First of all, thank you for using AC70T series crane drives.

VEICHI Electric is committed to producing safe, efficient and reliable hoisting-specific products. Combined with many years of experience in the hoisting industry, AC70T series products feature excellent control performance and functions since they integrate special functions such as brake control, stable hoisting, constant power, zero-speed hovering, anti-shake luffing, brake torque detection, etc., which are mainly used for driving and controlling hoisting, slewing and traveling mechanisms in hoisting equipment.

This manual describes how to correctly use AC70T series products, and provides users with relevant precautions such as install method, parameter setting, operation and fault diagnosis.

In order to use this AC drive correctly, please read this manual carefully before using it. And if there are any doubts about the contents of this manual, please consult our technical personnel.

VEICHI is always committed to product innovation and technological breakthrough, and providing the best products and solutions to meet the application needs of hoisting. Content changes caused by continuous updates and upgrades of products are subject to no further notice.

Catalog

1 General

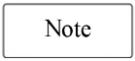
Thank you for purchasing AC70T series high-performance crane drive designed and manufactured by Suzhou VEICHI Electric Co, Ltd. This manual describes how to use this product for benefits. Please read it carefully before using the product (installation, wiring, operation, maintenance, inspection, etc.).

1.1 Safety Precaution

Please use this product only after the safety precautions described in this manual are fully understood to ensure personal and device safety.

- **Signs and Meanings**

The following signs are used in this manual to highlight the safety key points. Failure to observe these points may result in damages to this product and the associated system, or even personal injuries.

	**DANGER:** Incorrect operation may result in death or major safety incidents.
	**DANGER:** Incorrect operation may result in death or major safety incidents.
	**CAUTION:** Incorrect operation may result in minor injuries.
	**NOTE:** Incorrect operation may result in damage to the product and the associated system.

- **Operator**

This product must be installed, wired, operated and maintained by trained professionals. "Trained professionals," as referenced in this manual, are operators of this product who have received specialized training in its installation, wiring, operation, and maintenance, enabling them to appropriately handle emergencies that may occur during use.

- **Safety Guide**

The safety rules and warning signs presented for safety are measures taken to prevent personal injuries and damages to the product and the associated system. Please carefully read this manual before using and adhere to the safety guidelines and warnings, which are

categorized into six sections: general instruction, transportation and storage, installation and wiring, operation, maintenance, and dismantling and disposal.

● General

Warning	● This product carries a dangerous voltage and controls a potentially dangerous motion mechanism. Non-compliance with the regulations or failure to operate in accordance with this manual may result in personal injury or death and damage to the product and the associated system. ● This product must be operated by trained professionals familiar with the manual's safety and operation guidelines. Proper use and maintenance are vital for safety and stable performance. ● Do not perform wiring work while the power is on, as there is a risk of death by electric shock. Before performing wiring, inspection, maintenance, etc., disconnect the power supply to all associated equipment and make sure that the DC voltage in the main circuit has dropped to a safe level for 5 minutes.
Caution	● Prevent children and the public from contacting or approaching this product. ● This product may only be used for purposes specified by the manufacturer, and shall not be used without authorization in special areas related to emergency, rescue, marine, medical, aviation, and nuclear facilities. ● Unauthorized modifications or using of spare and accessory parts not sold or recommended by the manufacturer of this product may cause malfunctions.
Note	● Ensure this manual is provided directly to the actual user, who must read it thoroughly prior to use. ● Ensure that you have thoroughly read and comprehended the associated safety guidelines and warning notices before installing and adjusting the AC drive.

● Storage and Transportation

Warning	● Correct transportation, storage, installation, as well as careful operation and maintenance, for the safe operation of the AC drive is essential.
Caution	● Ensure that the drive is not subjected to shocks and vibrations during transportation and storage, and also ensure that it is stored in places that is dry, free of corrosive gases and conductive dust, and its ambient temperature is lower than 60℃.

● Installation and Wiring

Warning	● This product must be operated only by trained professionals. ● All power, motor, and control cables must be securely connected, and the grounding terminal reliably earthed with a resistance below 10Ω. ● Cut off the power supply to all connected equipment before accessing the AC drive panel to verify the main circuit DC voltage is at a safe level, and wait 5 minutes before proceeding with any operations.

	● Human static electricity can damage sensitive internal components. Follow specified electrostatic discharge (ESD) precautions to prevent damage to the drive before any work. ● Output voltage of the drive is in a pulse waveform, so if there are devices such as capacitors for power factor improvement or varistors for lightning protection installed on the output side, be sure to remove or move them to the input side. ● Do not add switching devices such as circuit breakers and contactors to the output side of the drive (if a switching device must be connected to the output side, the output current of the drive is must be guaranteed to be zero when it is switched on).

● Operation

	● The AC drive operates at high voltage, resulting in hazardous voltage in specific product components. ● Faults in control equipment can lead to serious accidents or injuries, identifying as potential hazards; hence, supplemental measures like external current limiters, mechanical guards, etc., are necessary to ensure safety. ● Ensure the motor parameters in the AC drive match the actual usage specifications for proper motor overload protection.

● Maintenance

	● Maintenance of this product should be performed only by Suzhou VEICHI Electric Technology Co., Ltd's service department, its authorized service center, or its trained and authorized professionals, who must be well-versed in this manual's safety warnings and instructions. ● Any defective devices must be replaced timely. ● Disconnect power and confirm the main DC voltage drop to the safe level before maintenance, then wait 5 minutes before proceeding with any operations.

● Dismantling and Disposal

	● The AC drive's packaging box is reusable; please retain it for future needs or return it to the manufacturer. ● Disassembled metal devices are recyclable. ● Certain components, like electrolytic capacitors, can harm the environment; please dispose of them following environmental regulations.

1.2 Technical Specifications

Item		Specification
Power Input	Voltage, frequency	Three-phase 380V 50Hz/60Hz
	Allowable fluctuation	Voltage: 320V~440V;voltage imbalance rate: <3%; frequency: ±5% Distortion rate meets IEC61800-2 requirements
	Power factor	≥0.94 (with DC reactor)
	AC drive efficiency	≥96%
Power Output	Output voltage	Output under rated conditions: 3-phase, 0V~input voltage, deviation
	Output current	Please refer to the rated specifications.
	Output frequency range	0Hz~320Hz
	Output frequency	±0.5% of the max. frequency
Main Control Performance	Control mode	0: SVC1 3: SVC2 4: FVC
	Motor type	Asynchronous motor
	Carrier frequency	0.6kHz~15.0kHz
	Steady-status speed	SVC: ≤1% rated synchronous speed
	Starting torque	SVC: 180% of the motor rated torque at 0.5Hz
	Frequency accuracy	Digit setting: Max. speed × ±0.01% Analog setting: Max. frequency × ±0.2%
	Frequency resolution	Digit setting: 0.01Hz; Analog setting: Max. frequency × 0.05%
	Speed fluctuation	± 2% (SVC) ± 1% (FVC)
	Overload	150% rated current for 1min, 180% rated current for 10s, 200%
	Brake	100% brake power for long term operation, 120% brake power for
Basic Function	DC brake	Starting frequency: 0.00Hz~60.00Hz Brake time: 0.0s~60.0s Brake current: 0.0%~150.0% rated current
	Accel./decel. curve	2 types: linear, S-curve 4 time sets; unit: 0.01s; max. duration: 650.00s
	Auto voltage regulation	The output voltage can be automatically kept constant when the grid voltage fluctuates.
	Auto current limit	Auto current limit during operation to prevent frequent tripping from over-current fault
	Instantaneous power	Uninterrupted operation through bus voltage control in case of

	Frequency setting channel	Set via keyboard numbers, keyboard potentiometer, analog voltage terminal VS1, VS2, pulse current terminal AS, communication and	
	Feedback input channel	Set via voltage terminal VS1, VS2, current terminal AS,	
	Command channel	Set via operation panel, external terminals and communication	
	Input command signal	Start, stop, forward and reverse, jog, multi-segment speed, free stop, reset, acceleration/deceleration time, frequency channel selection,	
	External output signal	2-channel RO, 1-channel collector output,0V~10V output, 4mA~20mA output, frequency pulse output	
	Brake control	Built-in brake control for crane	
Display	Keyboard display	Dual-line 4-digit	Monitor 2 AC drive status parameters
	Parameter copy	The function code information of the AC drive can be uploaded and	
	Status monitoring	Output frequency, given frequency, output current, I/O voltage, motor speed, module temperature, I/O terminal status, etc.	
	Fault alarm	Overvoltage, undervoltage, overcurrent, short-circuit, phase loss, overload, overheat, stall, damaged data, current fault status, and fault history	
Environment	Installation site	Indoor, at an altitude of not more than 1000m, non-corrosive gas and	
	Temperature,humidity	-10℃~+40℃ (wall-mounted), 20%RH~90%RH (non-condensing)	
	Vibration	<0.5G below 20Hz	
	Storage temperature	-25℃~+65℃	
	Installation method	Wall-mounted	
	IP	IP20	
	Cooling	Forced air-cooled	
Protection	Overvoltage, undervoltage, current limit, overcurrent, overload, overheat, stall, data protection		

