Preface

Thank you for purchasing the HAV-SP series drive developed and produced by Himel

HAV-SP drives are full-featured dedicated drives for parabolic load applications like pumps, fans, and chillers. HAV-SP has a wide range of integrated features like multi-pump control, dry run protection, sensor-less flow and energy calculation, pump cleaning, fire override mode, frost, condensation and hammer effect protections to meet the needs of pump, fans and chillers for modern buildings. HAV-SP also has functions like PID control, simple PLC, multi-speed control and other functions to meet different process requirements.

Before using this drive, the users and relevant technicians shall read this manual carefully to ensure that the drive can be properly installed and operated, so that the drive can perform its best performance.

If there is any change to this user manual, please refer to the new version without notice.

High-performance Drive

User Manual

Edition Code: V1.0
Drive's software version: V100.12

This product implements standards:

The design and production of this product refer to the latest national standards (GB or GB/T), International Electrotechnical Commission Standards (IEC) and International System of Units (SI). The technical parameters of the relevant parts can meet the requirements of national standards (GB or GB/T) and International Electrotechnical Commission Standards (IEC). Main standards:

GB/T 12668.2-2002 Adjustable Speed Electrical Power Drive Systems - Part 2: General Requirements - Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems

GB 12668.3-2012 Adjustable Speed Electrical Power Drive Systems - Part 3: EMC Requirements and Specific Test Methods

GB 12668.501-2013 Adjustable Speed Electrical Power Drive Systems - Part 5: Safety Requirements - Electrical, Thermal and Energy

GB/T 2423.1-2008 Environmental Testing for Electric and Electronic Products - Part 1: Test Methods Tests A: Cold

GB/T 2423.2-2008 Environmental Testing for Electric and Electronic Products - Part 2: Test Methods Tests B: Dry Heat

GB/T 2423.3-2006 Environmental Testing - Part 2: Testing Method - Test Ca: Damp Test, Steady State

GB/T 2423.4-2008 Environmental Testing for Electric and Electronic Products - Part 2: Test method - Test Db: Damp heat, cyclic (12h+12h Cycle)

GB/T 2423.9-2006 Environmental Testing for Electric and Electronic Products - Part 9: Test Methods Tests Cb: Constant damp heat for equipment

GB/T 2423.7-1995 Environmental Testing for Electric and Electronic Products - Part 7: Test Methods Tests Ed: Free Fall

GB/T 2423.22-2012 Environmental Testing for Electric and Electronic Products - Part 2: Test method - Test N: Change of Temperature

GB/T4798.1-2005 Environmental Conditions Existing in the Application of Electric and Electronic Products - Storage

GB/T4798.2-2008 Environmental Conditions Existing in the Application of Electric and Electronic Products - Transport

GB/T4798.3-2007 Environmental Conditions Existing in the Application of Electric and Electronic Products - Work

Danger

The drive must be reliably grounded. If the drive is not reliably grounded, there may be a potential danger of personal injury in the device.

Readers

This user manual is suitable for the following readers.

Drive installers, engineering technicians (electrical engineers, electrical operators, etc.), designers, etc. Please ensure that this user manual reaches the end users.

Notational conventions in this manual

Caution: Moderate or minor injuries may occur due to failure to operate as required.

Danger: Deaths or serious injuries may occur due to failure to operate as required.

Warning

1. Before connecting, please make sure the power supply has been cut off for more than 10min, otherwise, there would be electric shock danger.
2. Never to connect the power line to the output terminals U, V, W of drive.
3. Because there is leakage current in the drive, the drive and motor must be grounded safely, the ground wire shall be copper conductor of more than 3.5mm² and the grounding resistance shall be less than 10Ω.
4. User shall not conduct the withstand voltage test for the drive as it has passed this test before leaving factory.
5. Between drive and motor shall not be installed with electro-magnetic contactor and absorbing capacitor or another resistance--capacitance absorbing implements.
6. To take the convenience for over-current protection of input side and power failure maintenance, the drive shall be connected to power supply through intermediate breaker.
7. DI and DO connect wire should choose more than 0.75mm² twisted wire or shielded wire.

Danger

1. Make sure the power supply of drive has been cut off thoroughly, all LED lamps of keypad has went out, and wait for 10 min, confirm the DC current voltage value between the drive main circuit terminal (+) (-) to drop below DC36V, till now, can perform the wiring operation.
2. Only the qualified professional who has been trained and authorized can perform the wiring operation.
3. Please pay attention that before energizing, check whether the voltage class of drive is identical with the supply voltage, otherwise, it would be result in person casualty and damage of device.

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Chapter I Product Specification and Ordering Instructions

1.1 Drive series models

The inverter has two input voltage levels: 200V~240V and 380V~480V. Suitable motor power range: 460V: 2.2kW~315kW; 230V: 2.2KW~45KW. The parameter in the below table is tested based on the AC 380V and AC 220V . Table 1-1 lists the models of the inverter series.

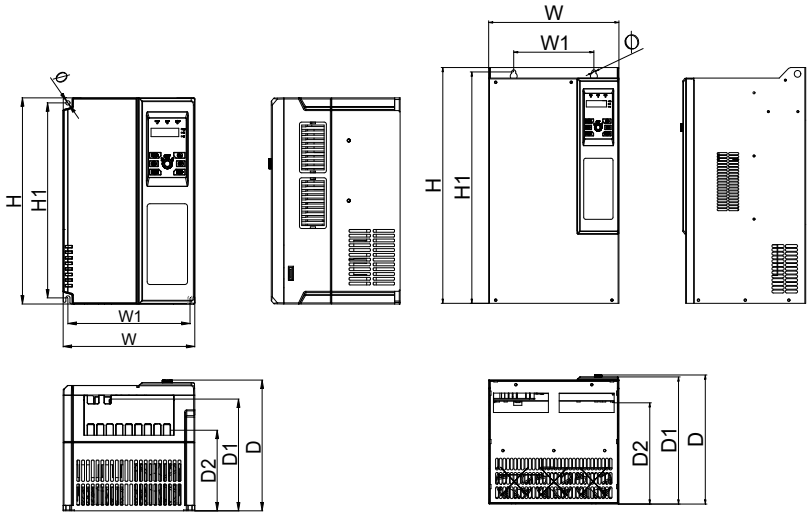
Table 1-1 Drive Models

Drive model	Rated capacity (kVA)	Rated output current(A)	Adaptable motor (kW)
AC:380V~480V class series			
HAV-SP-4T0022P	3.7	5.0	2.2
HAV-SP-4T0030P	4.9	7.5	3.0
HAV-SP-4T0040P	7.5	8.8	4.0
HAV-SP-4T0055P	8.5	13	5.5
HAV-SP-4T0075P	11	17	7.5
HAV-SP-4T0110P	17	25	11
HAV-SP-4T0150P	21	32	15
HAV-SP-4T0185P	24	37	18.5
HAV-SP-4T0220P	30	45	22
HAV-SP-4T0300P	40	60	30
HAV-SP-4T0370P	50	75	37
HAV-SP-4T0450P	60	90	45
HAV-SP-4T0550P	72	110	55
HAV-SP-4T0750P	100	157	75
HAV-SP-4T0900P	116	180	90
HAV-SP-4T1100P	138	214	110
HAV-SP-4T1320P	167	256	132
HAV-SP-4T1600P	200	307	160
HAV-SP-4T1850P	230	350	185
HAV-SP-4T2000P	250	380	200

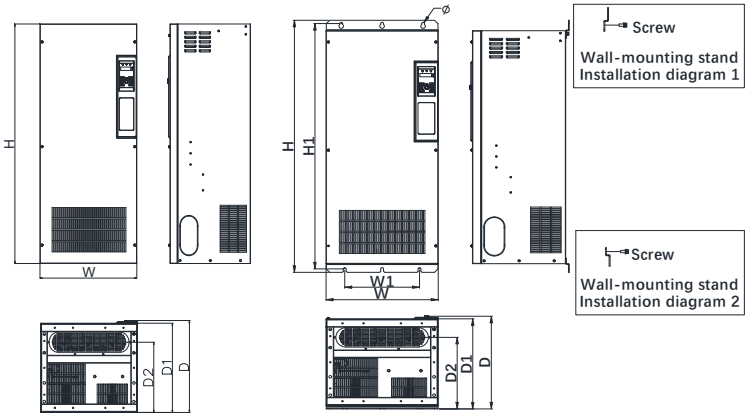
Drive model	Rated capacity (kVA)	Rated output current(A)	Adaptable motor (kW)
HAV-SP-4T2200P	280	456	220
HAV-SP-4T2500P	317	497	250
HAV-SP-4T2800P	355	556	280
HAV-SP-4T3150P	450	626	315
AC:200V~240V class series			
HAV-SP-2T0022P	3.7	10.8	2.2
HAV-SP-2T0030P	4.9	11.5	3.0
HAV-SP-2T0040P	7.5	16.2	4.0
HAV-SP-2T0055P	8.5	20.3	5.5
HAV-SP-2T0075P	11	26.7	7.5
HAV-SP-2T0110P	17	39	11
HAV-SP-2T0150P	21	52.5	15
HAV-SP-2T0185P	24	62.4	18.5
HAV-SP-2T0220P	30	73.6	22
HAV-SP-2T0300P	40	98.7	30
HAV-SP-2T0370P	50	121	37
HAV-SP-2T0450P	60	147	45

Note: If you need models of other power ranges, please consult the manufacturer before ordering!

1.2 Product appearance and installation dimensions



(a) A specification (b) B specification



(c) C specification (d) D specification

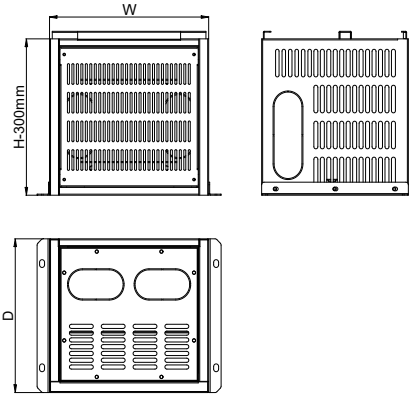
Table 1-2 Drive Appearance and Installation Series Dimensions (Unit: mm)

Drive model	Dimensions（mm）						Mounting Dimensions（mm）		Mounting hole diameter (Φ)（mm）	Reference picture
	W	H	D	D1	D2	D3	W1	H1		
HAV-SP-4T0022P	120	215	163	136	90	-	109	204	5.5	（a）
HAV-SP-4T0030P										
HAV-SP-4T0040P										
HAV-SP-4T0055P										
HAV-SP-4T0075P										
HAV-SP-2T0022P										
HAV-SP-2T0030P										
HAV-SP-2T0040P										
HAV-SP-4T0110P	150	259	181	149	104	-	138	247	5.5	（a）
HAV-SP-4T0150P										
HAV-SP-2T0055P										
HAV-SP-2T0075P										
HAV-SP-4T0185P	205	322	215	176	130	-	188	305	6.5	（a）
HAV-SP-4T0220P										
HAV-SP-2T0110P										
HAV-SP-4T0300P	235	370	235	200	146	-	218	350	7	（a）
HAV-SP-4T0370P										
HAV-SP-2T0150P										
HAV-SP-2T0185P										
HAV-SP-4T0450P	305	490	275	264	211	-	200	470	10	（b）
HAV-SP-4T0550P										
HAV-SP-2T0220P										
HAV-SP-2T0300P										
HAV-SP-4T0750P	320	560	307	295	241	-	197	543	10	（b）
HAV-SP-4T0900P										
HAV-SP-4T1100P										
HAV-SP-2T0370P										
HAV-SP-2T0450P										

Drive model	Dimensions（mm）						Mounting Dimensions（mm）		Mounting hole diameter (Φ)（mm）	Reference picture
	W	H	D	D1	D2	D3	W1	H1		
HAV-SP-4T1320P	355	678	319	307	261	-	240	659	11	（b）
HAV-SP-4T1600P										
HAV-SP-4T1850P	450	900	377	365	302	-	300	875	12	（b）
HAV-SP-4T2000P										
HAV-SP-4T2200P	480	1070	411	399	314	-	-	-	-	（c）
HAV-SP-4T2500P										
HAV-SP-4T2800P	525	1300	437	425	335	-	-	-	-	（c）
HAV-SP-4T3150P										
HAV-SP-4T2200P（Wall-mounting）	480	1158	426	414	329	-	320	1127	12	（d）
HAV-SP-4T2500P（Wall-mounting）										
HAV-SP-4T2800P（Wall-mounting）	525	1387	452	440	350	-	400	1356	12	（d）
HAV-SP-4T3150P（Wall-mounting）										

Note: 1. The base of HAV-SP-4T0450P～HAV-SP-4T1600P and HAV-SP-2T0220P～HAV-SP-2T0450P are optional.

1.3 Dimensions of optional base



Note: The dimensions of the base in W and D directions are consistent with the corresponding model, as shown in Table 1-2, and the H dimension is fixed at 300mm.

Table 1-3 Base Matching Table

Base jacking model	Adaptable models
HAV-XS-4T0370DZ (black)	HAV-SP-4T0450P~HAV-SP-4T0550P HAV-SP-2T0220P~HAV-SP-2T0300P
HAV-XS-4T0750DZ (black)	HAV-SP-4T0750P~HAV-SP-4T1100P HAV-SP-2T0370P~HAV-SP-2T0450P
HAV-XS-4T1100DZ (black)	HAV-SP-4T1320P~HAV-SP-4T1600P
HAV-XS-4T1600DZ (black)	HAV-SP-4T1850P~HAV-SP-4T2000P

1.4 Keypad size

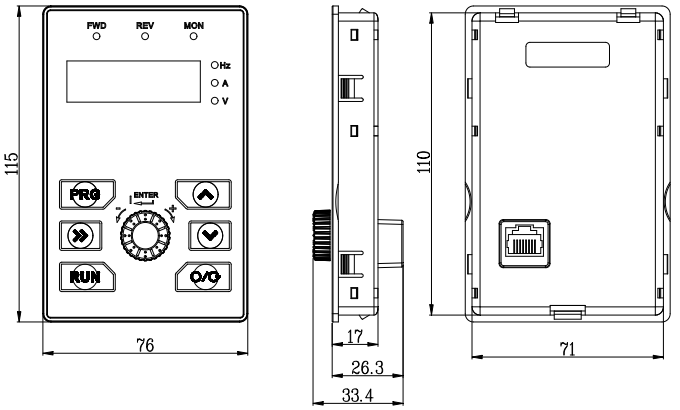


Figure 1-1 Remote Control Keypad 1 HAV-SP-LKD（unit：mm）

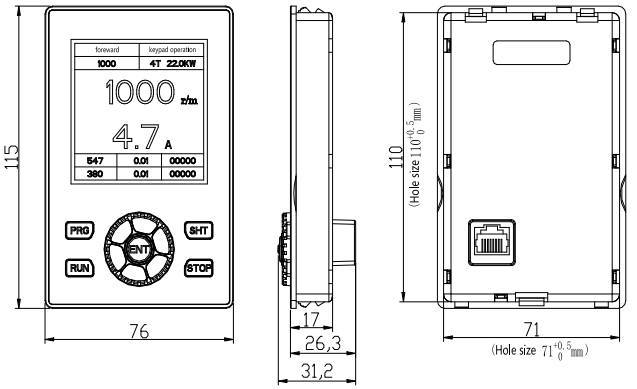


Figure 1-2 Remote Control Keypad 2 HAV-SP-LCD （unit：mm）

Note:

1. The standard available lengths of optional extension cables are 2m and 5m. The external keypad port uses an RJ45 port. The extension cable is a common network cable (EIA/TIA568B standard is used for the connector)..

2. If you need extension keypad cables of other specifications, please order separately.

3. Using an extension keypad cable to connect the RJ45 port on the keypad to the RJ45 port on the control card.

4. Remote Control Keypad 1 (HAV-SP-LKD): the keypad extension cable should not be longer than 80m

5. Remote Control Keypad 2 (HAV-SP-LCD): the keypad extension cable should not be longer than 5m.

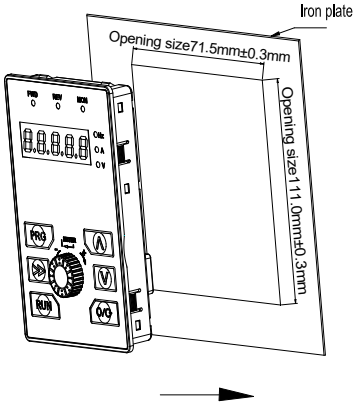
Table 1-4 Datasheet of HAV-SP-LCD

Item	Description
Display screen size	55*55mm
Display resolution	160*160
Display mode	Blue screen
Keypad interface	RJ45 interface
USB interface	Micro USB
Humidity	Less than 95%RH, no condensation
Vibration	Less than 5.9m/s2
Environment temperature	－10℃～＋50℃
Storage temperature	－40℃～＋60℃
Protection class	IP20

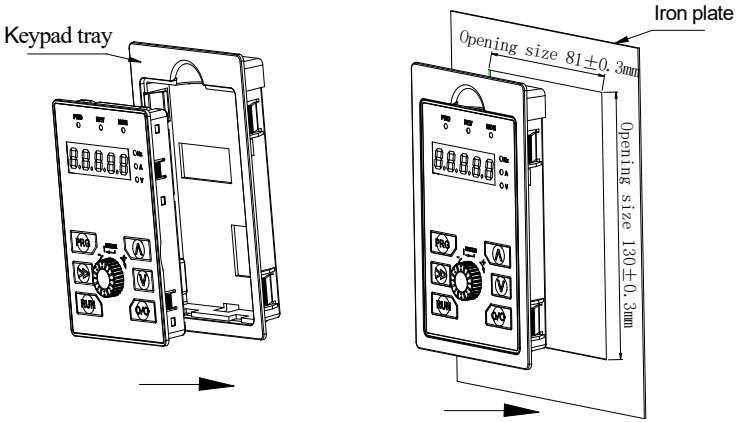
1.5 Installation of remote keypad

1.5 .1 Installation of remote keypad

The remote keypad can be installed in two ways, one is directly installed on an iron plate, and the other is installed on an optional keypad tray.



When the remote keypad is installed on an iron plate, the installation process is shown in the figure. Press down the keypad in the direction of the arrow until a "click" sound is heard.



When the remote keypad is installed on an optional keypad tray, the installation process is shown in the figure. Place the keypad into the tray in the direction of the arrow and press down the entire keypad in the direction of the arrow, until a "click" sound is heard.

1.5.2 Dust-proof sticker for optional parts (schematic diagram of outlet position of outgoing keypad line)

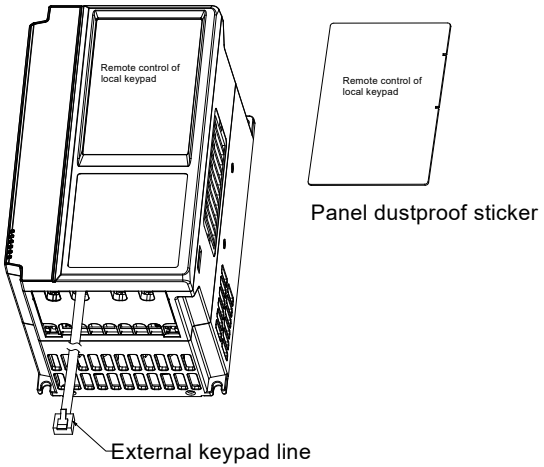


Table 1-5 Dustproof Sticker Model

Dustproof sticker model	Adaptable models
HAV-XS-FCT	HAV-SP-4T0022P~HAV-SP-4T1600P HAV-SP-2T0022P~HAV-SP-2T0450P

1.6 Name of each part of this series drives

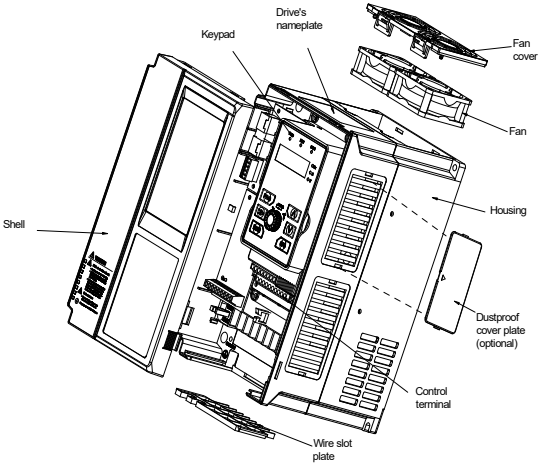


Table 1-6 Dustproof Cover Plate Model

Dustproof cover plate model	Adaptable models
HAV-XS-4T0220 (black)	HAV-SP-4T0022P~HAV-SP-4T0370P HAV-SP-2T0022P~HAV-SP-2T0185P

1.7 Accessary of HAV-SP

If you need the accessories as follow, please specify when ordering.

Table 1-7 Inverter options list

Name	Reference	Short Description	Applicable Product
Dust cover	HAV-SP-FCB	Prevent dust from entering the drive	HAV-SP-4T0022P~HAV-SP-4T0370P HAV-SP-2T0022P~HAV-SP-2T0185P
Keypad tray	HAV-SP-JPT	Use when an external keypad is installed	All SP series
LCD Keypad	HAV-SP-LCD	LCD keypad	All SP series
IO expansion card	HAVXSIO3DIR	Expand 3 DI, 1 relay	HAV-SP-4T0022P~HAV-SP-4T3150P HAV-SP-2T0022P~HAV-SP-2T0450P **Note:** When using the HAVXSIO3DIR expansion card, the ten digit of the parameter F0.04 should be set to 1, and then power off and restart the drive.
Expansion card	HAVSPIO4DI8R	Expand 4 DI, 8 relay	HAV-SP-4T0022P~HAV-SP-4T3150P HAV-SP-2T0022P~HAV-SP-2T0450P **Note:** Only applicable to multi-pump control function, when using HAVSP4DI8R expansion card, the ten digit of the parameter F0.04 should be set to 0, and then power off to restart the drive.
Mounting bracket	HAV-XS-4T*	For embedded installation of drive	*：For detailed model and power matching, please refer to Table 2-2
Mounting base	HAV-XS-4T*	Used for cabinet installation	*：For detailed model and power matching, please refer to Table 1-3
Dustproof sticker	HAV-SP-FCT	Use when an external keypad is installed	All SP series

Chapter II Installation and Wiring of Drive

2.1 Drive installation environment

2.1.1 Installation environment requirements

(1) Install in a well-ventilated indoor place. The ambient temperature is required to be within the range of -10ºC-40ºC. If the temperature exceeds 40 ° C, the drive needs to be derated. Derating by 3% for every 1° C increased in temperature，the maximum temperature is 50° C.

(2) Avoid installing in places with direct sunlight, dusty, floating fibers and metal powder.

(3) Do not install in places with corrosive or explosive gases.

(4) The humidity is required to be lower than 95%RH, without condensation of water droplets.

(5) Install in places where the plane fixed vibration is less than 5.9 m/s^2.

(6) Try to keep away from electromagnetic interference sources and other electronic instruments and equipment that are sensitive to electromagnetic interference.

(7) The drive is not allowed to be stored in humid, high temperature, outdoor exposure for a long time.

(8) Long-term storage will lead to deterioration of electrolytic capacitors. The drive must be power on once 6 months and at least 5 hours. The input voltage must be slowly increased to the rated value with a regulator.

2.1.2 Installation direction and space

(1) Generally, vertical installation shall be adopted.

(2) Minimum installation intervals and distances are shown in Figure 2-1.

(3) When multiple drives are installed up and down, the baffle applied in the middle is shown in Figure 2-2.

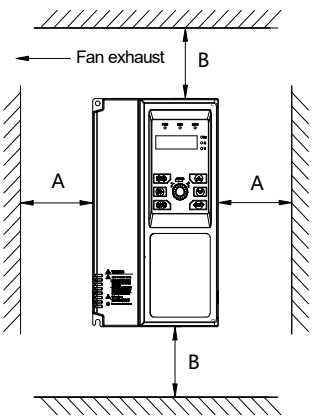


Figure 2-1 Installation Diagram

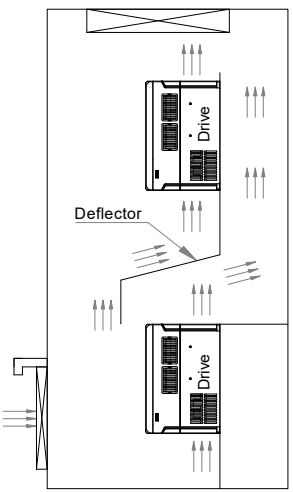


Figure 2-2 Installation Diagram of Multiple Drives

Table 2-1 Installation Space Requirements

Drive model	Installation space (mm)	
	A	B
HAV-SP-4T0022P～HAV-SP-4T0550P HAV-SP-2T0022P～HAV-SP-2T0300P	≥50	≥100
HAV-SP-4T0750P～HAV-SP-4T3150P HAV-SP-2T0370P～HAV-SP-2T0450P	≥50	≥200

2.1.3 Mechanical installation methods and steps

According to different power levels, HAV-SP series has two structures named plastic and sheet metal. According to different installation applications, there are two installation methods: Wall-mounted and embedded.

1. Wall mounting of plastic structure

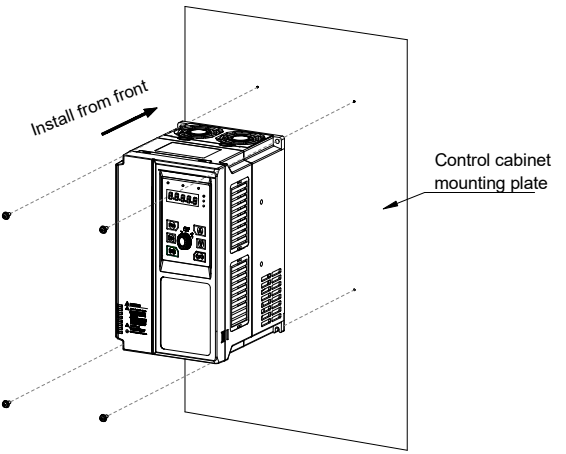


Figure 2-3 Wall-mounted Installation Diagram of Plastic Structure

2. Embedded installation of plastic structure

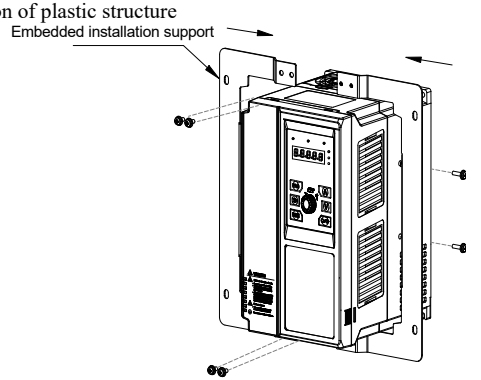


Figure 2-4 Embedded Support Installation Diagram of Plastic Structure

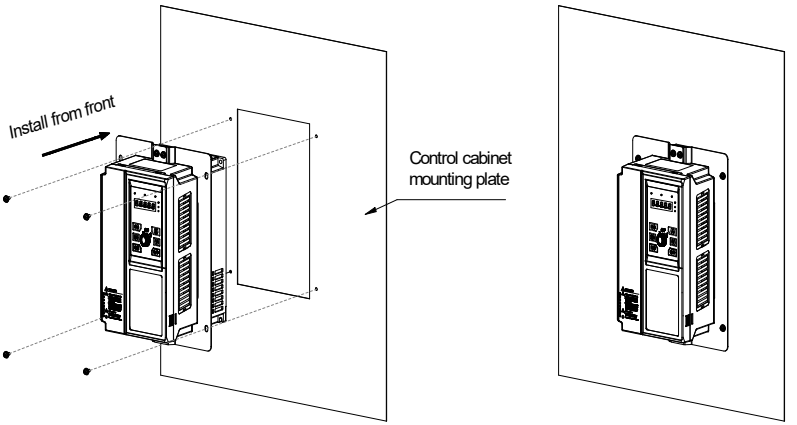


Figure 2-5 Embedded Installation Diagram of Plastic Structure

3. Wall mounting of sheet metal structure

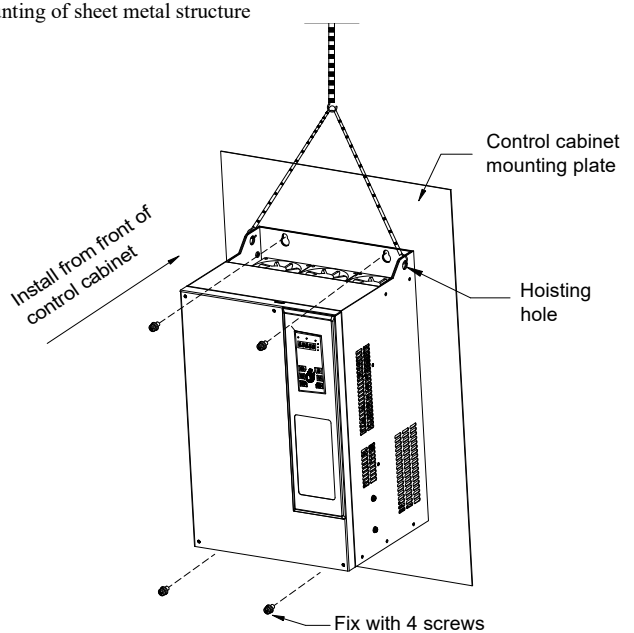


Figure 2-6 Wall-mounted Installation Diagram of Sheet Metal Structure

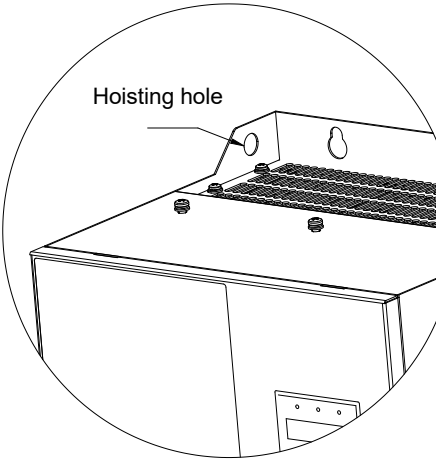


Figure 2-7 Hoisting Diagram of Sheet Metal Structure

Table 2-2 Wall hanging mounting bracket selection

Wall hanging mounting bracket Model	Adaptation
HAVXS-4T2200-BGZJ	HAV-SP-4T2200P~HAV-SP-4T2500P
HAVXS-4T2800-BGZJ	HAV-SP-4T2800P~HAV-SP-4T3150P

4. Embedded installation of sheet metal structure

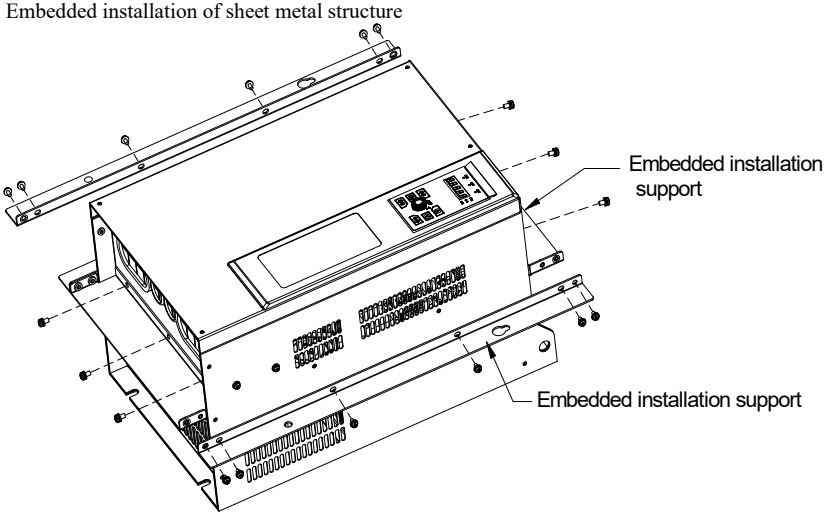


Figure 2-8 External Support Diagram of Sheet Metal Structure

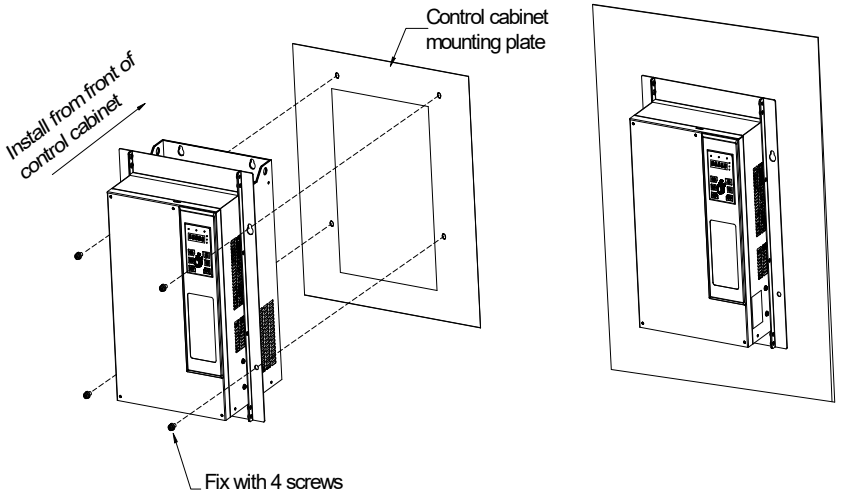


Figure 2-9 Embedded Installation Diagram of Sheet Metal Structure

Table 2-3 Matching Table of Embedded Installation Support

Model of Embedded Installation Support	Adaptable models
HAV-XS-4T0040QRZJ	HAV-SP-4T0022P~HAV-SP-4T0075P HAV-SP-2T0022P~HAV-SP-2T0040P
HAV-XS-4T0075QRZJ	HAV-SP-4T0110P~HAV-SP-4T0150P HAV-SP-2T0055P~HAV-SP-2T0075P
HAV-XS-4T0150QRZJ	HAV-SP-4T0185P~HAV-SP-4T0220P HAV-SP-2T0110P
HAV-XS-4T0220QRZJ	HAV-SP-4T0300P~HAV-SP-4T0370P HAV-SP-2T0015P~HAV-SP-2T0185P
HAV-XS-4T0370QRZJ	HAV-SP-4T0450P~HAV-SP-4T0550P HAV-SP-2T0220P~HAV-SP-2T0300P
HAV-XS-4T0750QRZJ	HAV-SP-4T0750P~HAV-SP-4T1100 HAV-SP-2T0370P~HAV-SP-2T0450P
HAV-XS-4T1320QRZJ	HAV-SP-4T1320P~HAV-SP-4T1600P
HAV-XS-4T1600QRZJ	HAV-SP-4T1850P~HAV-SP-4T2000P

2.2. Removal and installation of drive panel

2.2.1 Removal and installation of drive cover plate with plastic case

◆ Remove cover plate

Use tools to jack out the hooks on the left and right sides of the cover plate in direction 1 as shown in Figure 2-10, and then lift the cover plate in direction 2.

◆ Install cover plate

Align the groove above the cover plate with the clip of the main body as shown in Figure 2-11 and press down the cover plate in direction 1 until a “click” sound is heard.

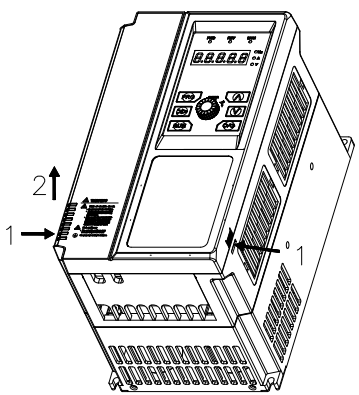


Figure 2-10 Removal of Cover Plate

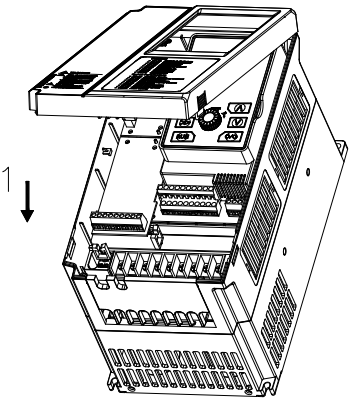


Figure 2-11 Installation of Cover Plate

2.2.2 Removal and installation of sheet metal box cover plate

◆ Remove cover plate

Remove the mounting screws at cover plate 1 in Figure 2-12, and then lift it up in direction 2.

◆ Install cover plate

Insert the clip of the cover plate into the groove of the main body as shown in Figure 2-13, install the cover plate in direction 1, and then fasten the screws at cover plate 2.

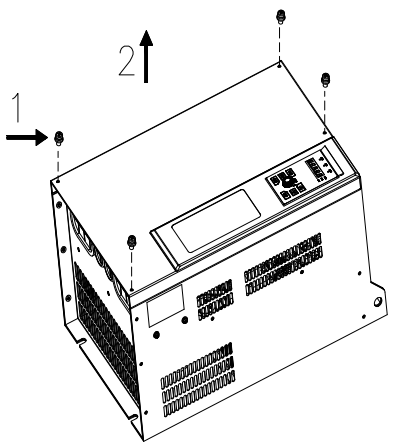


Figure 2-12 Removal of Cover Plate

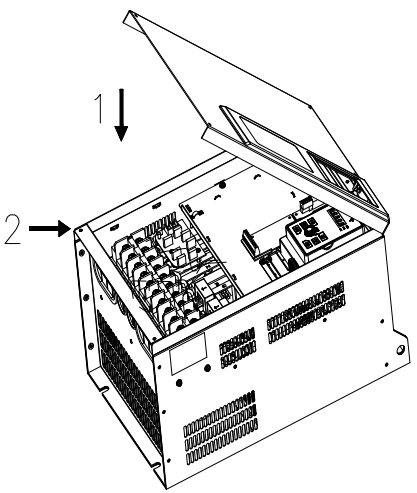


Figure 2-13 Installation of Cover Plate

2.2.3 Removal and installation of keypad

- Removal and installation of cover plate
- Remove the keypad
- Please refer to 2-10 to 2-13 to remove cover plate

Press groove 1 on both sides of the keypad with your fingers as shown in Figure 2-14, and then take out the keypad body in direction 2.

- Install the keypad

Insert the network cable into the network port in the control box as shown in Figure 2-15, and insert the other end onto the keypad, and then press down the keypad in the arrow direction until a “click” sound is heard. Never install the keypad from other directions, otherwise it may cause poor contact of the keypad.

