checked	Main inspections		Criteria
	Inspection content	Frequency	Means/Metnods
Operation environment	1. temperature 2. humidity 3. visual 4. vapor 5. gases	1. Point thermometer hygrometer 2. observation 3. Visual Examination and smelling	1.ambient temperature shall be lower than 40°C , otherwise, the rated values should be decreased. Humidity shall meet the requirement 2.no dust accumulation,no traces of water leakage and no condensate. 3. no abnormal color and smell.
servo drive	1. vibration 2. cooling and heating 3. noise	1. Point thermometer 2.Comprehensive observation 3. listening	1. smooth operation without vibration 2. fan is working in good condition. Speed and air flow are normal. No abnormal heat.

Items to be checked	Main inspections		Criteria
	Inspection content	Frequency	Means/Metnods
Motor	1. vibration 2. heat 3. noise	1.Comprehensive observation 2. Point thermometer 3. listening	1. No abnormal vibration and no abnormal noise. 2. No abnormal heat. 3. No abnormal noise
Operation status parameters	1. power input voltage 2. servo drive output voltage 3. servo drive output current 4.Internal temperature	1. voltmeter 2.Rectifying voltmeter 3. ammeter 4. Point thermometer	1. satisfying the specification 2. satisfying the specification 3. satisfying the Specification 4. temperature rise is lower than 40°C

7.2 Periodic Maintenance

Customer should check the drive every 3 months or 6 months according to the actual environment.

6.2.1 Check whether the screws of control terminals are loose. If so, tighten them with a screwdriver;

6.2.2 Check whether the main circuit terminals are properly connected; whether the mains cables are over heated;

6.2.3 Check whether the power cables and control cables are damaged, check especially for any wear on the cable tube;

6.2.4 Check whether the insulating tapes around the cable lugs are stripped;

6.2.5 Clean the dust on PCBs and air ducts with a vacuum cleaner;

6.2.6 For drives that have been stored for a long time, it must be powered on every 2 years. W hen supplying AC power to the drive,use a voltage regulator to raise the input voltage to rated input voltage gradually. The drive should be powered for 5 hours without load.

6.2.7 Before performing insulation tests, all main circuit input/ output terminals should be short-circuited with conductors. Then proceed insulation test to the ground. Insulation test of single main circuit terminal to ground is forbidden; otherwise the drive might be damaged. Please use a 500V Mega-Ohm-Meter.

6.2.8 Before the insulation test of the motor, disconnect the motor

from the drive to avoid damaging it.

6.3 Replacement of wearing parts

Fans and electrolytic capacitors are wearing part, please make periodic replacement to ensure long term, safety and failure-free operation. The replacement periods are 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.

Chapter 8
Peripheral Devices Selection

Check the motor capacity of the servo drive you purchased. Appropriate peripheral devices must be selected according to the capacity. Refer to the following list and prepare appropriate peripheral devices:

8.1 Peripheral Devices Description

Peripheral Devices Name	Description
Moulded case circuit break (MCCB) or earth leakage circuit break (ELB), fuse	The breaker must be selected carefully since an In-rush curreH flows in the servo drive at power on.
Magnetic coHactor (MC)	Install the MC to ensure safety. Do not use this MC to start and stop the servo drive. Doing so will cause the servo drive life to be shorten.
AC Reactor	Reactor (option) should be used when power harmonics measures are taken, the power factor is to be improved or the servo drive is installed near a large power supply system (1000KVA or more). The servo drive may be damaged if you do not use reactors. Select the reactor according to the model.
Noise filter	Install a noise filter to reduce the electromagnetic noise generated from the servo drive. Effective in the rang from about 1MHz to 10MHz. When more wires are passed throug, a more effective result can be obtained.
Brake resistor and brake unit	To improve the brake capability at deceleration.
Ferrite ring	To reduce the disturbance which is generated by servo drive