1.3 Product Features

Function	Description
Brake Failure Protection	Upon detecting motor shaft rotation while in standby mode, the AC drive automatically engages zero-speed servo control to maintain the heavy load's current position and sounds an alarm for the operator to lower the hook, thus providing optimal equipment operation safety.
Stable Hoisting	During tower crane hoisting, if the AC drive senses the wire rope transitioning from slack to taut, it initiates low-speed hoisting, followed by acceleration once the load stabilizes, to prevent jib "nodding" caused by the rope's overextension.
Snag Prevention	If the main hook is hung up by an external object during hoisting, the AC drive will emit a warning or fault signal.
Constant Power	The speed limit is automatically calculated according to the current load during hoisting, achieving "high speed for light load and low speed for heavy load".
Abnormal Torque Prevention	Torque is monitored during the whole process, and when an abnormal torque output is detected, the output is blocked immediately for an emergency stop.
Stable Slewing	Low-speed operation is stable without “stuttering”, and gear shifting and jib operation function smoothly without “stopping”.
Anti-swing Luffing	An anti-swing algorithm based on rope length ensures no swinging of heavy loads after shutdown.
Crane Brake Control	Implement special brake logic control via brake release frequency, brake release current, brake release time, and brake apply time to ensure system safety and reliability.

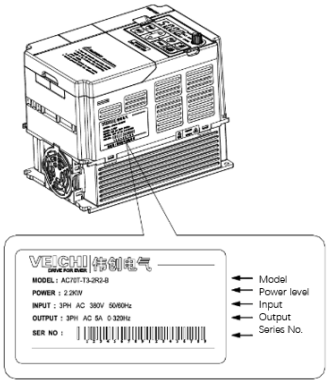
2 Before Use

2.1 Unpacking Inspection

When receiving your order, please inspect the exterior packaging for damage, and open it after confirming that it is complete and undamaged, scratches, or dirt (damages caused during transportation are not covered by VEICHI's warranty). If the product received is damaged during transportation, please contact us or the transportation company immediately.

After confirming that the product received is complete and undamaged, please double-check that the model number of the received drive is the same as what you have ordered. Please see the model number on the "MODEL" column of the nameplate on the side of the AC drive. If the model does not match your order, please contact the agent from whom you purchased the product or our sales department.

2.2 Nameplate



AC70T - T 3 - 011 - B

AC70T
Crane drive

Code	Volt. rating
T	Three-phase
S	Single-phase

Code	Volt. rating
2	220V
3	380V

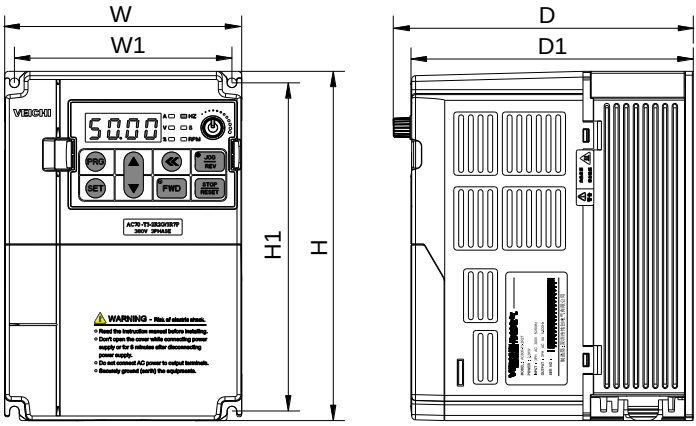
Code	Brake unit
B	Built-in

Code	Power level (kW)
7R5	7.5
011	11
018	18.5
132	132

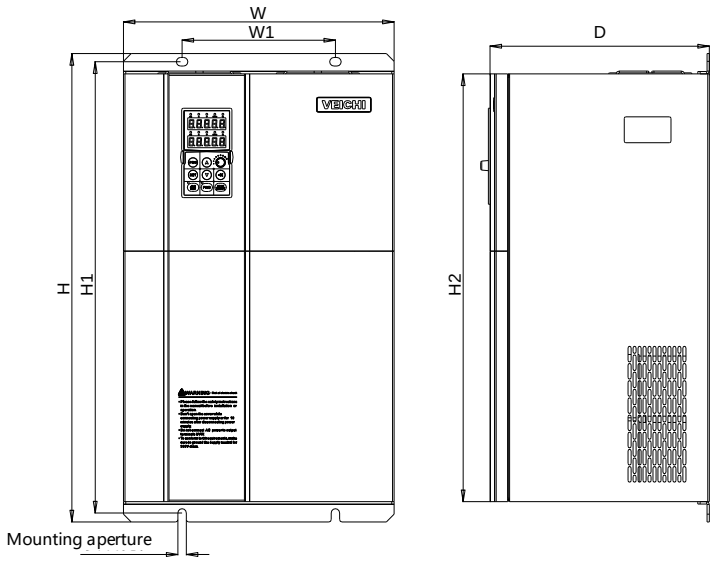
2.3 Technical Data

Model	Motor power	Rated input voltage	Rated current
AC70T-T3-R75-B	0.75kW	Three-phase 380VAC	2.3A
AC70T-T3-1R5-B	1.5kW		3.7A
AC70T-T3-2R2-B	2.2kW		5A
AC70T-T3-004-B	4kW		10A
AC70T-T3-5R5-B	5.5kW		13A
AC70T-T3-7R5-B	7.5kW		17A
AC70T-T3-011-B	11kW		25A
AC70T-T3-015-B	15kW		32A
AC70T-T3-018-B	18kW		38A
AC70T-T3-022-B	22kW		45A
AC70T-T3-030-B-2	30kW		60A
AC70T-T3-037-B-2	37kW		75A
AC70T-T3-045-B-2	45kW		90A
AC70T-T3-045-B	45kW		90A
AC70T-T3-055-B-	55kW		110A
AC70T-T3-075-B	75kW		150A
AC70T-T3-090-B	90kW		180A
AC70T-T3-110	110kW		210A
AC70T-T3-132	132kW		250A
AC70T-T3-160	160kW		310A
AC70T-T3-185	185kW		340A
AC70T-T3-200	200kW		380A

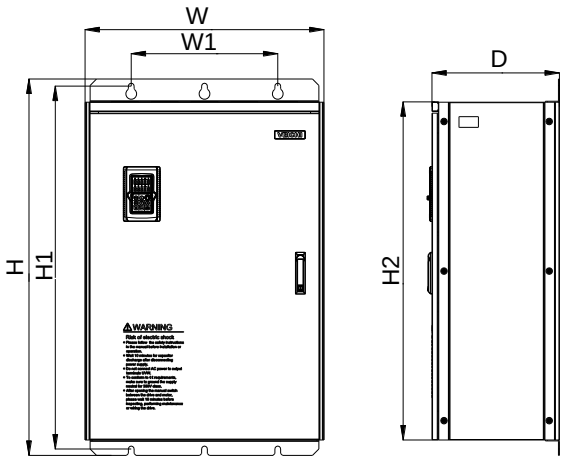
2 Product Dimensions



Drive model	Dimensions				Hole site		Aperture
	W	H	D	D1	W1	H1	
AC70T-T3-R75-B	122	182	154.5	145	112	171	ϕ5
AC70T-T3-1R5-B							
AC70T-T3-2R2-B							
AC70T-T3-004-B	159	246	157.5	148	147.2	236	ϕ5.5
AC70T-T3-5R5-B							
AC70T-T3-7R5-B	195	291	167.5	158	179	275	ϕ7
AC70T-T3-011-B							
AC70T-T3-015-B	230	330	200	190	208	315	ϕ7
AC70T-T3-018-B							
AC70T-T3-022-B							