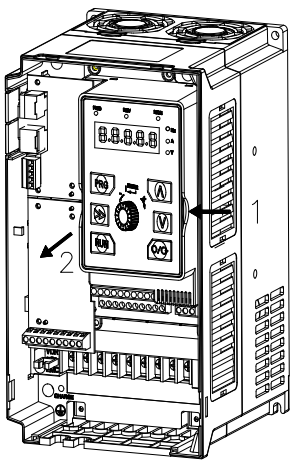


Figure 2-14 Removal of Keypad

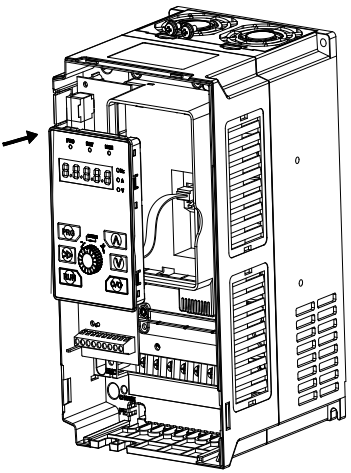


Figure 2-15 Installation of Keypad

2.3 Wiring of main circuit terminals

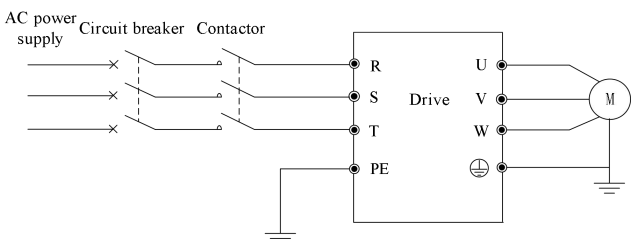
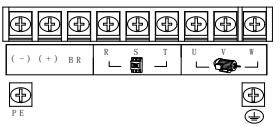
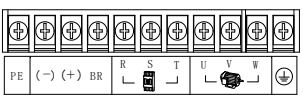
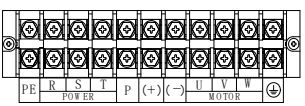
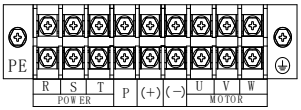
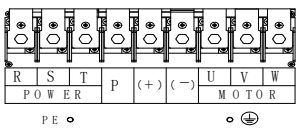
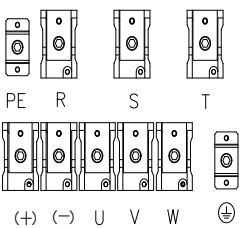


Figure 2-16 Basic Wiring of Main Circuit

2.3.1 Wiring of main circuit terminals

(1)The main circuit input and output terminals are shown in Table 2-4.

Applicable models	Main circuit terminals	Terminal name	Function description
HAV-SP-4T0022P HAV-SP-4T0030P HAV-SP-4T0040P HAV-SP-4T0055P HAV-SP-4T0075P HAV-SP-4T0110P HAV-SP-4T0150P HAV-SP-4T0185P HAV-SP-4T0220P HAV-SP-2T0022P HAV-SP-2T0030P HAV-SP-2T0040P HAV-SP-2T0055P HAV-SP-2T0075P HAV-SP-2T0110P		R, S, T	Three-phase AC input terminal
		U, V, W	Three-phase AC output terminal
		BR	Design reserve only, no braking function
		⏚	Motor ground terminal
		(+), (-)	DC positive and negative bus output terminals
		PE	Protective ground terminal
HAV-SP-4T0300P HAV-SP-4T0370P HAV-SP-2T0150P HAV-SP-2T0185P		R, S, T	Three-phase AC input terminal
		U, V, W	Three-phase AC output terminal
		BR	Design reserve only, no braking function
		(+), (-)	DC positive and negative bus output terminal
		⏚	Motor ground terminal
		PE	Protective ground terminal
HAV-SP-4T0450P HAV-SP-4T0550P HAV-SP-2T0220P HAV-SP-2T0300P		R, S, T	Three-phase AC input terminal
		U, V, W	Three-phase AC output terminal
		P, (+)	Reserved terminal of external DC reactor
		(+), (-)	DC positive and negative bus output terminals
		⏚	Motor ground terminal
		PE	Protective ground terminal

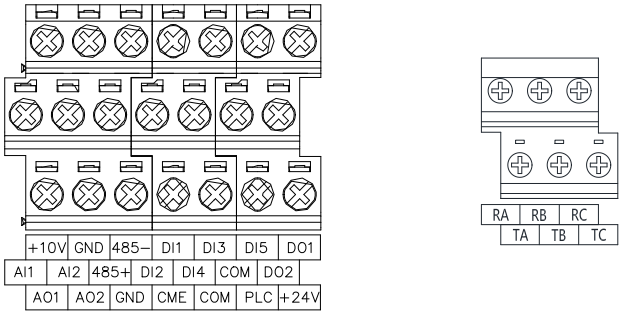
Applicable models	Main circuit terminals	Terminal name	Function description
HAV-SP-4T0750P HAV-SP-2T0370P		R, S, T	Three-phase AC input terminal
		U, V, W	Three-phase AC output terminal
		P, (+)	Reserved terminal of external DC reactor
		(+), (-)	DC positive and negative bus output terminals
		⏚	Motor ground terminal
		PE	Protective ground terminal
HAV-SP-4T0900P HAV-SP-4T1100P HAV-SP-4T1320P HAV-SP-4T1600P HAV-SP-4T1850P HAV-SP-4T2000P HAV-SP-2T0450P		R, S, T	Three-phase AC input terminal
		U, V, W	Three-phase AC output terminal
		P, (+)	Reserved terminal of external DC reactor
		(+), (-)	DC positive and negative bus output terminals
		⏚	Motor ground terminal
		PE	Protective ground terminal
HAV-SP-4T2200P HAV-SP-4T2500P HAV-SP-4T2800P HAV-SP-4T3150P		R、S、T	Three-phase AC input terminal
		U、V、W	Three-phase AC output terminal
		P、(+)	Reserved terminal of external DC reactor
		(+)、(-)	DC positive and negative bus output terminals
		⏚	Motor ground terminal
		PE	Protective ground terminal

(2) The selection of main circuit cable diameters, inlet protection circuit breaker QF or fuse in Table 2-5 is as follows:

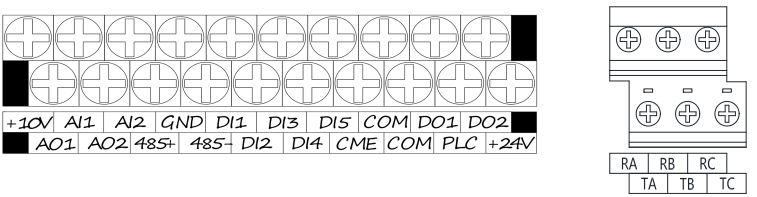
Model	Circuit breaker (A)	Recommended contactor (A)	Recommended input and output power wires (mm^2)	Control wire (mm^2)
HAV-SP-4T0022P	16	10	2.5	1.0
HAV-SP-4T0030P	20	16	2.5	1.0
HAV-SP-4T0040P	20	16	2.5	1.0
HAV-SP-4T0055P	25	25	4	1.0
HAV-SP-4T0075P	40	32	4	1.0
HAV-SP-4T0110P	63	38	6	1.0
HAV-SP-4T0150P	63	40	6	1.0
HAV-SP-4T0185P	100	50	10	1.0
HAV-SP-4T0220P	100	65	10	1.0
HAV-SP-4T0300P	125	80	16	1.0
HAV-SP-4T0370P	160	95	25	1.0
HAV-SP-4T0450P	200	115	35	1.0
HAV-SP-4T0550P	200	170	35	1.0
HAV-SP-4T0750P	250	205	70	1.0
HAV-SP-4T0900P	315	245	70	1.0
HAV-SP-4T1100P	400	300	95	1.0
HAV-SP-4T1320P	400	300	150	1.0
HAV-SP-4T1600P	630	410	185	1.0
HAV-SP-4T1850P	630	475	240	1.0
HAV-SP-4T2000P	630	475	240	1.0
HAV-SP-4T2200P	800	475	150*2	1.0
HAV-SP-4T2500P	800	620	150*2	1.0
HAV-SP-4T2800P	1000	620	150*2	1.0
HAV-SP-4T3150P	1000	800	185*2	1.0

2.4 Control circuit configuration and wiring

2.4.1 Control circuit terminal arrangement is as follows



Note: Arrangement Sequence of control plate terminals of HAV-SP-4T0075P and below （HAV-SP-2T0040P and below）



Note: Arrangement Sequence of control plate terminals of HAV-SP-4T0110P and above (HAV-SP-2T0055P and above)

Figure 2-17 Arrangement Sequence of Control Plate Terminals

2.4.2 CN2 terminal function description is shown in Table 2-6.

Table 2-6 Control Terminal Function Table

Terminal Label	Name	Terminal function description	Specification
485+	RS485 communication interface	RS485 differential signal positive terminal	For standard RS485 communication interface, please use twisted pair or shielded wire.
485-		RS485 differential signal negative terminal	
DO1 DO2	Open collector output terminal	It can be programmed and defined as switch output terminal with multiple functions, see terminal function parameters F6.11 and F6.12 for details, output terminal function introduction (common port: COM)	Optocoupler isolated output Working voltage range: 9-30V Maximum output current: 50mA
TA TB TC	Programmable relay Terminal output	No-action: TA-TB is normally off; TA-TC is normally on. Action: TA-TB is normally on; TA-TC is normally off. (See F6.13 for details)	Contact rating NO: 5A 250VAC NC: 3A 250VAC
RA RB RC	Programmable relay1 Terminal output	No-action: RA-RB normally off; RA-RC normally on; Action: RA-RB normally on; RA-RC normally off (See F6.37 for details)	Contact rating NO: 5A 250VAC NC: 3A 250VAC
RA1 RB1 RC1	Programmable relay2 Terminal output	No-action: RA-RB normally off; RA-RC normally on; Action: RA-RB normally on; RA-RC normally off (See F6.35 for details)	Contact rating NO: 5A 250VAC NC: 3A 250VAC (**Note:** When using the HAVXSIO3DIR expansion card, the ten digit of the parameter F0.04 should be set to 1, and then power off and restart the drive)
AI1	Analog input AI1	Receive analog current and voltage input (reference ground: GND)	Input voltage range: 0～10V (input impedance: 100KΩ) Resolution: 1/1000 Input current range: 0～20mA (Input impedance: 500Ω) Resolution: 1/1000
AI2	Analog input AI2	Receive analog current and voltage input (reference ground: GND)	
AO1	Analog output AO1	Provide analog voltage output, which can correspond to 12 physical quantities, default output frequency when leaving the factory (see F5.25 for details)	Voltage output range: 0～10V Current output range: 0～20mA

Terminal Label	Name	Terminal function description	Specification
AO2	Analog output AO2	Provide analog voltage output, which can correspond to 12 physical quantities, default output frequency when leaving the factory (see F5.26 for details)	Voltage output range: 0～10V Current output range: 0～20mA
DI1	Multifunctional input terminal 1	It can be programmed and defined as switch input terminal with multiple functions, see Chapter VI terminal function parameters (switch input and output) for input terminal function introduction. (Common port: COM) (See F6.00-6.04 for details)	
DI2	Multifunctional input terminal 2		
DI3	Multifunctional input terminal 3		
DI4	Multifunctional input terminal 4		
DI5	Multifunctional input terminal 5		
DI6	Multifunctional input terminal 6	It can be programmed and defined as switch input terminal with multiple functions, see Chapter VI terminal function parameters (switch input and output) input terminal function introduction. (Common port: COM) (See F6.05-6.08 for details)	**Note:** Expansion card function
DI7	Multifunctional input terminal 7		
DI8	Multifunctional input terminal 8		
10V	+10V power supply	Provides +10V power supply for external	Maximum output current: 50mA
GND	+10V power supply common port	Reference ground of analog signal and +10V power supply	COM and GND are internally isolated from each other
COM	+24V power supply common port	Digital signal input and output common port	
+24V	+24V power supply	Digital signal power supply	Maximum output current: 200mA
PLC	Multifunctional input common port	Common port of DI1-DI5	Shot-circuited to 24V when leaving the factory
CME	Digital output common port	Multifunctional output terminal common port	Short-circuited to COM when leaving the factory

2.4.3 Wiring of analog input and output terminals

AI1, AI2, AO1, AO2 terminals and jumper J1 ~ J4 position as shown in figure 2-18 (a) .

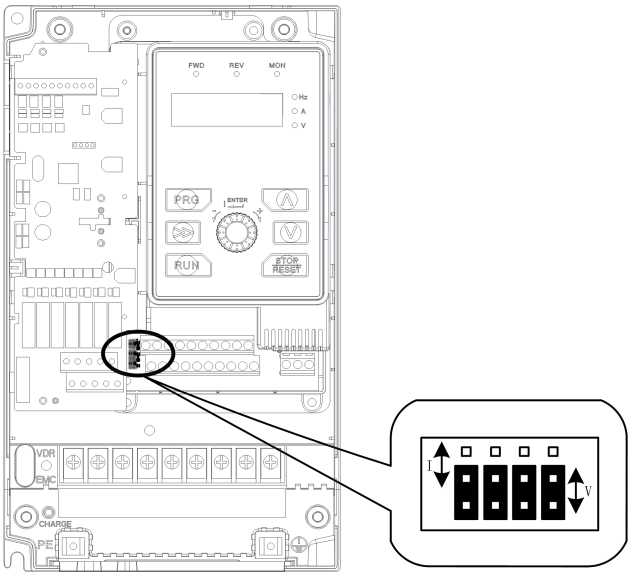
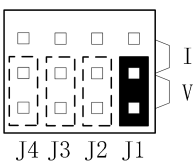
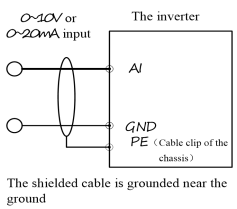
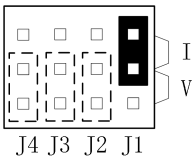
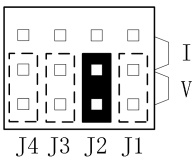
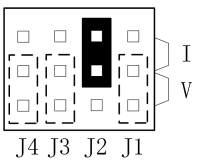
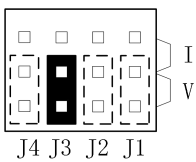
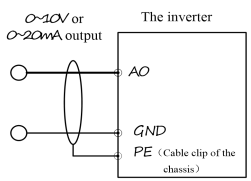
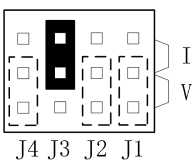
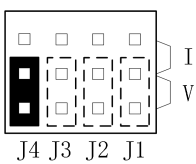
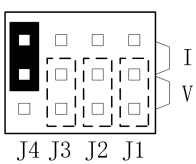


Figure2-18(a) Position of jumper plug J1 to J4

AI1 and AI2 terminals receive analog signal input and select input voltage (0 ~ 10V) or input current (0 ~ 20mA) through J1 and J2 jumpers.

The analog output AO1 and AO2 can output both voltage and current, which can be selected by J3 and J4 jumpers. AO1 and AO2 are 0 ~ 10V voltage output by default, and the corresponding output physical quantity is set by parameters F5.25 and F5.26.

Terminal	Signal type	Jumper position	Wiring diagram	Level range
AI1	Voltage signal (Factory default)			0~10V

Terminal	Signal type	Jumper position	Wiring diagram	Level range
	Current signal			0~20mA
AI2	Voltage signal (Factory default)			0~10V
	Current signal			0~20mA
AO1	Voltage signal (Factory default)		 The shielded cable is grounded near the ground	0~10V
	Current signal			0~20mA
AO2	Voltage signal (Factory default)			0~10V
	Current signal			0~20mA

2.4.4 Wiring mode of drive control circuit

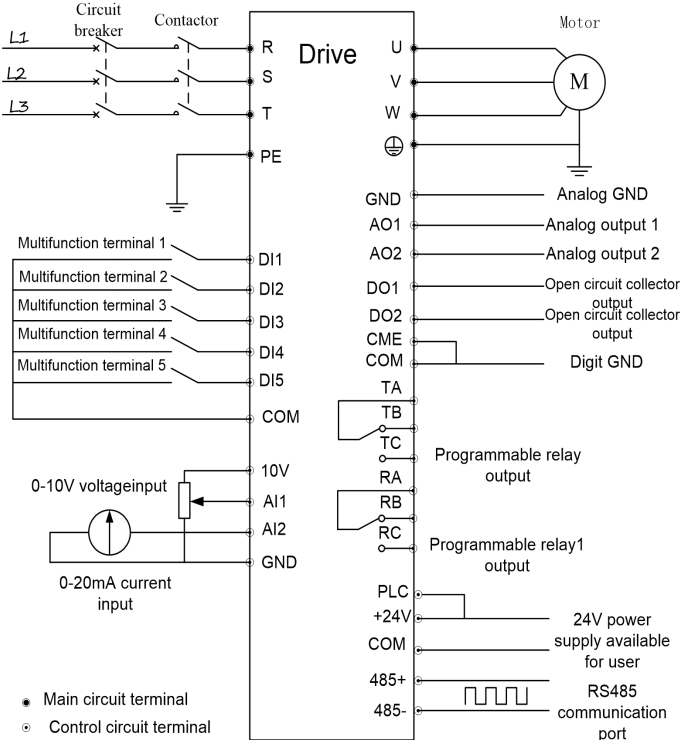


Figure 2-19 Basic Operation Wiring Diagram

Applicable models: HAV-SP-4T0370P and below

HAV-SP-2T0185P and below

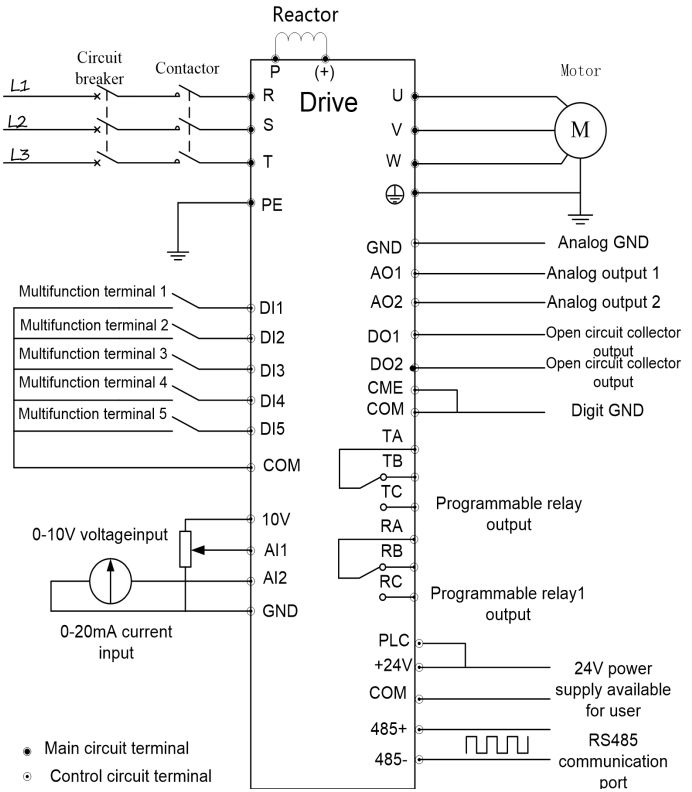


Figure 2-20 Basic Operation Wiring Diagram

Applicable models: HAV-SP-4T0450P and above

HAV-SP-2T0220P and above

2.4.5 Wiring of signal input terminal

NPN and PNP mode switching terminals are shown in Figure 2-21 to Figure 2-24.

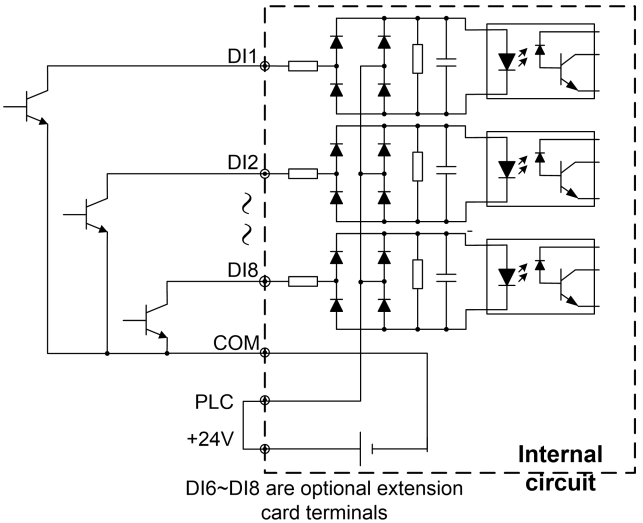


Figure 2-21 NPN Diagram of Internal Power Supply (OC)

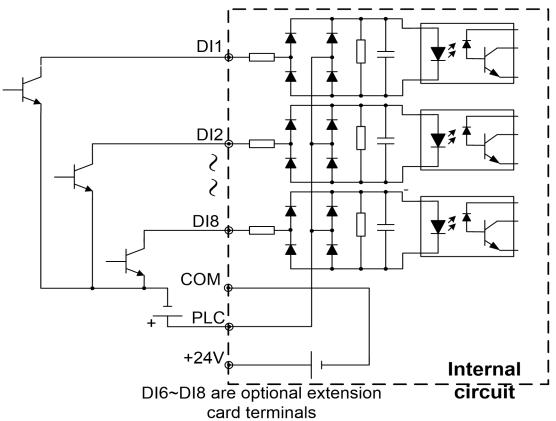


Figure 2-22 NPN Diagram of External Power Supply (OC)

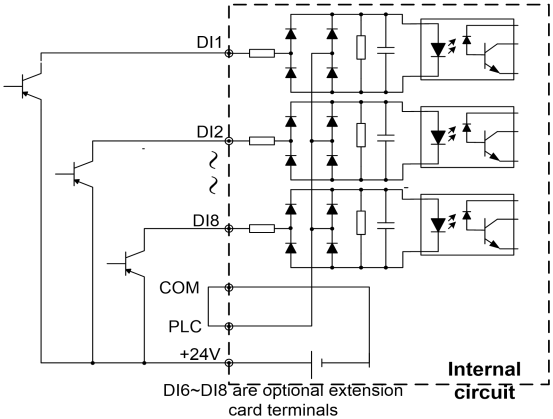


Figure 2-23 PNP Diagram of Internal Power Supply (OE)

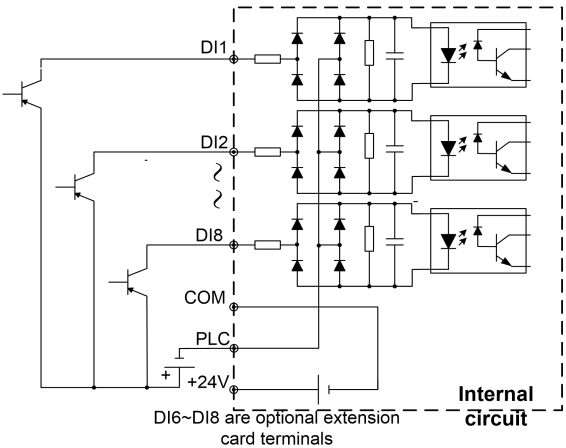


Figure 2-24 PNP Diagram of External Power Supply (OE)

Chapter III Operation Instructions of Drive

3.1 Key function description

The key functions of HAV-SP-LKD and HAV-SP-LCD are defined in Table 3-1 and Table 3-2.

Table 3-1 LED Keypad Function Table

Key	Name	Label in the manual	Function description
PRG	Program/Exit key	PRG	Enter or exit programming state
RUN	Run key	RUN	In the keypad mode, press this key to run the drive.
	Stop key	STOP	When the drive is in the normal running state, if the drive's running instruction channel is set to the keypad stop effective mode, press this key and the drive will stop according to the set mode. When the drive is in the fault state, press this key to reset the drive and return to the normal stop state.
	Increment key	▲	Increase data or function code
	Decrement key	▼	Decrease data or function code
	Shift key	υυ	In the edit state, you can select the modification bit of the set data
	Rotary encoder	ENT 	When pressed down, it is the ENT key, you can enter the drop-down menu or confirm data. When the input frequency channel is set to keypad, the rotary encoder can modify the set frequency of the drive.

Table 3-2 LCD Keypad Function Table

Key	Name	Label in the manual	Function description
PRG	Program/Exit key	PRG	Enter or exit programming state
RUN	Run key	RUN	In the keypad mode, press this key to run the drive.
STOP	Stop key	STOP	When the drive is in the normal running state, if the drive's running instruction channel is set to the keypad stop effective mode, press this key and the drive will stop according to the set mode. When the drive is in the fault state, press this key to reset the drive and return to the normal stop state.

SHT	SHT	SHT	Shift between digits
ENT	Enter key	ENT	Enter menu or data confirmation
	Rotary encoder		Menu, function code and data can be modified. If the frequency channel of the drive is the operation panel, the rotation button can modify the set frequency of the drive.

3.2 Keypad operation methods

You can perform various operations on the drive by operating the keypad, as follows:

3.2.1 Shortcut monitoring parameter view

Six shortcut parameters are fixedly displayed in the shortcut monitoring interface, which can be switched by the Up or Down key. When the ENT key is pressed down in this interface, it will immediately return to the first shortcut parameter, and the six shortcut parameter sequence list is as follows.

Shortcut parameter 1	Determined by function code FC.17
Shortcut parameter 2	Output current
Shortcut parameter 3	Bus voltage
Shortcut parameter 4	Set frequency
Shortcut parameter 5	AI1
Shortcut parameter 6	Terminal state 1

The above is the shortcut display in the general mode, which will vary with different industry characteristics in other industry selections.

3.2.2 Settings of function code parameters

The function parameter system of this drive includes function code F0～FF group, monitoring parameter U0 group, and fault record parameter U1 group. Each function group includes several function codes. The function code is identified by (function code group number + function code number). For example, “F5.08” indicates the 8th function code of the 5th function group.

Function code setting example:

Example 1: Change the forward jog frequency setting from 5Hz to 10Hz (F2.20 changed from 5.00Hz to 10.00Hz)

1) Press the PRG key to enter the programming state, the digital tube displays function parameter “**-F0-**” and press the ▲ key to make the LED digital tube display “**-F2-**”.

2) Press ENT, you can see the digital tube displays function parameter “**F2.00”.**

3) Press the ▲ key to make the digital tube display function parameter “**F2.20**”.

4) Press the ENT key, you will see the data (5.00) corresponding to F2.20, meanwhile, the LED (Hz) corresponding to its unit frequency lights up.

5) Press the ∪∪ key, if flashes, shift to the highest bit “5”, and press the ▲ key five times, to change to **10.00**.

6) Press the ENT key, if the parameter does not flash, it indicates the modification is successful.

7) Press the PRG key, to exit the programming state.

Note: In P.off state, it is forbidden to modify the function code parameter.

3.2.3 Jog function operation

Use the keypad to perform the jog operation of the drive:

1) Press the PRG key three times to enter the jog operation state, and the digital tube displays function parameter "**JOG-".**

2) Press and hold the Up key to forward and jog.

3) Press and hold the Down key to reverse and jog.

3.2.4 Parameter upload and download operations

The external keypad has the functionality of uploading and downloading the function code.

1) On the external keypad, press the υ υkey + the ▲ key, to execute the function code uploading function. The external keypad reads all the function code values from the control board, and then writes into the keypad memory chip.

2) On the external keypad, press the υ υ key + the ▼ key, to execute the function code downloading function. The external keypad reads all the function code values from the memory chip, and then writes into the drive control board chip. However, when downloading, the keypad will automatically distinguish the software version, drive voltage level, and drive power level. The specific conditions are as follows:

a. If the downloaded function code is inconsistent with the drive software version of the parameter to be downloaded, it will not be downloaded and an E028 fault will be reported.

b. If the downloaded function code is inconsistent with the drive voltage level of the parameter to be downloaded (e.g. the downloaded function code is of 2S model, but the drive is of 4T model), it will not be downloaded and an E028 fault will be reported.

c. If the downloaded drive model parameter is inconsistent with the drive model of the drive whose parameter are being downloaded, the download will not be performed and an E028 fault will be reported.

d. If the software of drive is consistent with the software version, voltage level, and machine model of the parameters to be downloaded, but the power level is inconsistent, the "F3 group: Motor related parameters" will not be downloaded, and other parameters will be downloaded normally.

e. If the downloaded function code is consistent with the drive's software version, voltage level, machine model, and power level of the parameters to be downloaded, all parameters will be downloaded.

Chapter IV Function Parameter Table

4.1 Function parameter table

Description of symbols in the table:

× - Indicates this parameter cannot be changed during the operation.

○ - Indicates this parameter can be changed during the operation.

● - Indicates the actual test parameter, which cannot be changed.

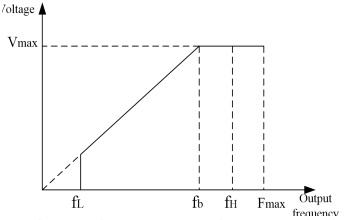
***** - Indicates this parameter is the reserved parameter of the manufacturer, which is prohibited to be changed.

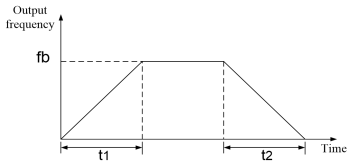
<table>
<tr><th>Parameter Code</th><th>Parameter name</th><th>Parameter detailed description</th><th>Contact address</th><th>Factory value</th><th>Change</th></tr>
<tr><td colspan="6">F0 group: System management parameters</td></tr>
<tr><td>F0.00</td><td>Parameter operation protection</td><td>0: Password operation. You can view the function code value without entering a password, but you cannot change it. You need to enter the correct password in F0.05 before changing the function code.
1: Password operation. You cannot view the function code value when no password is entered, and the function code will display “-----”. You need to enter the correct password in F0.05 before viewing and changing the function code.
Note:
This function will take effect only after setting the function code operation password in F0.05.</td><td>0x0000</td><td>0</td><td>○</td></tr>
<tr><td>F0.02</td><td>Drive operation deadline</td><td>Set range: 0~Maximum timing 65535h
0: indicates unlimited.</td><td>0x0002</td><td>0h</td><td>○</td></tr>
<tr><td>F0.03</td><td>Parameter initialization</td><td>0: No operation
1: Restore the factory settings (the drive model, running time, and fault records will not be restored)
2: Clear the fault memory information (clear fault memory parameters of U1 group)</td><td>0x0003</td><td>0</td><td>×</td></tr>
<tr><td>F0.04</td><td>Industry code</td><td>0: Universal drive
1: Special drive for water supply
Note:
Changing the industry code will restore other function codes to their factory settings.
The factory value of part of function codes of the special drive for water supply is set according to the following list:
<table><tr><th>Function code</th><th>Factory value</th></tr><tr><td>F1.01</td><td>1</td></tr></table></td><td>0x0004</td><td>00</td><td>×</td></tr>
</table>

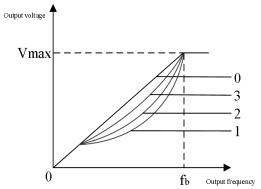
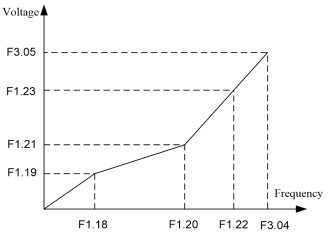
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		F1.02 8 **F8.14 4ms** **F8.15 5.0%** **FC.17 14** LED tens digit: Reserved **Note:** **When using the HAVXSIO3DIR expansion card, the ten digit of the parameter F0.04 should be set to 1, and then power off and restart the drive.** **When using the HAVSPIO4DI8R expansion card, set the ten digit of the parameter F0.04 to 0, and then power off and restart the drive.**			
F0.05	Function code operation password	Setting range: 0~65535 0: Indicates no password, set any non-zero number, the password protection function will take effect immediately, please keep the set password in mind. If you want to change the password again after setting the password, you need to clear the password by performing the following operations: (1) Enter the correct password first. (2) Set the password to 0. (3) Enter new password. **Note:** **The password protection authority is set in F0.00, which is used to prohibit unauthorized personnel from viewing and changing the function code parameters.**	0x0005	0	○
F1 group :Basic operating parameters					
F1.00	Control mode	0: Reserved 1: V/F control: Sound versatility, and stable operation, can effectively improve low-frequency torque and suppress current oscillation, with slip compensation and automatic voltage adjustment functions, further improving control accuracy.	0x0100	1	*
F1.01	Channel of running commands	0: Keypad run command channel: By the RUN key, and the STOP key, you can control the drive to run and stop, press and hold the ▲ key and the ▼ key in the "**JOG-**" interface, you can perform forward jog and reverse jog. 1: Terminal run command channel: Control the running and stopping of the drive through the multifunctional input terminal forward, reverse, forward jog, reverse jog, etc. (The corresponding	0x0101	0	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		multifunctional input terminal's function must be defined by the F6 and Fd parameter groups). 2: Serial port run command channel: Control the running and stopping of the drive through communication.			
F1.02	Setting channel of main frequency x command	0: Keypad digital potentiometer input The frequency is set by adjusting the digital potentiometer on the panel. 1: Digital input 1 Setting frequency by modifying function code F1.05 (corresponding to auxiliary frequency Y) or F1.07 (corresponding to main frequency X). 2: Digital input 2 The frequency is adjusted by setting the UP/DN function through the multifunctional input terminal. 3: Digital input 3 Communication input. The frequency is set by the serial port frequency set command. 4: AI1 input Frequency setting is determined by AI1 terminal analog voltage/current, input range: DC 0～10V or DC 0～20mA (J1 jumper selection), and the corresponding frequency curve is set in F5.00～F5.05 function code. 5: AI2 input Frequency setting is determined by AI2 terminal analog voltage/current, input range: DC 0～10V or DC 0～20mA (AI2 jumper selection), and the corresponding frequency curve is set in F5.00～F5.05 function code. 6: Terminal pulse input The frequency setting is determined by the terminal pulse frequency (input by DI5, and the function code F6.19 needs to be set to "high-frequency pulse input" function before use). The input pulse signal frequency range is 0~50.0kHz, and the corresponding frequency curve is set in F5.19～F5.23 function code. 7: Multi-step speed input The drive runs in multi-step speed mode, selects multi-step speed operation or simple PLC operation through function code F9.00. When multi-step speed operation is selected, set the multi-step speed	0x0102	0	○
F1.03	Setting channel of auxiliary frequency Y command		0x0103	1	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		terminal combination through group F6 and Fd to select the current running stage, and determine the current running frequency and ACC/DEC time through group F9 function code. When simple PLC operation is selected, determine the PLC operation mode, the number of operation stages, the phase operation frequency, the phase operation direction, and the phase operation time through group F9 function code. 8: PID input The drive operation mode is process PID control, and the operation frequency is the frequency value after PID action. In this case, you need to set PID related functions through group F8. 9-15: Reserved			
F1.04	Frequency source combination mode	0: X, the current frequency is set to the main frequency X. 1: Y, the current frequency is set to the auxiliary frequency Y. 2: X+Y, the current frequency is set to the main frequency X + the auxiliary frequency Y. 3: X-Y, the current frequency is set to the main frequency X - the auxiliary frequency Y. 4: Max (X,Y). The larger of the main frequency X and the auxiliary frequency Y is the set frequency. 5: Min (X,Y). The smaller of the main frequency X and the auxiliary frequency Y is the set frequency. **Note:** **If the X and Y directions are not the same, the frequency direction after the combination of 2 and 3 is based on the main frequency X, while 4 and 5 is based on the selected frequency direction.** **Besides the calculation during combination is based on the absolute value of the main and auxiliary frequencies, if the calculated value is less than 0, it will run at zero frequency.** **The combination mode can be switched through the multifunctional input terminal (group F6).**	0x0104	0	○
F1.05	Digital setting of auxiliary frequency Y	Set range: Lower limit frequency ~ upper limit frequency When the auxiliary frequency Y input	0x0105	50.00Hz	○

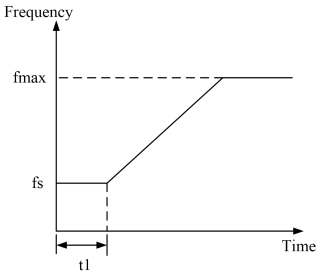
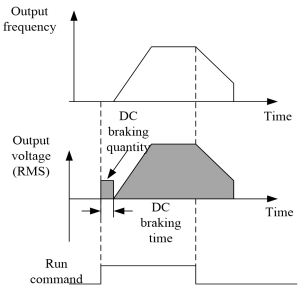
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		channel is selected to “digital setting 1”, this function code value is the frequency set value of the auxiliary frequency Y.			
F1.06	Max output frequency	Set range: Upper limit frequency～599.00Hz  1. The maximum output frequency is the highest frequency allowed by the drive, such as fmax shown in the figure. 2. The rated frequency of F3.04 is the corresponding minimum frequency when the drive outputs the highest voltage, such as fb shown in the figure. 3. The maximum output voltage of F3.05 is the corresponding output voltage when the drive outputs the rated frequency, such as Vmax shown in the figure. **Note:** **Be sure to set fmax, fb, and Vmax according to the motor parameters, otherwise the equipment may be damaged.**	0x0106	50.00Hz	×
F1.07	Main frequency X digital setting	Set range: Lower limit frequency ~ upper limit frequency When the main frequency X input channel is selected to “digital setting 1”, this function code value is the frequency set value of the main frequency X.	0x0107	50.00Hz	○
F1.09	Upper limit of running frequency	Set range: Lower limit frequency ~ maximum output frequency The upper limit frequency is the upper limit value of the output frequency of the drive. The value shall be less than or equal to the maximum output frequency. When the set frequency is higher than the upper limit frequency, it runs at the upper limit frequency.	0x0109	50.00Hz	○
F1.10	Lower limit of running frequency	Set range: 0.00~upper limit frequency The lower limit frequency is the lower limit value of the drive output frequency. When the set frequency is lower than the lower limit frequency, it runs at the lower limit frequency. **Note:**	0x010A	0.00Hz	○

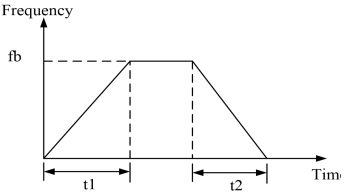
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		Maximum output frequency ≥ upper limit frequency ≥ lower limit frequency			
F1.11	ACC time 1	Set range: 0.01～600.00  	0x010B	Model determination	○
F1.12	DEC time 1	1. The ACC time refers to the time required for the drive to accelerate from zero frequency to the rated frequency of the motor, as shown in t1 in the figure. 2. The DEC time refers to the time required for the drive to decelerate from the rated frequency to zero frequency of the motor, as shown in t2 in the following figure. 3. There are four groups of acceleration and deceleration time parameters for this series of drives. Other acceleration and deceleration time (2, 3, 4) are defined in parameters F2.14～F2.19. The factory default ACC/DEC time is ACC/DEC time 1. To select other ACC and DEC time groups, you must select them by terminal (see group F6 parameters). The ACC and DEC times during the motor parameter self-tuning operation are set in F3.13 separately. The ACC and DEC times during jog operation are set in F2.22 and F2.23 separately. 4. The ACC time is only valid for normal acceleration process, excluding start DC braking time and start frequency hold time. The DEC time is only valid for normal deceleration process, excluding stop DC braking time. **Note:** **The default unit is s. For the selection of acceleration/deceleration time unit, see FC.07.**	0x010C		○
F1.13	ACC/DEC filtering time	Set range: 0～1000ms (0 indicates on filter) Acceleration/deceleration filter time constant. The longer the filter time is, the longer the actual acceleration/deceleration time that set.	0x010D	0ms	○