8.2 Applied AC reactor Specification

Applicable servo drive Type	Motor Output (kW)	AC Reactor Selection		remark
		Rated currency (A)	Inductance value (mH)	
AT10-07R5G2	7.5	40	0.15	optional
AT10-011G2	11	60	0.1	
AT10-015G2	15	80	0.07	
AT10-018.5G2	18.5	90	0.06	
AT10-022G2	22	120	0.05	
AT10-030G2	30	150	0.035	
AT10-037G2	37	200	0.03	
AT10-045G2	45	250	0.025	
AT10-055G2	55	250	0.02	
AT10-075G2	75	330	0.015	
AT10-090G2	90	400	0.013	
AT10-07R5G4	7.5	20	0.13	
AT10-011G4	11	30	0.087	
AT10-015G4	15	40	0.066	
AT10-018.5G4	18.5	50	0.052	
AT10-022G4	22	60	0.045	optional
AT10-030G4	30	80	0.032	
AT10-037G4	37	90	0.03	
AT10-045G4	45	120	0.023	
AT10-055G4	55	150	0.019	
AT10-075G4	75	200	0.014	
AT10-090G4	90	250	0.011	
AT10-110G4	110	250	0.011	
AT10-132G4	132	290	0.008	
AT10-160G4	160	330	0.008	
AT10-185G4	185	400	0.005	
AT10-200G4	200	490	0.004	
AT10-220G4	220	490	0.004	
AT10-250G4	250	530	0.003	
AT10-280G4	280	600	0.003	
AT10-315G4	315	660	0.002	
AT10-350G4	350	800	0.002	
AT10-400G4	400	800	0.002	
AT10-450G4	450	1000	0.0012	

8.3 Applied Braking resistor Specification

Applicable servo drive Type	Brake resistor		Brake Unit CDBR	Motor Output (kW)
	Power (W)	Resistance Value(Ω) (≥)		
AT10-07R5G2	1000W	16	built in	7.5
AT10-011G2	1500W	11		11
AT10-015G2	2500W	8		15
AT10-018.5G2	3.7KW	6.7		18.5
AT10-022G2	4.5KW	6.7		22
AT10-030G2	5.5KW	5		30
AT10-037G2	7.5KW	3.3		37
AT10-045G2	4.5KW*2	5*2		45
AT10-055G2	5.5KW*2	5*2		55
AT10-075G2	16KW	3.3		75
AT10-090G2	6.5*3	6.3*3	external	90
AT10-07R5G4	1000W	65	built in	7.5
AT10-011G4	1500W	43		11
AT10-015G4	2000W	32		15
AT10-018.5G4	4KW	24		18.5
AT10-022G4	4.5KW	24		22
AT10-030G4	6KW	19.2		30
AT10-037G4	7KW	14.8		37
AT10-045G4	9KW	12.8		45
AT10-055G4	11KW	9.6		55
AT10-075G4	15KW	6.8		75
AT10-090G4	9KW*2	9.3*2		90
AT10-110G4	11KW*2	9.3*2		110
AT10-132G4	13KW*2	6.2*2		132
AT10-160G4	16KW*2	6.2*2		160
AT10-185G4	19KW*2	2.5*2	external	185
AT10-200G4	19KW*2	2.5*2		200
AT10-220G4	21KW*2	2.5*2		220
AT10-250G4	24KW*2	2.5*2		250
AT10-280G4	27KW*2	2.5*2		280
AT10-315G4	20KW*3	2.5*3		315
AT10-350G4	23KW*3	2.5*3		350
AT10-400G4	26KW*3	2.5*3		400
AT10-450G4	29KW*3	2.5*3		450

Note: * 2 indicates two braking unit with its own braking resistor in parallel, * 3 / * 4 / * 5 * 2 the same meaning

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

Moreover, the Braking resistor value is related to braking torque Mbr%, and to the differeH braking torque the Braking resistor values are differeH, and the calculation formula is as follow:

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

The braking power is related to braking torque and braking frequency. the foregoing illustration gives the braking torque as 125% and the frequency is 10%, and according to the differeH loading situations, the numbers in the illustration are for reference.

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