Drive model	Dimensions				Hole site		Aperture
	W	H	D	H2	W1	H1	
AC70T-T3-030-B-2	255	410	200	370	180	395	Φ7
AC70T-T3-037-B-2							
AC70T-T3-045-B-2							
AC70T-T3-045-B	305	570	260	522	180	550	Φ9
AC70T-T3-055-B							
AC70T-T3-075-B	380	620	290	564	240	595	ϕ11
AC70T-T3-090-B							
AC70T-T3-110							



Drive model	Dimensions				Hole site		Aperture
	W	H	D	H2	W1	H1	
AC70T-T3-132	500	780	340	708	350	755	ϕ11
AC70T-T3-160	650	1060	400	950	400	1023	ϕ16
AC70T-T3-185							
AC70T-T3-200							

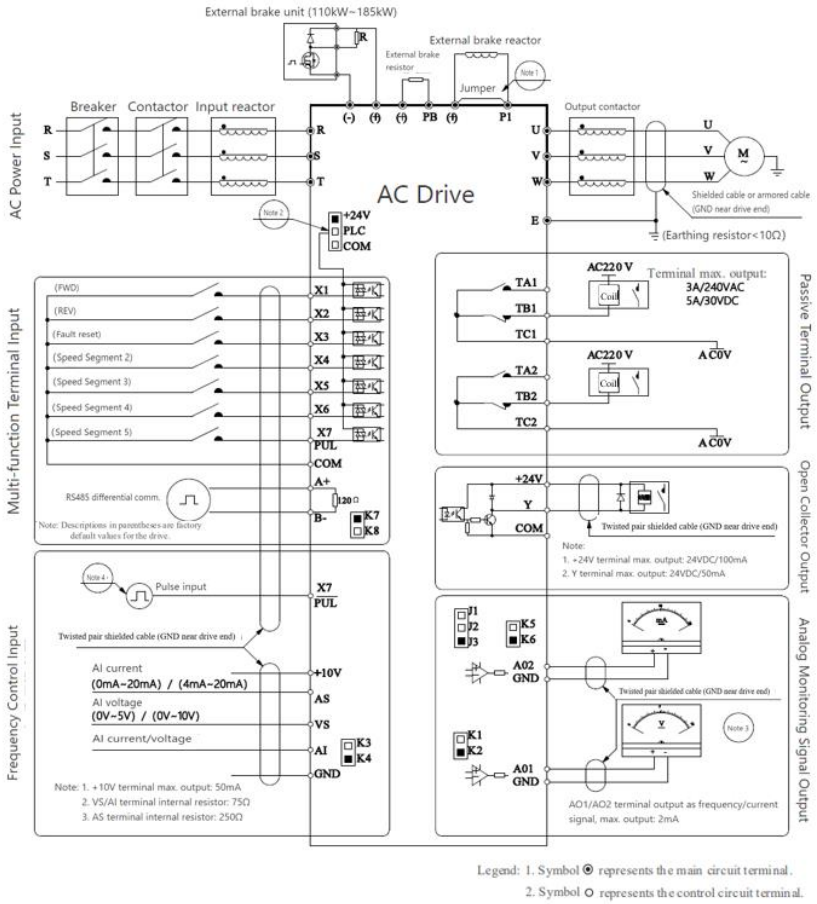
2.5 Electrical Installation

This section describes essential safety measures and requirements to guarantee the product's safe operation, AC drive performance and reliability.

- **Precautions**

Warning	● The AC drive must be reliably grounded during operation to prevent potential injury, fatalities, and ensure reliable equipment function. ● This product must be installed, wired by trained professionals to ensure safe operation of the AC drive. ● Do not carry out work with the power supply on, as there is a risk of electric shock and death. ● Please cut off power to all related equipment, confirm the main circuit DC voltage is at safe level, and wait 5 minutes before proceeding with any operations.
Caution	● Keep AC drive control cables, power supply cables, and motor connection cables separate, avoiding shared cable ducts or trays. ● This product should be used only for the purpose specified by the manufacturer. For other special applications, please contact our sales department.
Note	● Do not use high-voltage insulation test tools on the AC drive and their connected cables. ● When the AC drive and peripheral equipment (filters, reactors, etc.) need the insulation test, it should first use a 500 V megohm-meter to measure its insulation resistance to ground, and the insulation resistance should not be less than 4 MΩ.

2.6 Standard Wiring



Note:

1. Ensure the shorting jumper between the P1 and (+) terminal is removed when installing the DC reactor.
2. The multi-function input terminals (X1~X7/PUL) support NPN or PNP transistor signals, while a bias voltage can be from the AC drive's internal power (+24V terminal) or an external supply (PLC terminal). In the default illustration above, setting the switch to +24 indicates a short between “+24V” and “PLC”.
3. Analog monitoring output is dedicated for frequency meter ammeter, voltmeter and other indication meters, and cannot be used for feedback control or other controls.
4. The control panel adopts AC80CC0N-A1.1 or higher versions.

Multi-function terminal wiring

● NPN wiring

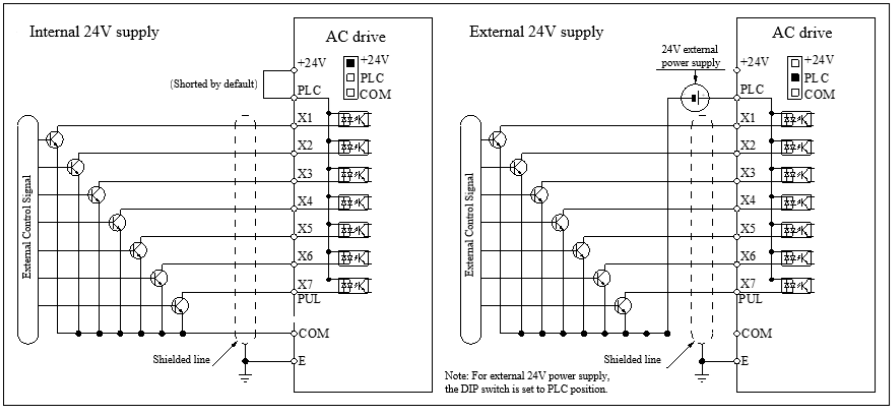


Figure 2-1: NPN Wiring for DI Signals

● PNP wiring

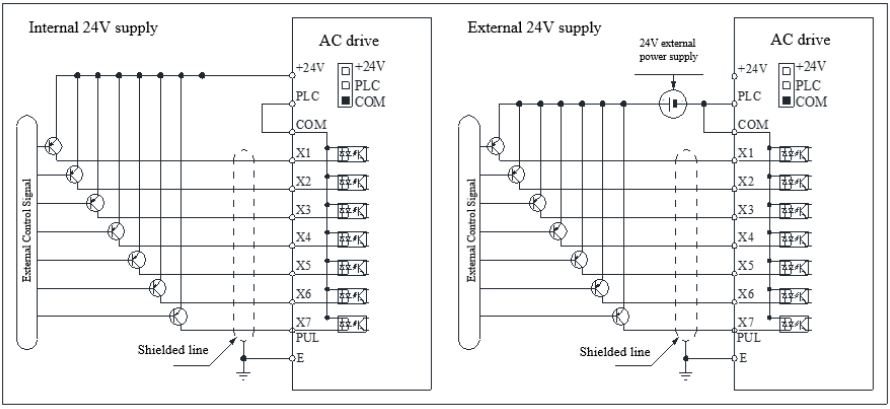
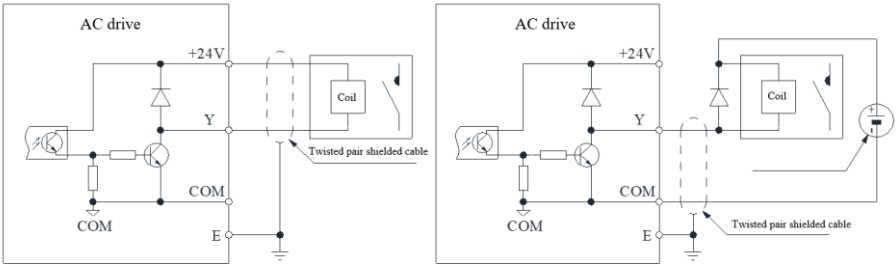