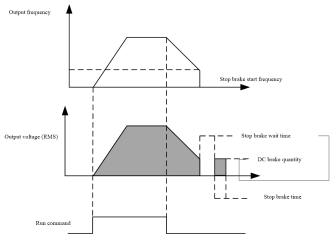
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F1.17	V/F curve setting	The V/F setting mode is defined in this function code, to meet the needs of different load characteristics. According to the definition, you can select 4 fixed curves and 1 custom curve. 0: Straight line V/F, as shown in curve 0 in the figure. 1: User-defined V/F curve, see F1.18~F1.23 function code setting for details. 2: Reduced torque characteristic curve 1 (2.0 power), as shown in curve 1 in the figure. 3: Reduced torque characteristic curve 2 (1.7 power), as shown in curve 2 in the figure. 4: Reduced torque characteristic curve 3 (1.2 power), as shown in curve 3 in the figure.  **Note:** **Curves 1, 2, and 3 are suitable for variable torque loads of fans and pumps. Users can adjust according to the load characteristics to achieve the best energy saving effect.**	0x0111	0	×
F1.18	V/F frequency value F1	F1.18 set range: 0.00～F1.20 F1.19 set range: 0～F1.21 F1.20 set range: F1.18～F1.22 F1.21 set range: F1.19～F1.23 F1.22 set range: F1.20～F3.04 F1.23 set range: F1.21～100.0%  1. When the F1.17 V/F curve is set to 1, the user can customize the V/F curve through F1.18～F1.23, as shown in the figure. The V/F curve is defined by adding (V1, F1), (V2, F2), and (V3, F3)	0x0112	12.50Hz	×
F1.19	V/F voltage value V1		0x0113	25.0%	×
F1.20	V/F frequency value F2		0x0114	25.00Hz	×
F1.21	V/F voltage value V2		0x0115	50.0%	×
F1.22	V/F frequency value F3		0x0116	37.50Hz	×
F1.23	V/F voltage value V3		0x0117	75.0%	×

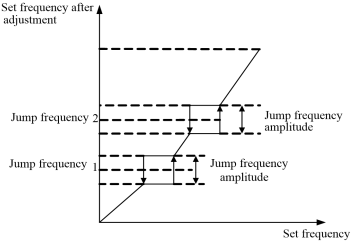
<table>
<tr><th>Parameter Code</th><th>Parameter name</th><th>Parameter detailed description</th><th>Contact address</th><th>Factory value</th><th>Change</th></tr>
<tr><td></td><td></td><td>three-point line, to adapt to special load characteristics.
2. This function parameter group is used to flexibly set the V/F curve required by the user.
Note:
V1<V2<V3, F1<F2<F3, setting the low-frequency voltage too high may cause the motor to overheat or even get burned, and the drive may also have overcurrent stall or overcurrent protection. It shall be set according to the load characteristics of the motor.</td><td></td><td></td><td></td></tr>
<tr><td>F1.24</td><td>Running direction setting</td><td>LED single digit: The running direction
0: Default direction
1: Opposite direction
LED tens digit: anti-reverse selection
0: Reverse allowed
1: Reverse prohibited
The steering of the motor can be changed by changing this function code, which is equivalent to the conversion of the rotation direction of the motor by adjusting any two lines of the motor line U, V, and W.
Note:
After the function code parameters are restored to the factory setting, the motor running direction will be restored to the factory value. Use with caution on the occasions that it is forbidden to change the motor steering after system debugging.</td><td>0x0118</td><td>00</td><td>○</td></tr>
<tr><td>F1.25</td><td>Carrier frequency setting</td><td>Set range: 1～15kHz
<table><tr><th>Carrier frequency</th><th>Motor noise</th><th>Leakage current</th><th>Interference</th></tr><tr><td>Decrease</td><td>↑</td><td>↓</td><td>↓</td></tr><tr><td>Increase</td><td>↓</td><td>↑</td><td>↑</td></tr></table>1. Advantages of high carrier frequency: Ideal current waveform, less current harmonics, and low motor noise.
2. Disadvantages of high carrier frequency: The switching loss increases, the drive temperature rises and the output ability of the drive is affected. Under high carrier frequency, the drive needs to be derated; at the same time, the leakage current of the drive increases, and the external electromagnetic interference increases.
3. The use of low carrier frequency is contrary to the above situation. Too low carrier frequency will cause low frequency operation instability, torque</td><td>0x0119</td><td>Model determination</td><td>○</td></tr>
</table>

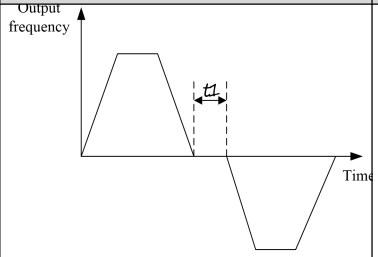
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		decrease and even oscillation. 4. When the drive leaves the factory, the manufacturer has set the carrier frequency reasonably. Generally, users do not need to change this parameter.			
F1.26	Overmodulation factor	Setting range: 100～150% This function enables PWM to work when the modulation ratio is greater than 1, which can increase the output voltage of the drive. Thereby increasing the torque output and effectively improving the maximum load capacity of the motor but the harmonic components of the output voltage will increase and cause the temperature of the motor to rise.	0x011A	110%	×
F1.27	Automatic carrier frequency adjustment	0: disable 1: enable When the automatic adjustment of the carrier frequency is enabled, the drive will automatically adjust the carrier frequency according to the temperature.	0x011B	0	○
F2 group: Start-stop control					
F2.00	Start operation mode	LED single digit: Start mode 0: Start from the start frequency: Start at the start frequency set by F2.01, and accelerate to the set frequency after running the hold time set by F2.02 at this frequency. 1: Brake first and then start from the start frequency: First start with the DC braking current set in F2.03 and the DC braking time set in F2.04 for DC braking and then start from the start frequency. 2: Speed tracking and restart: Tracking the current speed and direction of the motor, and perform smooth start without impact on the motor that is still rotating. LED tens digit: Speed tracking mode 0: Tracking down from the frequency of shutdown, usually this method is used. 1: Tracking down from the maximum frequency, suitable for power generation load.	0x0200	00	×
F2.01	Start frequency	F2.01 set range: 0.20～60.00Hz F2.02 set range: 0.0～10.0s	0x0201	0.50Hz	○
F2.02	Start frequency hold time		0x0202	0.0s	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		 1. The start frequency refers to the initial frequency of the drive at start. As shown in fs in the figure, setting a proper start frequency can increase the torque at start. 2. Within the hold time of the start frequency, as shown as t1 in the figure, the output frequency of the drive is the start frequency, and then operate from the start frequency to the target frequency. 3. The start frequency value is not limited by the lower frequency limit.			
F2.03	DC braking current before start	F2.03 set range: 0.0～150.0% drive rated current F2.04 set range: 0.0～30.0s (0.0 indicates the DC braking is not active)	0x0203	100.0%	○
F2.04	DC braking time before start	 The process of brake first and then restart from the start frequency, as shown in the figure: When the drive is put into operation, first perform the DC braking before starting according to the DC braking current and the DC braking time set by F2.03 and F2.04; then start from this frequency and operate the set time according to the regulations of F2.01 and F2.02; then enter the normal acceleration phase according to parameters such as the	0x0204	0.0s	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		set acceleration and deceleration times, the acceleration and deceleration time methods, etc. and accelerate to the set frequency.			
F2.05	ACC/DEC mode selection	0: Linear acceleration/deceleration: The output frequency increases or decreases linearly  1: Reserved	0x0205	0	×
F2.06	Start protection selection (only valid for two-wire control)	This function enables the drive to automatically start running when the drive is powered on, the fault is cleared, or the command channel is switched to the terminal two-wire mode. 0: If the run command is valid, the drive does start, and the drive is in the running protection state. The drive will not run until the run command terminal is canceled and then the terminal is enabled. 1: If the running command is valid, the drive speed tracking starts. 2: If the run command is valid, the drive starts at the start frequency (F2.01).	0x0206	0	×
F2.07	Start protection wait time	Set range: 0.0～1000.0s	0x0207	5.0s	○
F2.08	Stop mode	0: Deceleration stop: After receiving the stop command, the drive will gradually reduce the output frequency according to the deceleration time and stop when the frequency reaches to zero. 1: Free running stop: After receiving the stop command, the drive immediately stops the output, and the load stops freely according to the mechanical inertia. 2: Deceleration stop + DC braking: After receiving the stop command, the drive reduces the output frequency according to the deceleration time and starts the DC braking when reaching the stop braking start frequency.	0x0208	0	×
F2.09	Starting frequency of DC braking for stop	F2.09 set range: 0.00～60.00Hz F2.10 set range: 0.00～10.00s F2.11 set range: 0.0～150.0% drive rated	0x0209	0.00Hz	○

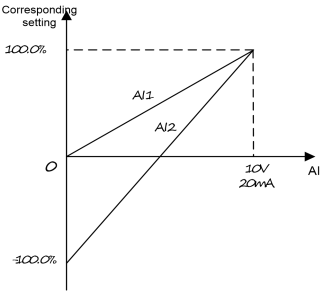
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F2.10	DC braking wait time at stop	current F2.12 set range: 0.0～60.0s (0.0 indicates the DC braking does not act) F2.13 set range: 0～1  1. DC braking start frequency at stop: Means that the drive starts DC braking when reaching this frequency during the deceleration stop. 2. DC braking wait time at stop: During decelerating and stopping, the time interval from the moment when the operation frequency reaches the start frequency of braking to the moment when the DC braking is applied. 3. DC braking current at stop: Refers to the DC braking amount that added. The larger the current, the stronger the DC braking effect. 4. DC braking time at stop: The duration of the DC braking amount. When the time is set to 0, the DC braking is disabled. 5. Action selection during stop DC braking wait time: Refers to the operation status of the drive during the braking wait time. When set to 0, it indicates no output, when set to 1, it indicates to run at the braking start frequency.	0x020A	0.10s	○
F2.11	DC braking current for stop		0x020B	100.0%	○
F2.12	DC braking time for stop		0x020C	0.0s	○
F2.13	Action selection within DC braking wait time for stop		0x020D	1	○
F2.14	ACC time 2	Set range: 0.01～600.00 For specific definition, see F1.11 and F1.12. **Note:** **The default unit is s. For the selection of acceleration/deceleration time unit, see FC.07.**	0x020E	Model determination	○
F2.15	DEC time 2		0x020F		○
F2.16	ACC time 3		0x0210		○
F2.17	DEC time 3		0x0211		○
F2.18	ACC time 4		0x0212		○
F2.19	DEC time 4		0x0213		○
F2.20	Running frequency of jog	Set range: 0.10～F1.09 Define the frequency during jog operation.	0x0214	5.00Hz	○
F2.21	Jog interval time	Set range: 0.0～100.0s	0x0215	0.0s	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F2.22	ACC time for jogging	Set range: 0.01～600.00s 1. The acceleration time refers to the time required for the drive to accelerate from zero frequency to the jog run frequency F2.20 of the motor. 2. The jog deceleration time refers to the time required for the drive to decelerate from the jog run frequency F2.20 to zero frequency of the motor.	0x0216	6.00s	○
F2.23	DEC time for jogging		0x0217		○
F2.24	Jump frequency 1	F2.24 set range: 0.00～599.00Hz F2.25 set range: 0.00～30.00Hz F2.26 set range: 0.00～599.00Hz F2.27 set range: 0.00～30.00Hz F2.28 set range: 0.00～599.00Hz F2.29 set range: 0.00～30.00Hz  1. Set the jump frequency can make the drive avoid the mechanical resonance point of the load. a) When the jump frequency is set to 0, this function is invalid. b) Once these jump points are set, the drive will automatically avoid stable operation at these frequency points during operation. 2. During the acceleration and deceleration, the output frequency of the drive can cross the jump frequency zone normally.	0x0218	0.00Hz	×
F2.25	Jump frequency 1 range		0x0219	0.00Hz	×
F2.26	Jump frequency 2		0x021A	0.00Hz	×
F2.27	Jump frequency 2 range		0x021B	0.00Hz	×
F2.28	Jump frequency 3		0x021C	0.00Hz	×
F2.29	Jump frequency 3 range		0x021D	0.00Hz	×
F2.30	FWD/REV running deadzone time	Set range: 0.00～360.00s The forward and reverse dead zone time refers to the transition interval for which the drive waits at the output zero frequency for the transition from the current operating direction to the opposite operating direction after receiving the reverse run command, shown as t1 in the figure.	0x021E	0.01s	×

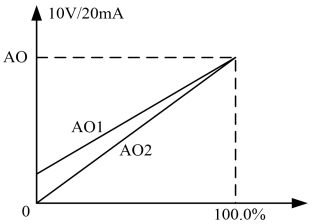
<table>
<tr><th>Parameter Code</th><th>Parameter name</th><th>Parameter detailed description</th><th>Contact address</th><th>Factory value</th><th>Change</th></tr>
<tr><td></td><td></td><td> 
</td><td></td><td></td><td></td></tr>
<tr><td colspan="6">F3 group: Motor and torque control parameters</td></tr>
<tr><td>F3.00</td><td>Motor model code</td><td>Set range: 1～118
The motor model code indicates the power code.
Partial codes are as follows:
<table>
<tr><th>Model code</th><th>Motor power</th></tr>
<tr><td>6</td><td>4T 2.2kW</td></tr>
<tr><td>7</td><td>4T 4.0kW</td></tr>
<tr><td>8</td><td>4T 5.5kW</td></tr>
<tr><td>9</td><td>4T 7.5kW</td></tr>
<tr><td>10</td><td>4T 11.0kW</td></tr>
<tr><td>11</td><td>4T 15.0kW</td></tr>
<tr><td>12</td><td>4T 18.5kW</td></tr>
<tr><td>13</td><td>4T 22.0kW</td></tr>
<tr><td>14</td><td>4T 30.0kW</td></tr>
<tr><td>15</td><td>4T 37.0kW</td></tr>
<tr><td>16</td><td>4T 45.0kW</td></tr>
<tr><td>17</td><td>4T 55.0kW</td></tr>
<tr><td>18</td><td>4T 75.0kW</td></tr>
<tr><td>19</td><td>4T 90.0kW</td></tr>
<tr><td>20</td><td>4T 110kW</td></tr>
<tr><td>21</td><td>4T 132kW</td></tr>
<tr><td>22</td><td>4T 160kW</td></tr>
<tr><td>23</td><td>4T 185KW</td></tr>
<tr><td>24</td><td>4T 200KW</td></tr>
<tr><td>25</td><td>4T 220KW</td></tr>
<tr><td>26</td><td>4T 250KW</td></tr>
<tr><td>27</td><td>4T 280KW</td></tr>
<tr><td>28</td><td>4T 315KW</td></tr>
<tr><td>106</td><td>2T 2.2KW</td></tr>
<tr><td>107</td><td>2T 3.7KW</td></tr>
<tr><td>108</td><td>2T 5.5KW</td></tr>
<tr><td>109</td><td>2T 7.5KW</td></tr>
<tr><td>110</td><td>2T 11.0KW</td></tr>
<tr><td>111</td><td>2T 15.0KW</td></tr>
<tr><td>112</td><td>2T 18.5KW</td></tr>
<tr><td>113</td><td>2T 22.0KW</td></tr>
<tr><td>114</td><td>2T 30.0KW</td></tr>
<tr><td>115</td><td>2T 37.0KW</td></tr>
<tr><td>116</td><td>2T 45.0KW</td></tr>
</table></td><td>0x0300</td><td>Model determination</td><td>×</td></tr>
</table>

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		Note: **1. When this function code is reset, F3.01～F3.10 motor parameters can be initialized.** **2. Model code parameters not mentioned in this table are reserved parameters.**			
F3.01	Rated power	F3.01 set range: 0.4～999.9kW F3.02 set range: 0.1～6553.5A F3.03 set range: 1～65535rpm F3.04 set range: 1.00～599.00Hz F3.05 set range: 1～480V 1. Set the parameters of the controlled asynchronous motor. 2. In order to ensure the control performance, make sure to set the values of F3.01～F3.05 correctly according to the nameplate parameters of the asynchronous motor. 3. This drive provides parameter self-tuning function. The accurate parameter self-tuning comes from the accurate settings of the motor nameplate parameters. 4. In order to ensure the control performance, please configure the motor according to the standard adapter motor of the drive. If the gap between the motor power and the standard adapter motor is too large, the control performance of the drive will decrease significantly.	0x0301	Model determination	×
F3.02	Rated current		0x0302		×
F3.03	Rated speed		0x0303		×
F3.04	Rated frequency		0x0304		×
F3.05	Rated voltage		0x0305		×
F3.06	No-load current I0	F3.06 set range: 0.1～6553.5A F3.07 set range: 0.000～50.000Ω F3.08 set range: 0.0～6553.5mH F3.09 set range: 0.000～50.000Ω F3.10 set range: 0.0～6553.5mH 1. After changing the motor model code F3.00, the drive automatically sets the parameters of F3.06～F3.10 to the parameters of the corresponding motor. 2. If the parameters of the motor are known, please write the values in F3.06～F3.10 accordingly. If the motor parameter self-tuning is performed, the set values of F3.06～F3.10 will be updated automatically after the tuning is completed normally. 3. These parameters are the reference parameters for drive control and have direct impact on control performance.	0x0306	Model determination	×
F3.07	Stator resistance R1		0x0307		○
F3.08	Leakage inductance X		0x0308		○
F3.09	Rotor resistance R2		0x0309		○
F3.10	Mutual inductance Xm		0x030A		○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		Note: **Users shall not change this group of parameters at random.**			
F3.11	Motor poles	2~14	0x030B	4	×
F3.12	Motor parameter autotuning	0: No action 1: Action (motor rotation): Perform comprehensive auto-tuning of motor parameters. It is recommended to use rotary auto-tuning for occasions with high control accuracy requirements. **Note:** **Before starting the auto-tuning, make sure that the motor is stopped and remove the load form motor shaft, otherwise the auto-tuning cannot be performed normally.** Parameter auto-tuning steps: 1. According to the characteristics of the motor, set the function codes “F3.01 rated power” and “F3.02 rated current”, “F3.03 rated speed”, “F3.04 rated frequency”, “F3.05 rated voltage”, and “F3.11 motor poles” correctly. 2. Set F3.12 to 1, press the ENT key, and then press the RUN key to start parameter auto-tuning. In this case, the keypad displays “STU--”. 3. When the keypad no longer displays “STU--”, it indicates that the parameter auto-tuning is completed, and the set value of F3.12 will be set to 0 automatically.	0x030C	0	×
F3.13	Autotuning acc and dec speeds	0.01～600.00s Set acceleration/deceleration time during auto-tuning no-load test.	0x030D	Model determination	○
F3.14	Autotuning current	1~100% motor rated current Set the current during auto-tuning DC test.	0x030E	25%	×
F5 group: Analog terminal parameters					
F5.00	AI1 minimum value	F5.00 set range: 0.00～F5.02 F5.01 set range: -100.0%～100.0% F5.02 set range: F5.00～10.00V F5.03 set range: -100.0%～100.0% F5.04 set range: 0.00～10.00V F5.05 set range: 0～1000ms F5.06 set range: 0.00～F5.08 F5.07 set range: -100.0%～100.0% F5.08 set range: F5.06～10.00V F5.09 set range: -100.0%～100.0% F5.10 set range: 0.00～10.00V F5.11 set range: 0～1000ms 1. The function code defines the	0x0500	0.00V	○
F5.01	Corresponding setting of AI1 minimum value		0x0501	0.0%	○
F5.02	AI1 maximum value		0x0502	10.00V	○
F5.03	Corresponding setting of AI1 maximum value		0x0503	100.0%	○
F5.04	AI1 zero point offset		0x0504	0.00V	○
F5.05	AI1 input filter time		0x0505	10ms	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F5.06	AI2 minimum value	relationship between the analog input voltage and the corresponding set value of the analog input. When the analog input voltage exceeds the set maximum or minimum input range, it will be calculated with the maximum or minimum input. 2. When analog input is current input, a current of 0～20mAcorresponds to a voltage of 0～10V. 3. In different applications, the nominal values corresponding to the analog setting 100.0% are different, please refer to the instructions of applications for details. The following legend illustrates the different settings:  4. Filter time of analog input: Adjust the sensitivity of the analog input. Increasing this value appropriately can enhance the anti-interference of the analog quantity, but will weaken the sensitivity of the analog input. 5. Analog zero drift setting: Generally, there will be some zero drift in the analog quantity. On some occasions with high accuracy requirements, the zero drift setting will achieve a better corresponding effect. **Note:** **Analog AI1 supports 0~10V/0~20mA input (selected by jumper J1), and analog AI2 supports 0~10V/0~20mA input (selected by jumper J2).**	0x0506	0.00V	○
F5.07	Corresponding setting of AI2 minimum value		0x0507	0.0%	○
F5.08	AI2 maximum value		0x0508	10.00V	○
F5.09	Corresponding setting of AI2 maximum value		0x0509	100.0%	○
F5.10	AI2 zero point offset		0x050A	0.00V	○
F5.11	AI2 input filter time		0x050B	10ms	○
F5.18	Analog automatic zero point offset adjustment	Set range: 0～1 When set to 1, the automatic zero drift adjustment of the analog quantity must be performed. It must be ensured that there is no external analog input quantity input.	0x0512	0	○
F5.19	PULSE minimum frequency input	0.00～F5.21	0x0513	0.00KHz	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F5.20	Corresponding setting of PULSE minimum frequency input	-100.0%～100.0%	0x0514	0.0%	○
F5.21	PILSE maximum frequency input	F5.19～50.00KHz	0x0515	50.00KHz	○
F5.22	Corresponding setting of HDIA upper limit frequency	-100.0%～100.0%	0x0516	100.0%	○
F5.23	HDIA frequency input filter time	0～1000ms	0x0517	10ms	○
F5.24	HDO function selection	0: Running frequency (0～Maximum output frequency) 1: Set frequency (0～Maximum output frequency) 2: Output current (0～2 times rated current) 3: Output torque (0～2 times rated torque) 4: Output voltage (0～1.2 times rated voltage) 5: Bus voltage (0～1000V) 6: AI1 (0～10V/0～20mA) 7: AI2 (0～10V/0～20mA) 8: Reserved 9: Output power (0～2 times rated frequency) 10: Pulse input (0～50.00KHz) 11: Communication setting (0～F1.06) 12: Operating frequency after compensation (0～maximum output frequency)	0x0518	5	○
F5.25	AO1 output		0x0519	0	○
F5.26	AO2 output		0x051A	0	○
F5.27	HDO output lower limit	F5.27 set range: 0.0～F5.29 F5.28 set range: 0.00～50.00KHz F5.29 set range: F5.27～100.0% F5.30 set range: 0.00～50.00KHz F5.31 set range: 0.0～F5.33 F5.32 set range: 0.00～10.00V F5.33 set range: F5.31～100.0% F5.34 set range: 0.00～10.00V F5.35 set range: 0.0～F5.37 F5.36 set range: 0.00～10.00V F5.37 set range: F5.35～100.0% F5.38 set range: 0.00～10.00V 1. The function code defines the corresponding relationship between the output value and the analog output.	0x051B	0.0%	○
F5.28	HDO output frequency corresponding to lower limit		0x051C	0.00KHz	○
F5.29	HDO output upper limit		0x051D	100.0%	○
F5.30	HDO output frequency corresponding to upper limit		0x051E	50.00KHz	○
F5.31	AO1 output lower limit		0x051F	0.0%	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F5.32	AO1 output voltage corresponding to lower limit	When the output value exceeds the set maximum output or minimum output range, it will be calculated as either upper limit output or lower limit output. 2. When the analog output is current output, 1mA current is equivalent to 0.5V voltage. 3. In different applications, the analog output corresponding to 100% of the output value is different. The following legend illustrates the different settings:  **Note:** **AO1 supports 0~10V/0~20mA output (selected by jumper J3), and AO2 supports 0~10V/0~20mA output (selected by jumper J4).**	0x0520	0.00V	○
F5.33	AO1 output upper limit		0x0521	100.0%	○
F5.34	AO1 output voltage corresponding to upper limit		0x0522	10.00V	○
F5.35	AO2 output lower limit		0x0523	0.0%	○
F5.36	AO2 output voltage corresponding to lower limit		0x0524	0.00V	○
F5.37	AO2 output lower limit		0x0525	100.0%	○
F5.38	AO2 output voltage corresponding to upper limit		0x0526	10.00V	○
F6 group: Digital terminal parameters					
F6.00	Function selection of DI1	0: No function 1: Forward running FWD (edge+ level) 2: Reverse running REV (edge+ level) 3: Three-wire control Sin (level) 4: Forward jog (level) 5: Reverse jog (level) 6: Free stop (level) 7: Fault reset (edge signal) 8: Run pause (level) 9: External fault input 10: Frequency setting increase (UP) 11: Frequency setting decreases (DOWN) 12: Multi-step speed terminal 1 13: Multi-step speed terminal 2 14: Multi-step speed terminal 3 15: Multi-step speed terminal 4 16: Acceleration/deceleration time selection 1 17: Acceleration/deceleration time selection 2 18: PLC pause 19: PLC operation stop and reset 20: PID control pause 21: PID parameter switching 22: Counter trigger	0x0600	1	×
F6.01	Function selection of DI2		0x0601	2	
F6.02	Function selection of DI3		0x0602	7	
F6.03	Function selection of DI4		0x0603	12	
F6.04	Function selection of DI5		0x0604	13	
F6.05	Function selection of DI6 (expansion card)		0x0605	0	
F6.06	Function selection of DI7 (expansion card)		0x0606	0	

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F6.07	Function selection of DI8 (expansion card)	23: Counter reset 24: Length reset 25: Acceleration/deceleration prohibited (level) 26: Immediate DC braking 27: UP/DOWN setting cleared 28: Control command switched to keypad 29: Control command switched to terminal 30: Control command switched to communication 31: Frequency source switched to the main frequency X 32: Frequency source switched to auxiliary frequency Y 33: High-frequency pulse count reset 35: Water shortage signal 38: Fire override mode 2 42: Pump cleaning mode 43: Bypass function 52: Fire override mode 1 53: Motor cable connection detection in fire override mode **Note:** **The function assigned to different terminals cannot be the same. If the functions of the two terminals are set to the same, the DI ports ranked first will work first, and the latter ones will not work.** Detailed description of terminal functions: 1～3: Forward running FWD, reverse running REV, three-wire running control Sin: For terminal two-wire and three-wire control signals, see function code F6.09 description for details. 4～5: Forward jog and reverse jog: Used for jog running control under terminal run command mode, the jog running frequency, jog interval time and jog acceleration/deceleration time are defined in F2.20～F2.23. 6: Free stop: If the function of this terminal is valid, the drive immediately terminates the output, and the load stops freely according to its mechanical inertia. 7: Fault reset: When a fault alarm occurs in the drive, the fault can be reset through this terminal. Its function is consistent with the STOP key function of the keypad.	0x0607	0	

<table>
<tr><th>Parameter Code</th><th>Parameter name</th><th>Parameter detailed description</th><th>Contact address</th><th>Factory value</th><th>Change</th></tr>
<tr><td></td><td></td><td>8: Running pause: If this terminal is valid during running, the drive will decelerate to lower limit of running frequency running according to the deceleration time. This function is invalid during jog running.
9: External fault input: The fault signals of external devices can be input through this terminal, which is convenient for the drive to monitor the faults of external devices. After receiving fault signals from external devices, the drive displays “E015”, which is the fault alarm of external devices.
10~11: Frequency setting increase UP, and frequency setting decrease DOWN: The frequency increase or decrease is realized through the control terminal, to perform remote control replacing the keypad. It is effective when the main frequency F1.02 = 2 or the auxiliary frequency F1.03 = 2, the acceleration/deceleration rate is set by F6.10.
12~15: Multi-step speed terminals 1~4: By selecting the terminal ON/OFF combination of these functions, you can define up to 16 stages of multi-speed running. The frequency of multi-step speed, acceleration/deceleration time, and the rotating direction are set in group F9.
<table>
<tr><td>K4</td><td>K3</td><td>K2</td><td>K1</td><td>Frequency setting</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Multi-step instruction 1</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>Multi-step instruction 2</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>Multi-step instruction 3</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>Multi-step instruction 4</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>Multi-step instruction 5</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>Multi-step instruction 6</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>Multi-step instruction 7</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>Multi-step instruction 8</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Multi-step instruction 9</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>Multi-step instruction 10</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>Multi-step instruction 11</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>ON</td><td>Multi-step instruction 12</td></tr>
</table></td><td></td><td></td><td></td></tr>
</table>

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change

ON	ON	OFF	OFF	Multi-step instruction 13
ON	ON	OFF	ON	Multi-step instruction 14
ON	ON	ON	OFF	Multi-step instruction 15
ON	ON	ON	ON	Multi-step instruction 16

16~17: Acceleration/deceleration time selection 1~2: The ON/OFF combination of acceleration/deceleration time terminals 1 and 2 can realize the selection of acceleration/deceleration time 1~4.

K2	K1	Acceleration/deceleration time selection
OFF	OFF	Acceleration/deceleration time 1
OFF	ON	Acceleration/deceleration time 1
ON	OFF	Acceleration/deceleration time 3
ON	ON	Acceleration/deceleration time 4

18: PLC pause: Used to pause the running PLC process. When this terminal is valid, drive runs at lower limit of running frequency. The PLC running is not counted.

19: PLC running stop and reset: PLC is prohibited from starting when the terminal is valid, deceleration and stop control is implemented for the PLC running process, and the PLC is reset to the initial state.

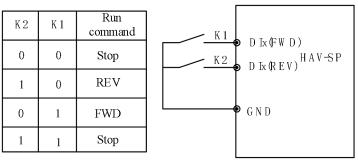
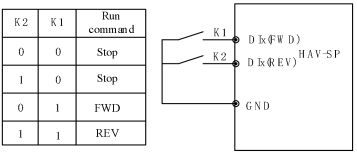
20: PID control pause: PID is temporarily pause, and the drive maintains the current output frequency without performing PID adjustment.

21: PID parameter switching: When the PID parameter switching condition (F8.12) is set to 1 (via terminal switching), the F8.06~F8.08 are used for PID parameters when the terminal is invalid, and F8.09~F8.11 are used when the terminal is valid.

22: Counter trigger: Count pulse input port of the built-in counter, the highest pulse frequency: 200Hz, and the current count value is stored when power is off. See function codes F6.22 and F6.23 for details.

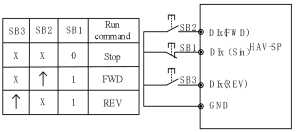
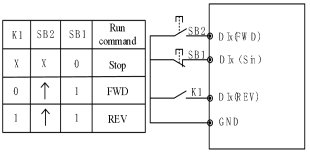
23: Counter reset: Clear the built-in counter of the drive and use it in conjunction with function 22 (counter trigger signal input).

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		24: Length reset: When the function terminal is valid, the actual length is cleared to zero. 25: Acceleration/deceleration prohibition: Keep the motor from being affected by any external signal (except stop command), and maintain operation at the current speed. This function is invalid during jog running. 26: Immediate DC brake: When the stop mode is deceleration stop + DC braking" (F2.08=2), it applies DC brake when a valid signal is given to this terminal. 27: UP/DOWN setting is cleared: When the frequency input channel is set to terminal UP/DN, this function terminal can directly clear the frequency set by UP/DN. 28: Control command switch to keypad 29: Control command switch to terminal 30: Control command switch to communication If the above three terminals or two of them are closed at the same time, the priority is keypad> terminal> communication. **Note:** **When switching to terminal two-wire control, the running state changes are affected by the F2.06 parameter; when switching to other control modes, the current running state is maintained.** 31: Switch frequency mode to main frequency X 32: Switch frequency mode to auxiliary frequency Y If the above two terminals are closed at the same time, the priority of switching to the main frequency X> switching to the auxiliary frequency Y 33: High-frequency pulse count reset: The high-frequency pulse count value recorded by function code U0.16 is cleared. 35: Water shortage alarm: When the water supply mode is running, the E024 water shortage alarm is reported. 38: Fire override mode 2; This terminal is used for fire override mode 2, see Parameter FA.17 for details. 42: Pump cleaning function: this terminal is used to select whether to clean the water pump when starting in the water			

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		pump mode. 43: Bypass function: After this function is turned on, the operation instruction is received, and the contactor of the drive is closed firstly (see DO or relay No. 29 function for details). After 100ms delay, the drive starts to run. If the frequency reach to 50Hz, the drive is free to stop. After that, if the stop command is received, the power frequency contactor will be disconnected. **Notes:** **1. The bypass function requires the connection of two contactors: frequency conversion contactors and power frequency contactors, which need to be interlocked.** **2. Before using this function, it is necessary to run the drive to confirm that the operation direction of the drive is consistent with that of the direct connection to the power grid.** 52: Fire override mode 1, see Parameter FA.17 for details. 53: Motor cable connection detection in fire override mode, see Parameter FA.17 for details.			
F6.09	FWD/REV running mode setting	0: Two-wire control mode 1: This mode is the most commonly used two-wire mode. The forward and reverse direction of the motor can be changed using defined FWD and REV terminals.  1: Two-wire control mode 2: This mode uses the defined FWD as the running terminal and the direction is determined by the defined REV terminal. 	0x0609	0	×

K2	K1	Run command
0	0	Stop
1	0	REV
0	1	FWD
1	1	Stop

K2	K1	Run command
0	0	Stop
1	0	Stop
0	1	FWD
1	1	REV

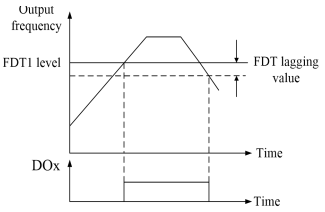
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		2: Three-wire control mode 1: This mode uses the defined Sin as the enable terminal, the run command is generated by FWD or REV, and both also motor direction. When the drive operates, the terminal Sin must be closed. The terminal FWD or REV needs a rising edge signal to control the operation and direction of the drive. When the drive stops, the terminal Sin must be disconnected to complete the stop.  3: Three-wire control mode 2: This mode uses the defined Sin as the enable terminal, the run command is generated by FWD, and the direction is controlled by REV. When the drive operates, the terminal Sin must be closed. The FWD terminal needs a rising edge signal to start the motor. The REV terminal determines the operation direction. When the drive stops, the Sin terminal must be disconnected to complete the stop. 			
F6.10	UP/DN rate	0.01～99.99Hz/s This function code defines the change rate of the set frequency modified by the UP/DN terminal.	0x060A	1.00Hz/s	○
F6.11	Output DO1	0: No output 1: Drive running signal (RUN) 2: Frequency arrival signal (FAR) 3: Frequency level detection signal (FDT1) 4: Frequency level detection signal (FDT2) 5: Overload detection signal(OL) 6: Undervoltage lockout stopping (LU) 7: External fault stop (EXT) 8: Frequency upper limit (FHL) 9: Frequency lower limit (FLL) 10: Drive running at zero frequency	0x060B	0	×
F6.12	Output DO2 (HDO terminal)		0x060C	1	×
F6.13	Relay output (TA/TB/TC)		0x060D	17	×

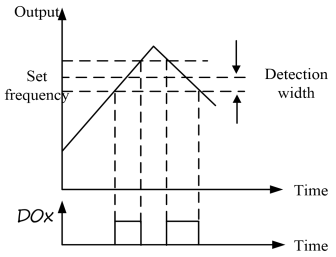
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		11: PLC phase running completion 12: PLC cycle completion 13: Set count value arrival 14: Specified count value arrival 15: Set length arrival 16: Drive ready to run (RDY) 17: Drive fault 19: Set cumulative running time arrival 20: Forward running 21: Reverse running 23: Water supply sleep running indication 24: Water pipe overpressure indication 25: Water pipe under-pressure indication 26: Water pipe shortage indication 27: Water tank shortage indication 28: Water pipe break indication 29: Drive control of bypass function 31: Power grid control of bypass function 32: Fire override mode activates feedback 33: The fault of motor cable connection in fire override mode **Note:** **Features not mentioned are reserved.** Detailed description of terminal functions: 1: Drive running signal (RUN): Outputs an indication signal id the drive is running. 2: Frequency arrival signal (FAR): Refer to the function description of F6.18. 3: Frequency level detection signal (FDT1): Refer to the function description of F6.14～F6.15. 4: Frequency level detection signal (FDT2): Refer to the function description of F6.16～F6.17. 5: Overload detection signal (OL): If the output current of the drive exceeds the FA.15 overload detection level, it outputs an indication signal after FA.16 overload detection time. 6: Undervoltage lockout stopping (LU): When the DC bus voltage is lower than the under-voltage limit level, it outputs an indication signal, and the LED displays “P.oFF” 7: External fault stop (EXT): When the drive has an external fault trip alarm (E015), it outputs an indication signal. 8: Frequency upper limit (FHL): When the set frequency ≥ the upper limit frequency and the operation frequency reaches the upper limit; an indication signal is output.			

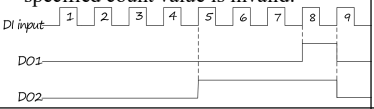
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		9: Frequency lower limit (FLL): When the set frequency ≤ the lower limit frequency and the operation frequency reaches the lower limit; an indication signal is output. 10: Drive running at zero frequency: Output frequency ≤ FC.10 zero frequency arrival range, it outputs an indication signal under operation status. 11: PLC phase operation completed: After a single stage of simple PLC operation is completed, an indication signal (single pulse signal, width is 250ms) is output. 12: PLC cycle completed: After the simple PLC completes one complete cycle, an indication signal (single pulse signal, width is 250ms) is output. 13: Set count value arrival 14: Specified count value arrival For functions 13~14, refer to F6.22~F6.23 function description. 15: Set length arrival: When the actual length U0.15≥FC.11 set length, an indication signal is output. 16: Drive ready to run (RDY): When the drive has no fault, the bus voltage is normal, and no signal is given at the drive operation prohibition terminal, it outputs an indication signal. In this case, the drive indicates that the start command can be given to the drive. 17: Drive fault: If the drive fails, an indication is output. 19: Set the accumulated running time arrival: When the accumulated running time of the drive (U0.27) reaches the running cutoff time (F0.02) of the drive, an indication signal is output. 20: Forward running indication: Outputs an indication signal when drive is running in forward direction. 21: Reverse running indication: Outputs an indication signal when drive is running in reverse direction. 22: Reserved 23: Water supply sleep indication: During water supply application, output an indication signal if the drive is in sleep mode.			

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		24: Water pipe overpressure indication: During water supply application, output a signal if the water pipe is in overpressure state at any time. 25: Water pipe under-pressure indication: During water supply application, output a signal if the water pipe is in under-pressure state at any time. 26: Water pipe shortage indication: During water supply application, if the drive finds that the water pipe is in short of water at any time, it outputs an indication signal. 27: Water tank shortage indication: During water supply application, if the drive finds that the water tank is in short of water at any time, it outputs an indication signal. 28: Water pipe break indication: During water supply application, if the drive finds that the water pipe burst at any time, it outputs an indication signal. 29: Drive control of bypass function: When the bypass function is enabled and the contactor is closed, an indicator signal is output. For details, see function description in parameter group DI 43. 31: Power grid control of bypass function When the bypass function is enabled and the bypass power frequency contactor is closed, an indicator signal is output. For details, see function description in parameter group DI 43. 32: Fire override mode activates feedback After fire mode 1 or fire mode 2 is enabled, an indicator signal is output. 33: The fault of motor cable connection in fire override mode If the motor cable connection is wrong in fire override mode, the drive will report fault E012, and the fault output of motor cable connection detection is valid. The fault output of motor cable connection detection is invalid after fault reset. **Note:** **Features not mentioned are reserved.**			
F6.14	FDT1 level	F6.14 set range: 0.00～599.00Hz	0x060E	50.00Hz	○
F6.15	FDT1 lag	F6.15 set range: 0.00～599.00Hz	0x060F	1.00Hz	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F6.16	FDT2 level	F6.16 set range: 0.00～599.00Hz F6.17 set range: 0.00～599.00Hz F6.14～F6.15 are supplementary definitions for No. 3 function FDT1 in the terminal output function, F6.16～F6.17 are supplementary definitions for No. 4 function FDT2 in the terminal output function. The usage of both is the same. In the following, In the below example, F6.14～F6.15 are taken as an example: When the output frequency is greater than or equal to a certain set frequency (FDT1 level), it outputs an indication signal until the output frequency drops to a frequency (FDT1 level - FDT1 lag) lower than FDT1 level, as shown in the figure.	0x0610	25.00Hz	○
F6.17	FDT2 lag		0x0611	1.00Hz	○
F6.18	Frequency arrival (FAR) detection width	0.00～599.00Hz This parameter is a supplementary definition for No. 2 function in the terminal output function. As shown in the figure, when the output frequency of the drive is within the positive and negative detection widths of the set frequency, a pulse signal is output.	0x0612	2.50Hz	○
F6.19	HDI input type (DI5)	0: Switch input 1: High-frequency pulse input (see F5.19～F5.23)	0x0613	0	×
F6.20	HDO output type (DO2)	0: Switch output 1: High-frequency pulse output (see F5.27～F5.30)	0x0614	0	×



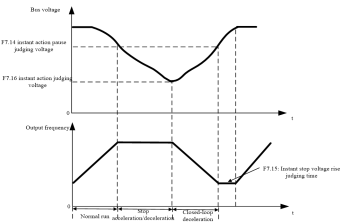


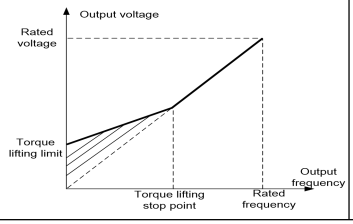
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F6.22	Counter reset value setting (set count value arrival)	F6.22 set range: F6.23～9999 F6.23 set range: 0～F6.22 F6.22 and F6.23 are supplementary definitions for No. 13 and No. 14 functions in the terminal output function.	0x0616	0	○
F6.23	Counter detection value setting (specified count value arrival)	1. The set count value input refers to the number of input pulses from DIx (count trigger signal input function terminal), before the DOx (open collector output terminal) or the relay outputs an indication signal. As shown in the figure, when DIx inputs the 8th pulse, DO1 outputs an indication signal, and F6.22 = 8 in this case. 2. The specified count value input refers to the number of input pulses from DIx, before the DOx or the relay outputs an indication signal, till the set count value is reached. As shown in the figure, when DIx inputs the 5th pulse, DO2 outputs an indication signal, till the set count value 8 is reached, in this case F6.23 = 5. 3. When the specified count value is greater than the set count value, the specified count value is invalid. 	0x0617	0	○
F6.24	DI polarity switch 1	00000~11111 LED single digit: DI1 polarity LED tenth digit: DI2 polarity LED hundredth digit: DI3 polarity LED thousandth digit: DI4 polarity LED 10 thousandth digit: DI5 polarity This function code is used to set the polarity of the digital input. When the bit is set to 1, the input polarity is positive (connected to the common terminal is valid and disconnected is invalid). When the bit is set to 0, the input polarity is negative (connected with the common terminal is invalid, disconnected is valid).	0x0618	11111	○
F6.25	DI polarity switch 2	00000～11111 LED unit digit: DI6 polarity (expansion card) LED tenth digit: DI7 polarity (expansion card) LED hundredth digit: DI8 polarity (expansion card) LED thousandth digit: reserved	0x0619	11111	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		LED ten thousandth digit: reserved This function code is used to set the polarity of the digital input. When the bit is set to 1, the input polarity is positive (connected to the common terminal is valid and disconnected is invalid). When the bit is set to 0, the input polarity is negative (connected with the common terminal is invalid, disconnected is valid).			
F6.26	DO output switch polarity 1	00000~11111 LED single digit: DO1 positive/negative logic definition LED tens digit: DO2 positive/negative logic definition LED hundreds digit: Relay positive/negative logic definition LED thousands digit: Reserved LED ten thousands digit: Relay 1 positive/negative logic definition This function code is used to set the polarity of the output switch. When the bit is set to 1, the output switch is positive logic, when the bit is set to 0, the output switch is negative logic.	0x061A	11111	○
F6.28	DI filter time	0～1000ms Set DI1～DI5 common terminal function input filter time. In the case of large interference, you shall increase the set value of this function code to prevent mis-operation.	0x061C	5ms	○
F6.29	DO1 switch-on delay	Set range: 0.0～600.0s This function code defines the delay from the status change of the switch output terminal and the relay to the output change.	0x061D	0.0s	○
F6.30	DO1 switch-off delay		0x061E	0.0s	○
F6.31	DO2 switch-on delay		0x061F	0.0s	○
F6.32	DO2 switch-off delay		0x0620	0.0s	○
F6.33	Relay switch-on delay		0x0621	0.0s	○
F6.34	Relay switch-off delay		0x0622	0.0s	○
F6.35	Relay 2 output function (HAVXSIO3DIR expansion card function)	Same as F6.11 to F6.13 function code. **Note:** **Before use, the ten digit of the parameter F0.04 should be set to 1, and then power off to restart the drive.**	0x0623	0	×

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F6.37	Relay 1 Output function (RA/RB/RC)	Same as F6.11 to F6.13 function code.	0X0625	0	×
F7 group:Advanced function parameters					
F7.00	Overvoltage stalling protection voltage	F7.00 set range: 100.0～160.0%Udc F7.01 set range: 0.000～10.000V F7.02 set range: 0～1000 F7.03 set range: 1～1000ms 1. The overvoltage stall protection function detects the bus voltage during the decelerating operation of the drive and compares with the overvoltage stall point defined by F7.00 (relative to the standard bus voltage) and the overvoltage control voltage defined by F7.01 (relative to the bus voltage change rate), if the bus voltage exceeds the overvoltage stall point or the bus voltage change rate exceeds the overvoltage control voltage, the drive will adjust the deceleration time to make the output frequency slow down. 2. Overvoltage stall gain, and overvoltage stall integration time: Used to adjust the drive's ability to suppress overvoltage during deceleration. The larger the gain, and the longer the integration time, the stronger the ability to suppress overvoltage, and the drive's deceleration time becomes longer accordingly. So, under the premise of no overvoltage, the smaller the gain and the longer the integration time, the better the deceleration effect. **Note:** **When the set stall point is low, it is suggested that the user shall increase the deceleration time appropriately.**	0x0700	Model determination	○
F7.01	Overvoltage control voltage		0x0701	5.000V	○
F7.02	Overvoltage stall gain Kp		0x0702	5	○
F7.03	Overvoltage stall integration time		0x0703	200ms	○
F7.04	Overcurrent stall level	F7.04 set range: 80.0～230.0% F7.05 set range: 0～1 F7.06 set range: 0～1000 F7.07 set range: 1～1000ms 1. The overcurrent stall function is to automatically limit the overcurrent stall level (F7.04) not exceeding the setting, through the real-time control of the load 2. current, to prevent fault trips caused by current overshoot. For load occasions with large inertia or intense changes, this function is especially suitable.	0x0704	Model determination	○
F7.05	Overcurrent stall action selection		0x0705	1	○
F7.06	Overcurrent stall gain Kp		0x0706	5	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F7.07	Overcurrent stall integration time	3. The overcurrent stall level (F7.04) defines the current threshold of the overcurrent stall action, and its setting range is relative to the percentage of the drive rated current. When this parameter value is exceeded, the drive starts to implement the overcurrent stall protection function. 4. Overcurrent stall gain, and overcurrent stall integration time: Used to adjust the drive's ability to suppress overcurrent during acceleration and deceleration. The larger the gain, and the longer the integration time, the stronger the ability to suppress overcurrent, and the drive's acceleration/deceleration time becomes longer accordingly. So, under the premise of no overcurrent, the smaller the gain and the longer the integration time, the better the effect. 5. The overcurrent stall function is always effective under the acceleration/deceleration status. Whether the overcurrent stall function is effective during constant speed operation is determined by the overcurrent stall action selection (F7.05). F7.05＝0 overcurrent stall is invalid during constant speed operation; F7.05＝1 overcurrent stall is valid during constant speed operation.	0x0707	60ms	○
F7.08	Speed tracking gain Kp	F7.08 set range: 0～100 F7.09 set range: 1～1000ms F7.10 set range: 0.1～600.0s F7.11 set range: 1～100% F7.12 set range: 1～100% 1. Speed tracking acceleration/deceleration: The faster the acceleration/deceleration, the faster the speed tracking, but too fast setting may cause the speed tracking result unreliable. 2. Speed tracking threshold: When the torque current is smaller than the F7.11 threshold (relative to the motor rated current) during speed tracking, the tracking is considered successful. 3. Threshold for speed tracking switching completion: After speed tracking has successfully tracked the current	0x0708	10	○
F7.09	Speed tracking integration time		0x0709	50ms	○
F7.10	Speed tracking acceleration and deceleration		0x070A	20.0s	○
F7.11	Speed tracking threshold		0x070B	10%	○
F7.12	Speed tracking switching completion judgment threshold		0x070C	3%	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		frequency, the expected output voltage is calculated based on this frequency and the output voltage is gradually increased until the difference between the applied voltage and the expected output voltage is less than F7.12 threshold, in this case, it will enter normal operation status.			
F7.13	Instant stop/nonstop function selection	F7.13 set range: 0～1 F7.14 set range: 80.0～100.0% F7.15 set range: 0.00～100.00s F7.16 set range: 70.0～100.0% F7.17 set range: 0～1000 F7.18 set range: 1～1000ms F7.19 set range: 0～300.0s The instant stop/nonstop function is used to determine whether the drive will automatically perform low voltage compensation when the voltage drops or instant undervoltage. Reduce the output frequency appropriately and feed back the energy through the load to maintain the drive operation without tripping. F7.13 is set to 0, no action. F7.13 is set to 1, action (deceleration). In case of a momentary outrage or a sudden drop in voltage, the drive decelerates. When the bus voltage returns to normal, the drive will normally accelerate to the set frequency.  	0x070D	0	○
F7.14	Instant stop action pause judgment voltage		0x070E	90.0%	○
F7.15	Instant stop voltage rise time		0x070F	0.50s	○
F7.16	Instant stop action voltage		0x0710	80.0%	○
F7.17	Instant stop gain Kp		0x0711	5	○
F7.18	Instant stop integration time		0x0712	100ms	○
F7.19	Instant stop deceleration time setting		0x0713	20.0s	○
F7.20	Overcurrent stall speed recovery time limit	Set range: 0.01～600.00s After the overcurrent stall is canceled, the drive output frequency will resume to the set frequency, but the fastest acceleration / deceleration time for recovery is limited by this function code.	0x0714	Model determination	○
F7.21	Torque boost limit	F7.21 set range: 0.1～30.0% F7.22 set range: 0.00～F3.04	0x0715	4.0%	○
F7.22	Torque boost cutoff	F7.23 set range: 0～500 (when set to 0, it is manual torque boost)	0x0716	50.00Hz	○

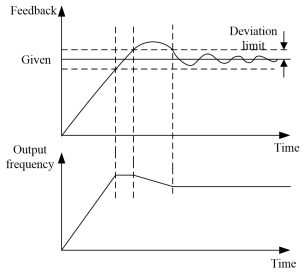
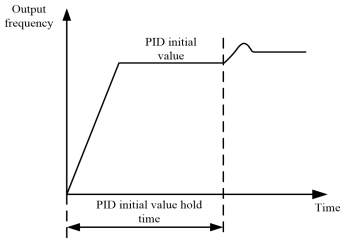
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F7.23	Torque boost gain 1	F7.24 set range: 1～10000ms F7.25 set range: 0.00～F3.04 F7.26 set range: 0～500 F7.27 set range: 1～10000ms F7.28 set range: 0～100% 1. The torque boost is to compensate the output voltage of the drive when the drive is running at low frequency. The torque boost can improve the low frequency characteristics in V/F control mode. 2. The torque boost amount shall be set appropriately according to the load. The load can increase the boost amount, but the boost amount shall not be set too large. When the torque boost is too large, the motor will run in over-excitation and the drive output current will increase. The motor heats up and the efficiency decreases. 3. Torque boost cutoff point: Below this frequency point, the torque boost is valid, and is invalid when the set frequency is exceeded. 4. Torque boost gain switching frequency point: Switching frequency point during high-speed and low-speed variable gains. 5. Setting of the torque boost gain and integration time: Increasing the gain can speed up the system's dynamic response, but if the gain is too large, the system is easy to generate oscillation; reducing the integration time can speed up the system's dynamic response, but if the integration is too small, the system overshoot is large and is easy to generate oscillation. Usually, the proportional gain is adjusted first to maximize under the premise that the system is not oscillating; then the integration time is adjusted to make the system have a fast dynamic response and reduce the system overshoot.  	0x0717	20	○
F7.24	Torque boost integral time 1		0x0718	1500ms	○
F7.25	Torque boost gain switching frequency point		0x0719	Model determination	○
F7.26	Torque boost gain 2		0x071A	10	○
F7.27	Torque boost integral time 2		0x071B	500ms	○
F7.28	Automatic torque boost factor		0x071C	30%	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F7.29	Motor oscillation suppression methods	F7.29 set range: 0～1 F7.30 set range: 0～1000 F7.31 set range: 0～10000ms In V/F control mode, it is easy to generate current oscillation at certain frequency. In minor cases, the motor can have an unstable operation, in serious cases, it will cause the drive overcurrent. The oscillation suppression function is used to suppress the natural oscillations generated when the drive cooperates with the motor. If the output current changes repeatedly during the constant load operation, by properly adjusting the oscillation suppression parameters, based on the factory parameters, F7.29=0 Suppress oscillations by adjusting output frequency; F7.29=1 Suppress oscillations by adjusting output voltage.	0x071D	1	○
F7.30	Motor oscillation suppression coefficient		0x071E	Model determination	○
F7.31	Motor oscillation suppression filter time		0x071F	100ms	○
Group F8: PID control parameters					
F8.00	PID operation control selection	0: Disable (Ready mode) 1: Enable (Ready mode)	0x0800	0	×
F8.01	PID reference source	When the frequency input channel is selected to 8, the drive operation mode is process PID control. 0: F8.05 digital input; 1: AI1; 2: AI2; 3: Reserved 4: PULSE setting; 5: Communication setting 6: Multi-step speed setting **Note:** **When F0.04 bit is 1, the multi-step speed setting function is invalid.** 7: Keypad digital potentiometer input 8: Reserved This function code determines the target input channel of PID. The set target of PID is a relative value, and the set 100% corresponds to 100% of the feedback signal of the controlled system. The system always performs calculation based on relative value (0 to 100.0%).	0x0801	0	×
F8.02	PID feedback source	This function code is used to select the PID feedback channel. 0: AI1; 1: AI2; 2: Reserved	0x0802	0	×

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		3: Pulse 4: Communication setting **Note:** **The target input channel and the feedback channel cannot be the same, otherwise, the PID cannot be controlled effectively.**			
F8.03	PID reference source smoothing time	Set range: 0～1000ms The external target input signal and feedback signal often overlap a certain interference. The channel is filtered by setting the filter time. The longer the filter time, the stronger the anti-interference ability, but the response becomes slower; the faster the filter time, the faster the response, but the anti-interference ability weakens.	0x0803	10ms	○
F8.04	PID feedback source smoothing time		0x0804	10ms	○
F8.05	PID digital setting	Universal drive mode setting range: 0.0～100.0% Water supply drive mode setting range: 0.0～F8.23	0x0805	0.0% or 0.0bar	○
F8.06	Proportional gain Kp1	Set range: 0～1000 Determine the adjustment intensity of the entire PID. The larger the proportional gain, the stronger the adjustment intensity. When there is a deviation between the feedback and target value, the output and the deviation are adjusted in proportion. If the deviation is constant, the adjustment amount is also constant. Proportional adjustment can quickly respond to changes in feedback, but just proportional adjustment cannot achieve non-differential control. The larger the proportional gain, the faster the adjustment speed of the system, but if it is too large, oscillations will occur. The adjustment method is to first set the integration time to be very long and the differential time to zero. Use only proportional adjustment to make the system run, change the target value, and observe the stable deviation (static difference) between the feedback signal and the target value. If the static difference is in the direction of target value changes (for example, increasing the input quantity, the feedback quantity is always less than the target value after the system is stable), continue to increase the proportional gain, otherwise decrease the proportional gain, and repeat the above	0x0806	10	○

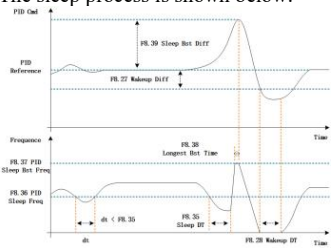
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		process until the static difference is relatively small.			
F8.07	Integration time Ti1	Set range: 1～10000ms Determine how fast the PID regulator performs integral adjustment on the deviation between the PID feedback and the target value. The shorter the integration time, the greater the adjustment intensity. When there is a deviation between the feedback and the target value, the output adjustment accumulates continuously. If the deviation persists, increase the adjustment constantly, until there is no deviation. The integral regulator can effectively eliminate static difference. If the integral regulator is too strong, there will be repeated overshoot, making the system unstable until oscillation occurs. The characteristics of the oscillation caused by excessive integration are as follows: The feedback signal swings up and down at an input quantity, and the swing gradually increases until it oscillates. The adjustment of the integration time parameter is generally from large to small, gradually adjust the integration time, and observe the effect of the system adjustment until the stable speed of the system reaches the requirements.	0x0807	500ms	○
F8.08	Differential time Td1	Set range: 0～10000ms Determine how strong the PID regulator performs adjustment on the deviation change rate between the PID feedback quantity and the target value. The shorter the differential time, the greater the adjustment intensity. When the deviation between feedback and target value changes, an adjustment proportional to the deviation change rate is output. The adjustment is only related to the direction and magnitude of the deviation change, and has nothing to do with the direction and magnitude of the deviation itself. The function of differential adjustment is to adjust according to the changing trend when the feedback signal changes, thus to suppress the change of the feedback signal. Please use the differential regulator with caution, because the differential regulation is easy to amplify the interference of the	0x0808	0ms	○

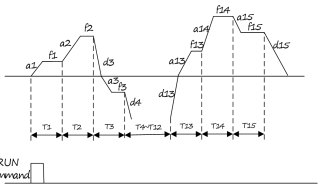
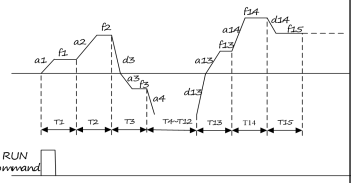
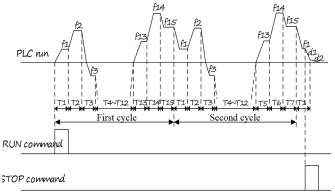
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		system, especially the interference with a higher change frequency.			
F8.09	Proportional gain Kp2	F8.09 set range: 0～1000 F8.10 set range: 1～10000ms **Note:** **When F8.10 is set to 0, the integration effect is invalid.** F8.11 set range: 0～10000ms The parameter functions are the same as F8.06～F8.08, when used to switch the two groups of PID parameters. Please refer to F8.12 for switching between both PID parameters.	0x0809	5	○
F8.10	Integration time Ti2		0x080A	2000ms	○
F8.11	Differential time Td2		0x080B	0ms	○
F8.12	Gain switching conditions	0: Do not switch 1: Switch through the DI terminal: The function of the DI terminal is set to 21 (PID parameter switch). When the terminal is invalid, select parameter group 1 (F8.06～F8.08). When the terminal is valid, select parameter group 2 (F8.09～F8.11). 2: Automatic switch based on the deviation: Select the parameter group 1 (F8.06～F8.08) when the absolute value of the deviation between the target value and the feedback quantity is less than the switch threshold (F8.13), and select the parameter group 2 (F8.09 ~ F8.11) when greater than the switch threshold (F8.13) . 3: Switch automatically according to PID output: When the PID output (0～maximum output frequency corresponds to 0.0～100.0%) is less than the switch threshold (F8.13), select parameter group 1 (F8.06～F8.08), and select parameter group 2 (F8.09~F8.11) when greater than the switch threshold (F8 .13)	0x080C	0	○
F8.13	Gain switching threshold	Set range: 0.0～100.0% The PID parameter switch threshold is valid when the gain switch condition (F8.12) is set to 2 or 3.	0x080D	0.0%	○
F8.14	Sampling cycle	Set range: 1～60000ms The sampling period T is a sampling period of the feedback quantity, and the PID regulator operates once in each sampling period. The greater the sampling period, the slower the response.	0x080E	1ms	○

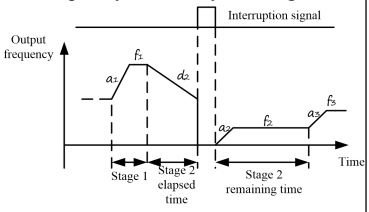
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F8.15	PID control deviation limit	Set range: 0.0～50.0% The deviation limit corresponds to a closed-loop input value. When the absolute value of the deviation between the target value and the feedback quantity is within this range, the PID stops adjusting, as shown in the figure. The proper setting of this function helps to consider the accuracy and stability of the system output. 	0x080F	0.0%	○
F8.16	Closed-loop regulation features	0: Positive action. When the feedback signal is less than the input quantity, the output frequency of the drive rises to make the PID reach balance. Such as rewinding tension PID control. 1: Negative action. When the feedback signal is less than the input quantity, the output frequency of the drive drops to make the PID reach balance. Such as unwinding tension PID control.	0x0810	0	○
F8.17	PID initial value	F8.17 set range: 0.0～100.0% F8.18 set range: 0.00～600.00s	0x0811	0.0%	×
F8.18	PID initial value hold time	1. After the drive starts, accelerate to the initial PID value (F8.17) according to the acceleration time. After running for a period of time at this initial value (F8.18), the PID starts the closed-loop adjustment operation. 2. This function allows the closed-loop adjustment to quickly enter the stable phase. 	0x0812	0.00s	×

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F8.19	Closed-loop output polarity selection	0: Closed-loop output is negative, run at zero-frequency 1: Closed-loop output is negative, reverse	0x0813	0	○
F8.20	PID reverse cutoff frequency	Set range: 0.00~upper limit frequency When the PID output frequency is negative (i.e. the drive reverses), determine the upper limit of the reverse frequency.	0x0814	2.00Hz	×
F8.21	Feedback offline detection value	F8.21 set range: 0.0～100.0%(when 10% is set,10% of the Maximum sensor range is corresponding) F8.22 set range: 0.0～200.0s (0.0s indicates no detection) When the feedback value is less than the feedback loss detection value and the feedback loss detection time has passed, the drive reports a closed-loop feedback loss fault (E020).	0x0815	10.0%	○
F8.22	Feedback offline detection time		0x0816	0.0s	○
F8.23	Maximum sensor range	Set range: 0.0～200.0bar The maximum range of the sensor corresponds to the maximum value of the closed-loop input value.	0x0817	10.0bar	○
F8.24	Water supply sleep selection	0: Automatic sleep 1: Run at lower limit frequency	0x0818	0	○
F8.25	Water supply sleep detection time	F8.25 set range: 0.0～3600.0s F8.26 set range: 0.01～600.00s Sleep detection pressure = (100.0%-F8.15) * set pressure value. When the drive is running, it will detect whether the feedback pressure is higher than the sleep detection pressure. If the feedback pressure is higher than the sleep detection pressure, the drive starts the sleep detection. After the water supply sleep detection delay time set by F8.25, if the feedback pressure is still greater than the sleep detection pressure, it exit the PID adjustment and the drive gradually reduces the output frequency according to the water supply sleep deceleration time defined by F8.26. If the feedback pressure becomes lower than the sleep detection pressure in the above process, the drive determines that the sleep detection has failed, and the drive returns to the PID adjustment status.	0x0819	2.0s	○
F8.26	Water supply sleep deceleration time		0x081A	30.00s	○
F8.27	Water supply wake pressure tolerance	F8.27 set range: 0.0～100.0% (100.0% is the set pressure value) F8.28 set range: 0.0～3600.0s 1. Water supply wake-up pressure =	0x081B	10.0%	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F8.28	Water supply wake detection time	(100.0%-F8.27) * set pressure value. 2. When the drive enters the sleep status, if the feedback pressure is lower than the water supply wake-up pressure, the drive starts wake-up detection. After the water supply wake-up detection time set by F8.28, if the feedback pressure is still lower than the wake-up pressure, the wake-up is successful and the drive returns to the PID adjustment status, otherwise the wake-up fails. Setting the wake-up pressure too high may cause the drive to start and stop frequently. Setting it too low may cause insufficient water supply pressure.	0x081C	2.0s	○
F8.29	Water pressure overpressure alarm detection value	Set range: 0.0～100.0% (Do not test when set to 0, 100.0% is the maximum range of pressure sensor) When the feedback pressure is greater than or equal to this set value, and after the F8.31 pressure abnormal alarm detection time, a water pipe overpressure indication is output (the terminal outputs No. 24 function).	0x081D	90.0%	○
F8.30	Water pressure under-pressure alarm detection value	Set range: 0.0～100.0% (Do not test when set to 0, 100.0% is the maximum range of pressure sensor) When the feedback pressure is less than or equal to this set value, and after the F8.31 pressure abnormal alarm detection time, a water pipe under-pressure indication is output (the terminal outputs No. 25 function).	0x081E	0.0%	○
F8.31	Water pressure abnormal alarm detection time	Set range: 0.0～3600.0s	0x081F	50.0s	○
F8.32	Water shortage alarm set value	F8.32 set range: 0.0～100.0% (100.0% is the set pressure value) F8.33 set range: 0.0～3600.0s F8.34 set range: 0～10000min (0min indicate there's no water shortage restart function) When the output frequency reaches the upper limit, the feedback pressure is still less than or equal to F8.32 water shortage set value and after F8.33 water shortage alarm detection time, a water pipe water shortage indication (the terminal outputs No. 26 function) will be output and the E023 water shortage fault will be reported.	0x0820	0.0%	○
F8.33	Water shortage alarm detection time		0x0821	20.0s	○
F8.34	Water shortage restart wait time		0x0822	0min	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		When the E023 water shortage fault occurs, without resetting the fault manually, it will automatically reset and restart the operation after the F8.34 water shortage restart wait time.			
F8.35	Water supply absolute sleep detection time	Setting range: 0~3600.0s When the drive sleeps and decelerates to the lower limit frequency, it will run at the lower limit frequency for the time defined by F8.35 and then go to zero frequency operation.	0x0823	10.0s	○
F8.36	Sleep frequency	F8.35 Setting range: 0~3600.0s F8.36 Setting range: Lower limit frequency to Upper limit frequency F8.37 Setting range: Lower limit frequency to Upper limit frequency F8.38 The value ranges: 0 ~ 300.0s F8.39 Setting range: 0 ~ 10.0%(When 10% is set, 10% of the Maximum sensor range is corresponding) After the drive quits PID adjustment after the Water supply sleep detection time (F8.25), if it runs below the sleep frequency (F8.36) and the continuous operation time exceeds the Water supply absolute sleep detection time (F8.35), if F8.38 (longest boost time) = 0, it will be reduced to zero frequency operation. If F8.38 (longest boost time) > 0, the drive will run to the sleep boost frequency (F8.37) and maintain the operation at this frequency, and will be reduced to zero frequency operation after meeting any of the following conditions. 1. Meet the water pressure conditions: feedback pressure > (set pressure + Sleep boost tolerance (F8.39). 2. Meet the time condition: the system is running at the sleep boost frequency (F8.37) and the running time exceeds the longest boost time (F8.38) The sleep process is shown below:  	0x0824 0x0825 0x0826	0.00Hz 50.00Hz 0.0s	○ ○ ○
F8.39	Sleep boost tolerance		0x0827	0.0%	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
Group F9: Multi-step speed control parameters					
F9.00	Simple PLC mode	LED single digit: PLC run mode 0: No action 1: Stop after a single cycle: The drive will stop automatically after completing one cycle. You need to give a run command again to start.  2: Keep the final value after a single cycle: The drive will automatically keep the operation frequency and direction of the last stage after completing one cycle.  3: Continuous cycle: The drive will automatically start the next cycle after completing one cycle, till there's a stop command.  4: DI selection operation: Determine the current operation stage by selecting the ON/OFF combination of input terminal functions 12~15. For the combination method, please refer to No. 12~15 function description of group F6 multifunctional input terminals. LED tens digit: Start mode 0: Restart from the first stage: Stop during operation (caused by stop command, fault or power failure), and start from the first stage after restart.	0x0900	0004	×

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		1: Continue operation from the stage of interruption: Stop during operation (caused by stop command or fault), the drive automatically records the run time of the current stage, and automatically enters this stage after restarting, and continues the operation in the remaining time at the frequency defined by this stage.  LED hundreds digit: Stage time unit selection 0: Second 1: Minute LED thousands digit: Store at power failure 0: Do not store at power failure 1: Stage at power failure storage interruption			
F9.01	Running steps	Set range: 1～16 Number of stages in a single PLC cycle.	0x0901	16	○
F9.02	Multi-step speed 1	Lower limit frequency ~ upper limit frequency	0x0902	20.00Hz	○
F9.03	Step 1 speed setting	LED single digit: 0: Multi-step speed 1 (F9.02) 1: AI1 2: AI2 3: Pulse frequency 4: Communication 5: Keypad digital potentiometer input 6: Reserved LED tens digit: 0: Acceleration/deceleration time 1 1: Acceleration/deceleration time 2 2: Acceleration/deceleration time 3 3: Acceleration/deceleration time 4 LED hundreds digit: 0: Forward running 1: Reverse running **Note:** **Only the LED single digit frequency source of stage 1 instruction can be set.**	0x0903	005	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.04	Running time of step 1	Set range: 0.1～6000.0 **Note:** **For the time unit selection, see F9.00 hundreds digit setting.**	0x0904	10.0	○
F9.05	Multi-step speed 2	Stage X instruction (F9.05, F9.08, F9.11, F9.14, F9.17, F9.20, F9.23, F9.26, F9.29, F9.32, F9.35、F9.38, F9.41, F9.44, and F9.47) setting range: Lower limit frequency ~ upper limit frequency Stage X instruction (F9.06, F9.09, F9.12, F9.15, F9.18, F9.21, F9.24, F9.27, F9.30, F9.33, F9.36、F9.39, F9.42, F9.45, and F9.48) setting range: LED single digit: 0: Multi-step speed x 1: Reserved LED tens digit: 0: Acceleration/deceleration time 1 1: Acceleration/deceleration time 2 2: Acceleration/deceleration time 3 3: Acceleration/deceleration time 4 LED hundreds digit: 0: Forward running 1: Reverse running Stage X instruction running time (F9.07, F9.10, F9.13, F9.16, F9.19, F9.22, F9.25, F9.28, F9.31, F9.34, F9.37、F9.40, F9.43, F9.46, and F9.49) setting range: 0.1~6000.0 **Note:** **For the time unit selection, see F9.00 hundreds digit setting.**	0x0905	20.00Hz	○
F9.06	Step 2 speed setting		0x0906	000	○
F9.07	Running time of step 2		0x0907	10.0	○
F9.08	Multi-step speed 3		0x0908	20.00Hz	○
F9.09	Step 3 speed setting		0x0909	000	○
F9.10	Running time of step 3		0x090A	10.0	○
F9.11	Multi-step speed 4		0x090B	20.00Hz	○
F9.12	Step 4 speed setting		0x090C	000	○
F9.13	Running time of step 4		0x090D	10.0	○
F9.14	Multi-step speed 5		0x090E	20.00Hz	○
F9.15	Step 5 speed setting		0x090F	000	○
F9.16	Running time of step 5		0x0910	10.0	○
F9.17	Multi-step speed 6Multi-step		0x0911	20.00Hz	○
F9.18	Step 6 speed setting		0x0912	000	○
F9.19	Running time of step 6		0x0913	10.0	○
F9.20	Multi-step speed 7		0x0914	20.00Hz	○
F9.21	Step 7 speed setting		0x0915	000	○
F9.22	Running time of step 7		0x0916	10.0	○
F9.23	Multi-step speed 8		0x0917	20.00Hz	○
F9.24	Step 8 speed setting		0x0918	000	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.25	Running time of step 8		0x0919	10.0	○
F9.26	Multi-step speed 9		0x091A	20.00Hz	○
F9.27	Step 9 speed setting		0x091B	000	○
F9.28	Running time of step 9		0x091C	10.0	○
F9.29	Multi-step speed 10		0x091D	20.00Hz	○
F9.30	Step 10 speed setting		0x091E	000	○
F9.31	Running time of step 10		0x091F	10.0	○
F9.32	Multi-step speed 11		0x0920	20.00Hz	○
F9.33	Step 11 speed setting		0x0921	000	○
F9.34	Running time of step 11		0x0922	10.0	○
F9.35	Multi-step speed 12		0x0923	20.00Hz	○
F9.36	Step 12 speed setting		0x0924	000	○
F9.37	Running time of step 12		0x0925	10.0	○
F9.38	Multi-step speed 13		0x0926	20.00Hz	○
F9.39	Step 13 speed setting		0x0927	000	○
F9.40	Running time of step 13		0x0928	10.0	○
F9.41	Multi-step speed 14		0x0929	20.00Hz	○
F9.42	Step 14 speed setting		0x092A	000	○
F9.43	Running time of step 14		0x092B	10.0	○
F9.44	Multi-step speed 15		0x092C	20.00Hz	○
F9.45	Step 15 speed setting		0x092D	000	○
F9.46	Running time of step 15		0x092E	10.0	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.47	Multi-step speed 16		0x092F	20.00Hz	○
F9.48	Step 16 speed setting		0x0930	000	○
F9.49	Running time of step 16		0x0931	10.0	○
Group FA: Protection function parameters					
FA.00	DC bus undervoltage protection point	Set range: 50～999V This function code specifies the allowed lower limit voltage of the DC bus when the drive works normally. **Note:** **When the grid voltage is too low, the output torque of the motor will decrease. So, the drive needs to be derated for long-term operation at low grid voltage.**	0x0A00	Model determination	×
FA.01	Undervoltage fault action selection	0: During running, the voltage is lower than the undervoltage point, and an undervoltage fault E007 is reported. 1: During running, the voltage is lower than the undervoltage point, and P.off is reported.	0x0A01	0	×
FA.02	Motor overload protection action selection	0: No action 1: Action, E008 fault is reported when the motor is overloaded.	0x0A02	1	○
FA.05	Input phase loss protection action selection	LED single digit: Select the action of phase protection. 0: No action 1: Action, E011 fault is reported during input phase loss. LED tens digit: Reserved LED hundreds digit: 0: indicates the per-wave current limiting function. 1: Transient overcurrent protection function If the hundred digit of parameter FA.05 is set to 0, see parameter FA.10 for details. When the hundreds digit of FA.05 is set to 1 and the output current is greater than the per-wave current limit set in FA.10, overcurrent protection is implemented. (The relevant fault code is E001 or E002 or E003)	0x0A05	00000	×
FA.06	Output phase loss protection delay time	Set range: 0.0～6000.0s (0.0s indicates no detection for output phase loss)	0x0A06	6.0s	×

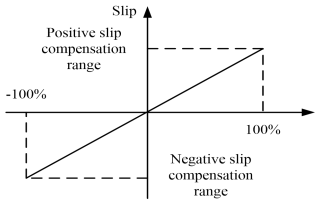
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
FA.07	485 communication fault protection action selection	0: No action 1: Action, E016 fault is reported when 485 communication is abnormal.	0x0A07	0	○
FA.08	Auto fault reset count	FA.08 set range: 0～100 (0 indicates no automatic reset function)	0x0A08	0	×
FA.09	Auto fault reset interval	FA.09 set range: 0.1～1000.0s 1. Number of automatic resets: When the drive selects automatic reset for faults, it is used to set the number of automatic resets. When the number of continuous resets exceeds this value, the drive will report a fault and stop and will not reset automatically. 2. Fault automatic reset interval time: Select the time interval from the fault occurrence to the automatic reset action. 3. Within 2 minutes after the drive operates, if there is no fault, it will automatically clear the number of resets, and accumulate the number of resets from the beginning. 4. When the number of automatic resets is set to 0, it indicates that automatic reset is prohibited and fault protection is performed immediately. **Note:** **The drive module protection (E010) and external equipment failure (E015) have no automatic reset function. After the automatic reset is completed, it will automatically start and run at the speed tracking. Use the automatic fault reset function with caution, otherwise, it may cause personal injuries and property losses.**	0x0A09	5.0s	×
FA.10	Wave-by-wave current limiting points setting	FA.10 set range: 0.0~200.0% (0.0% indicates there is no wave-by-wave current limiting function) FA.11 set range: 0~60000 ms (0 ms indicates no fault alarm function of wave-by-wave current limiting) When the output current is greater than the wave-by-wave current limiting point set by FA.10, perform wave-by-wave current limiting, and when the current limiting time exceeds the wave-by-wave current limiting time set by FA.11, report the E029 fault.	0x0A0A	145.0%	×
FA.11	Wave-by-wave current limiting time		0x0A0B	4000ms	×
FA.12	Delay time of abnormal protection of	Set range: 0.0~20.0s (0.0s indicates no detection function for abnormal buffer circuit)	0x0A0C	1.0s	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
	buffer circuit	In the running state, if the buffer circuit is abnormal and exceeds the delay time set by FA.12, report the E026 fault.			
FA.14	Overload pre-alarm detection setting	LED unit digit: action selection 0: Always check 1: Only check during constant speed LED tenth digit: alarm selection 0: No alarm and continue running 1: Alarm and shutdown LED hundredth digit: Detection reference 0: Relative to motor rated current (E008) 1:Relative to drive's rated current(E009)	0x0A0E	000	×
FA.15	Overload pre-alarm detection level	Setting range: 20.0~200.0%	0x0A0F	130.0%	×
FA.16	Overload pre-alarm detection time	Setting range: 0.0~60.0s	0x0A10	5.0s	×
FA.17	Fire override mode selection	FA.17Setting range：0x00~0xFF LED unit digit: 0：invalid 1：Fire override mode 1: 2：Fire override mode 2 LED tenth digit： 0: The motor cable connection detection is invalid 1: The motor cable connection detection is valid	0x0A11	00	○
FA.18	Setting frequency in fire override mode		0x0A12	50.00Hz	○
FA.19	Fire mode 1 Inspection interval time		0x0A13	10.0s	○
FA.20	The current of motor cable connection detection in fire override mode	FA.18 Setting range: lower frequency ~ upper frequency After fire override mode 1 or 2 is enabled and Fb.37 is set to 0, the setting frequency of fire mode is set by FA.18. FA.19 Setting range：10.0s~100.0s FA.20 Setting range：20.0%~80.0% The current setting of motor cable connection detection in fire override mode 1 or 2 Fire override mode 1 Working process: Set DIx to 52 or the unit digit of FA.17=1, the display of the drive will flash FIrE0 on the standby. If the running signal is received, it runs and displays FIrE3 blinking. When the motor cable connection detection is enabled (the ten digits of the FA.17 = 1 or the DI terminal is set to 53), and there is no running signal, the standby	0x0A14	40.0%	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		time is FA.19 (Motor cable connection detection interval time), and the flashing display is FIrE2, to detect whether the motor cable connection has issue. If the motor cable connection has issue, the drive will display fault E012. If there is no fault, time it again for interval time you set, and then detect whether the motor cable connection has issue. Repeat until you give the run signal or exit this mode. Fire override mode 2 Working process: Set DIx to 38 or the unit digit of FA.17=1, flashing FIrE2, then start to detect whether the motor cable connection has issue. If the fault is found, the drive will display fault E012, and stop, if no fault, start to run according to the frequency set in the fire override mode (FA.18) and setting direction (F1.24), display FIrE3.			
Group Fb: Serial communication parameters					
Fb.00	Local communication address	Set range: 0～247 The local address is unique in the communication network, which is the basis for the point-to-point communication between the host computer and the drive. **Note:** **0 is the broadcast address**	0x0B00	1	×
Fb.01	Communication baud rate	LED single digit: Baud rate selection 0: 1200BPS 1: 2400BPS 2: 4800BPS 3: 9600BPS 4: 19200BPS 5: 38400BPS LED tens digit: Data format 0: 1-8-2-N format, RTU 1: 1-8-1-E format, RTU 2: 1-8-1-O format, RTU 3: 1-7-2-N format, ASCII 4: 1-7-1-E format, ASCII 5: 1-7-1-O format, ASCII 6: 1-8-1-N format, RTU **Note:** **The baud rate set by the upper computer and the drive must be consistent, otherwise, the communication cannot be carried out. The greater the baud rate, the faster the communication speed.**	0x0B01	03	×