Figure 2-2: PNP Wiring for DI Signals

Wiring for DO signals



Control of external relay with drive's internal 24V supply

Control of external relay with external 24V supply

Figure 2-3: Wiring for DO Signals

Wiring for AO signals

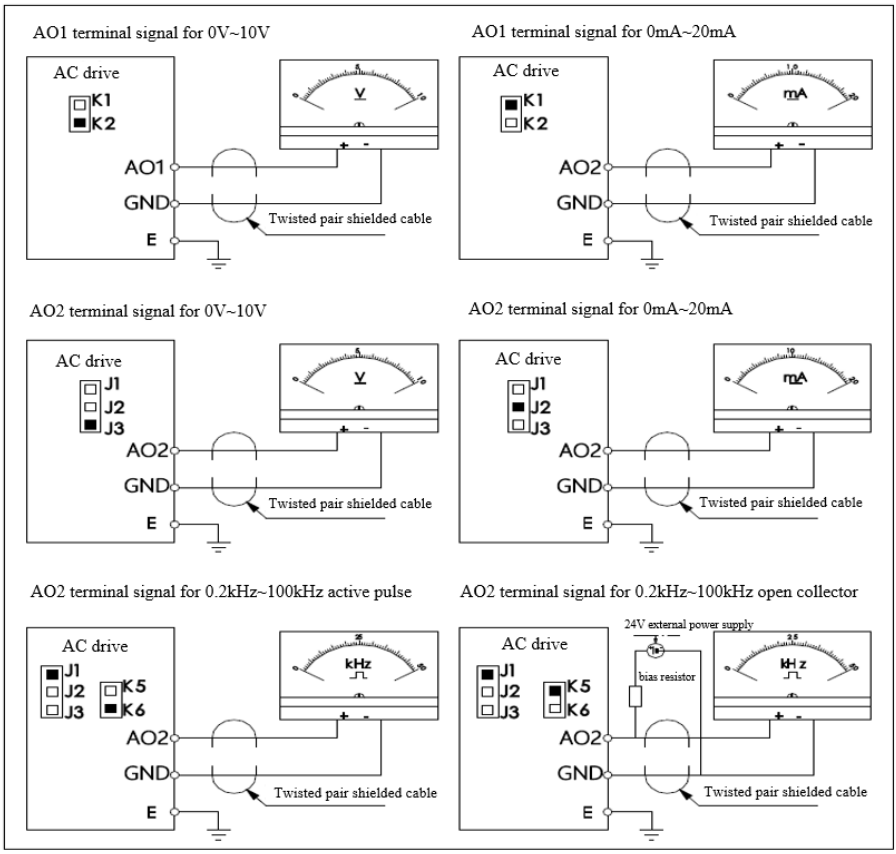


Figure 2-4: Wiring for AO Signals

Wiring for pulse input signals

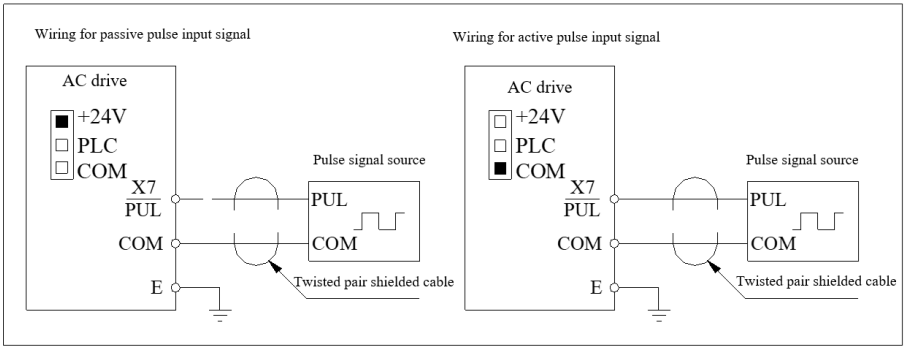
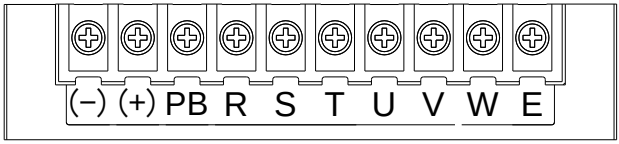


Figure 2-5: Wiring for Pulse Input Signals

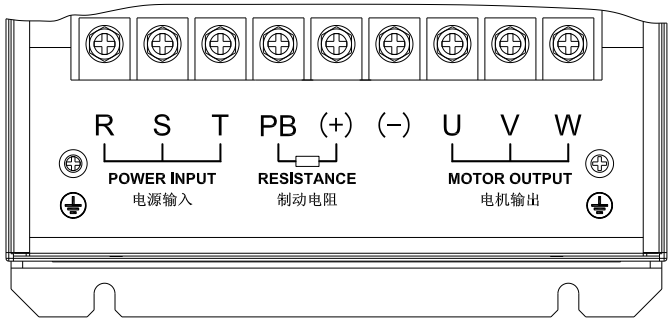
2.7 Main Circuit Terminals

● Main circuit terminal arrangement and definition

Terminal arrangement for main circuit of 22kW and below:



Terminal arrangement for main circuit of 30kW~110kW:

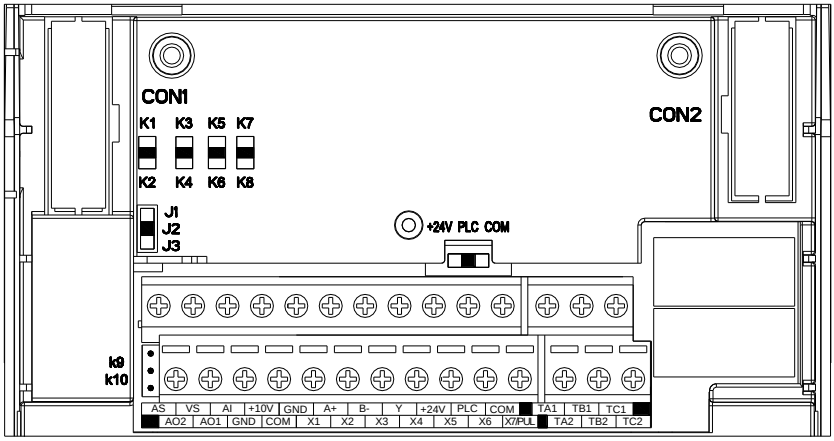


Mark	Name	Description
(-)	DC power terminal	(-) is the cathode of the DC bus.
(+)	Brake resistor terminal	For connecting external brake resistor. (+) is the anode of the DC bus.
PB		
R	Drive input terminal	For connecting three-phase AC supply.

S		
T		
U	Drive output terminal	For connecting motor.
V		
W		
⏚	Grounding	Grounding terminal, with the grounding resistance < 10Ω.
E		

2.8 Control Circuit Terminal

● **Control circuit terminal arrangement**



Item	Mark	Name	Description
Power Supply	+10V-GND	+10V DC power supply	Provide +10V power supply to the external, with max. output current of 50mA; Generally used as the power supply for external potentiometer with the resistance range of 1kΩ~5kΩ.
	+24V-COM	+24V DC power supply	Provide +24V power supply to the external; generally used as the power supply for DI and DO terminals and external sensors. Max. output current: 100mA
	PLC	External common terminal	Connect to +24V by factory default. When X1-X5/PUL is driven by external signals, PLC needs to be connected to external power supply and disconnected from the +24V power supply.

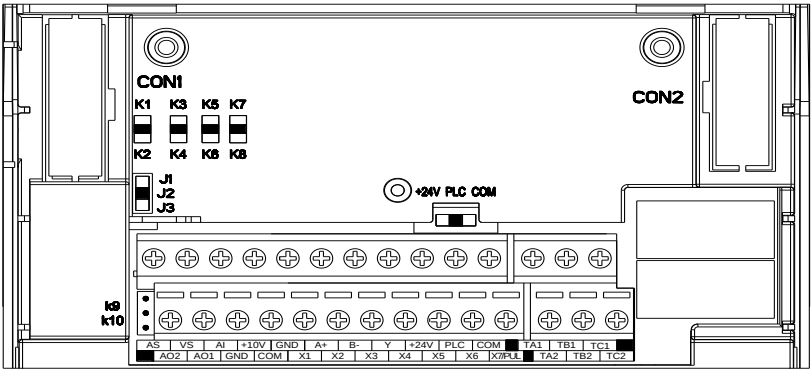
Analog Input	AS-GND	Current analog input	1. Input current: DC 0mA~20mA 2. Input impedance: 500Ω
	VS-GND	Voltage analog input	1. Input voltage: DC 0V~10V 2. Input impedance: 75kΩ
	AI-GND	Voltage or current AI	1. Range: DC 0V~10V/0mA~20mA, up to DIP switch S2 on the control panel. 2. Voltage impedance: 75kΩ 3. Current impedance: 500Ω
Digital Input	X1-PLC	Multi-function terminal input 1	Optocoupler isolation, compatible with bipolar input. 1. Input impedance: 4.4kΩ 2. Voltage at level input: 10V~30V
	X2-PLC	Multi-function terminal input 2	
	X3-PLC	Multi-function terminal input 3	
	X4-PLC	Multi-function terminal input 4	
	X5-PLC	Multi-function terminal input 5	
	X6-PLC	Multi-function terminal input 6	
	X7-PLC	Multi-function terminal input 7	
Analog Output	AO1-GND	AO1	Use DIP switch S1 to select voltage or current output. 1.Voltage range: DC 0V~10V 2. Current range: DC 0mA~20mA
	AO2-GND	AO2	Use DIP switch S5 to select voltage, current or high-speed pulse output 1. Voltage range: DC 0V~10V 2. Current range: DC 0mA~20mA 3. Pulse range: 0kHz~100kHz For pulse output, set parameter [F3.53] to tens-bit=3, and use DIP switch S3 to select between active pulse output or open collector output
Digital Output	Y-COM	DO1	Optocoupler isolated, open collector output 1. Voltage range: DC 0V~30V 2. Curren range: DC 0mA~50mA
Relay Output	TA1-TC1	Normally open terminal 1	Contact drive capacity: 240VAC, 3A 30VDC, 5A
	TB1-TC1	Normally closed terminal 1	
	TA2-TC2	Normally open terminal 2	
	TB2-TC2	Normally closed terminal 2	
Communication Terminal	A+	Communication terminal A+	RS485 communication interface.

	B-	Communication terminal B-	Use DIP switch S4 to decide the connection of the RS485 communication to a 120 Ω terminal resistor.

● Auxiliary terminal output capability

Terminal	Definition	Max. output
+10V	10V auxiliary power output, forming a	50mA
AO1/ AO2	Analog monitoring output, forming a circuit with GND.	The max. output is 2mA for the signal of frequency and voltage type.
+24V	24V auxiliary power output, forming a	100mA
Y	Open collector output, action object	DC24V/50mA
TA1/TB1-/TC1 TA2/ TB2-TC2	Passive contact output, action object can be set in the software.	3A/240VAC 5A/30VDC

● Switch function diagram and description



Pin	Position	Description
S1	K1	AO1: 0mA~20mA or 4mA~20mA
	K2	AO1: 0V~10V
S2	K3	AI: 0mA~20mA or 4mA~20mA
	K4	AI 0V~10V
S3	K5	For AO2=0.0kHz~100.0kHz (J1 is ON), turn AO2 to open-collector output
	K6	For AO2=0.0kHz~100.0kHz (J1 is ON), turn AO2 to active output
S4	K7	RS485 communication is connected to 120Ω terminal resistor
	K8	RS48 is disconnected from 120Ω terminal resistor
S5	J1	AO2 port: 0.0kHz~100.0kHz frequency (PWM frequency pulse output)
	J2	AO2 port: 0mA~20mA or 4mA~20mA current
	J3	0V~10V voltage output

S6	+24V	+24V shorted to PLC
	PLC	PLC receives external power input
	COM	PLC shorted to COM
S7	K9	Disconnect from GND and PE chassis discharge circuit.
	K10	Connect to GND and PE chassis discharge circuit.

3 Basic Keyboard Operation

3.1 Safety Precaution

Danger	● Do not perform wiring work with the power supply on, as there is a risk of electric shock;
Warning	● Do not operate the AC drive with the casing open as there is a risk of electric shock; ● Ensure that the motor casing is grounded, otherwise there is a risk of electric shock or fire; ● Please cut off power to all related equipment before wiring, then confirm the main circuit DC voltage is at safe level, and wait 5 minutes before proceeding with any operation; ● Non-professionals shall not perform any maintenance, inspection, or part replacement work; ● Do not remove the AC drive casing with the power supply on, as there is a risk of electric shock; ● Do not touch the AC drive printed board with the power supply on, as there is a risk of electric shock; ● Ensure all main circuit cables are connected securely, otherwise the loose ones may lead to overheating or even fire; ● Reconfirm the supply voltage before power-up, and incorrect voltage can lead to drive malfunction, damage, or even fire; ● Do not mount the AC drive on or near flammable materials, keep the area clear of debris before power-up.
Note	● Follow specified electrostatic discharge (ESD) precautions during operation to prevent damage to the AC drive. ● Do not disconnect or connect the motor while the AC drive is running; only do so when the drive is powered down so as to avoid damage. ● Use a twisted pair shielded cable for control wiring and ground the shield to the AC drive's grounding terminal to prevent abnormal operation. ● Non-professionals shall not perform any operation, installation, wiring, debugging, maintenance and repair work; ● Unauthorized modifications, disassembly, or repairs can damage the AC drive and such damages are not covered by the warranty.

3.2 Keyboard Layout and Function Description

Mark	Definition	Description
PRG	Menu	Enter the function menu interface when standby or running; press the key to exit the modification when in the parameter modification status; long press the key (3 second) when standby or running to enter the status monitoring interface directly.
SET	Set/ Modify	Press the key to enter edit mode and then confirm with another press; pressing the key in standby or running status can change the LED monitor items while off.
▲ ▼	Up/Down	Choose a parameter group in the menu interface, then adjust its value in the modification mode.
≪	Shift	In the menu interface, use up/down keys to select function code digit bit for editing; in modification mode, select the parameter bit.
FWD	Forward	When Run/Stop is controlled by the keyboard, press this key to make the AC drive operate in forward direction. When run/stop is controlled by the keyboard, press the key to turn the drive

	Reverse/ Jog	F4.07 can define the function of the key. As a “reverse key” (REV), it makes the AC drive to operate in reverse direction, and the function indicator of the key is off. As a “Jog” key, it makes the AC drive jog, and the function indicator of the key is on.
	Stop/ Reset	When the command channel is set to keyboard control, press the key to stop the drive; expand its effective range through the parameter [F4.08]; press the key to reset the drive in fault status. (It will not be reset when the fault is not eliminated).

3.3 Keyboard Indicator Description

Name		Status	Meaning
Unit indicator	Hz	Flash	The displayed number is the given frequency.
	Hz	ON	The displayed number is the output frequency.
	A	ON	The displayed number is the actual output current.
	V	On	The displayed number is the input voltage.
	V	Flash	The displayed number is the output voltage.
	S	ON	The time unit is seconds.
	S	Flash	The time unit is milliseconds, minutes or hours.
	RPM	On	The displayed 4-numbers is the motor speed.
Status indicator	FWD	ON	AC drive is in forward operation.
	FWD	Flash	AC drive is in reverse operation.
	FWD	OFF	AC drive is in the shutdown status.
Function indicator	REV/JOG	ON	As a JOG key.
	REV/JOG	OFF	As a REV key.