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
Fb.03	Communication response delay	Set range: 0～1000ms The local response delay refers to the interval between the end of drive data receiving and the sending of response data to the host computer. If the response delay is less than the system processing time, the response delay is based on the system processing time. If the response delay is greater than the system processing time, after the system has processed the data, it must wait until the response delay time is reached before sending data to the host computer.	0x0B03	5ms	×
Fb.04	Communication timeout time	Set range: 0.0～100.0s If the communication timeout fault time is set to 0, this function is invalid. If the time interval between two communications exceeds the communication timeout fault time, the system reports a communication fault E016, and the communication condition can be monitored. Usually, it is set to invalid. If this parameter is set in a continuous communication system, the communication condition can be monitored.	0x0B04	0.0s	×
Fb.05	Master send selection	LED unit digit：Running status of the current master 0：disable 1：enable LED tenth digit：Current running frequency of the master 0：disable 1：enable 1.When the drive is set as the communication master (Fb.00 is set to 0), it can send data to the slave computer. At this point, the master drive sends a broadcast command, and all slaves receive the command sent by the master. 2.The master can send a maximum of two frames of data in polling mode. If this parameter is set to invalid, the master does not send data. **Note:** **Only RTU communication mode supports master sending.**	0x0B05	11	×
Fb.06	Network interface enable	0：Disable 1：Enable	0x0B06	0	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
Fb.07	Network protocol	0：Modbus TCP protocol 1：Firmware Upgrade Protocol	0x0B07	0	○
Fb.08	Local port number	1～65535 Set the local port number for Ethernet communication.	0x0B08	502	○
Fb.09	The local IP address is 1 segment	Set range：0～255 Set the local IP address for Ethernet communication. Local IP address format： Fb.09.Fb.10.Fb.11.Fb.12. For example: the local IP address is 192.168.1.30.	0x0B09	192	○
Fb.10	The local IP address is 2 segment		0x0B0A	168	○
Fb.11	The local IP address is 3 segment		0x0B0B	1	○
Fb.12	The local IP address is 4 segment		0x0B0C	30	○
Fb.13	Subnet mask 1 segment	Set range：0～255 Set the subnet mask for Ethernet communication. Subnet mask format: Fb.13.Fb.14.Fb.15.Fb.16. For example,:the subnet mask is 255.255.255.0.	0x0B0D	255	○
Fb.14	Subnet mask 2 segment		0x0B0E	255	○
Fb.15	Subnet mask 3 segment		0x0B0F	255	○
Fb.16	Subnet mask 4 segment		0x0B10	0	○
Fb.17	Gateway 1 section	Set range：0～255 Set the gateway for Ethernet communication. The gateway format： Fb.17.Fb.18.Fb.19.Fb.20. For example: the gateway is 192.168.1.1.	0x0B11	192	○
Fb.18	Gateway 2 section		0x0B12	168	○
Fb.19	Gateway 3 section		0x0B13	1	○
Fb.20	Gateway 4 section		0x0B14	1	○
Fb.36	The duration time of motor cable connection detection in fire override mode	Set range：1.0s~6.0s Set the hold time of the motor cable connection detection function in fire override mode.			
Fb.37	The frequency source selection in fire override mode	Set range：0~1 0: Setting frequency in fire override mode is set by FA.18 1: Setting frequency channel in fire override mode is set by F1.02			
Group FC: Auxiliary function parameters					

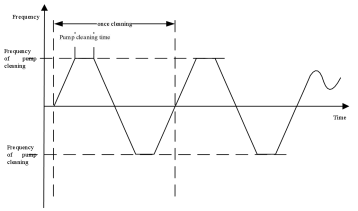
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
FC.02	AVR function selection	0: No action 1: Act always 2: Do not act only during deceleration When the input voltage deviates from the rated value, this function can keep the output voltage constant, so generally the AVR shall operate, especially when the input voltage is higher than the rated value. **Note:** **When decelerating and stopping, the AVR does not act, the deceleration time is short, but the running current is slightly larger; when the AVR acts all the time, the motor decelerates smoothly and the running current is small, but the deceleration time becomes longer.**	0x0C02	2	×
FC.03	Automatic energy-saving run	0: No action 1: Action During the no-load or light-load operation, the motor detects the load current and adjusts the output voltage appropriately to achieve the purpose of energy saving.	0x0C03	0	○
FC.04	V/F slip compensation gain	FC.04 set range: 0～1000 (0 indicates no compensation) FC.05 set range: 0.1～20.0ms 1. The change of the motor load torque will affect the motor slip and cause the motor speed to change. Through slip compensation, the output frequency of the drive is automatically adjusted according to the load torque of the motor, which can reduce the speed change of the motor caused by load changes, as shown in the figure.  2. Electric status: When the actual speed is lower than the input speed, gradually increase the compensation gain (FC.04). 3. Generation status: When the actual speed is higher than the input speed, gradually increase the compensation	0x0C04	0	○
FC.05	Slip compensation smoothing time		0x0C05	10.0ms	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		gain (FC.04). 4. The filter time constant of slip compensation. The shorter the filter time, the faster the response, but too short will easily cause oscillation and speed instability.			
FC.06	Cooling-fan running mode	0: Run in automatic mode **Note:** **The fan is turned off at least 3 minutes after stop and when the temperature is lower than 40 degrees.** 1: The fan keeps rotating during power-on 2: Running regulation When the temperature is higher than 45 ° C, the fan runs. When the temperature is lower than 40 ° C, the fan stops	0x0C06	0	×
FC.07	Acceleration/ deceleration time unit	0: Second 1: Minute	0x0C07	0	×
FC.09	Deceleration factor	Set range: 50.0%～180.0% For the coefficient of voltage-frequency ratio during deceleration, increase the voltage-frequency ratio during deceleration, in this case, the output voltage will increase and the deceleration will be faster, which is good for quick stop without reporting overvoltage.	0x0C09	100.0%	○
FC.10	Zero frequency arrival range	Set range: 0.00～10.00Hz When the output frequency is less than or equal to the set value of this function code, an indication signal is output (the terminal outputs No. 10 function).	0x0C0A	0.00Hz	○
FC.11	Set length	FC.11 set range: 0～65535m (0 indicates the fixed-length stop function is invalid) FC.12 set range: 0.001～10.000m FC.13 set range: 1～9999 1. This group of functions is used to realize the fixed-length stop function. 2. The drive inputs counting pulses from DI5 (F6.19 needs to be set to 1), and obtains the actual length according to the number of pulses per revolution of the speed measuring shaft (FC.13) and the shaft circumference (FC.12). 3. Actual length = Number of counting pulses/number of pulses per revolution × circumference of the measuring shaft. 4. When the actual length (U0.15) ≥ the set length (FC.11), the drive will automatically send a stop command to	0x0C0B	0m	○
FC.12	Measuring shaft circumference		0x0C0C	0.100m	○
FC.13	Pulse per revolution		0x0C0D	1	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		stop. You need to clear the actual length before running again, otherwise it will not start. **Note:** **The multifunctional input terminal can be used to clear the actual length (DIx is defined to No. 24 function), the normal counting and the actual length calculation can be performed only after the terminal is disconnected.** **The actual length is U0.15, and it is automatically stored during power failure.**			
FC.15	STOP key stop function selection	0: Only valid for keypad control 1: Valid for all control modes (invalid in two-wire control mode)	0x0C0F	0	○
FC.16	Digital potentiometer power failure save selection	0: The digital potentiometer frequency is not saved during power failure and will start from 0.00Hz after power-on. 1: The digital potentiometer frequency is saved during power failure and will start from the power failure frequency after power-on.	0x0C10	1	○
FC.17	The first shortcut parameter display selection	Set range: 0～31 When set to 0～30, it corresponds to group U0 parameter number; When set to 31, it displays the operation frequency during operation, and displays the setting frequency during standby; When set to 14, it displays the feedback pressure during operation, and displays the setting pressure during standby; When set to 5, it displays the operating linear speed during operation, and displays the setting linear speed during standby; When set to 4, it displays the operating RPM during operation, and display the setting RPM during standby.	0x0C11	31	○
FC.18	Speed display factor	Set range: 0.01～100.00 This function code is used to correct the display error of the rotation speed and has no effect on the actual rotation speed. **Note:** **Speed = 120*frequency*FC.18/ number of motor poles (F3.11)**	0x0C12	1.00	○
FC.19	Linear speed display factor	Set range: 0.01～100.00 This function code is used to correct the display error of the linear speed and has no effect on the actual linear speed. **Note:** **Linear speed = speed*FC.19**	0x0C13	1.00	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
FC.20	Frequency linkage selection	0: No linkage ratio 1: FC.21 is the coefficient linkage main frequency and acceleration/deceleration 1 2: FC.21 is used as the factor linkage main frequency 3: AI1 voltage value is the coefficient linkage main frequency and acceleration/deceleration 1 4: AI1 voltage value is used as the factor linkage main frequency	0x0C14	0	○
FC.21	Linkage ratio factor	Set range: 0.000～10.000	0x0C15	1.000	○
FC.22	Terminal jog priority	0: disable 1: enable Set whether the terminal jog function has the highest priority when the "Run command channel" is set to terminal. When FC.22 is set to 1, the DI multi-function input terminal function 4 (forward jog) or 5 (reverse jog) is valid in normal operation, and it can enter the jog operation state immediately.	0x0C16	0	○
FC.23	Zero frequency threshold (acting on the entire frequency range)	Setting range: 0.00~599.00Hz When the set frequency is less than or equal to the set value of this function code, it will run at zero frequency.	0x0C17	0.00Hz	○
FC.24	Display selection	LED unit digit: quick parameter display selection 0: Display 6 shortcut parameters (Refer to Chapter 3 Operation Instructions for details) 1: Display 1 shortcut parameter, determined by function code FC.17 LED tenth digit: U group display selection 0: Display U group 1: Do not display U group	0x0C18	00	○
Group Fd: Virtual terminal parameter function					
Fd.00	VDI1 terminal function selection	Same as F6.00～F6.08 function code setting. **Note:** **The VDI virtual terminal is an extension of the physical input terminal. The communication sends instructions to simulate the actual terminal. Each bit in the communication data represents a terminal, and the value of each bit**	0x0D00	0	×
Fd.01	VDI2 terminal function selection		0x0D01	0	×
Fd.02	VDI3 terminal function selection		0x0D02	0	×

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
Fd.03	VDI4 terminal function selection	**represents the status of the corresponding terminal. For specific bit definition, please refer to the communication address 0x1206 description.** **The function of each terminal cannot be the same. If the functions of the two terminals are set to the same, the physical terminal will act prior to the virtual terminal in order, the DI ports ranked first will work first, and the latter ones will not work.**	0x0D03	0	×
Fd.04	VDI5 terminal function selection		0x0D04	0	×
Fd.05	VDI6 terminal function selection		0x0D05	0	×
Fd.06	VDI7 terminal function selection		0x0D06	0	×
Fd.07	VDI8 terminal function selection		0x0D07	0	×
Fd.08	VDI9 terminal function selection		0x0D08	0	×
Fd.09	VDI10 terminal function selection		0x0D09	0	×
Fd.10	VDO1 terminal function selection	Same as F6.11～F6.13 function code setting. **Note:** **The VDO virtual terminal is an extension of the physical output terminal. The virtual terminal status can be read only through communication. Each bit in the communication data represents a terminal, and the value of each bit represents the status of the corresponding terminal. For specific bit definition, please refer to the communication address 0x1207 description.**	0x0D0A	0	×
Fd.11	VDO2 terminal function selection		0x0D0B	0	×
Fd.12	VDO3 terminal function selection		0x0D0C	0	×
Fd.13	VDO4 terminal function selection		0x0D0D	0	×
Fd.14	VDO5 terminal function selection		0x0D0E	0	×
Fd.15	VDO1 output on delay	Same as F6.29～F6.34 function code setting.	0x0D0F	0.0s	○
Fd.16	VDO2 output on delay		0x0D10	0.0s	○
Fd.17	VDO3 output on delay		0x0D11	0.0s	○
Fd.18	VDO4 output on delay		0x0D12	0.0s	○
Fd.19	VDO5 output on delay		0x0D13	0.0s	○
FE group: Water pump protection function 1					

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
FE.00	Dry run detection current	FE.00 setting range: 0.0～100.0% motor rated current FE.01 setting range: 0.0～300.0s dry run detection time When FE.00 = 0.0, dry run detection is not performed When the drive's running current is less than the dry run detection current, and the running frequency reaches the upper limit frequency. Drive waits for the dry run detection time and displays E032 dry run alarm if the above condition persists.	0x0E00	50.0%	×
FE.01	Dry run detection time		0x0E01	0.0	○
FE.02	Motor stall protection time	FE.02 setting range: 0.0～6000.0s FE.03 setting range: lower limit frequency ~ upper limit frequency FE.04 setting range: 0.0～100.0% drive's rated current. When the motor stall protection time is 0, the motor stall detection is disabled. When the operating frequency is less than the motor stall detection frequency and the operating current is greater than the motor stall current then after the motor stall time the drive displays E018 alarm.	0x0E02	0.0s	×
FE.03	Motor stall detection frequency		0x0E03	10.00Hz	○
FE.04	Motor stall current		0x0E04	50.0%	○
FE.05	Acceleration and deceleration frequency switching point	Setting range: lower limit frequency ~ upper limit frequency When the running frequency is greater than FE.05, use F2.14 and F2.15 for acceleration and deceleration. When it is less than FE.05, use F1.11 and F1.12 for acceleration and deceleration.	0x0E05	50.00Hz	○
FE.06	Pump cleaning repetitions	FE.06 setting range: 0～100 FE.07 setting range: lower limit frequency ~ upper limit frequency FE.08 setting range: 0.0～300.0s When the FE.06 is 0, the water pump cleaning is disabled. FE.07 Set the operational frequency for pump cleaning. A wave crest runs at FE.07 for FE.08 seconds 	0x0E06	0	×
FE.07	Pump cleaning frequency		0x0E07	10.00Hz	○
FE.08	Pump cleaning time		0x0E08	6.0s	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
FE.09	Frost Protection / Defrost function	Setting range: 00～11 LED unit digit: Frost protection 0: disable 1: enable LED ten digits: Defrost function 0: disable 1: enable	0x0E09	00	×
FE.10	Defrost operating frequency	FE.10 Setting range: lower limit frequency ~ upper limit frequency FE.11 setting range: 0.0～6000.0s FE.12 setting range: 0.0～6000.0s Every FE.12 seconds, run at FE.10 frequency for FE.11 seconds.	0x0E0A	8.00Hz	○
FE.11	Defrost running time		0x0E0B	60.0s	○
FE.12	Defrost operation interval		0x0E0C	300.0s	○
FE.13	Defrost braking current	FE.13 Setting range: 0.0～100.0% （When 100% is set, it is the rated current of the motor） FE.14 setting range: 0.0～6000.0s FE.15 setting range: 0.0～6000.0s Every FE.15 seconds, apply DC braking current FE.13 for FE.14 seconds.	0x0E0D	100.0%	○
FE.14	Defrost running time		0x0E0E	60.0s	○
FE.15	Deicing operation interval		0x0E0F	300.0s	○
FE.16	Signal source of water shortage	Setting range: 0～3 0: Reserved. 1: Use terminal input When the multi-function DI terminal is set to 35, then this terminalis used to detect water shortage signal. 2: AI1 (0.00～10.00V) 3: AI2 (0.00～10.00V)	0x0E10	1	○
FE.17	Water tank shortage threshold	Setting range: 0.0～100.0% (100% means 10V) If FE.16 is set to AI1 or AI2, it detects the lack of water in the water tank by using this threshold. If the AIx is less than the threshold, the drive will protect and stop and display E024. Further, all industrial frequency pumps (auxiliary pumps) will stop working.	0x0E11	10.0%	○
FE.18	Water pipe leakage threshold	FE.18 setting range: 0.0～30.0% set pressure value. FE.19 setting range: 0.0～6000.0s When FE.19 is 0, water pipe leakage detection is disabled. When the pressure feedback value is less than the water pipe leakage threshold (FE.18), and the operating frequency is greater than or equal to the upper limit frequency, a fault will be reported after	0x0E12	10.0%	○
FE.19	Detection time of water pipe break		0x0E13	0.0s	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		the detection time (FE.19), "E034" will be displayed and the drive will stop freely.			
FF group: Water pump protection function 2					
FF.00	Flow rate	Setting range: 0.0~5000.0 The flow rate Qn of the pump at rated frequency and rated head. Unit: cubic meter/hour	0x0F00	10.0	○

4.2 Monitoring parameter group U0

Parameter Code	Contact address	Parameter name	Parameter detailed description
U0.00	0x1000	Output frequency	Displays the output frequency of the current drive
U0.01	0x1001	Set frequency	Displays the set frequency of the current drive
U0.02	0x1002	Output current	Displays the output current of the current drive
U0.03	0x1003	Bus voltage	Displays the bus voltage of the current drive
U0.04	0x1004	Running speed	Displays the running speed of the current drive **Note: Speed = 120*frequency*speed display factor (FC.18)/number of motor poles (F3.11)**
U0.05	0x1005	Linear running speed	Displays the linear running speed of the current drive **Note: Linear speed = speed*linear speed display factor (FC.19)**
U0.06	0x1006	Output power	Displays the output power of the current drive
U0.07	0x1007	Output torque	Displays the output torque of the current drive
U0.08	0x1008	Output voltage	Displays the output voltage of the current drive
U0.09	0x1009	AI1	Displays the actual input voltage/current of AI1 of the current drive (when the input is of current type, 1mA current corresponds to 0.5V voltage display)
U0.10	0x100A	AI2	Displays the actual input voltage of AI2 of the current drive (when the input is of current type, 1mA current corresponds to 0.5V voltage display)
U0.11	0x100B	PID setting	Displays the PID set value of the current drive
U0.12	0x100C	PID feedback	Displays the PID feedback value of the current drive
U0.13	0x100D	Counter value	Displays the counter value of the current drive
U0.14	0x100E	Closed-loop pressure display	Displays the closed-loop pressure value of the current drive **Note: Closed-loop pressure = PID feedback value*pressure sensor range (F8.23)**
U0.15	0x100F	Actual length	Displays the actual length accumulated by the fixed length control function of the current drive
U0.16	0x1010	Software version	Displays the software version subversion number of the drive

Parameter Code	Contact address	Parameter name	Parameter detailed description
		subversion number	
U0.17	0x1011	Pulse frequency display	Displays the pulse frequency of the DI5 high-speed input signal of the current drive
U0.18	0x1012	Drive rated power	Displays the rated power of the drive
U0.19	0x1013	Drive rated voltage	Displays the rated voltage of the drive
U0.20	0x1014	Drive rated current	Displays the rated current of the drive
U0.21	0x1015	Reserved	Reserved
U0.22	0x1016	IGBT temperature	Displays the IGBT temperature of the current drive
U0.23	0x1017	DI terminal status 1	Displays current input terminal function status (defined by bit, 0 indicates that the current terminal input function is invalid, and 1 indicates that the current terminal input function is valid): LED single digit: DI1 input status LED tens digit: DI2 input status LED hundreds digit: DI3 input status LED thousands digit: DI4 input status LED ten thousands digit: DI5 input status
U0.24	0x1018	DI terminal status 2	Displays the digital input terminal status (defined by bit, 0 means the terminal status is invalid, 1 means the current terminal input function is valid) LED unit digit: DI6 input status (expansion card) LED tenth digits: DI7 input status (expansion card) LED hundredth digit: DI8 input status (expansion card) LED thousandth digit: reserved LED ten thousandth digit: reserved
U0.25	0x1019	DO terminal status	Displays current output terminal function status (defined by bit, 0 indicates that the current terminal output function is invalid, and 1 indicates that the current terminal output function is valid): LED single digit: DO1 output status LED tens digit: DO2 output status LED hundreds digit: Relay output status LED thousands digit: Reserved LED 10 thousands digit: Reserved
U0.26	0x101A	Output frequency (after compensation)	Displays the current output frequency of the drive (after compensation)

Parameter Code	Contact address	Parameter name	Parameter detailed description
U0.27	0x101B	Running time accumulation	Displays the accumulated running time of the current drive
U0.28	0x101C	Software version number	Displays the software version number of the drive
U0.29	0x101D	Energy consumption	Displays the current accumulative power consumption of the drive
U0.30	0x101E	Current flow	Displays the current drives flow Q = Qn * f / fn (Q: current flow; Qn rated flow; f: current operating frequency; fn: rated frequency)

4.3 Fault record parameter group U1

Parameter Code	Parameter name	Parameter detailed description	Factory value	Change
U1.00	Historical fault number	Set range: 0～9 According to the setting of this function code, you can view the fault record information of the last 10 times. By setting different values within U1.01～U1.06, the corresponding fault record will display.	0	○
U1.01	Fault code during fault	Fault record information at the xth fault (x is the set value of U1.00)	-	*
U1.02	Bus voltage during fault		-	*
U1.03	Output current during fault		-	*
U1.04	Running frequency during fault		-	*
U1.05	Running temperature during fault		-	*
U1.06	Fault occurrence time		-	*

The address table of nearly 10 failure codes and running parameters is as follows.

Content / Number	Parameter Code	Bus voltage	Output current	Output frequency	Operating temperature	Occurrence time
0	0x1100	0x1101	0x1102	0x1103	0x1104	0x1105
1	0x1106	0x1107	0x1108	0x1109	0x110A	0x110B
2	0x110C	0x110D	0x110E	0x110F	0x1110	0x1111
3	0x1112	0x1113	0x1114	0x1115	0x1116	0x1117
4	0x1118	0x1119	0x111A	0x111B	0x111C	0x111D
5	0x111E	0x111F	0x1120	0x1121	0x1122	0x1123
6	0x1124	0x1125	0x1126	0x1127	0x1128	0x1129
7	0x112A	0x112B	0x112C	0x112D	0x112E	0x112F
8	0x1130	0x1131	0x1132	0x1133	0x1134	0x1135
9	0x1136	0x1137	0x1138	0x1139	0x113A	0x113B
Note: The six communication addresses (0x1100 to 0x1105) numbered 0 are records of the last fault.						

4.4 Fault code summary table

Fault code	Fault type	Fault code	Fault type
E001	Drive overcurrent during acceleration	E017	Current detection circuit fault alarm
E002	Drive overcurrent during deceleration	E018	Motor blocking alarm
E003	Drive overcurrent during constant-speed running	E019	Reserved
E004	Drive overvoltage during acceleration	E020	Closed-loop feedback loss alarm
E005	Drive overvoltage during deceleration	E021	Water pressure overpressure alarm
E006	Drive overvoltage during constant-speed running	E022	Reserved
E007	Undervoltageduring running	E023	Water shortage alarm
E008	Motor overload alarm	E024	Reserved
E009	Drive overload alarm	E025	Reserved
E010	Drive module protection alarm	E026	Buffer circuit abnormal alarm
E011	Input phase loss alarm	E027	Reserved
E012	Output phase loss alarm	E028	Keypad parameter copy error alarm
E013	Drive module radiator overheat alarm	E029	Wave-by-wave current limiting alarm
E014	Rectifier module radiator overheat alarm	E034	Water pipe break alarm
E015	External fault alarm	E099	Internal fault
E016	485 communication error alarm		

Abnormal state	Exception type	Abnormal state	Exception type
C.OFF	Communication interruption alarm between plates	P.OFF	Bus voltage below DC bus undervoltage protection point (FA.00)

Chapter V Basic Operation Instructions

5.1 Start operation mode

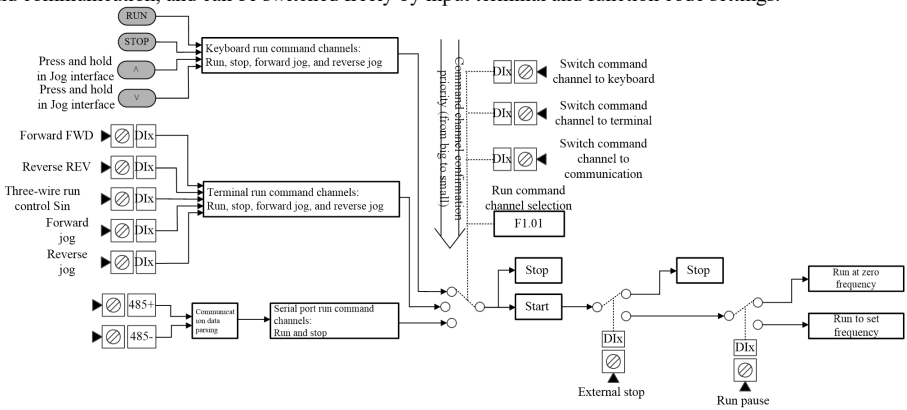
The HAV-SP series drive's start operation control includes three different ways as follows:

1. Start when the drive gives a run command normally;
2. Start after the automatic fault reset of the drive;
3. Start under the terminal two-wire start protection (the drive starts automatically when the drive is powered on, the fault is cleared or the command channel is switched to the terminal two-wire mode, which is only valid to terminal two-wire control).

The three different start-stop control statuses are described in the following.

5.1.1 Logic block diagram of start when the drive gives a run command normally

The HAV-SP series drive's run command input has three channels named keypad, terminal and communication, and can be switched freely by input terminal and function code settings.

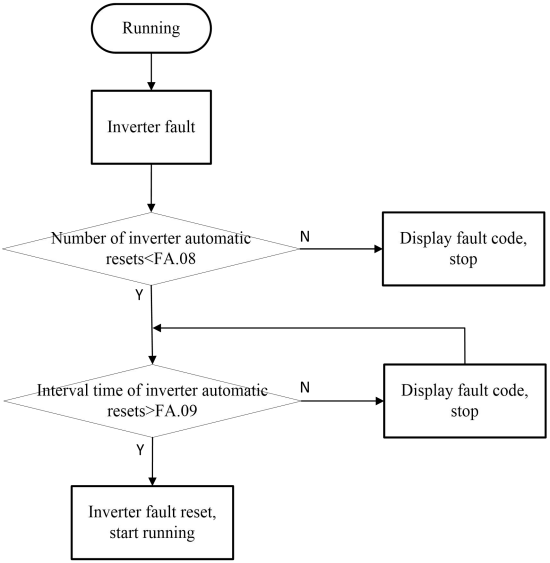


5.1. 2 Logic block diagram of start after the automatic fault reset of the drive

The automatic reset function can automatically reset the running faults according to the set times and intervals. When the number of automatic resets is set to 0, it indicates that automatic reset is prohibited and fault protection is performed immediately. Within 2 minutes after the drive operates, if there is no fault, it will automatically clear the number of resets, and accumulate the number of resets from the beginning.

The drive module protection (E010) and external equipment failure (E015) have no automatic reset function. After the automatic reset is completed, it will automatically start and run at the speed tracking.

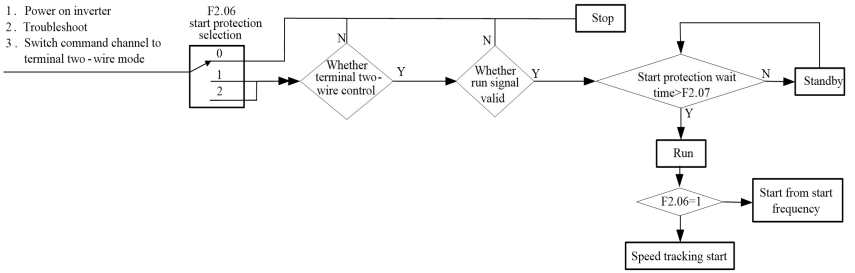
For safety's sake, use this function with caution, otherwise, it may cause personal injuries and property losses.



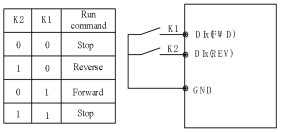
5.1.3 Terminal two-wire start protection and start logic block diagram

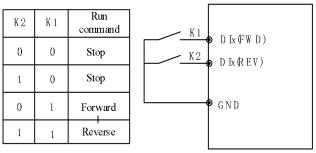
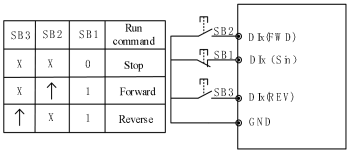
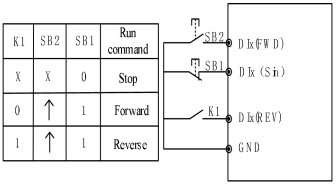
The terminal two-wire start protection start can realize that the drive automatically starts when the drive is powered on, the fault is cleared, or the command channel is switched to the terminal two-wire mode, if the terminal run command is valid.

For safety's sake, use this function with caution, otherwise, it may cause personal injuries and property losses.



5.1.3 Related parameter table:

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F1.01	Channel of running commands	0: Keypad run command channel 1: Terminal run command channel 2: Serial port run command channel	0x0101	0	○
F1.24	Running direction setting	LED single digit: The running direction 0: Default direction 1: Opposite direction LED tens digit: anti-reverse selection 0: Reverse allowed 1: Reverse prohibited	0x0118	00	○
F2.06	Start protection selection (only valid for two-wire control)	This function enables the drive to automatically start running when the drive is powered on, the fault is cleared, or the command channel is switched to the terminal two-wire mode. 0: If the run command is valid, the drive does start, and the drive is in the running protection state. The drive will not run until the run command terminal is canceled and then the terminal is enabled. 1: If the running command is valid, the drive speed tracking starts 2: If the run command is valid, the drive starts at the start frequency (F2.01).	0x0206	0	×
F2.07	Start protection wait time	Set range: 0.0～1000.0s	0x0207	5.0s	○
F2.30	FWD/REV running deadzone time	Set range: 0.00～360.00s	0x021E	0.01s	×
F6.09	FWD/REV running mode setting	0: Two-wire control mode 1: This mode is the most commonly used two-wire mode. The forward and reverse of the motor are determined by the defined FWD and REV terminal commands.  1: Two-wire control mode 2: This mode uses the defined FWD as the running terminal and the direction is determined by the REV status that defined.	0x0609	0	×

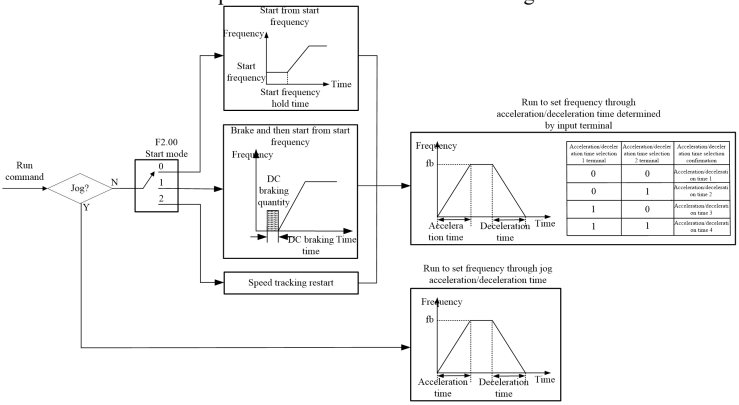
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		 2: Three-wire control mode 1: This mode uses the defined Sin as the enable terminal, the run command is generated by FWD or REV, and both control the operation direction. When the drive operates, the terminal Sin must be closed. The terminal FWD or REV generates a rising edge signal to control the operation and direction of the drive. When the drive stops, the terminal Sin must be disconnected to complete the stop.  3: Three-wire control model 2: This mode uses the defined Sin as the enable terminal, the run command is generated by FWD, and the direction is controlled by REV. When the drive operates, the terminal Sin must be closed. The terminal FWD generates a rising edge signal, and the drive starts operating. The status of terminal REV determines the operation direction. When the drive stops, the terminal Sin must be disconnected to complete the stop. 			
FA.08	Auto fault reset count	FA.08 set range: 0～100 (0 indicates no automatic reset function)	0x0A08	0	×
FA.09	Automatic reset interval	FA.09 set range: 0.1～1000.0s	0x0A08	5.0s	×

5.2 Start-stop control

5.2.1 Logical block diagram of the starting mode

There are three ways to start the HAV-SP series drive:

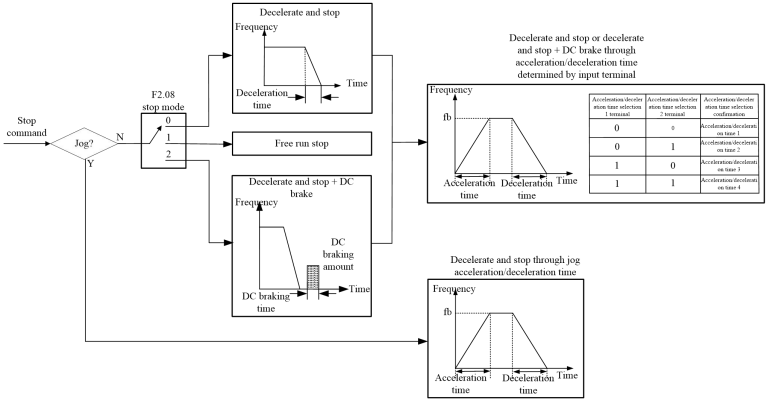
1. Start from the start frequency: Start at the start frequency set by F2.01, and accelerate to the set frequency after running the hold time set by F2.02 at this frequency.
2. Brake first and then start from the start frequency: First start with the DC braking current set in F2.03 and the DC braking time set in F2.04 for DC braking and then start from the start frequency.
3. Speed tracking and restart: Track the current speed and direction of the motor, and perform smooth start without impact on the motor that is still rotating.



5.2.2 Logical block diagram of the stopping mode

There are three ways to stop the HAV-SP series drive:

1. Deceleration stop: After receiving the stop command, the drive will gradually reduce the output frequency according to the deceleration time, and stop when the frequency decreases to zero.
2. Free running stop: After receiving the stop command, the drive immediately stops the output, and the load stops freely according to the mechanical inertia.
3. Deceleration stop + DC braking: After receiving the stop command, the drive reduces the output frequency according to the deceleration time, and starts the DC braking when reaching the stop braking start frequency.



5.2.3 Related parameter table:

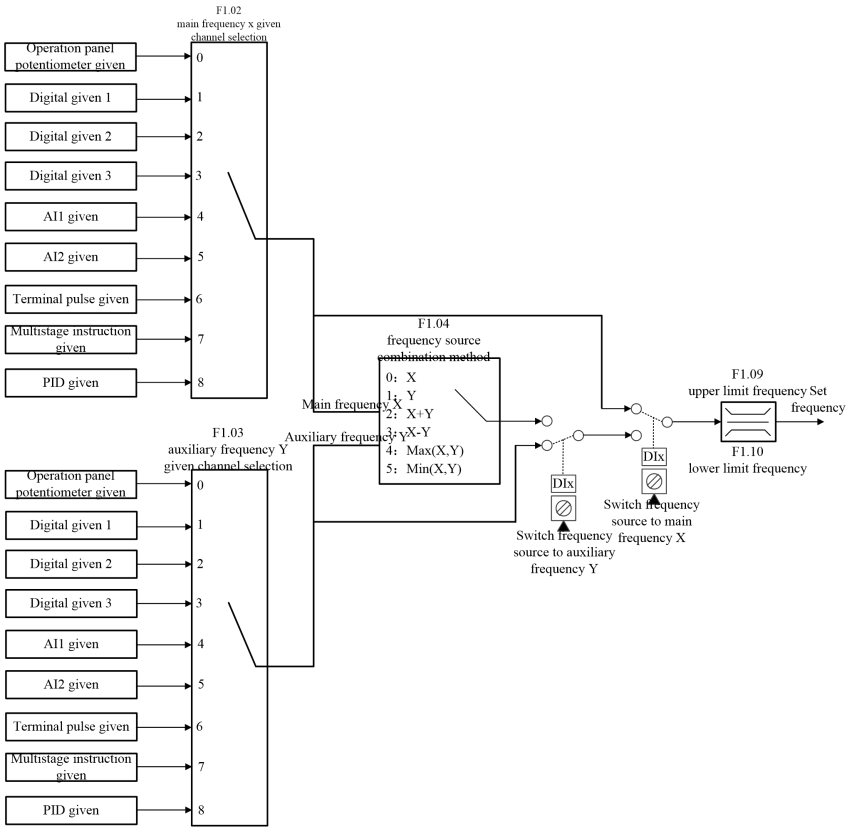
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F1.11	ACC time 1	Set range: 0.01～600.00	0x010B	Model determination	○
F1.12	DEC time 1		0x010C		○
F1.13	ACC/DEC filtering time	Set range: 0～1000ms (0 indicates on filter)	0x010D	0ms	○
F2.00	Start operation mode	LED single digit: Start mode 0: Start from start frequency. 1: Brake and then start from the start frequency. 2: Speed tracking restart. LED tens digit: Speed tracking mode 0: Track down from the frequency of shutdown, usually this method is used. 1: Track down from the maximum frequency, suitable for power generation load.	0x0200	00	×
F2.01	Start frequency	F2.01 set range: 0.20～60.00Hz F2.02 set range: 0.0～10.0s	0x0201	0.50Hz	○
F2.02	Start frequency hold time		0x0202	0.0s	○
F2.03	DC braking current before start	F2.03 set range: 0.0～150.0% drive rated current F2.04 set range: 0.0～30.0S (0.0 indicates the DC braking does not act)	0x0203	100.0%	○
F2.04	DC baking time before start		0x0204	0.0s	○
F2.05	ACC/DEC mode selection	0: Linear acceleration/deceleration: The output frequency increases or decreases according to a constant slope. 1: Reserved	0x0205	0	×
F2.08	Stop mode	0: Decelerate and stop 1: Run freely and stop 2: Decelerate and stop + DC brake	0x0208	0	×
F2.09	Starting frequency of DC braking for stop	F2.09 set range: 0.00～60.00Hz F2.10 set range: 0.00～10.00s F2.11 set range: 0.0～150.0% drive rated current F2.12 set range: 0.0～60.0S (0.0 indicates the DC braking does not act) F2.13 set range: 0～1	0x0209	0.00Hz	○
F2.10	DC braking wait time at stop		0x020A	0.10s	○
F2.11	DC braking current for stop		0x020B	100.0%	○
F2.12	DC braking time for stop		0x020C	0.0s	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F2.13	Action selection within DC braking wait time for stop		0x020D	1	○
F2.14	ACC time 2	Set range: 0.01～600.00	0x020E	Model determination	○
F2.15	DEC time 2		0x020F		○
F2.16	ACC time 3		0x0210		○
F2.17	DEC time 3		0x0211		○
F2.18	ACC time 4		0x0212		○
F2.19	DEC time 4		0x0213		○
F2.20	Running frequency of jog	Set range: 0.10～F1.09	0x0214	5.00Hz	○
F2.21	Jog interval time	Set range: 0.0～100.0s	0x0215	0.0s	○
F2.22	ACC time for jogging	Set range: 0.01～600.00s	0x0216	6.00s	○
F2.23	DEC time for jogging		0x0217		○
F7.08	Speed tracking gain Kp	F7.08 set range: 0～100 F7.09 set range: 1～1000ms F7.10 set range: 0.1～600.0s F7.11 set range: 1～100% F7.12 set range: 1～100%	0x0708	10	○
F7.09	Speed tracking integration time		0x0709	50ms	○
F7.10	Speed tracking acceleration and deceleration		0x070A	20.0s	○
F7.11	Speed tracking judgment threshold		0x070B	10%	○
F7.12	Speed tracking switching completion judgment threshold		0x070C	3%	○

5.3 Frequency setting

5.3.1 Logical block diagram of frequency setting

There're many ways for the HAV-SP series drive frequency input, and its input channels can be divided into three types named the main frequency X, the auxiliary frequency Y, and the combination input. It can be switched freely by setting the terminal function.