3.4 Cross Reference Table

Character	Display	Character	Display	Character	Display
0		C		O	
1		D		P	
2		E		Q	
3		F		R	
4		G		S	
5		H		T	
6		I		U	
7		J		V	
8		K		W	
9		L		X	No display
A		M		Y	
B		N		Z	No display

Table 3-1: Cross Reference Table

3.5 Basic Keyboard Operation

● **Parameter initialization**

Set F0.19=1 to initialize the parameters. See the details as below:

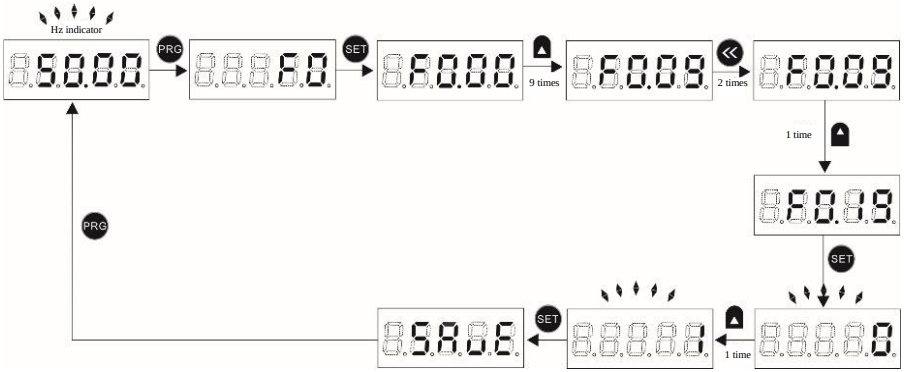


Figure 3-1: Parameters Initialization

● **Command channel**

Here are the command channels which can be set via [F0.02]: 0: Keyboard control; 1: Terminal control; 2: RS485 communication control; 3: Optional cards. The following is an example by setting F0.02=1 (terminal control):

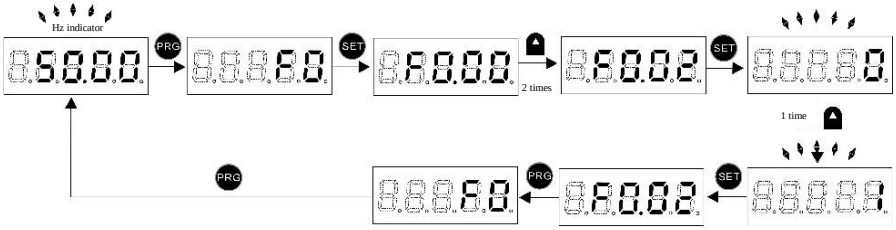


Table 3-2: Command Channel

The two-line terminal control mode1 in the figure is only one method of terminal control, please see other methods in Chapter 9 for details.

● **Frequency setting channel**

There are multiple channels to set frequency, please see those options in Chapter 9 for details.

The following is an example by setting F0.03=1 (via keyboard potentiometer):

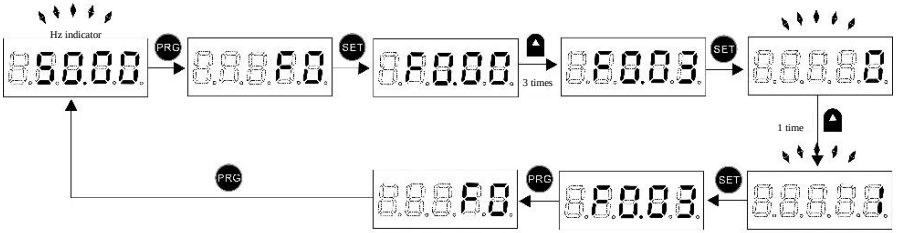


Table 3-3: Frequency Setting Channel

● **Acceleration/deceleration time selection**

There are 4 groups of the accel./decel. time. Unless specified, acceleration/deceleration time 1 is set by default. The following is an example by setting F0.14=8.0 (acceleration time 1).

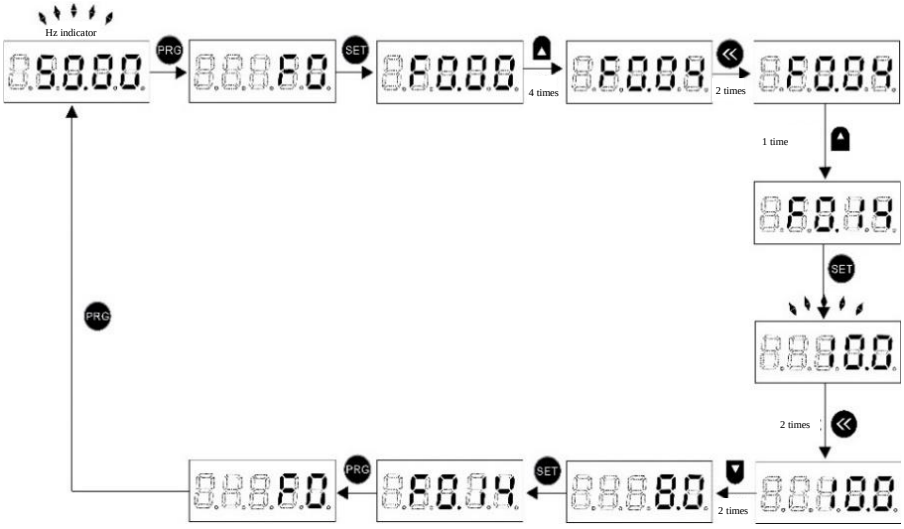


Figure 3-4: Acceleration/Deceleration Time Selection

● Monitoring parameter check

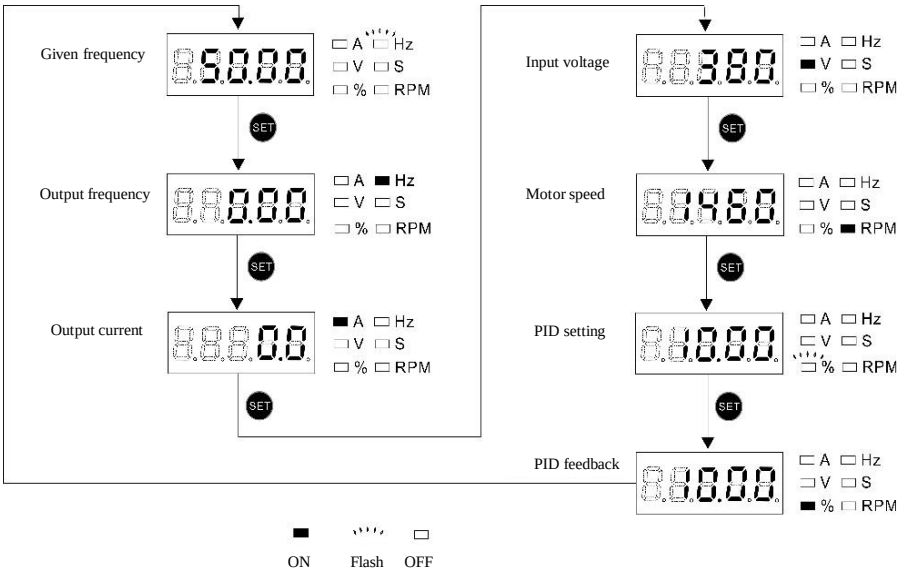


Figure 3-5: Monitoring Parameter Check

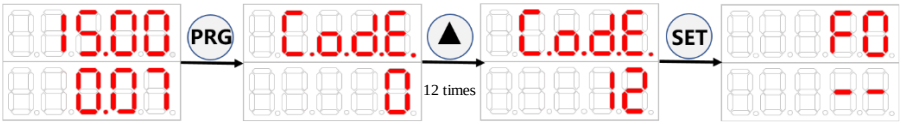
4 Debugging Guide

4.1 Unlocking

AC70T provides a password protection function, which requires entering the password to unlock before parameter setting. The steps are as follows:

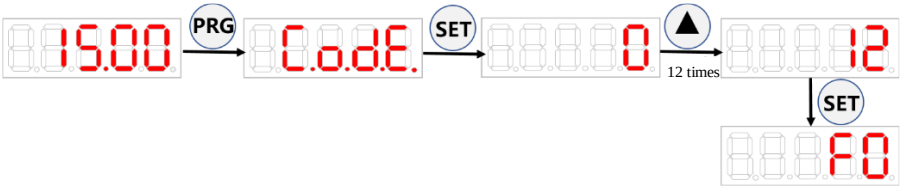
1. Dual-line keyboard unlocking

Press the "PRG" menu key to display "CodE" on the keyboard's first line. Use the up and down keys to enter the user password on the second line, then press "SET" to unlock.



2. Single-line keyboard unlocking

Press "PRG" key to display "CodE" on the first line of the keyboard, then press "Set" to see the number flash. Use the up and down keys to enter the correct password, and press "SET" again to unlock.



4.2 Trial Operation Guide

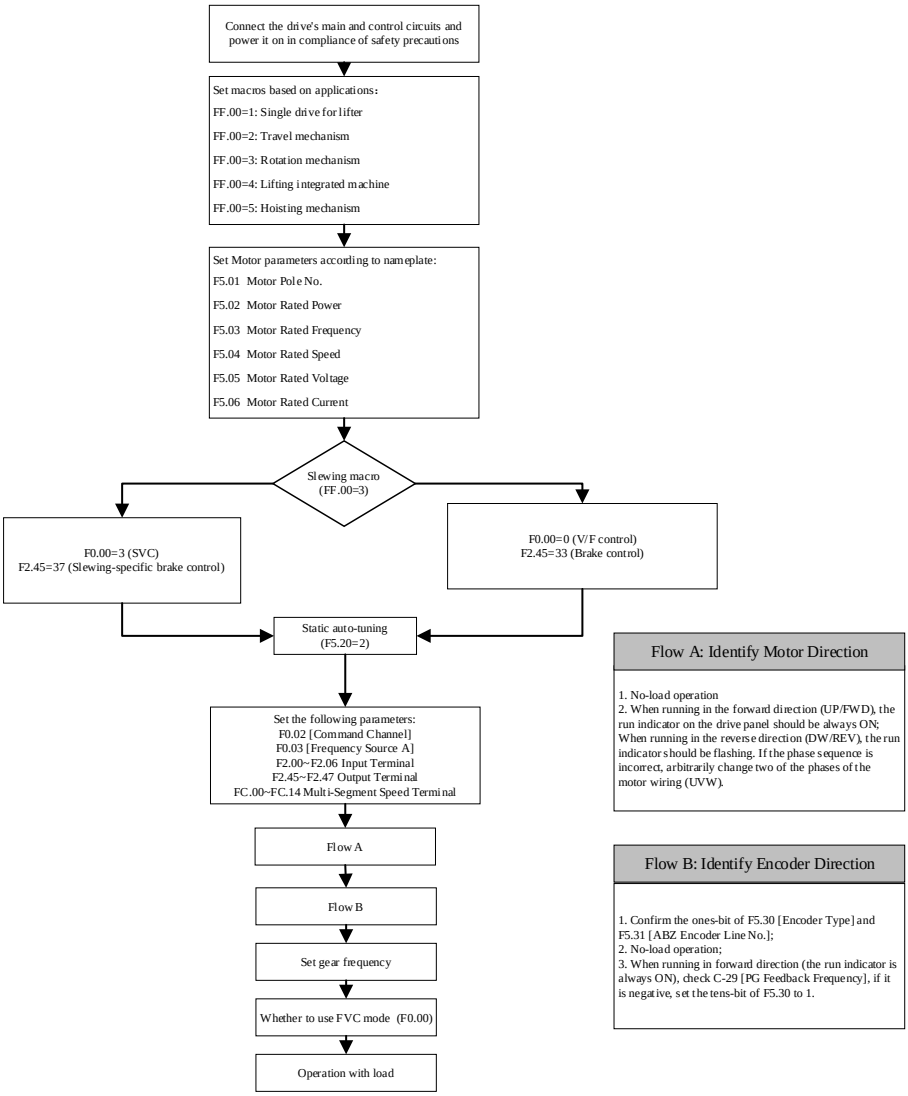


Figure 4-1 Trial Operation Guide

4.3 Checklist Before Power-up

Please check the following items before power-up.

Item	Content
Power supply voltage	Check whether the power supply voltage is correct.
	Check whether the R/S/T/N power terminals are wired reliably.
	Check whether the drive and motor are reliably grounded.
Wiring between AC drive output and motor	Check whether the AC drive output U/V/W and motor are securely wired.
AC drive control circuit wiring	Check whether the drive's control circuit connections with other devices are secure.

4.4 Checklist After Power-up

The display of normal operating panel after power-up is shown below:

Status	Display	Description
Normal		Keyboard displays xxHz by default.
Faulty		The AC drive stops and the error code is displayed.

4.5 Motor Parameter Auto-tuning

4.5.1 Auto-tuning Mode

Mode	Application	Effect	Setting
Dynamic auto-tuning	For scenarios where the motor can be disconnected from the load	Excellent	F5.20=1
Static auto-tuning	For all scenarios	Excellent	F5.20=2

Rapid static auto-tuning	For scenarios requiring mediocre control precision	Good	F5.20=3

4.5.2 Auto-tuning Steps

1. Ensure high/low voltage wiring is correct and safety protection for the motor or a safe operating environment.
2. Enter the correct F5.01 to F5.06 parameters according to the motor nameplate.

Note:

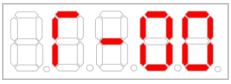
For one drive controlling multiple motors:

F5.02= slewing motor numbers*motor rated power;

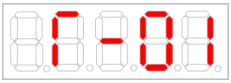
F5.06= slewing motor numbers*motor rated current.

3. Set the auto-tuning mode.

For hoisting industry, generally use F5.20=2 (static auto-tuning), and press “SET” to confirm. The keyboard displays:



Then press the green key “FWD” and see:



For successful auto-tuning, see the frequency on the panel; otherwise see fault alarm E.TE1, and please troubleshoot via FA.39 [Fault Diagnostic Information] for details.

4.6 Motor Control Mode

Code	Definition	Application
F0.00	0: SVC1	For hoisting or travel mechanisms
	3: SVC2	For slewing mechanism
	4: FVC	For high-precision speed control (an encoder must be added to the motor side, and the AC must be equipped with a PG card of the same type as the encoder).

4.7 Start/Stop Command

Code	Name	Definition
F0.02	Command Channel	0: Keyboard control 1: Terminal control 2: RS485 communication control

0: Keyboard control

Controlled by RUN and STOP on the panel, it takes effect upon pressing.

Via keyboard operations: Set F0.02=0 for keyboard control. Press RUN to start the AC drive and the RUN indicator is on; press STOP to shutdown the drive and then the indicator is off.

1: Terminal control

Via multi-function terminals: Set F0.02=1 for terminal control.

Parameters F2.00~F2.06 are for terminal control, see "7 Output Terminal Function" for details.

Example: To set X1 for forward operation, set F2.00 to 1, short X1 to COM on the terminal strip, and disconnect to stop.

Example: To set X2 for reverse operation, set F2.00 to 2, short X2 to COM on the terminal strip, and disconnect to stop.

Note: Do not short to run terminal commands at the same time, see the wiring diagram in "2.8 Control Circuit Terminal".

2: Communication control

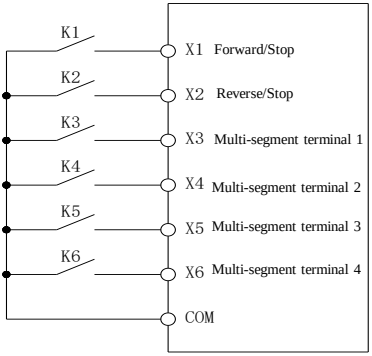
Via writing response command from the 485 communication port: Set F0.02=1 for communication control, see "Appendix I: RS485 Communication".

Communication control is achieved by host computer control, connecting RS485's serial ports to A and B terminals, and needs to set FD.00~FD.06.

Example: Communication command forward operation: 0106 30 01 00 01 16 CA

4.8 Multi-segment Speed Setting

Set the multi-segment speed by the X terminal function, with terminal number 16, 17, 18, 19 correspond to multi-segment speed 1, 2, 3, 4 respectively. The wiring follows the diagram provided, with the target frequency set according to the multi-segment speed table.



Terminal Wiring Schematic

With FC.00 set to 10.00Hz and the X3 terminal connected, it corresponds to multi-segment speed terminal 1, and now the given frequency is 10.00Hz.

With FC.05 set to 20.00Hz and the X4, X5 terminals connected, it corresponds to multi-segment speed terminal 2, 3 respectively, and now the given frequency is 20.00Hz.

Multi-segment speed control has priority after jogging, and its setting table is as follows:

Multi-segment speed terminal 4	Multi-segment speed terminal 3	Multi-segment speed terminal 2	Multi-segment speed terminal 1	Terminal / Speed
OFF	OFF	OFF	ON	1X [FC.00]
OFF	OFF	ON	OFF	2X [FC.01]
OFF	OFF	ON	ON	3X [FC.02]
OFF	ON	OFF	OFF	4X [FC.03]
OFF	ON	OFF	ON	5X [FC.04]
OFF	ON	ON	OFF	6X [FC.05]
OFF	ON	ON	ON	7X [FC.06]
ON	OFF	OFF	OFF	8X [FC.07]
ON	OFF	OFF	ON	9X [FC.08]
ON	OFF	ON	OFF	10X [FC.09]
ON	OFF	ON	ON	11X [FC.10]
ON	ON	OFF	OFF	12X [FC.11]
ON	ON	OFF	ON	13X [FC.12]
ON	ON	ON	OFF	14X [FC.13]
ON	ON	ON	ON	15X [FC.14]

4.9 Analog Input Terminal Characteristics

The AC70T series drive supports the 3-channel analog input as AI, VS and AS on the control board respectively, as shown in the following table:

Name	Characteristics
AI	DIP switch to K3: receive 0mA~20mA and 4mA~20mA signal DIP switch to K4: receive 0VDC~10VDC signal
AS	Receive 0mA~20mA and 4mA~20mA signal
VS	Receive 0V~5V and 0VDC~10VDC signal

The AC drive adopts external voltage and current signals as frequency sources to set and modify given frequency via AI, VS, and AS terminals. The actual given or feedback which corresponds to current or voltage can be set through Group F3; analogs of VS, AI, and AS can be read via C-16, C-17, and C-18 respectively.