5.3.2 Related parameter table:

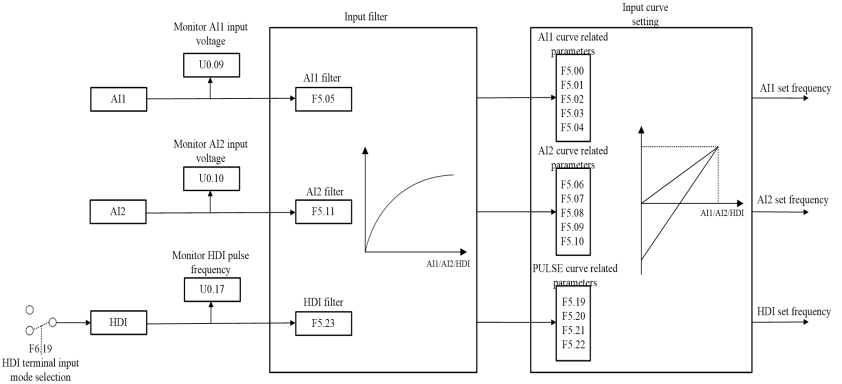
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F1.02	Setting channel of main frequency X command	0: Keypad digital potentiometer input 1: Digital input 1 2: Digital input 2 3: Digital input 3 4: AI1 input 5: AI2 input 6: Terminal pulse input 7: Multi-step speed input 8: PID input 9-15: Reserved	0x0102	0	○
F1.03	Setting channel of auxiliary frequency Y command		0x0103	1	○
F1.04	Frequency source combination mode	0: X 1: Y 2: X+Y 3: X-Y 4: Max (X, Y) 5: Min (X, Y)	0x0104	0	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F1.05	Digital setting of auxiliary frequency Y	Lower limit of running frequency ~ upper limit of running frequency	0x0105	50.00Hz	○
F1.06	Max. output frequency	Upper limit of running frequency～599.00Hz	0x0106	50.00Hz	×
F1.07	Main frequency x digital setting	Lower limit of running frequency ~ upper limit of running frequency	0x0107	50.00Hz	○
F1.09	Upper limit of running frequency	Lower limit of running frequency ~ max. output frequency	0x0109	50.00Hz	○
F1.10	Lower limit of running frequency	0.00~upper limit of running frequency	0x010A	0.00Hz	○

5.4 Analog input and HDI

The HAV-SP series is configured with 2 analog input terminals (AI1 and AI2 are of 0~10V/0~20mA input, AI1 can select voltage input or current input through jumper J1, and AI2 can select voltage input or current input through jumper J2) and 1 high-speed pulse input terminal. Each input can be filtered independently, and be adjusted. The corresponding input curve can be set by setting the input corresponding to the maximum and minimum values.

5.4.1 Logical block diagram of analog input and HDI control



5.4.2 Related parameter table:

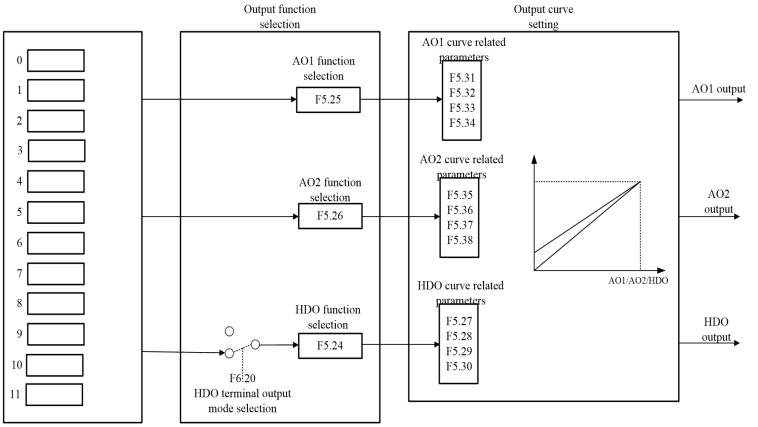
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F5.00	AI1 minimum value	0.00～F5.02	0x0500	0.00V	○
F5.01	Corresponding setting of AI1 minimum value	-100.0%～100.0%	0x0501	0.0%	○
F5.02	AI1 maximum value	F5.00～10.00V	0x0502	10.00V	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F5.03	Corresponding setting of AI1 maximum value	-100.0%～100.0%	0x0503	100.0%	○
F5.04	AI1 zero point offset	0.00～10.00V	0x0504	0.00V	○
F5.05	AI1 input filter time	0～1000ms	0x0505	10ms	○
F5.06	AI2 minimum value	0.00～F5.08	0x0506	0.00V	○
F5.07	Corresponding setting of AI2 minimum value	-100.0%～100.0%	0x0507	0.0%	○
F5.08	AI2 maximum value	F5.06～10.00V	0x0508	10.00V	○
F5.09	Corresponding setting of AI2 maximum value	-100.0%～100.0%	0x0509	100.0%	○
F5.10	AI2 zero point offset	0.00～10.00V	0x050A	0.00V	○
F5.11	AI2 input filter time	0～1000ms	0x050B	10ms	○
F5.18	Analog automatic zero point offset adjustment	0~1	0x0512	0	○
F5.19	PULSE minimum frequency input	0.00～F5.21	0x0513	0.00KHz	○
F5.20	Corresponding setting of PULSE minimum frequency input	-100.0%～100.0%	0x0514	0.0%	○
F5.21	PULSE maximum frequency input	F5.19～50.00KHz	0x0515	50.00KHz	○
F5.22	Corresponding setting of PULSE maximum frequency	-100.0%～100.0%	0x0516	100.0%	○
F5.23	PULSE frequency input filter time	0～1000ms	0x0517	10ms	○
F6.19	HDI input type(DI5)	0: Switch input 1: High-frequency pulse input (see F5.19～F5.23)	0x0613	0	×

5.5 Analog output and HDO

The HAV-SP series is configured with 2 analog output terminals (AO1 and AO2 are of 0~10V/0~20mA output, AO1 can select voltage input or current input through jumper J3, and AO2 can select voltage input or current input through jumper J4) and 1 high-speed pulse output terminal. The proportional relationship can be adjusted by setting the maximum and minimum values and their corresponding output percentages. The analog output signal can output the operation frequency, output current, output torque, output voltage and output power in a certain proportion.

5.5.1 Logical block diagram of analog output and HDO control



5.5.2 Related parameter table:

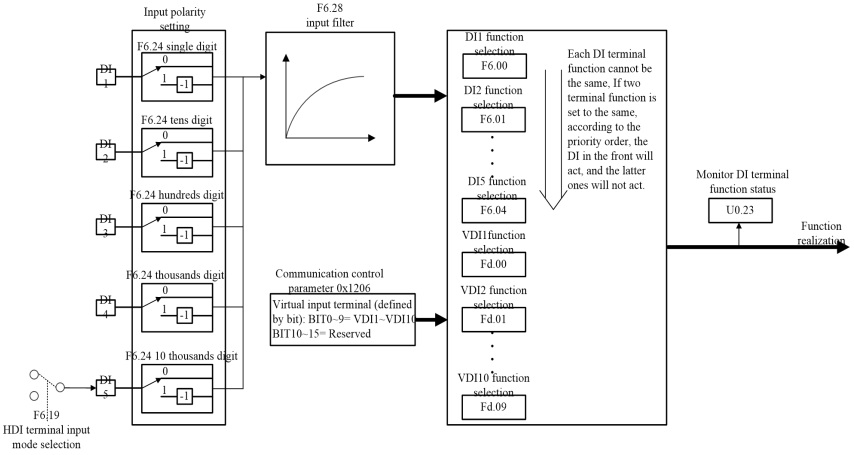
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F5.24	HDO function selection	0: Running frequency (0～Maximum output frequency) 1: Set frequency (0～Maximum output frequency) 2: Output current (0～2 times rated current) 3: Output torque (0～2 times rated torque) 4: Output voltage (0～1.2 times rated voltage) 5: Bus voltage (0～1000V) 6: AI1 (0～10V/0～20mA) 7: AI2（0～10V/0～20mA） 8: Reserved 9: Output power (0～2 times rated frequency) 10: Pulse input (0～50.00KHz) 11: Communication setting (0～1000) 12: Operating frequency after compensation (0～maximum output frequency)	0x0518	5	○
F5.25	AO1 output		0x0519	0	○
F5.26	AO2 output		0x051A	0	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F5.27	HDO output lower limit	0.0～F5.29	0x051B	0.0%	○
F5.28	HDO output frequency corresponding to lower limit	0.00～50.00KHz	0x051C	0.00KHz	○
F5.29	HDO output upper limit	F5.27～100.0%	0x051D	100.0%	○
F5.30	HDO output frequency corresponding to upper limit	0.00～50.00KHz	0x051E	50.00KHz	○
F5.31	AO1 output lower limit	0.0～F5.33	0x051F	0.0%	○
F5.32	Corresponding lower limit AO1 output voltage	0.00～10.00V	0x0520	0.00V	○
F5.33	AO1 output upper limit	F5.31～100.0%	0x0521	100.0%	○
F5.34	Corresponding upper limit AO1 output voltage	0.00～10.00V	0x0522	10.00V	○
F5.35	AO2 output lower limit	0.0～F5.37	0x0523	0.0%	○
F5.36	Corresponding lower limit AO2 output voltage	0.00～10.00V	0x0524	0.00V	○
F5.37	AO2 output lower limit	F5.35～100.0%	0x0525	100.0%	○
F5.38	Corresponding upper limit AO2 output voltage	0.00～10.00V	0x0526	10.00V	○
F6.20	HDO output type (DO2)	0: Switch output 1: High-frequency pulse output (see F5.27～F5.30)	0x0614	0	×

5.6 Digital input

The HAV-SP series is equipped with 5 DI input terminals and 10 VDI virtual input terminals. All input terminal functions can be programmed through function codes. Among them, DI5 can be selected as a high-frequency pulse input terminal or an ordinary switch input terminal through function code; when it is selected as a high-speed pulse input terminal (HDI), the user can also use the HDI high-speed pulse input as frequency input, count input, or length pulse input.

5.6.1 Logical block diagram for the control of digital input



5.6.2 Function table:

Set value	Function	Description
0	No function	The drive does not operate even if there is a signal input. Unused terminals can be set to having no function to prevent malfunction.
1	Forward running FWD (level + edge)	For terminal two-wire and three-wire control signals, see function code F6.09 description for details.
2	Reverse running REV (level + edge)	
3	Three-wire running control Sin (level)	
4	Forward jog (level)	Used for jog running control under terminal run command mode, the jog running frequency, jog interval time and jog acceleration/deceleration time are defined in F2.20～F2.23.
5	Reverse jog (level)	
6	Free stop (level)	If the function of this terminal is valid, the drive immediately terminates the output, and the load stops freely according to the mechanical inertia.
7	Fault reset (edge signal)	When a fault alarm occurs in the drive, the fault can be reset through this terminal. Its function is consistent with the STOP key function of the keypad.
8	Run pause (level)	If this terminal is valid during running, the terminal will decelerate to zero frequency running according to the deceleration time. This function is invalid during jog running.
9	External fault input	The fault signals of external devices can be input through this terminal, which is convenient for the drive to monitor the faults of external devices. After receiving fault signals from external devices, the drive displays “E015”, which is the fault alarm of external devices.

<table>
<tr><th>Set value</th><th>Function</th><th>Description</th></tr>
<tr><td>10</td><td>Frequency setting increase (UP)</td><td rowspan="2">The frequency increase or decrease is realized through the control terminal, to perform remote control replacing the keypad. Effective when the main frequency F1.02 = 2 or the auxiliary frequency F1.03 = 2, the acceleration/deceleration rate is set by F6.10.</td></tr>
<tr><td>11</td><td>Frequency setting decreases (DOWN)</td></tr>
<tr><td>12</td><td>Multi-step speed terminal 1</td><td rowspan="4">By selecting the terminal ON/OFF combination of these functions, you can define up to 16 stages of speed running curves, the frequency of Multi-step instructions, the selection of acceleration/deceleration time, and the rotating direction are set in group F9.
<table><tr><th>K4</th><th>K3</th><th>K2</th><th>K1</th><th>Frequency setting</th></tr><tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Multi-step speed 1</td></tr><tr><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>Multi-step speed 2</td></tr><tr><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>Multi-step speed 3</td></tr><tr><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>Multi-step speed 4</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>Multi-step speed 5</td></tr><tr><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>Multi-step speed 6</td></tr><tr><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>Multi-step speed 7</td></tr><tr><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>Multi-step speed 8</td></tr><tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>Multi-step speed 9</td></tr><tr><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>Multi-step speed 10</td></tr><tr><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>Multi-step speed 11</td></tr><tr><td>ON</td><td>OFF</td><td>ON</td><td>ON</td><td>Multi-step speed 12</td></tr><tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>Multi-step speed 13</td></tr><tr><td>ON</td><td>ON</td><td>OFF</td><td>ON</td><td>Multi-step speed 14</td></tr><tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>Multi-step speed 15</td></tr><tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>Multi-step speed 16</td></tr></table></td></tr>
<tr><td>13</td><td>Multi-step speed terminal 2</td></tr>
<tr><td>14</td><td>Multi-step speed terminal 3</td></tr>
<tr><td>15</td><td>Multi-step speed terminal 4</td></tr>
<tr><td>16</td><td>ACC/DEC time selection 1</td><td rowspan="2">The ON/OFF combination of ACC/DEC time terminals 1 and 2 can realize the selection of ACC/DEC time 1~4.
<table><tr><th>K2</th><th>K1</th><th>ACC/DEC time selection</th></tr><tr><td>OFF</td><td>OFF</td><td>ACC/DEC time 1</td></tr><tr><td>OFF</td><td>ON</td><td>ACC/DEC time 1</td></tr><tr><td>ON</td><td>OFF</td><td>ACC/DEC time 3</td></tr><tr><td>ON</td><td>ON</td><td>ACC/DEC time 4</td></tr></table></td></tr>
<tr><td>17</td><td>ACC/DEC time selection 2</td></tr>
<tr><td>18</td><td>PLC pause</td><td>Used to realize the pause control of the PLC running process. When this terminal is valid, it runs at zero frequency. The PLC running is not counted.</td></tr>
<tr><td>19</td><td>PLC operation stop and reset</td><td>PLC is prohibited from starting when the terminal is valid, deceleration and stop control is implemented for the PLC running process, and the PLC is reset to the initial state.</td></tr>
</table>

Set value	Function	Description
20	PID control pause	PID is temporarily invalid, and the drive maintains the current output frequency without performing PID adjustment.
21	PID parameter switching	When the PID parameter switching condition (F8.12) is set to 1 (via terminal switching), the F8.06~F8.08 are used for PID parameters when the terminal is invalid, and F8.09~F8.11 are used when the terminal is valid.
22	Counter trigger	Count pulse input port of the built-in counter, the highest pulse frequency: 200Hz, and the current count value can be stored and memorized when power is off. See function codes F6.22 and F6.23 for details.
23	Counter reset	Clear the built-in counter of the drive and use it in conjunction with function 22 (counter trigger signal input).
24	Length reset	When the function terminal is valid, the actual length is cleared to zero.
25	Acceleration/deceleration prohibited (level)	Keep the motor from being affected by any external signal (except stop command), maintain operating at the current speed. This function is invalid during jog running.
26	Immediate DC braking	When the stop mode is “decelerate and stop + DC brake”, it is switched to DC brake status when the terminal is valid during stop.
27	UP/DOWN setting cleared	When the frequency input channel is set to terminal UP/DN, this function terminal can directly clear the frequency set by UP/DN.
28	Control command switched to keypad	If the three terminals or two of them are closed at the same time, the priority is keypad> terminal> communication. **Note: When switching to terminal two-wire control, the running state changes are affected by the F2.06 parameter; when switching to other control modes, the current running state is maintained.**
29	Control command switched to terminal	
30	Control command switched to communication	
31	Frequency source switched to the main frequency X	If the above two terminals are closed at the same time, the priority is switching to the main frequency X> switching to the auxiliary frequency Y
32	Frequency source switched to auxiliary frequency Y	
33	High-frequency pulse count reset	When the function terminal is valid, the high-frequency pulse count value recorded by function code U0.16 is cleared.
35	Water shortage	When the water pump mode (F0.04=1) is running, the terminal effectively reports E023 water shortage fault.
38	Fire override mode 2	This terminal is used to enable fire override mode 2.
42	Cleaning mode	This terminal is used to select whether to clean the pump when the pump mode starts.
43	Bypass function	The terminal is used to enable the bypass function. For details, see Function description of parameter group DI 43.
52	Fire override mode 1	This terminal is used to enable fire mode 1.
53	Motor cable connection	This terminal is used to enable the line break detection

Set value	Function	Description
	detection in fire override mode	function in fire mode

5.6.3 Related parameter table:

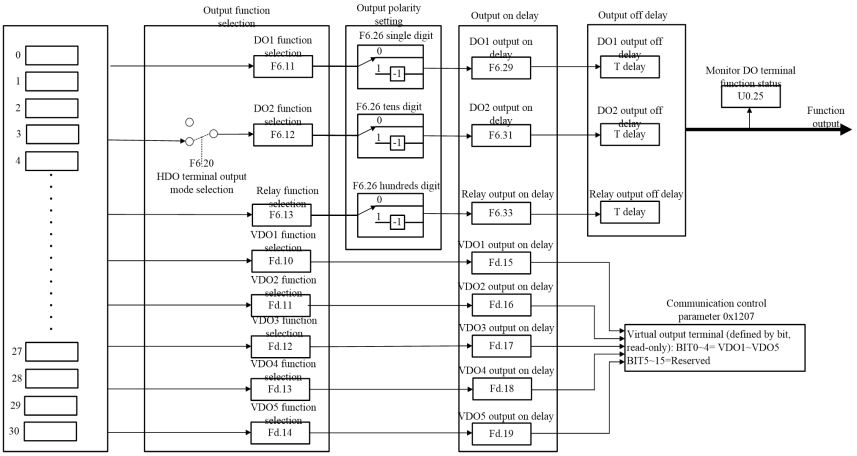
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F6.00	Function selection of DI1	0: No function 1: Forward running FWD (level + edge) 2: Reverse running REV (level + edge) 3: Three-wire running control Sin (level) 4: Forward jog (level) 5: Reverse jog (level) 6: Free stop (level) 7: Fault reset (edge signal) 8: Run pause (level) 9: External fault input 10: Frequency setting increase (UP) 11: Frequency setting decreases (DOWN) 12: Multi-step speed terminal 1 13: Multi-step speed terminal 2 14: Multi-step speed terminal 3 15: Multi-step speed terminal 4 16: ACC/DEC time selection 1 17: ACC/DEC time selection 2 18: PLC pause 19: PLC operation stop and reset 20: PID control pause 21: PID parameter switching 22: Counter trigger 23: Counter reset 24: Length reset 25: Acceleration/deceleration prohibited (level) 26: Immediate DC braking 27: UP/DOWN setting cleared 28: Control command switched to keypad 29: Control command switched to terminal 30: Control command switched to communication 31: Frequency source switched to the main frequency X 32: Frequency source switched to auxiliary frequency Y 33: High-frequency pulse count reset 35: Water shortage fault 38: Fire override mode 42: Pump cleaning mode 43: Bypass function 52: Fire override mode 1 53: Motor cable connection detection in fire override mode	0x0600	1	×
F6.01	Function selection of DI2		0x0601	2	
F6.02	Function selection of DI3		0x0602	7	
F6.03	Function selection of DI4		0x0603	12	
F6.04	Function selection of DI5		0x0604	13	
F6.19	HDI input type (DI5)	0: Switch input 1: High-frequency pulse input (see F5.19～F5.23)	0x0613	0	×

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F6.24	DI input switch polarity 1	00000~11111 LED single digit: DI1 positive/negative logic definition LED tens digit: DI2 positive/negative logic definition LED hundreds digit: DI3 positive/negative logic definition LED thousands digit: DI4 positive/negative logic definition LED 10 thousands digit: DI5 positive/negative logic definition	0x0618	11111	○
F6.28	DI filter time	0～1000ms		5ms	○
Fd.00	VDI1 terminal function selection	Same as F6.00～F6.08 function code setting.	0x0D00	0	×
Fd.01	VDI2 terminal function selection		0x0D01	0	×
Fd.02	VDI3 terminal function selection		0x0D02	0	×
Fd.03	VDI4 terminal function selection		0x0D03	0	×
Fd.04	VDI5 terminal function selection		0x0D04	0	×
Fd.05	VDI6 terminal function selection		0x0D05	0	×
Fd.06	VDI7 terminal function selection		0x0D06	0	×
Fd.07	VDI8 terminal function selection		0x0D07	0	×
Fd.08	VDI9 terminal function selection		0x0D08	0	×
Fd.09	VDI10 terminal function selection		0x0D09	0	×

5.7 Digital output

The HAV-SP series is equipped with two open collector output terminals, one relay output terminal, and five VDO virtual output terminals. All digital output terminal functions can be programmed through function codes. Among them, the high-speed pulse output terminal HDO can also be set to high-speed pulse output or switch output through function code selection.

5.7.1 Logical block diagram for the control of digital output



5.7.2 Function table:

Set value	Function	Description
0	No output	The output terminal has no function.
1	Drive running signal (RUN)	The drive is under the running status and outputs an indication signal.
2	Frequency arrival signal (FAR)	Refer to the function description of F6.18.
3	Frequency level detection signal (FDT1)	Refer to the function description of F6.14～F6.15.
4	Frequency level detection signal (FDT2)	Refer to the function description of F6.16～F6.17.
5	Overload detection signal(OL)	If the output current of the drive exceeds the FA.15 overload detection level, it outputs an indication signal after FA.16 overload detection time.
6	Undervoltage lockout stopping (LU)	When the DC bus voltage is lower than the undervoltage limit level, an indication signal is output, and the LED displays “P.oFF”.
7	External fault stop (EXT)	When the drive has an external fault trip alarm (E015), it outputs an indication signal.
8	Frequency upper limit (FHL)	When the set frequency ≥ the upper limit frequency and the operation frequency reaches the upper limit, an indication signal is output.
9	Frequency lower limit (FLL)	When the set frequency ≤ the lower limit frequency and the operation frequency reaches the lower limit, an indication signal is output.

Set value	Function	Description
10	Drive running at zero frequency	When the drive output frequency is less than or equal to FC.10 zero frequency arrival range, and under the operation status, an indication signal is output.
11	PLC phase running completion	After the simple PLC phase operation is completed, an indication signal (single pulse signal, width 250ms) is output.
12	PLC cycle completion	After the simple PLC completes one operation cycle, an indication signal (single pulse signal, width 250ms) is output.
13	Set count value arrival	Refer to F6.22～F6.23 function description.
14	Specified count value arrival	
15	Set length arrival	When the actual length U0.15≥FC.11 set length, an indication signal is output.
16	Drive ready to run	When this signal output is valid, it indicates that the drive has no fault, the bus voltage is normal, and the drive operation prohibition terminal is invalid. In this case, the start command can be accepted.
17	Drive fault	If the drive fails, an indication is output.
19	Set cumulative running time arrival	When the accumulated running time of the drive (U0.27) reaches the running cutoff time (F0.02) of the drive, an indication signal is output.
20	Forward running	The drive is under the forward running status and outputs an indication signal.
21	Reverse running	The drive is under the reserve running status and outputs an indication signal.
23	Water supply sleep running indication	During water supply application, the drive is under the sleep status and outputs an indication signal.
24	Water pipe overpressure indication	During water supply application, the drive judges that the water pipe is overpressure at the time and outputs an indication signal.
25	Water pipe under-pressure indication	During water supply application, the drive judges that the water pipe is under-pressure at the time and outputs an indication signal.
26	Water pipe shortage indication	During water supply application, the drive judges that the water pipe is short of water at the time and outputs an indication signal.
27	Water tank shortage indication	During water supply application, if the drive finds that the water tank is in short of water at any time, it outputs an indication signal.
28	Water pipe burst indication	During water supply application, if the drive finds that the water pipe burst at any time, it outputs an indication signal.
29	Drive control of bypass function	When the bypass function is enabled and the contactor is closed, an indicator signal is output. For details, see function description in parameter group DI 43
31	Power grid control of bypass function	When the bypass function is enabled and the bypass power frequency contactor is closed, an indicator signal is output. For details, see function description in parameter group DI 43.
32	Fire override mode activates feedback	After fire mode 1 or fire mode 2 is enabled, an indicator signal is output.
33	The fault of motor cable connection in fire override mode	If the motor cable connection is wrong in fire override mode, the drive will report fault E012, and the fault output of motor cable connection detection is valid. The fault output of motor cable connection detection is invalid after fault reset.

5.7.3 Related parameter table:

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F6.11	Output DO1	0: No output 1: Drive running signal (RUN) 2: Frequency arrival signal (FAR) 3: Frequency level detection signal (FDT1) 4: Frequency level detection signal (FDT2) 5: Overload detection signal (OL) 6: Undervoltage lockout stopping (LU)	0x060B	0	×
F6.12	Output DO2 (HDO terminal)	7: External fault stop (EXT) 8: Frequency upper limit (FHL) 9: Frequency lower limit (FLL) 10: Drive running at zero frequency 11: PLC phase running completion	0x060C	1	×
F6.13	Relay output (TA/TB/TC)	12: PLC cycle completion 13: Set count value arrival 14: Specified count value arrival 15: Set length arrival 16: Drive ready to run (RDY) 17: Drive fault 18: Reserved 19: Set cumulative running time arrival 20: Forward running 21: Reverse running 23: Water supply sleep running indication 24: Water pipe overpressure indication 25: Water pipe under-pressure indication 26: Water pipe shortage indication 27: Water tank shortage indication 28: Water pipe break indication 29: Drive control of bypass function 31: Power grid control of bypass function 32: Fire override mode activates feedback 33: The fault of motor cable connection in fire override mode	0x060D	17	×
F6.20	HDO output type (DO2)	0: Switch output 1: High-frequency pulse output (see F5.27～F5.30)	0x0614	0	×
F6.26	DO output switch polarity 1	00000~11111	0x061A	11111	○
F6.29	DO1switch-on delay	Set range: 0.0～600.0s This function code defines the delay from the status change of the switch output terminal and the relay to the output change.	0x061D	0.0s	○
F6.30	DO1 switch-off delay		0x061E	0.0s	○
F6.31	DO2 switch-on delay		0x061F	0.0s	○
F6.32	DO2 switch off delay		0x0620	0.0s	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F6.33	Relay switch-on delay		0x0621	0.0s	○
F6.34	Relay switch-off delay		0x0622	0.0s	○
F6.35	Relay 2 output turn-on delay (HAVXSIO3 DIR expansion card function)	Same as F6.11 to F6.13 function code.	0x0623	0	×
F6.37	Relay 1 Output function (RA/RB/RC)	Same as F6.11 to F6.13 function code.	0X0625	0	×
Fd.10	VDO1 terminal function selection	Same as F6.11～F6.13 function code setting.	0x0D0A	0	×
Fd.11	VDO2 terminal function selection		0x0D0B	0	×
Fd.12	VDO3 terminal function selection		0x0D0C	0	×
Fd.13	VDO4 terminal function selection		0x0D0D	0	×
Fd.14	VDO5 terminal function selection		0x0D0E	0	×
Fd.15	VDO1 output on delay	Same as F6.29～F6.34 function code setting.	0x0D0F	0.0s	○
Fd.16	VDO2 output on delay		0x0D10	0.0s	○
Fd.17	VDO3 output on delay		0x0D11	0.0s	○
Fd.18	VDO4 output on delay		0x0D12	0.0s	○
Fd.19	VDO5 output on delay		0x0D13	0.0s	○

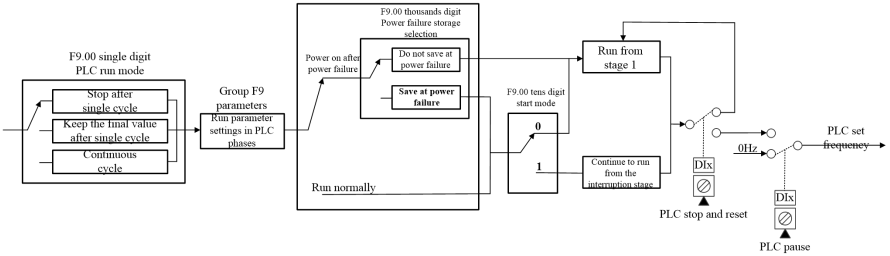
5.8 Simple PLC

The simple PLC function is a Multi-step speed generator. The drive can automatically change the operation frequency and direction according to the run time to meet the process requirements. This function used to be completed under the assistance of an external PLC. Now it can be realized by the drive itself.

This series of drives can realize 16-stage speed control, and there are 4 groups of acceleration/deceleration time for selection.

When the set PLC completes a cycle (or a stage), an ON signal can be output from the open. collector output terminal or relay.

5.8.1 Simple PLC logic block diagram



5.8.2 Related parameter table:

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.00	Simple PLC mode	LED single digit: PLC run mode 0: No action 1: Stop after a single cycle 2: Keep the final value after a single cycle 3: Continuous cycle 4: DI selective operation LED tens digit: Start mode 0: Start running from the first stage 1: Continue running from the stage of interruption LED hundreds digit: Stage time unit selection 0: Second 1: Minute LED thousands digit: Store at power failure 0: Do not store at power failure 1: Stage at power failure storage interruption	0x0900	0004	×
F9.01	Running steps	1~16	0x0901	16	○
F9.02	Multi-step speed 1	Lower limit frequency ~ upper limit frequency	0x0902	20.00Hz	○
F9.03	Step 1 speed setting	LED single digit: 0: Multi-step instruction 1 (F9.02)	0x0903	005	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		1: AI1 2: AI2 3: Pulse frequency 4: Communication 5: Keypad digital potentiometer input 6: Reserved LED tens digit: 0: Acceleration/deceleration time 1 1: Acceleration/deceleration time 2 2: Acceleration/deceleration time 3 3: Acceleration/deceleration time 4 LED hundreds digit: 0: Forward running 1: Reverse running **Note:** **Only the LED single digit frequency source of stage 1 instruction can be set.**			
F9.04	Running time of step 1	Set range: 0.1～6000.0 **Note:** **For the time unit selection, see F9.00 hundreds digit setting.**	0x0904	10.0	○
F9.05	Multi-step speed 2	Stage X instruction (F9.05, F9.08, F9.11, F9.14, F9.17, F9.20, F9.23, F9.26, F9.29, F9.32, F9.35、F9.38, F9.41, F9.44, and F9.47) setting range: Lower limit frequency ~ upper limit frequency Stage X instruction (F9.06, F9.09, F9.12, F9.15, F9.18, F9.21, F9.24, F9.27, F9.30, F9.33, F9.36、F9.39, F9.42, F9.45, and F9.48) setting range: LED single digit: 0: Multi-step instruction x 1: Reserved LED tens digit: 0: Acceleration/deceleration time 1 1: Acceleration/deceleration time 2 2: Acceleration/deceleration time 3 3: Acceleration/deceleration time 4 LED hundreds digit: 0: Forward running 1: Reverse running Stage X instruction running time (F9.07, F9.10, F9.13, F9.16, F9.19, F9.22, F9.25, F9.28, F9.31, F9.34, F9.37、F9.40, F9.43, F9.46, and F9.49) setting range: 0.1~6000.0 **Note:**	0x0905	20.00Hz	○
F9.06	Step 2 speed setting		0x0906	000	○
F9.07	Running time of step 2		0x0907	10.0	○
F9.08	Multi-step speed 3		0x0908	20.00Hz	○
F9.09	Step 3 speed setting		0x0909	000	○
F9.10	Running time of step 3		0x090A	10.0	○
F9.11	Multi-step speed 4		0x090B	20.00Hz	○
F9.12	Step 4 speed setting		0x090C	000	○
F9.13	Running time of step 4		0x090D	10.0	○
F9.14	Multi-step speed 5		0x090E	20.00Hz	○
F9.15	Step 5 speed setting		0x090F	000	○

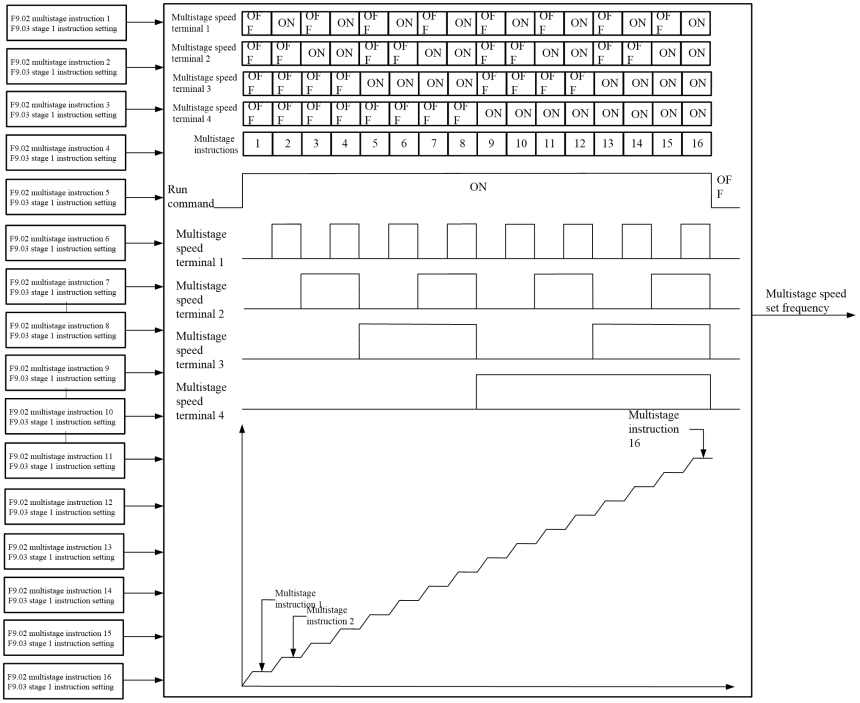
Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.16	Running time of step 5	**For the time unit selection, see F9.00 hundreds digit setting.**	0x0910	10.0	○
F9.17	Multi-step speed 6		0x0911	20.00Hz	○
F9.18	Step 6 speed setting		0x0912	000	○
F9.19	Running time of step 6		0x0913	10.0	○
F9.20	Multi-step speed 7		0x0914	20.00Hz	○
F9.21	Step 7 speed setting		0x0915	000	○
F9.22	Running time of step 7		0x0916	10.0	○
F9.23	Multi-step speed 8		0x0917	20.00Hz	○
F9.24	Step 8 speed setting		0x0918	000	○
F9.25	Running time of step 8		0x0919	10.0	○
F9.26	Multi-step speed 9		0x091A	20.00Hz	○
F9.27	Step 9 speed setting		0x091B	000	○
F9.28	Running time of step 9		0x091C	10.0	○
F9.29	Multi-step speed 10		0x091D	20.00Hz	○
F9.30	Step 10 speed setting		0x091E	000	○
F9.31	Running time of step 10		0x091F	10.0	○
F9.32	Multi-step speed 11		0x0920	20.00Hz	○
F9.33	Step 11 speed setting		0x0921	000	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.34	Running time of step 11		0x0922	10.0	○
F9.35	Multi-step speed 12		0x0923	20.00Hz	○
F9.36	Step 12 speed setting		0x0924	000	○
F9.37	Running time of step 12		0x0925	10.0	○
F9.38	Multi-step speed 13		0x0926	20.00Hz	○
F9.39	Step 13 speed setting		0x0927	000	○
F9.40	Running time of step 13		0x0928	10.0	○
F9.41	Multi-step speed 14		0x0929	20.00Hz	○
F9.42	Step 14 speed setting		0x092A	000	○
F9.43	Running time of step 14		0x092B	10.0	○
F9.44	Multi-step speed 15		0x092C	20.00Hz	○
F9.45	Step 15 speed setting		0x092D	000	○
F9.46	Running time of step 15		0x092E	10.0	○
F9.47	Multi-step speed 16		0x092F	20.00Hz	○
F9.48	Step 16 speed setting		0x0930	000	○
F9.49	Running time of step 16		0x0931	10.0	○

5.9 Multi-step speed operation

Set the parameters when using the drive for multi-step speed operation. The HAV-SP drive can set 16-stage speed, which is selected by the combination code of multi-step speed terminals 1～4, corresponding to multi-step speed 1 to multi-step speed 16 respectively.

5.9.1 Logical block diagram for the control of digital output



5.9.2 Related parameter table:

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.00	Simple PLC run mode selection	LED single digit: PLC run mode 0: No action 1: Stop after a single cycle 2: Keep the final value after a single cycle 3: Continuous cycle 4: DI selective operation LED tens digit: Start mode 0: Start running from the first stage 1: Continue running from the stage of interruption LED hundreds digit: Stage time unit selection 0: Second	0x0900	0004	×

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
		1: Minute LED thousands digit: Store at power failure 0: Do not store at power failure 1: Stage at power failure storage interruption			
F9.01	Running stages	1~16	0x0901	16	○
F9.02	Multi-step speed 1	Lower limit frequency ~ upper limit frequency	0x0902	20.00Hz	○
F9.03	Stage 1 instruction setting	LED single digit: 0: Multi-step speed 1 (F9.02) 1: AI1 2: AI2 3: Pulse frequency 4: Communication 5: Keypad digital potentiometer input 6: Reserved LED tens digit: 0: Acceleration/deceleration time 1 1: Acceleration/deceleration time 2 2: Acceleration/deceleration time 3 3: Acceleration/deceleration time 4 LED hundreds digit: 0: Forward running 1: Reverse running **Note:** **Only the LED single digit frequency source of stage 1 instruction can be set.**	0x0903	005	○
F9.04	Stage 1 instruction running time	Set range: 0.1～6000.0 **Note:** **For the time unit selection, see F9.00 hundreds digit setting.**	0x0904	10.0	○
F9.05	Multi-step speed 2	Stage X instruction (F9.05, F9.08, F9.11, F9.14, F9.17, F9.20, F9.23, F9.26, F9.29, F9.32, F9.35、F9.38, F9.41, F9.44, and F9.47) setting range: Lower limit frequency ~ upper limit frequency Stage X instruction (F9.06, F9.09, F9.12, F9.15, F9.18, F9.21, F9.24, F9.27, F9.30, F9.33, F9.36、F9.39, F9.42, F9.45, and F9.48) setting range: LED single digit: 0: Multi-step instruction x 1: Reserved LED tens digit: 0: Acceleration/deceleration time 1 1: Acceleration/deceleration time 2 2: Acceleration/deceleration time 3 3: Acceleration/deceleration time 4	0x0905	20.00Hz	○
F9.06	Stage 2 instruction setting		0x0906	000	○
F9.07	Stage 2 instruction running time		0x0907	10.0	○
F9.08	Multi-step speed 3		0x0908	20.00Hz	○
F9.09	Stage 3 instruction setting		0x0909	000	○
F9.10	Stage 3 instruction running time		0x090A	10.0	○
F9.11	Multi-step speed 4		0x090B	20.00Hz	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.12	Stage 4 instruction setting	LED hundreds digit: 0: Forward running 1: Reverse running	0x090C	000	○
F9.13	Stage 4 instruction running time	Stage X instruction running time (F9.07, F9.10, F9.13, F9.16, F9.19, F9.22, F9.25, F9.28, F9.31, F9.34, F9.37、F9.40, F9.43, F9.46, and F9.49) setting range: 0.1~6000.0 **Note:** **For the time unit selection, see F9.00 hundreds digit setting.**	0x090D	10.0	○
F9.14	Multi-step speed 5		0x090E	20.00Hz	○
F9.15	Stage 5 instruction setting		0x090F	000	○
F9.16	Stage 5 instruction running time		0x0910	10.0	○
F9.17	Multi-step speed 6		0x0911	20.00Hz	○
F9.18	Stage 6 instruction setting		0x0912	000	○
F9.19	Stage 6 instruction running time		0x0913	10.0	○
F9.20	Multi-step speed 7		0x0914	20.00Hz	○
F9.21	Stage 7 instruction setting		0x0915	000	○
F9.22	Stage 7 instruction running time		0x0916	10.0	○
F9.23	Multi-step speed 8		0x0917	20.00Hz	○
F9.24	Stage 8 instruction setting		0x0918	000	○
F9.25	Stage 8 instruction running time		0x0919	10.0	○
F9.26	Multi-step speed 9		0x091A	20.00Hz	○
F9.27	Stage 9 instruction setting		0x091B	000	○
F9.28	Stage 9 instruction running time		0x091C	10.0	○
F9.29	Multi-step speed 10		0x091D	20.00Hz	○
F9.30	Stage 10 instruction setting		0x091E	000	○

Parameter Code	Parameter name	Parameter detailed description	Contact address	Factory value	Change
F9.31	Stage 10 instruction running time		0x091F	10.0	○
F9.32	Multi-step speed 11		0x0920	20.00Hz	○
F9.33	Stage 11 instruction setting		0x0921	000	○
F9.34	Stage 11 instruction running time		0x0922	10.0	○
F9.35	Multi-step speed 12		0x0923	20.00Hz	○
F9.36	Stage 12 instruction setting		0x0924	000	○
F9.37	Stage 12 instruction running time		0x0925	10.0	○
F9.38	Multi-step speed 13		0x0926	20.00Hz	○
F9.39	Stage 13 instruction setting		0x0927	000	○
F9.40	Stage 13 instruction running time		0x0928	10.0	○
F9.41	Multi-step speed 14		0x0929	20.00Hz	○
F9.42	Stage 14 instruction setting		0x092A	000	○
F9.43	Stage 14 instruction running time		0x092B	10.0	○
F9.44	Multi-step speed 15		0x092C	20.00Hz	○
F9.45	Stage 15 instruction setting		0x092D	000	○
F9.46	Stage 15 instruction running time		0x092E	10.0	○
F9.47	Multi-step speed 16		0x092F	20.00Hz	○
F9.48	Stage 16 instruction setting		0x0930	000	○
F9.49	Stage 16 instruction running time		0x0931	10.0	○

5.10 PID control

The PID control is a commonly used method for process control. By performing proportional, integral, and differential operations on the feedback signal of the controlled quantity and the quantity of the target quantity signal, the output frequency of the drive is adjusted to form a negative feedback system, so that the controlled quantity is stable on the target quantity. Suitable for process control such as flow control, pressure control and temperature control.

5.10.1 PID control concept

The brief of PID control working principle and the introduction of adjustment method:

Proportional adjustment (Kp): When there is a deviation between the feedback and the input, the output and the deviation are adjusted in proportion. If the deviation is constant, the adjustment amount is also constant. Proportional adjustment can quickly respond to changes in feedback, but just proportional adjustment cannot achieve non-differential control. The larger the proportional gain, the faster the adjustment speed of the system, but if it is too large, oscillation will occur. The adjustment method is to first set the integration time to be very long and the differential time to zero. Use only proportional adjustment to make the system run, change the input quantity, and observe the stable deviation (static difference) between the feedback signal and the input quantity. If the static difference is in the direction of target value changes (for example, increasing the input quantity, the feedback quantity is always less than the target value after the system is stable), continue to increase the proportional gain, otherwise decrease the proportional gain, and repeat the above process until the static difference is relatively small.

Integration time (Ti): When there is a deviation between the feedback and the input value, the output adjustment accumulates continuously. If the deviation persists, the adjustment increases constantly, until there is no deviation. The integral regulator can effectively eliminate static difference. If the integral regulator is too strong, there will be repeated overshoot, making the system unstable until oscillation occurs. The characteristics of the oscillation caused by excessive integration are as follows: The feedback signal swings up and down at an input quantity, and the swing gradually increases until it oscillates. The adjustment of the integration time parameter is generally from large to small, gradually adjust the integration time, and observe the effect of the system adjustment until the stable speed of the system reaches the requirements.

Differential time (Td): When the deviation between feedback and input changes, an adjustment proportional to the deviation change rate is output. The adjustment is only related to the direction and magnitude of the deviation change, and has nothing to do with the direction and magnitude of the deviation itself. The function of differential adjustment is to adjust according to the changing trend when the feedback signal changes, thus to suppress the change of the feedback signal. Please use the differential regulator with caution, because the differential regulation is easy to amplify the interference of the system, especially the interference with a higher change frequency.

5.10.2 PID control adjustment method

General steps for PID parameter setting

a. Determine the proportional gain Kp

When determining the proportional gain Kp, first remove the integral and differential items of PID. Generally, assumed Ti = 0 and Td = 0 (for details, see the description of PID parameter setting), so that the PID is of pure proportional adjustment. The input is set to 60%～70% of the maximum value allowed by the system. The proportional gain Kp is increased from 0 gradually until the system oscillates; in turn, the proportional gain Kp is gradually decreased from this time until the system oscillation disappears. In this case, the proportional gain Kp is recorded, and the proportional gain Kp of PID is set to 60%～70% of the current value. The proportional gain Kp debugging is completed.

b. Determine the integration time Ti

After the proportional gain Kp is determined, set a larger initial value of the integration time Ti, and then gradually decrease Ti until the system oscillates, and then in turn, increase Ti gradually until the system oscillation disappears. Record the Ti at this time and set the integration time

constant Ti of PID to 150% ～ 180% of the current value. The integration time constant Ti debugging is completed.

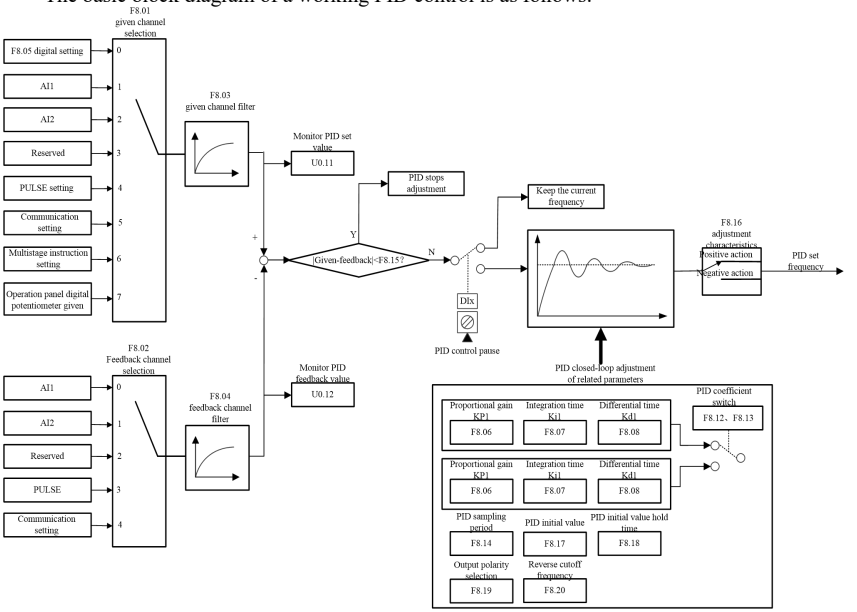
c. Determine the differential time Td

Generally, the differential time Td needs not to be set (0). To set, the method is the same with that of determining Kp and Ti, taking 30% without oscillation.

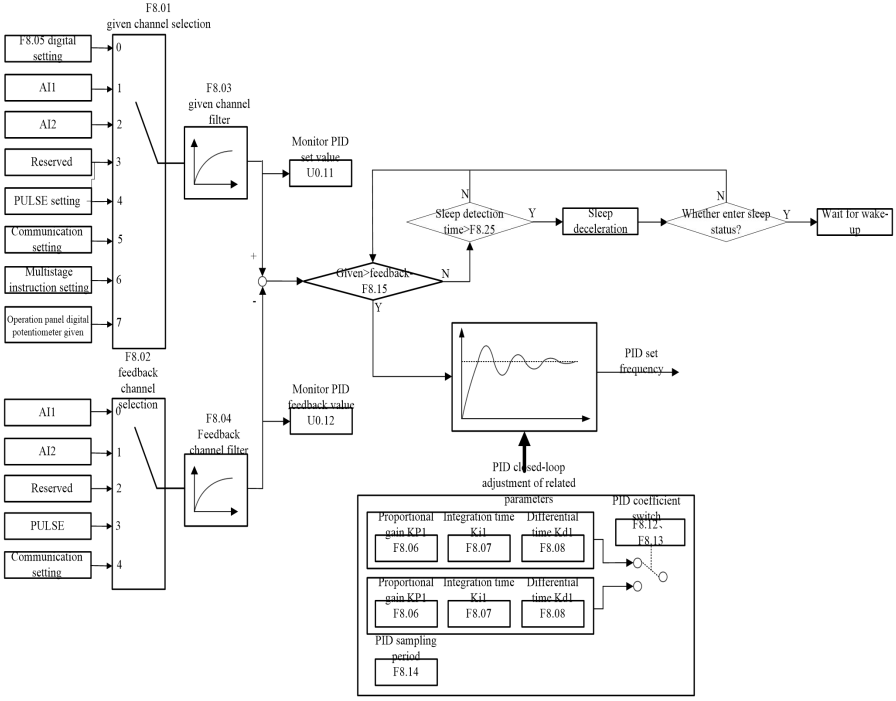
d. The system is debugged with or without load, and then the PID parameters are fine-tuned until the requirements are met.

5.10.3 Logic block diagram of PID control

The basic block diagram of a working PID control is as follows:



The basic block diagram of PID control for water supply application is as follows (used when F0.04 industry code is the special drive for water supply):



5.10.4 Related parameter table:

Parameter Code	Parameter name	Parameter detailed description	Minimum Unit	Factory value	Change
F8.00	PID operation control selection	0: Disable (Ready mode) 1: Enable (Ready mode)	0x0800	0	×
F8.01	PID reference source	0: F8.05 digital input; 1: AI1; 2: AI2; 3: Reserved 4: PULSE setting; 5: Communication setting 6: Multi-step speed setting 7: Keypad digital potentiometer input 8: Reserved	0x0801	0	×
F8.02	PID feedback source	0: AI1; 1: AI2; 2: Reserved 3: Pulse 4: Communication setting	0x0802	0	×
F8.03	PID reference source smoothing time	Set range: 0～1000ms	0x0803	10ms	○
F8.04	PID feedback source smoothing time		0x0804	10ms	○
F8.05	PID digital setting	Universal drive mode setting range: 0.0～100.0% Set range of professional drive mode for water supply : 0.0～F8.23	0x0805	0.0% Or 0.0bar	○
F8.06	Proportional gain Kp1	Set range: 0～1000	0x0806	10	○
F8.07	Integration time Ti1	Set range: 1～10000ms	0x0807	500ms	○
F8.08	Differential time Td1	Set range: 0～10000ms	0x0808	0ms	○
F8.09	Proportional gain Kp2	F8.09 set range: 0～1000 F8.10 set range: 1～10000ms F8.11 set range: 0～10000ms	0x0809	5	○
F8.10	Integration time Ti2		0x080A	2000ms	○
F8.11	Differential time Td2		0x080B	0ms	○
F8.12	Gain switching conditions	0: Do not switch 1: Switch through DI terminal 2: Switch automatically based on deviation 3: Switch automatically according to PID output	0x080C	0	○

Parameter Code	Parameter name	Parameter detailed description	Minimum Unit	Factory value	Change
F8.13	Gain switching threshold	Set range: 0.0～100.0%	0x080D	0.0%	○
F8.14	PID sampling cycle	Set range: 1～60000ms	0x080E	1ms	○
F8.15	PID control deviation limit	Set range: 0.0～50.0%	0x080F	0.0%	○
F8.16	Closed-loop regulation features	0: Positive action 1: Negative action	0x0810	0	○
F8.17	PID initial value	F8.17 set range: 0.0～100.0% F8.18 set range: 0.00～600.00s	0x0811	0.0%	×
F8.18	PID initial value hold time		0x0812	0.00s	×
F8.19	Closed-loop output polarity selection	0: Closed-loop output is negative, run at zero-frequency 1: Closed-loop output is negative, reverse	0x0813	0	○
F8.20	PID reverse cutoff frequency	Set range: 0.00~upper limit frequency	0x0814	2.00Hz	×
F8.21	PID feedback offline detection value	F8.21 set range: 0.0～100.0% F8.22 set range: 0.0～200.0s (0.0s indicates no detection)	0x0815	10.0%	○
F8.22	PID feedback offline detection time		0x0816	0.0s	○
F8.23	Maximum sensor range	Set range: 0.0～200.0bar	0x0817	10.0bar	○
F8.24	Water supply sleep selection	0: Automatic sleep 1: Run at lower limit frequency	0x0818	0	○
F8.25	Water supply sleep detection time	F8.25 set range: 0.0～3600.0s F8.26 set range: 0.01～600.00s	0x0819	2.0s	○
F8.26	Water supply sleep deceleration time		0x081A	30.00s	○
F8.27	Water supply wake pressure tolerance	F8.27 set range: 0.0～100.0% (100.0% is the set pressure value) F8.28 set range: 0.0～3600.0s	0x081B	10.0%	○
F8.28	Water supply wake detection time		0x081C	2.0s	○
F8.29	Water pressure overpressure alarm detection value	Set range: 0.0～100.0% (Do not test when set to 0, 100.0% is the maximum range of pressure sensor)	0x081D	90.0%	○

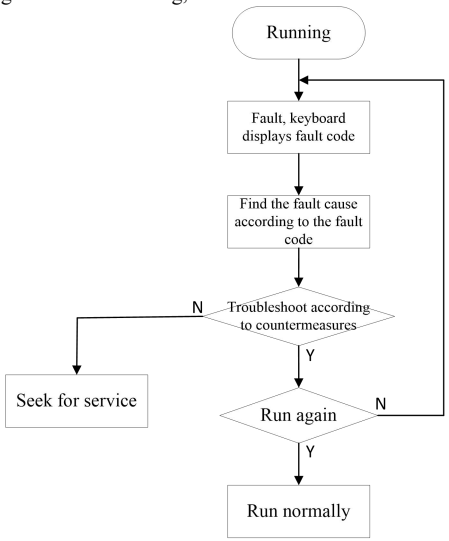
Parameter Code	Parameter name	Parameter detailed description	Minimum Unit	Factory value	Change
F8.30	Water pressure under-pressure alarm detection value	Set range: 0.0～100.0% (Do not test when set to 0, 100.0% is the maximum range of pressure sensor)	0x081E	0.0%	○
F8.31	Water pressure abnormal alarm detection time	Set range: 0.0～3600.0s	0x081F	50.0s	○
F8.32	Water shortage alarm set value	F8.32 set range: 0.0～100.0% (100.0% is the set pressure value) F8.33 set range: 0.0～3600.0s F8.34 set range: 0～10000min (0min indicate there's no water shortage restart function)	0x0820	0.0%	○
F8.33	Water shortage alarm detection time		0x0821	20.0s	○
F8.34	Water shortage restart wait time		0x0822	0min	○
F8.35	Water supply absolute sleep detection time	Setting range: 0~3600.0s When the drive sleeps and decelerates to the lower limit frequency, it will run at the lower limit frequency for the time defined by F8.35 and then go to zero frequency operation.	0x0823	10.0s	○
F8.36	Dormancy frequency	F8.35 Setting range: 0 to 3600.0s F8.36 Setting range: Lower limit frequency to Upper limit frequency F8.37 Setting range: Lower limit frequency to Upper limit frequency F8.38 The value ranges from 0 to 300.0s F8.39 Setting range: 0 to 10.0%	0x0824	0.00Hz	○
F8.37	Hibernation lifting frequency		0x0825	50.00Hz	○
F8.38	Hibernation lifting frequency hold time		0x0826	0.0s	○
F8.39	Sleep boost tolerance		0x0827	0.0%	○

5.11 Troubleshooting

5.11.1 Troubleshooting method

The HAV-SP series drive provides rich fault handling information. When the drive fails, the keypad will display the fault code and stop output. The fault record parameter group U1 can record the last 10 fault information. After the fault occurs, the processing steps are as follows:

1. When the drive fails, check whether the keypad display is abnormal? If yes, seek for service;
2. If there is no abnormality, please check the group U1 function code, confirm the corresponding fault record parameters, and determine the actual status at occurrence of the current fault through all parameters;
3. Check the fault alarm content and countermeasure table, and check whether there is a corresponding abnormal status according to the specific countermeasures?
4. Do troubleshooting or ask relevant personnel for help;
5. After confirming the troubleshooting, reset the fault and start running.



5.11.2 Related parameter table:

Parameter Code	Parameter name	Parameter detailed description	
U1.00	Historical fault number	Set range: 0～9 According to the setting of this function code, you can view the fault record information of the last 10 times. By setting different values within U1.01～U1.06, the corresponding fault record will display.	See the following table
U1.01	Fault code during fault	Fault record information at the xth fault (x is the set value of U1.00)	
U1.02	Bus voltage during fault		
U1.03	Output current during fault		
U1.04	Running frequency during fault		
U1.05	Running temperature during fault		
U1.06	Fault occurrence time		

The address table of nearly 10 failure codes and running parameters is as follows.

Content / Number	Parameter Code	Bus voltage	Output current	Output frequency	Operating temperature	Occurrence time
0	0x1100	0x1101	0x1102	0x1103	0x1104	0x1105
1	0x1106	0x1107	0x1108	0x1109	0x110A	0x110B
2	0x110C	0x110D	0x110E	0x110F	0x1110	0x1111
3	0x1112	0x1113	0x1114	0x1115	0x1116	0x1117
4	0x1118	0x1119	0x111A	0x111B	0x111C	0x111D
5	0x111E	0x111F	0x1120	0x1121	0x1122	0x1123
6	0x1124	0x1125	0x1126	0x1127	0x1128	0x1129
7	0x112A	0x112B	0x112C	0x112D	0x112E	0x112F
8	0x1130	0x1131	0x1132	0x1133	0x1134	0x1135
9	0x1136	0x1137	0x1138	0x1139	0x113A	0x113B
Note: The six communication addresses (0x1100 to 0x1105) numbered 0 are records of the last fault.						

5.11.3 Fault alarm content and countermeasure table:

Fault code	Fault type	Possible cause of failure	Countermeasures
E001	Drive overcurrent during acceleration	The acceleration time is too short.	Increase the acceleration time.
		The V/F curve is improper.	Adjust the V/F curve setting, adjust the manual torque boost or set the motor parameters correctly to ensure that the automatic torque boost is normal.
		Restarted the motor after an instant stop before letting the motor stop rotating completely.	Set the start mode F2.00 to speed tracking restart function.
		Low power grid voltage	Check the input power.
		The drive power is too small.	Use a drive with a large power level.
E002	Drive overcurrent during deceleration	The deceleration time is too short.	Increase the deceleration time.
		Load with potential energy or large inertia torque	Externally add a proper energy consumption braking component.
		The drive power is small.	Use a drive with a large power level.
E003	Drive overcurrent during constant-speed running	Sudden change of load	Reduce the sudden change of load.
		The acceleration/deceleration time is set to very short.	Increase the acceleration/deceleration time as appropriate.
		Abnormal load	Perform load check.
		Low power grid voltage	Check the input power.
		The drive power is small.	Use a drive with a large power level.
E004	Drive overvoltage during acceleration	Abnormal input voltage	Check the input power.
		The acceleration time is set to very short.	Increase the acceleration time to an appropriate value.
		Restarted the motor after an instant stop before letting the motor stop rotating completely.	Set the start mode F2.00 to speed tracking restart function.
E005	Drive overvoltage during deceleration	The deceleration time is too short (relative to regenerative energy).	Increase the deceleration time.
		Load with potential energy or large inertia torque	Select a proper energy consumption braking component.
E006	Drive overvoltage during constant-speed running	Abnormal input voltage	Check the input power.
		The acceleration/deceleration time is set to too short.	Increase the acceleration/deceleration time to an appropriate value..
		Abnormal change of the	Install an input reactor.

Fault code	Fault type	Possible cause of failure	Countermeasures
		input voltage	
		Large load inertia	Consider using an energy-saving brake component.
E007	Undervoltage during running	Abnormal input voltage	Check the input power voltage.
E008	Motor overload alarm	The V/F curve is improper.	Set the V/F curve and the torque boost correctly.
		Extremely low power grid voltage	Check the power grid voltage.
		The general motor operates for a long time at a low speed with a large load.	Special motor can be selected for long-term and low-speed operation.
		Incorrect motor rated current	Set the motor rated current correctly.
		Motor stalled or a large sudden change of load	Check the load.
E009	Drive overload alarm	The acceleration time is too short.	Increase the acceleration time
		Excessive DC braking current	Reduce the DC braking currentand extend the braking time.
		The V/F curve is improper.	Adjust the V/F curve and the torque boost.
		Restarted the motor after an instant stop before letting the motor stop rotating completely.	Set the start mode F2.00 to speed tracking restart function.
		Extremely low power grid voltage	Check the power grid voltage.
		Excessive load	Select a drive with a larger power.
E010	Drive module protection	Instantaneous overcurrent of drive	See overcurrent countermeasures
		The output three phases have phase-to-phase short circuit Or grounded short circuit	Rewiring
		Blocked air duct or damaged fan	Clear the air duct or replace the fan
		Too high ambient temperature	Reduce the ambient temperature.
		Loose wire connection or plug-in of control board	Check and reconnect the wire
		Abnormal current waveform caused by output phase loss etc.	Check wiring

Fault code	Fault type	Possible cause of failure	Countermeasures
		Damaged auxiliary power supply, undervoltage of drive	Seek for service.
		Drive module arm straight-through	Seek for service.
		Abnormal control board	Seek for service.
E011	Input phase loss alarm	Phase loss of input R, S, and T	Check the installation wiring
			Check the input voltage
E012	Output phase loss alarm	Phase loss of output U, V, and W	Check the output wiring.
			Check the motor and the cable.
E013	Drive module radiator overheat alarm	Too high ambient temperature	Reduce the ambient temperature.
		Blocked air duct	Clear the air duct.
		Damaged fan	Replace the fan.
		Abnormal drive module	Seek for service.
E014	Rectifier module radiator overheat alarm	Too high ambient temperature	Reduce the ambient temperature.
		Blocked air duct	Clear the air duct.
		Damaged fan	Replace the fan.
E015	External fault alarm	External fault emergency stop terminal closed	Check the external equipment input.
E016	485 communication error alarm	Improper baud rate setting	Set the baud rate properly.
		Serial port communication error	Press the STOP key to reset or seek for service.
		Improper fault alarm parameter setting	Modify the settings of Fb.04, Fb.03 and FA.07.
		The host computer doesn't work.	Check whether the host computer works or not, and whether the wiring is correct.
E017	Current detection circuit fault alarm	Damaged auxiliary power supply	Seek for service.
		Damaged Hall device	Seek for service.
		Abnormal amplification circuit	Seek for service.
E018	Reserved	-	-
E019	Reserved	-	-
E020	Closed-loop feedback loss alarm	Feedback circuit is disconnected	Check the feedback circuit.
E021	Water pressure overpressure alarm	Abnormal sensor feedback signal	Check the sensor wiring.
		Too low overvoltage alarm value	Modify the F8.29 setting.

Fault code	Fault type	Possible cause of failure	Countermeasures
		Too short alarm detection time	Modify the F8.31 setting.
E022	Reserved	-	-
E023	Water shortage alarm	Abnormal water pressure/water level	Check whether the water pressure at the pump inlet is abnormal.
		Broken line or poor contact of the sensor, system has no feedback signal	Check the sensor installation and wiring.
		Too low water shortage alarm value.	Modify the F8.32 setting.
		Too short water shortage detection time	Modify the F8.33 setting.
E024	Water shortage alarm	Abnormal water pressure or water level.	Check whether the water pressure at the water inlet is abnormal.
		The sensor is disconnected or in poor contact, and the system has no feedback signal	Check the sensor installation and cable connections
		The water shortage alarm value is set too high	Modify the FE.17 setting.
		The water shortage detection time is too short	Modify the F8.33 setting.
E025	Reserved	-	-
E026	Abnormal buffer circuit	Extremely low power grid voltage	Check the power grid voltage
		Damaged thyristor	Replace the main circuit contactor and seek for service
		Damaged power-on buffer resistance	Replace buffer resistance and seek for service
		Damaged control circuit	Seek for service.
		Input phase loss	Check the input R, S, T wiring
E027	Reserved	-	-
E028	Keypad parameter copy error alarm	Operation panel parameters are incomplete	Upload parameters in the backup operation panel again
		The software version of the operation panel parameters is inconsistent with that of the main control board parameters	Parameter Software versions are inconsistent. The parameter download function cannot be performed. Re-upload parameters in the backup operation panel
		The operating panel parameters are 2S models and the main	Parameter voltage levels are inconsistent. The parameter download function cannot be performed. Re-upload

Fault code	Fault type	Possible cause of failure	Countermeasures
		control board parameters are 4T models	parameters in the backup operation panel
		The operation panel parameters are different from the main control board parameters	Parameter The machine model is different. The parameter download function cannot be performed. Upload the parameters in the backup operation panel again
E029	Wave-by-wave current limiting alarm	Excessive load	Check whether the power grid voltage is normal
			Detect whether the motor is blocked
			Seeking services
E099	Internal fault	-	Seeking services

Abnormal state	Fault type	Possible cause of failure	Countermeasures
C.off	The communication between the keyboard and the control board fails	The communication cable between the keyboard and the control board is loose	Check whether the communication cable between the keyboard and the control board is loose
		Keyboard damage	Seek service
		Control board damage	Seek service
P.off	Bus voltage undervoltage fault	The input voltage is insufficient	Check whether the power grid voltage is normal
			Measure whether the bus voltage is less than the value set by parameter FA.00

Appendix I Communication Protocol

Networking mode

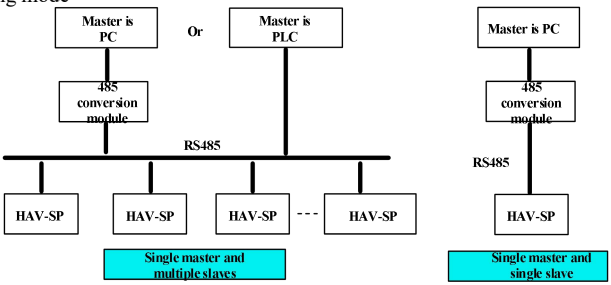


Figure 1: Schematic diagram of drive RS485 networking mode

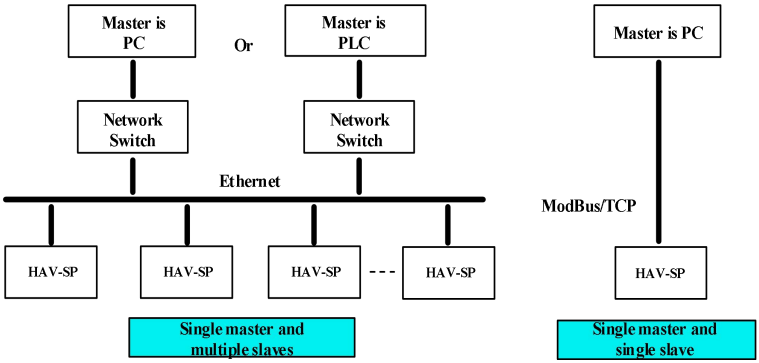


Figure 2: Schematic diagram of drive ethernet networking mode

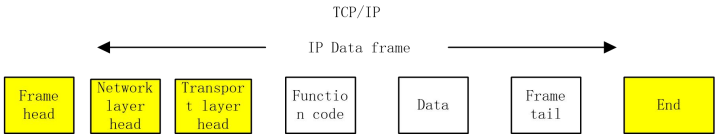
The interface way：

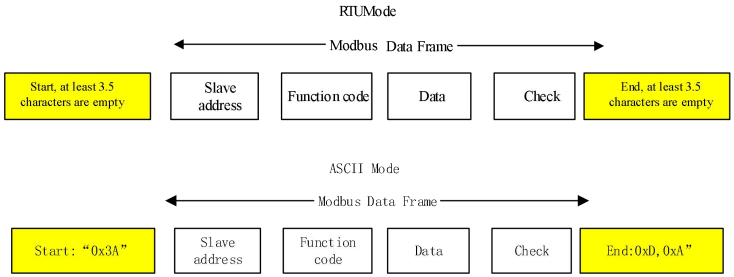
RS485，Asynchronous half duplex. Default：8-N-2，9600bps. See Fb group description for parameter Settings.

Ethernet, full duplex. Default: IP address 192.168.1.30，Subnet mask 255.255.255.0，Gateway 192.168.1.1. See Fb group description for parameter Settings.

Protocol format：

Modbus supports TCP, RTU, and ASCII modes. The corresponding frame formats are as follows：





Protocol function:

The main function of Modbus is to read and write parameters. Different function codes determine different operation requests. The drive Modbus protocol supports the following function code operations:

Function code	Function code significance
0x03	Read drive function code parameter and running status parameter
0x06	Rewrite control parameter of single register
0x10	Rewrite control parameter of multiple registers

The function code parameter, control parameter and status parameter of the drive are mapped as Modbus read-write registers. The read-write characteristics and range of the function code parameters follow the instructions in the drive user manual. The group number of the drive function code is mapped to the high byte address of the register, and the index in the group is mapped to the low byte address of the register. The control parameter of the drive is virtualized to the drive function code group 18, and the status parameter of the drive is virtualized to the drive function code group 19. The correspondence between the function code group number and the high byte of its mapped register address is as follows:

Group F0: 0x00; group F1: 0x01; group F2: 0x02; group F3: 0x03; group F4: 0x04; group F5: 0x05; group F6: 0x06; group F7: 0x07; group F8: 0x08; group F9: 0x09; FA group: 0x0A; Fb group: 0x0B; FC group: 0x0C; Fd group: 0x0D; FE group: 0x0E; FF group: 0x0F; U0 group: 0x10; U1 group: 0x11; drive control parameter group: 0x12; drive status parameter group: 0x13.

For example, the register address of the drive function code parameter F3.02 is 0x0302, and the register address of the drive function code parameter FE.01 is 0x0E01.

If the operation request fails, the response is an error code and an exception code. The error code is equal to (function code + 0x80), and the exception code indicates the error reason. The exception code is listed as follows:

Exception code	Exception code significance
0x1	Illegal function code.
0x2	Illegal register address.
0x3	Data error, that is, the data exceeds the upper or lower limit.
0x4	Slave operation failed (including errors caused by invalid data, although the data is within the upper and lower limits).
0x18	Information frame error: Including information length error and check error.
0x20	Parameters cannot be modified.
0x21	Out of the range of function group.

The drive control parameters can complete functions to start, stop, and set running frequency of the drive. By searching drive status parameters, parameters such as operating frequency, output current, and output torque of the drive can be obtained. The specific drive control parameters and status parameters are enumerated as follows (except 0x1207 virtual output terminal is read-only, other parameters are readable and writable):

HAV-SP drive control parameter index

Register address	Parameter name	Whether save after power failure
0x1200	Control command word 1	No
0x1201	Main frequency setting	Yes
0x1202	Reserved	-
0x1203	PID input	Yes
0x1204	PID feedback	Yes
0x1205	Analog output AO, high-speed DO2 setting	No
0x1206	Virtual input terminal: Define by bit: BIT0~9 = VDI1~VDI10, BIT10~15 = Reserved	No
0x1207	Virtual output terminals (read-only): Define by bit: BIT0~4 = VDO1~VDO5, BIT5~15 = Reserved	No
0x2000	Control command word 2	No
0x2001	Main frequency setting	Yes

HAV-SP drive status parameter index

Register address	Parameter name
0x1300	Running status word
0x1301	Drive model
0x1326	error code

The drive control word 1 (register address 0x1200) bit is defined as follows:

Control word (bit)	Value	Significance	Function description
Bit2, 1, 0	111B	Run command	Start the drive
	110B	Stop command	Stop according to the way set by function code F2.08
	Remaining	No command	
Bit3	1	Reverse	Set the running direction when the run command is valid (invalid for jog command)
	0	Forward	
Bit8～Bit4	0	Reserved	-
Bit9	1	Fault reset valid	
	0	Fault reset invalid	
Bit15～Bit5	0	Reserved	-

The drive control word 2 (register address 0x2000) bit is defined as follows:

Control word (bit)	Value	Significance	Function description
Bit1, 0	00B	No function	
	01B	Stop	Stop according to the way set by function code F2.08
	10B	Start	Start the drive
	11B	No function	
Bit3, 2	0	Reserved	-
Bit5, 4	00B	No function	
	01B	Forward instruction	
	10B	Reverse instruction	
	11B	Fault reset	
Bit15～Bit5	0	Reserved	-

The drive status word (register address 0x1300) bit is defined as follows:

Status word (bit)	Value	Significance	Remarks
Bit0	1	Drive operation	
	0	Drive stop	
Bit1	1	Drive reverse	
	0	Drive forward	
Bit2	1	Reach the main setting	
	0	Not reach the main setting	
Bit7～Bit3	0	Reserved	
Bit15～Bit8	00~0xFF	Fault code	0: Indicates the drive is normal; Not 0: Indicates a fault, and refer to the user manual of the drive of relevant type for detailed fault code significance. For example, the fault code for motor overload E008 is 0x08, and for undervoltage is 0x1F.

Application example

The command to start the 1# drive to run in the forward direction and set the speed to 50.00HZ (internally indicated as 5000) is as follows:

	Address	Function code	Register address	Register number	Register content bytes	Register content	Verification code
Request	0x01	0x10	0x1200	0x0002	0x04	0x0007, 0x1388	0x9B98
Response	0x01	0x10	0x1200	0x0002	None	None	0x44B0

5# drive fault reset:

Address	Function code	Register address	Register content	Verification code
0x05	0x06	0x1200	0x0200	0x8C56
0x05	0x06	0x1200	0x0200	0x8C56

Read the running frequency of the 4# drive, and the drive response running frequency is 50.00HZ:

Address	Function code	Register address	Register number or read bytes	Register content	Verification code
0x04	0x03	0x1000	0x0001	None	0x809F
0x04	0x03	None	0x02	0x1388	0x7912

Write the acceleration time 1 (i.e. function code F1.11) of 5# drive to 1.00s, and do not save after power failure.

Address	Function code	Register address	Register content	Verification code
0x05	0x06	0x010B	0x0064	0xF99B
0x05	0x06	0x010B	0x0064	0XF99B

Read the output current of 5# drive, and the drive response output current is 3.00A.

Address	Function code	Register address	Register number or read bytes	Register content	Verification code
0x05	0x03	0x1002	0x0001	None	0x208E
0x05	0x03	None	0x02	0x012C	0x49C9

Calibration relationship of the drive

A) The calibration of the frequency is 1:100

To make the drive run at 50Hz, the main setting shall be 0x1388 (5000).

B) The calibration of the time is 1:100

To make the drive acceleration time be 3s, the function code setting shall be 0x012C (300).

C) The calibration of the current is 1:100

If the drive feedback current is 0x012C (300), the current of the drive is 3A.

MMC function user manual

1.1 Introduction of constant pressure water supply system

The multi-pump control function is suitable for multiple motor systems where one drive controls the pump. The main pump connected to the output of the drive is controlled by PID, the auxiliary pump is connected to the power supply of the grid, and the breaking and closing are controlled by the internal relay of the drive.

2.1 Function code introduction

Function code introduction：
×— Indicates that this parameter cannot be changed during running
○— Indicates that the parameter can be changed during the running
●— Indicates the actual detection parameter and cannot be changed
*— Indicates that the parameter is reserved for the manufacturer and cannot be modified

2.1.1 Parameter macro

Parameter group	Parameter code	Parameter name	Parameter description	Factory value	Change
FF	**01**	**Parameter macro**	**0：Invalid** **1：MMC auto mode parameter macro** **2~9：Reserved**	**0**	×

Note: When the FF.01 is set to 1, the relevant parameters in the user manual of multi-pump control function will be set to the corresponding factory value, and the FF.01 will automatically restore to 0.

Parameter group	Parameter code	Parameter name	Parameter description	Factory value	Change
F0	04	Industry code	1：Special drive for water supply	1	×
F1	01	Channel of running commands	1：Terminal run command channel	1	○
	02	Setting channel of main frequency x command	8：PID	8	○
	06	Max output frequency	Upper limit frequency～599.00Hz	60.00Hz	×
	09	Upper limit of running frequency	Lower limit frequency ~ maximum output frequency	60.00Hz	○
	11	ACC time 1	0.01~600.00s	20.00s	○
	12	DEC time 1		30.00s	
F2	06	Start protection selection (only valid for two-wire control)	2: If the run command is valid, the drive starts at the start frequency (F2.01).	2	×
	07	Start protection wait time	0.0~1000.0s	5.0s	○
	08	Stop mode	0：Deceleration stop	0	×

Parameter group	Parameter code	Parameter name	Parameter description	Factory value	Change
	20	Running frequency of jog	0.10~F1.09	10.00Hz	○
	22	ACC time for jogging	0.01~600.00s	20.00s	○
	23	DEC time for jogging		30.00s	○
F4	00	MMC sel	4: Floating mode	4	×
	01	The number of the pump	2~8	4	×
	02	The tolerance of adding pump	0 ~ Maximum sensor range	0.2bar	○
	03	The ACC time of reducing pump	0.01~600.00s	6.00s	○
	04	Aux start DT	0.0~3600.0s	30.0s	○
	05	Auto change frequency	0.00~50.00Hz	20.00Hz	○
	06	The tolerance of reducing pump	0 ~ Maximum sensor range	0.2bar	○
	07	The DEC time of adding pump	0.01~600.00s	6.00s	○
	08	Aux stop DT	0.0~3600.0s	30.0s	○
	10	Auto change mode selection	0: None 1: Main Exchange	1	×
	11	Auto change time	1~65535min	72min	○
	12	Interlock DT	0.0~60.0s	3.0s	×
	13	The operating priority of MMC	0：FIFO 1：FILO	1	×
F6	00	Function selection of DI1	1: Forward running FWD (edge+ level)	1	×
	01	Function selection of DI2-DI5	44: Interlock 1	44	×
	02		45: Interlock 2	45	×
	03		46: Interlock 3	46	×
	04		47: Interlock 4	47	×
	06	Function selection of DI7 (expansion card)	48: Interlock 5	48	×
	08	Function selection of DI9 (expansion card)	49: Interlock 6	49	×
Fb	34	Function selection of DI11 (expansion card)	50: Interlock 7	50	×
	35	Function	51: Interlock 8	51	×

Parameter group	Parameter code	Parameter name	Parameter description	Factory value	Change
		selection of DI13 (expansion card)			
F6	13	Relay output (TA/TB/TC)	17: Drive fault	17	×
	38	TC1~TC8 Relay output	0: No function 30: MMC output	30	×
	39				×
	40				×
	41				×
	42			0	×
	43				×
F9	58				×
	59				×
F8	02	PID feedback source	1：AI2	1	×
	05	PID digital setting	0~ Maximum sensor range **Notes：Wake up pressure = PID digital setting (F8.05) – Water supply wake pressure tolerance (F8.27)** **Sleep pressure = PID digital setting (F8.05) – PID control deviation limit (F8.15)**	5.0bar	○
	27	Water supply wake pressure tolerance		1.0bar	○
	15	PID control deviation limit		0.2bar	○
	28	Water supply wake detection time	0.0~3600.0s	20.0s	○
	35	Water supply sleep detection time	0.0~3600.0s	20.0s	○
	36	Sleep frequency	Lower limit frequency ~ upper limit frequency	55.00Hz	○
F9	50	Motor 1 start frequency	F9.54~F1.09	45.00Hz	○
	51	Motor 2 start frequency	F9.55~F1.09	45.00Hz	○
	52	Motor 3 start frequency	F9.56~F1.09	45.00Hz	○
	53	Motor 4 start frequency	F9.57~F1.09	45.00Hz	○
	54	Motor 1 stop frequency	F1.10~F9.50	20.00Hz	○
	55	Motor 2 stop frequency	F1.10~F9.51	20.00Hz	○
	56	Motor 3 stop frequency	F1.10~F9.52	20.00Hz	○
	57	Motor 4 stop frequency	F1.10~F9.53	20.00Hz	○
FC	25	Motor 5 start frequency	FC.29~F1.09	45.00Hz	○
	26	Motor 6 start frequency	FC.30~F1.09	45.00Hz	○

Parameter group	Parameter code	Parameter name	Parameter description	Factory value	Change
	27	Motor 7 start frequency	FC.31~F1.09	45.00Hz	○
	28	Motor 8 start frequency	FC.32~F1.09	45.00Hz	○
	29	Motor 5 stop frequency	F1.10~FC.25	20.00Hz	○
	30	Motor 6 stop frequency	F1.10~FC.26	20.00Hz	○
	31	Motor 7 stop frequency	F1.10~FC.27	20.00Hz	○
	32	Motor 8 stop frequency	F1.10~FC.28	20.00Hz	○
FA	08	Automatic reset times	0~100	10	×
	09	Automatic reset interval time	0.1~1000.0s	8.0s	×

Note: Please refer to the detailed user manual for detailed explanation of the above table parameters;

2.1.2 Parameter specification

Parameter group	Parameter code	Parameter name	Parameter description
F4	00	MMC sel	2: Fixed mode 4: Floating mode
	01	The number of the pump	2~8 Decide how many pumps you need to use.
	02	The tolerance of adding pump	0~ Maximum sensor range Pressure difference between source and feedback to turn on aux motors. When the feedback pressure < (setting pressure-F4.02), the pressure conditions for adding an auxiliary pump are met. Pressure difference between source and feedback to turn off aux motors. When the feedback pressure > (setting pressure+F4.06), the pressure conditions for reducing an auxiliary pump are met.
	06	The tolerance of reducing pump	
	03	The ACC time of reducing pump	0.01~600.00s When the auxiliary pump starts or stops, the main pump stops PID control and performs general acceleration and deceleration operations. When the auxiliary pump starts, the main pump decelerates to the auxiliary pump reducing pump frequency (F9.54~F9.57, F9.29~F9.32 pump 1~8 reducing pump frequency) according to the deceleration time set at F4.07. When the auxiliary pump stops, the main pump will speed up to the adding pump frequency (F9.50~F9.53, F9.25~F9.28 pump 1~8 adding pump frequency) Accelerate according to the acceleration time set at F4.03.
	07	The DEC time of adding pump	
	04	Aux start DT	0.0～3600.0s When the pressure conditions of adding pump or reducing pump are met (see F4.02 or F4.06 parameter explanation), and the pump can be added or reduced at this time, the pump is added after the pump delay time (F4.04) or the pump is reduced after the pump delay time (F4.08).
	08	Aux stop DT	
	05	Auto change frequency	0.00~50.00Hz
	10	Auto change mode selection	0: None 1: Main Exchange
	11	Auto change time	1~65535min
	12	Interlock DT	0.0~60.0s
	13	The operating priority of MMC	0: FIFO 1: FILO Set the pump sequency in floating mode. FIFO: Same on/off sequence as auxiliary pump. FILO: Reverse the on/off sequence of the auxiliary pump.

Parameter group	Parameter code	Parameter name	Parameter description
	14	The number of running pump	0~8 Displays the number of pumps in operation.
	15	Pump priority 1	0~9999 Displays the running priority of the pump. According to setting by users, it can be influenced by Interlock, Auto Change and operating time. **Each digit of F4.15 represents one pump**: Thousand digits: pump 4 Hundreds digit: pump 3 Tens digit: pump 2 Unit digit: pump 1 **Each digit of F4.16 represents one pump**: Thousand digits: pump 8 Hundreds digit: pump 7 Tens digit: pump 6 Unit digit: pump 5 Value explanation： A smaller value indicates a higher priority. Eg: 1>2>3>4>5>6>7>8。
	16	Pump priority 2	
	17	Auto change operation time	000min:00s~655min:35s
	18	Pump running status 1	0~3333 Displays the running status of the pump. According to setting by users, it can be influenced by Interlock, Auto Change and operating time. **Each digit of F4.18 represents one pump**: Thousand digits: pump 4 Hundreds digit: pump 3 Tens digit: pump 2 Unit digit: pump 1 **Each digit of F4.19 represents one pump**: Thousand digits: pump 8 Hundreds digit: pump 7 Tens digit: pump 6 Unit digit: pump 5 **Value explanation** 1：Drive control 2：Power grid control 3：Standby 9：Stop
	19	Pump running status 2	
	20	Pump start serial number	0~7 The serial number of the pump with the highest priority 0 to 7 indicates pump 1 to 8.

3.1 Function Introduction

- Basic Sequence
- Standby Motor
- Auto Change
- Interlock

3.1.1 Multiple Motor Control (MMC) Basic Sequence

Multiple motor control (MMC) is an operation based on PID control. During an MMC operation, the main and auxiliary motors organically operate together.

In PID operation, there are two basic sequences, the sequence of adding pump and reducing pump.

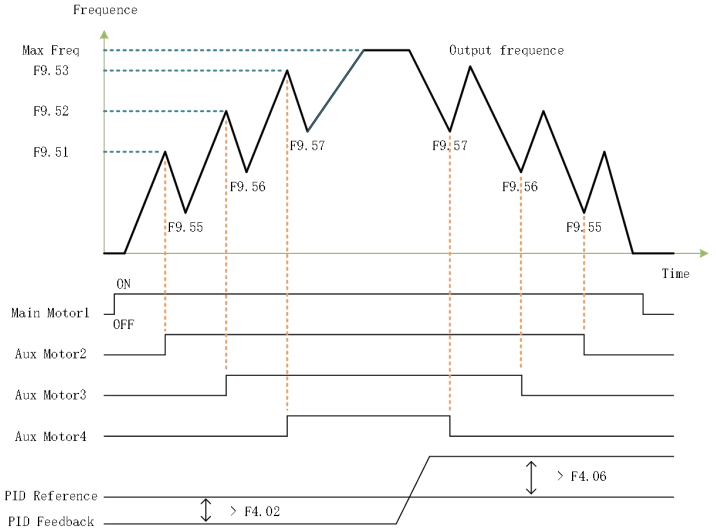
When the drive frequency reaches the start frequency set at F9.50-F9.53, F9.25-F9.28 (Pump 1-8 start frequency)，and after the Aux start delay time (F4.04), if the pressure conditions are met: feedback pressure < (setting pressure - the tolerance of adding pump (F4.02)), will add one aux pump. At the same time, in order to reduce the excessive fluctuation of water pressure, the drive stop PID control, and go to deceleration operation. After the DEC time of adding pump (F4.07), decelerating to the reducing pump frequency of the auxiliary pump. (F9.54~F9.57, F9.29~F9.32 pump 1~8 stop frequency).

When the drive frequency drop to the stop frequency set at (F9.54~F9.57, F9.29~F9.32 pump 1~8 stop frequency), and after the Aux stop delay time (F4.08), if the pressure conditions are met: feedback pressure > (setting pressure + the tolerance of reducing pump (F4.06)), will reduce one aux pump. At the same time, in order to reduce the excessive fluctuation of water pressure, the drive stop PID control, and go to acceleration operation. After the ACC time of reducing pump (F4.03)， accelerating to the adding pump frequency of the auxiliary pump. (F9.50~F9.53, F9.25~F9.28 pump 1~8 start frequency).

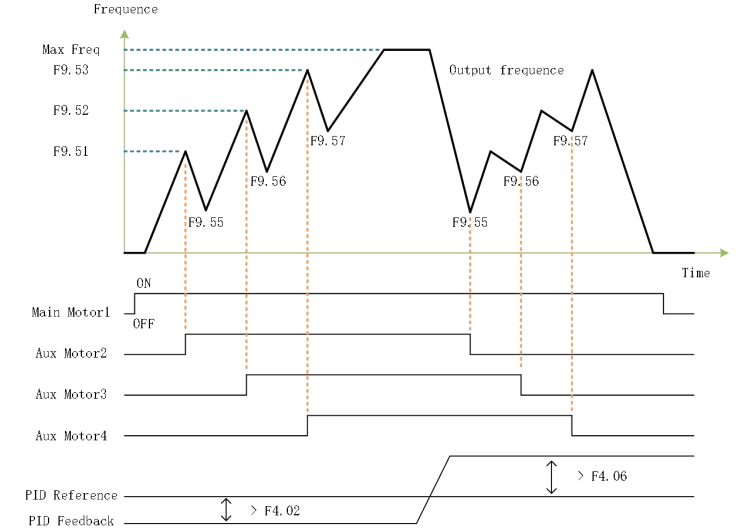
Parameter group	Parameter code	Parameter name	Parameter description
F9	50	Motor 1 start frequency	F9.54~F1.09
	51	Motor 2 start frequency	F9.55~F1.09
	52	Motor 3 start frequency	F9.56~F1.09
	53	Motor 4 start frequency	F9.57~F1.09
	54	Motor 1 stop frequency	F1.10~F9.50
	55	Motor 2 stop frequency	F1.10~F9.51
	56	Motor 3 stop frequency	F1.10~F9.52
	57	Motor 4 stop frequency	F1.10~F9.53
FC	25	Motor 5 start frequency	FC.29~F1.09
	26	Motor 6 start frequency	FC.30~F1.09
	27	Motor 7 start frequency	FC.31~F1.09
	28	Motor 8 start frequency	FC.32~F1.09
	29	Motor 5 stop frequency	F1.10~FC.25
	30	Motor 6 stop frequency	F1.10~FC.26
	31	Motor 7 stop frequency	F1.10~FC.27
	32	Motor 8 stop frequency	F1.10~FC.28

The following diagram depicts the basic sequence setup for multi-pump control based on

FILO and FIFO:

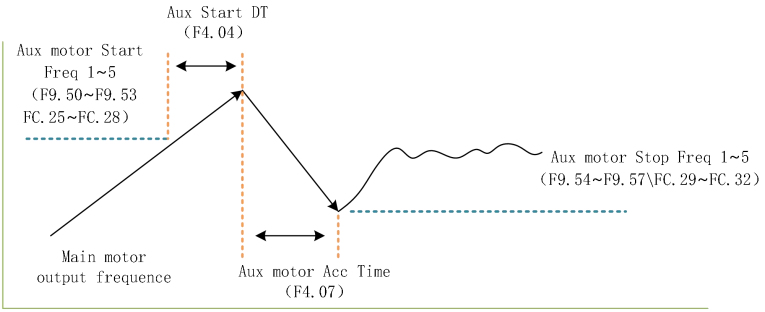


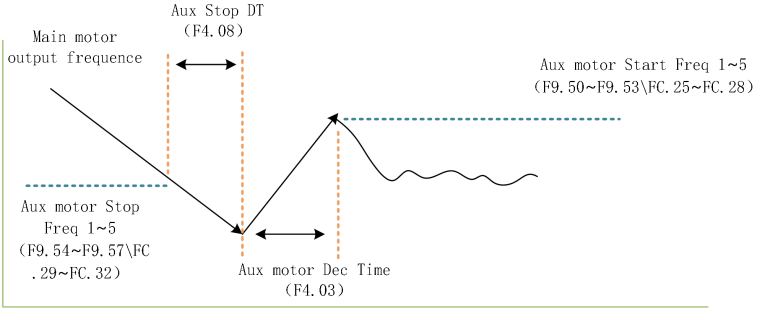
Basic operation - FILO



Basic operation - FIFO

The following diagram shows the running curves of the delay time for starting and stopping the auxiliary pump based on F4.04 (Start DT) and F4.08 (Stop DT) Settings。





When the output frequency of the drive reaches the start frequency or stop frequency of the auxiliary pump, the auxiliary pump waits for the time set by F4.04 (pumping delay) or F4.08 (depumping delay) before the auxiliary pump performs pumping or depumping operation.

3.1.2 Standby Motor

The drive will calculate the number of functions selected as 30 (multi-pump control output) according to the settings of parameters F6.38~F6.43 and F9.58~F9.59 (relay TC1~TC8 output function selection), and the calculation result is equivalent to the number of pumps connected.

The drive recognizes the maximum number of pumps operating at the same time according to the setting of parameter F4.01 (Number of pumps).

The drive determines whether the corresponding pump is allowed to participate in the multi-pump control according to the settings of parameters F6.01~F6.04, F6.06, F6.08, Fb.34, Fb.35 (function selection of multi-function input terminals DI2~DI5, DI7, DI9, DI11, DI139). Functions 44 to 51 correspond to multiple pump control input functions 1 to 8.

Eg: In this case, the parameters F6.38 = 30, F6.39 = 30, F6.40 = 30, F6.43 = 30, F9.58 = 30, then it is determined that five pumps are connected on the wiring, and these five pumps are pumps 1 to 5. If pumps 1 to 5 all detect multiple pump control input signals, and F4.01 = 3 (Number of pumps), the maximum number of pumps working at the same time is 3, and it is any 3 of pumps 1 to 5.

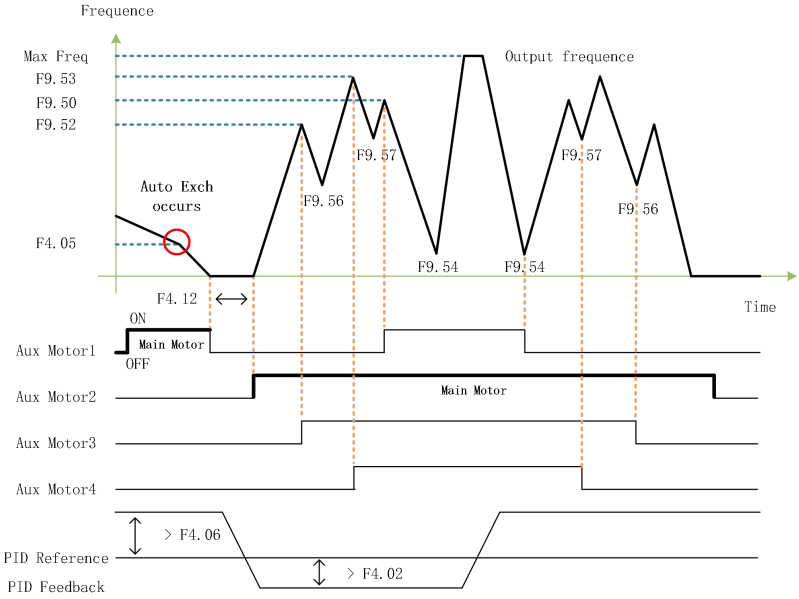
As shown in the following table：

Pump 1	Pump 2	Pump 3	Pump 4	Pump 5
Operable	Operable	Operable	Standby	Standby

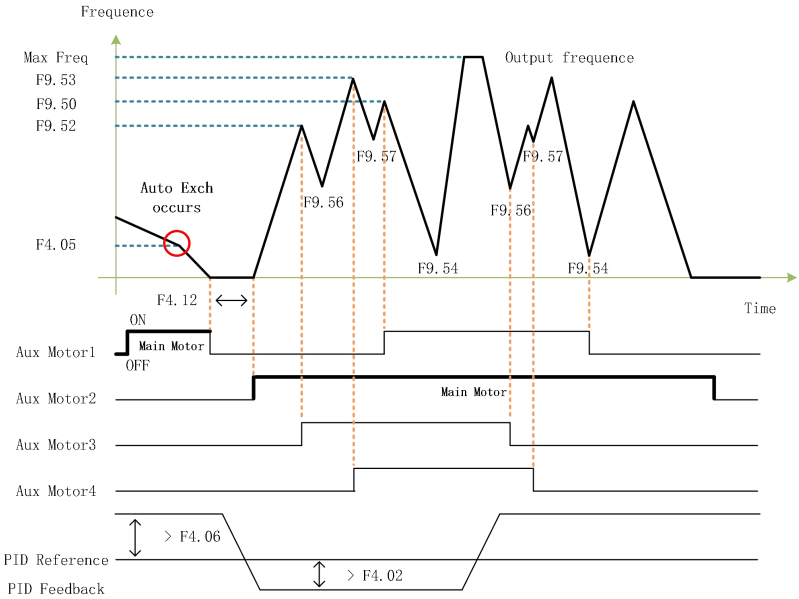
3.1.3 Auto Change

Parameter group	Parameter code	Parameter name	Parameter description
F4	10	Auto change mode selection	0: None 1: Main Exchange Choose whether to use auto change function
	05	Auto change frequency	0.00~50.00Hz
	11	Auto change time	1~65535min
	12	Interlock DT	0.0~60.0s
	17	Auto change operation time	000min:00s~655min:35s In the multi-pump control automatic mode, when only a single pump is running at a small flow, the inverter operating frequency is lower than F4.05 (auto change frequency) and F4.17 (auto change operation time display) < F4.11 (auto change setting time), F4.17 will start timing. F4.17 will clear to zero when the auto change operation is complete. The high three bits of F4.17 represent the running time in minutes, and the low two bits of F4.17 represent the running time in seconds. For example: 120:33: indicates that the running time is 120 minutes and 33 seconds.

In the multi-pump control automatic mode, when only one pump is running at a low flow, when the drive operating frequency is lower than F4.05 (auto change frequency) and F4.17 (auto change operating time display) > F4.11 (auto change setting time), the auto change operation will be carried out, and the pump driven by the current drive will be switched to the set pump.



Auto Change operation - FILO



Auto Change operation - FIFO

3.1.4 Interlock

When there is motor trouble, the interlock feature is used to stop the affected motor and replace it with another that is not currently operating (off state). To activate the interlock feature, connect the cables for abnormal motor signal to the drive digit input terminal and configure the DI terminals as interlock 1–5 inputs (F6.01~F6.04, F6.06, F6.08, Fb.34~Fb.35 Set to functions 44~51, corresponding to pumps 1~8 interlock). The drive determines whether the corresponding pump needs to be repaired according to the DI input signal (with signal input: no repair, without signal input: repair).

After F6.01~F6.04, F6.06, F6.08, Fb.34~Fb.35 are set as No. 44~51 interlock functions, for example, when the multi-pump control input signal of pump 1 is not detected, the output relay of the pump is off, and motor 1 will not participate in the auto change of multi-pump control, and the priority will be displayed as' 9 '. When the multi-pump control input signal of pump 1 is detected, the pump will re-participate in the auto change of multi-pump control, and the priority will change to the lowest priority, starting from the lowest priority.

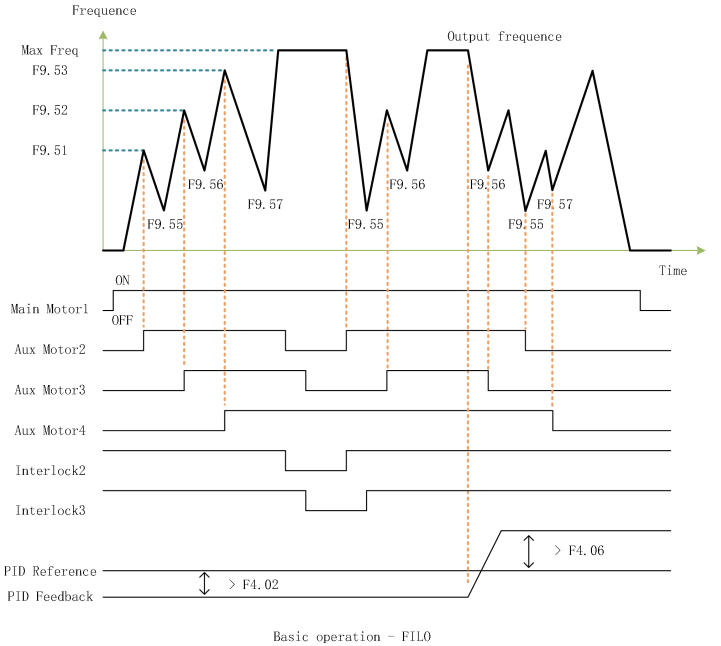
The following figure illustrates the interlock function with examples of FILO and FIFO sequence respectively.

In the figure below, motor 1 is the main pump, motor 2~4 are the auxiliary pump, where Interlock2 and Interlock3 respectively represent the multi-pump control input signals of pump 2 and pump 3, 'ON' is the signal input, 'OFF' is the no signal input.

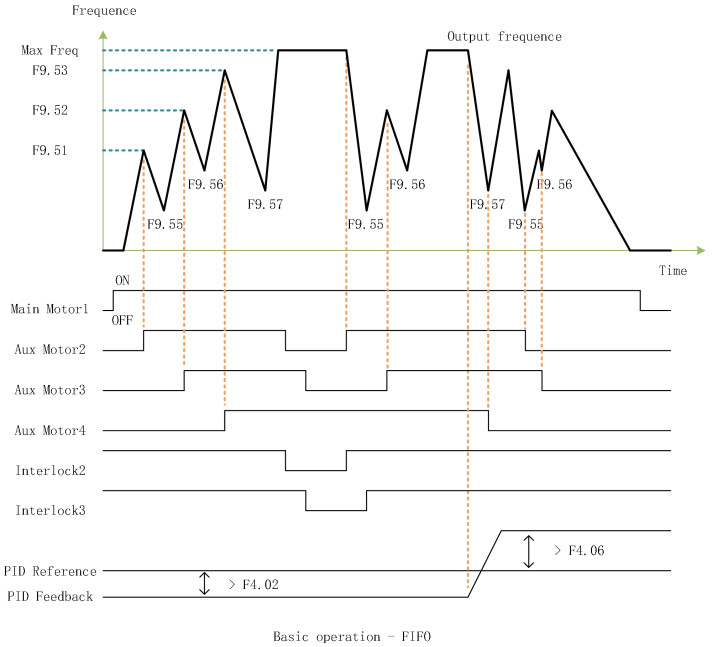
In the figure below, before Interlock2 and Interlock3 change from 'ON' to 'OFF', pumps 1 to 4 are in the running state. When Interlock2 and Interlock3 change from 'ON' to 'OFF', the relays controlling pump 2 and pump 3 are disconnected respectively. At this time, pump 2 and pump 3 are shut down freely, and only pump 1 and pump 4 are in operation.

When Interlock2 and Interlock3 change from 'OFF' to 'ON', since the feedback pressure < (set pressure - F4.02), it is still necessary to start pump 2 and pump 3 again.

When the feedback pressure > (set pressure + F4.06), the pump is shut down in accordance with FILO or FIFO sequence, as shown in the figure below.



Basic operation – FILO



Basic operation - FIFO

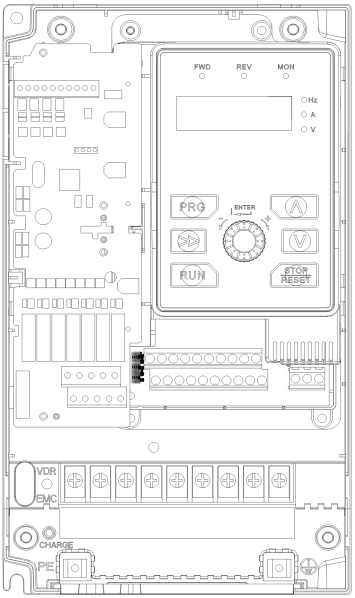
In the above figure, before Interlock2 and Interlock3 change from 'ON' to 'OFF', the priority display parameter (F4.15) of pumps 1 to 4 is' 4321 '. When Interlock2 changes from 'ON' to 'OFF', F4.15 becomes' 3291 '. When Interlock3 changes from 'ON' to 'OFF', F4.15 changes to '2991', where '9' indicates that the maintenance exits the multi-pump automatic control mode.

When Interlock2 changes from 'OFF' to 'ON', F4.15 becomes' 2931 ', and when Interlock3 changes from 'OFF' to 'ON', F4.15 becomes' 2431 '.

In the priority, 1>2>3>4>5>6>7>8, so according to the pump stop sequence of FILO, the pumps that are shut down in turn are: pump 3, pump 2, pump 4, pump 1, according to the pump stop sequence of FIFO, the pumps that are shut down in turn are: pump 4, pump 2, pump 3, pump 1.

3.2 The introduction of expansion card for multi-pump control function

3.2.1 The installation of expansion card



3.2.2 The terminal instruction of expansion card

This expansion card is usually used when using the MMC control function.
The external terminal layout is shown in the table.

Expansion card

DI7	DI9	DI11	DI13	COM	COM	PLC	PLC	24V	24V

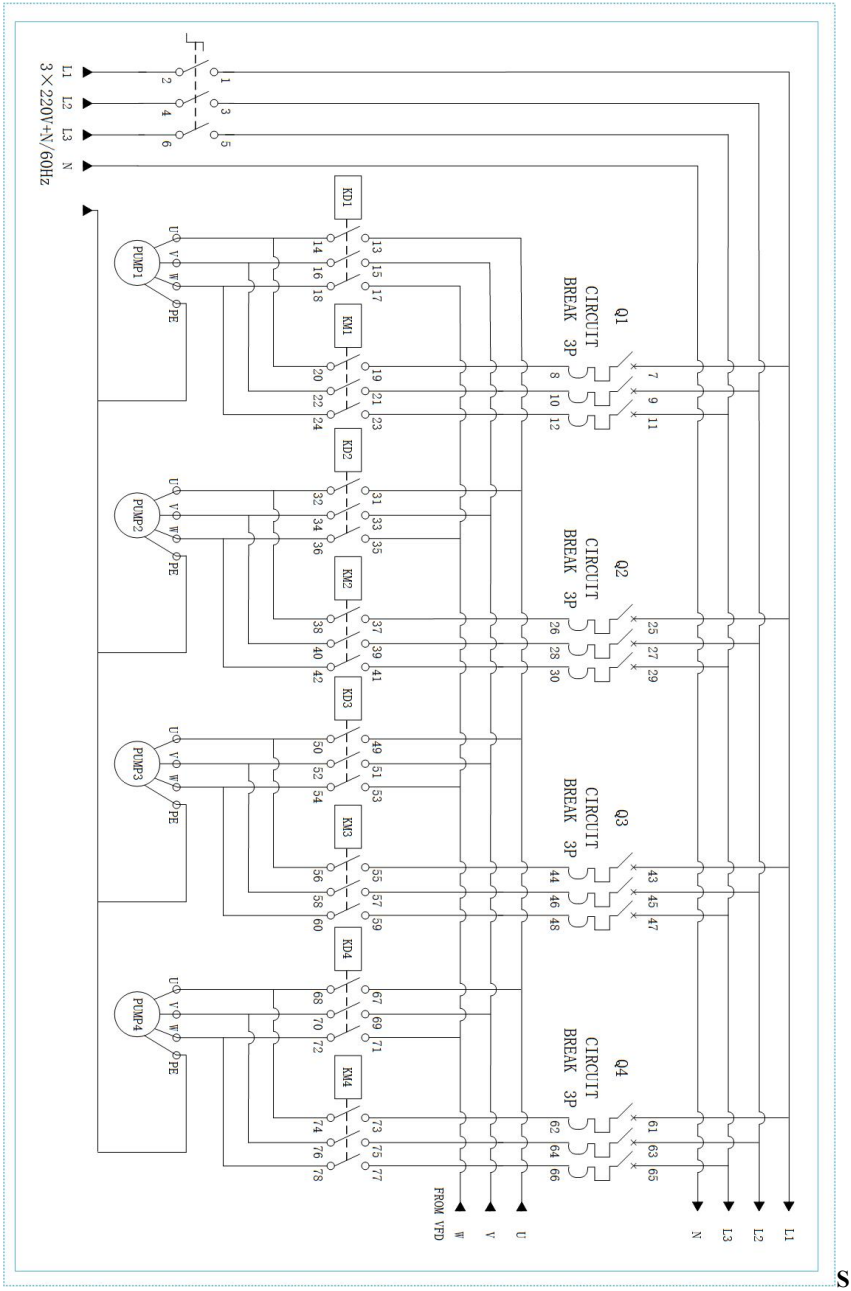
DI7/DI9/DI11/DI13 are multi-function input terminals. Their corresponding function setting parameters are F6.06/F6.08/Fb.34/Fb.35. For parameter setting, refer to the parameter F6.00 set in the manual or the application documentation.

NOTE : PLC and 24V are shorted by short splicing before delivery.

TC1	TC3	TC5	TC7	TA2
TC2	TC4	TC6	TC8	TA2

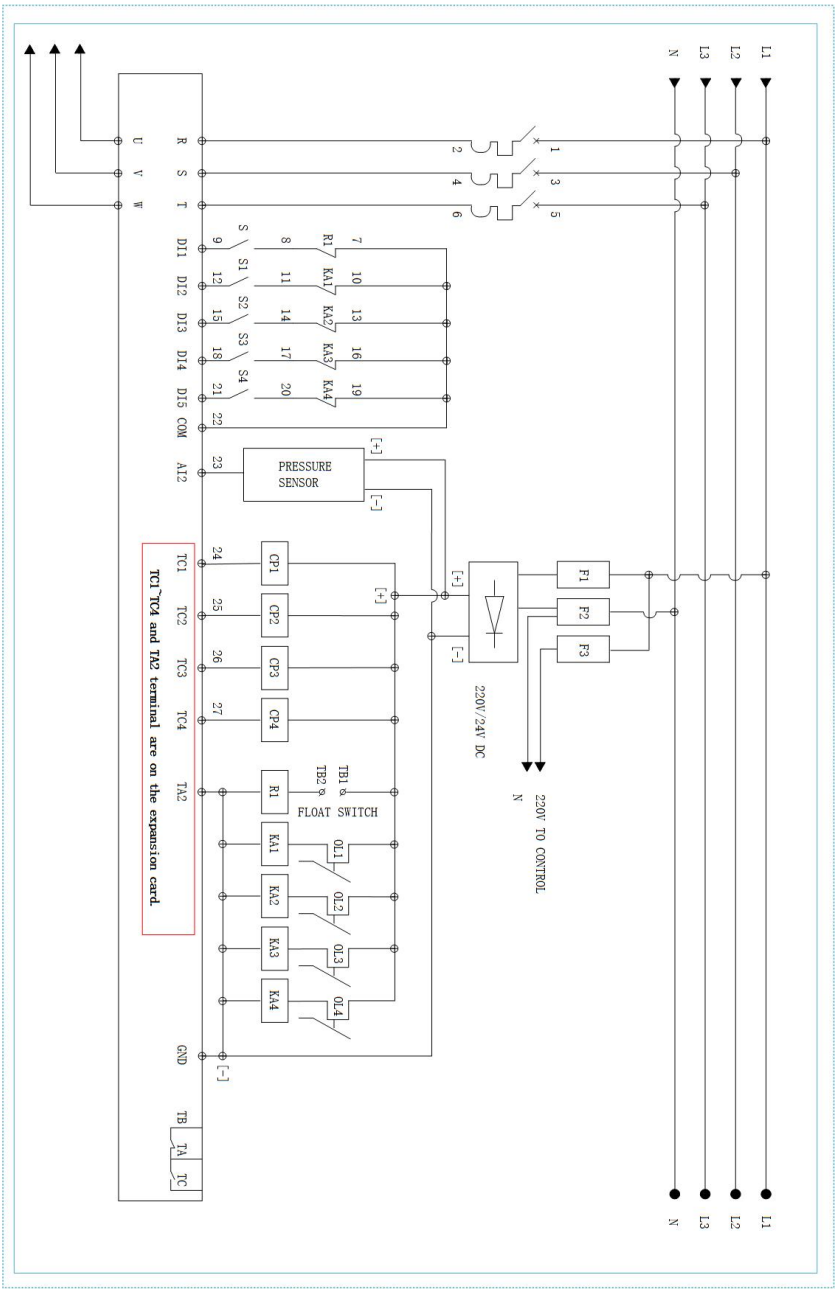
TC1~TC8 are normally open relays, among which TA2 is their common contact, TC1~TC8 relays corresponding function setting parameters are F6.38/F6.39/F6.40/F6.41/F6.42/F6.43/F9.58/F9.59, parameter setting can refer to the instruction manual And the application documentation on parameter F6.13 setting.

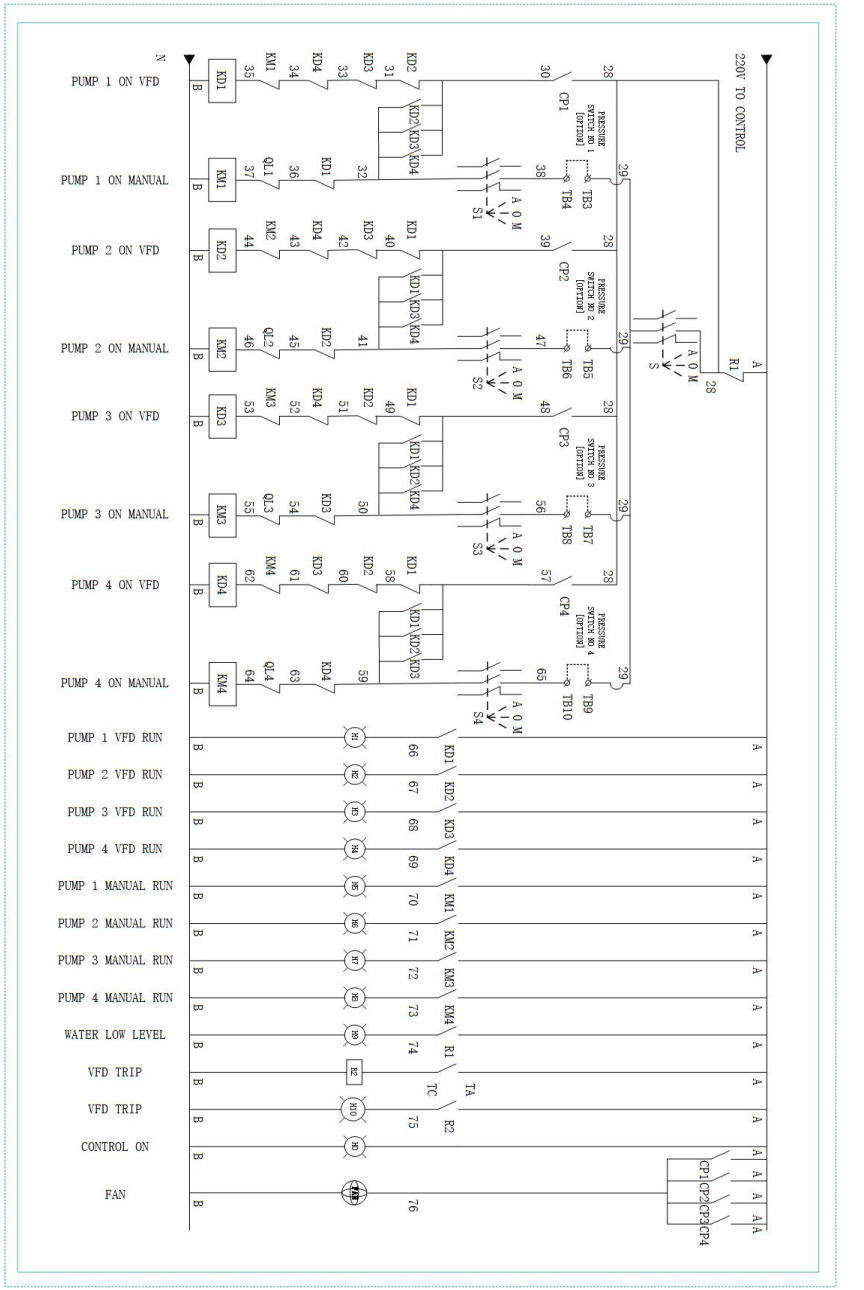
3.3 Power supply circuit



S

3.4 Control circuit




220V TO CONTROL
PUMP 1 ON VFD
PUMP 1 ON MANUAL
PUMP 2 ON VFD
PUMP 2 ON MANUAL
PUMP 3 ON VFD
PUMP 3 ON MANUAL
PUMP 4 ON VFD
PUMP 4 ON MANUAL
PUMP 1 VFD RUN
PUMP 2 VFD RUN
PUMP 3 VFD RUN
PUMP 4 VFD RUN
PUMP 1 MANUAL RUN
PUMP 2 MANUAL RUN
PUMP 3 MANUAL RUN
PUMP 4 MANUAL RUN
WATER LOW LEVEL
VFD TRIP
VFD TRIP
CONTROL ON
FAN
PRESSURE SWITCH 1
PRESSURE SWITCH 2
PRESSURE SWITCH 3
PRESSURE SWITCH 4
CP1
CP2
CP3
CP4
TB3
TB4
TB5
TB6
TB7
TB8
TB9
TB10
S1
S2
S3
S4
A 0 M
KD1
KD2
KD3
KD4
KM1
KM2
KM3
KM4
QL1
QL2
QL3
QL4
R1
R2
TA
TC

Warranty Agreement

1. The warranty covers only the drive itself.

2. During normal use, if the drive fails or is damaged within 18 months, the company shall be responsible for repairing;

If above 18 months, a reasonable maintenance fee will be charged.

3. The start of the warranty period is the date of manufacture of our company.

4. Within 18 months, a certain maintenance fee shall also be charged if:

- Unable to follow the operation steps in the user manual causing damages to the drive.
- The drive is damaged due to flood, fire, abnormal voltage, etc.
- The drive is damaged due to incorrect wiring, etc.
- Damages caused by using the drive for abnormal functions.

5. The related service fee is calculated based on actual

Drive warranty form

User unit:	
Detailed address:	
Zip code:	Contact person:
Telephone number:	Fax:
Machine number:	
Power:	Model:
Contract number:	Date of purchase:
Service unit:	
Contact person:	Telephone number:
Repairman:	Telephone number:
Date of repair:	

User comments and evaluation: □ Excellent □ Good □ Normal □ Poor

Other comments:

User signature: Day Month Year

Company return visit records:

Others:

Certificate of Conformity

Inspector _____

This product is qualified via inspection and is allowed to leave the factory.