4.10 Analog Output Terminal Characteristics

The AC70T series drive supports the 2-channel analog output as AO1 and AO2 on the control board respectively, as shown in the following table:

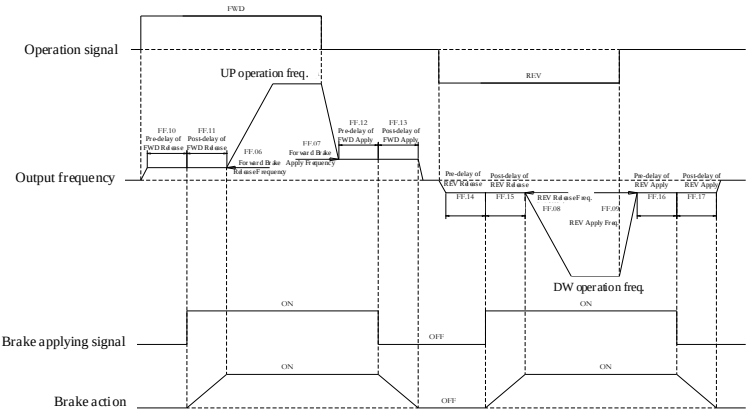
Name	Characteristics
AO1-GND	DIP switch to K1: output 0mA~20mA and 4mA~20mA signal DIP switch to K2: output 0V~10V
AO2-GND	DIP switch to J1: output frequency of 0.0kHz~50.0kHz DIP switch to J2: output current of 0mA~20mA or 4mA~20mA DIP switch to J3: output voltage of 0V~10V

AO1 and AO2 analogically control the AC drive's internal parameters which can be selected through F3.54 and F3.55, and modified before output through F3.54 and F3.55.

5 Specific Functions

5.1 Brake Control

The AC70T series drive has a built-in brake control function, which requires to set one DO to 33 (brake control). The control timing is as follows:



Brake Apply Logic

The braking mechanism is applied when unpowered and releases after power-up. Brake control function realized by brake release frequency, current, delay, and apply time can prevent slipping and ensure system safety. See related parameters as table below:

Code	Name	Description	Default
FF.01	Brake Control	**Ones-bit: Release torque condition** 0: Frequency reached 1: Frequency and current arrives at the same time 2: Output torque arrival (valid in vector control mode) **Tens-bit: Release torque direction** 0: Same as operation 1: Forward **Hundreds-bit: Apply torque direction** 0: Same as operation 1: Forward **Thousands-bit: Reserved**	1001
FF.02	Command Control	**Ones-bit: Reverse running command control** 0: OFF If a reverse running command is received during operation, the AC drive will stop outputting following the normal shutdown procedures, then start the reverse operation. 1: ON If a reverse running command is received during operation, the AC drive starts reversing after frequency zero-crossing, without outputting any brake apply commands.	0010

FF.03	Command Interval	After completing the braking and the time set in this parameter, the drive will respond to a running command received during braking and shutdown. Range: 0.00s~10.00s	0.30s
FF.04	Brake Release Current Coefficient	0.0%~100.0%	20.0%
FF.05	Zero-Crossing Jumping Frequency	0.00Hz~10.00Hz	1.00Hz
FF.06	Forward Brake Release Frequency	0.00Hz~10.00Hz	2.00Hz
FF.07	Forward Brake Apply Frequency	0.00Hz~10.00Hz	2.00Hz
FF.08	Reverse Brake Release Frequency	0.00Hz~10.00Hz	2.00Hz
FF.09	Reverse Brake Apply Frequency	0.00Hz~10.00Hz	2.00Hz
FF.10	Pre-delay of Forward Brake Release	0.00s~1.00s	0.20s
FF.11	Post-delay of Forward Brake Release	0.00s~1.00s	0.10s
FF.12	Pre-delay of Forward Brake Apply	0.00s~1.00s	0.0s
FF.13	Post-delay of Forward Brake Apply	0.00s~1.00s	0.50s
FF.14	Pre-delay of Reverse Brake Release	0.00s~1.00s	0.20s
FF.15	Post-delay of Reverse Brake Release	0.00s~1.00s	0.10s
FF.16	Pre-delay of Reverse Brake Apply	0.00s~1.00s	0.0s
FF.17	Post-delay of Reverse Brake Apply	0.00s~1.00s	0.30s

5.2 Brake Failure Protection

5.2.1 Function Description

1. This function is valid in FVC (closed-loop vector control) mode (F0.00=4);
2. With the function is ON (FF.60=1) and the AC drive stops operation, if the motor axis frequency fed back by the encoder reaches FF.61 [Brake Failure Protection Detection Threshold] and lasts over FF.63 [Brake Failure Filter Time], the AC drive automatically enters zero speed operation, with the heavy load suspended, and then stops again upon the zero servo operation reaches FF.62 [Brake Failure Protection Apply Time];
3. When the function is ON, the panel will display alarm A.078, the status can be output through DO terminal, assigned terminal function number 35 (Brake failure protection in progress);
4. When the function is ON, the AC drive responds to the UP/DW commands, with frequency limits set by FF.64 and FF.65.

5.2.2 Notice

1. Brake failure protection activation and holding need the AC drive powered on and fault-free, with all other electrical mechanisms functioning normally;

2. As long as the above conditions are met, protection can be activated without limit of times;
3. Without forced air-cooling on the hoist motor, take motor temperature rise into FF.62 [Brake Failure Protection Hold Time] for zero speed operation.

5.2.3 Relevant Parameters

Code	Name	Description	Default
FF.60	Brake Failure Protection	0: OFF 1: ON	1
FF.61	Brake Failure Protection Threshold	0.00Hz~5.00Hz	0.50Hz
FF.62	Brake Failure Protection Hold Time	0.0s~3000.0s	60.0s
FF.63	Brake Failure Filter Time	0.000s~2.000s	0.050s
FF.64	Brake Failure Upward Frequency Limit	0.00Hz~100.00Hz	0.0Hz
FF.65	Brake Failure Downward Frequency Limit	0.00Hz~100.00Hz	50.00Hz

5.3 Brake Torque Detection

This function actively checks whether the brake torque is normal, applicable in FVC (closed loop vector control) mode.

5.3.1 Activation Method

Set FF.55=1 to enable the brake torque detection function;

Via DI terminals (X1~X7) with the corresponding parameter (F2.00~F2.06) set to 82 (Brake torque detection), the function is enabled when the terminal is switched from OFF to ON.

5.3.2 Working Process

When the AC drive stops operation, it adopts 5.00Hz as the target frequency, and automatically operates with a toque limit by FF.57 [Brake Torque Detection Torque]. Consider a complete detection cycle as 5s of forward running, 3s stopping, 5s reverse, and 3s stopping. The AC drive stops once the detection count reach FF.56 [Braking Torque Detection No.]. During this, if the encoder feedback frequency is filtered (the filter time as FF.59) and reaches FF.58 [Brake Torque Detection Frequency Threshold], the AC drive reports E.061 error. The fault can be output as a digital signal via terminal number 36 (Insufficient brake torque fault detection).

5.3.3 Relevant Parameters

Code	Name	Description	Default
F2.00~F2.06	X1~X7 terminal	82: Brake torque detection Note: One terminal defined as 82 is enough.	
FF.55	Brake Torque Detection	0: OFF 1: ON	1
FF.56	Braking Torque Detection No.	0~10	3
FF.57	Brake Torque Detection Torque	0.0%~150.0%	100.0%
FF.58	Brake Torque Detection Frequency Threshold	0.00Hz~5.00Hz	2.00Hz
FF.59	Brake Torque Detection Filter Time	0.0s~2.000s	0.200s

5.4 Constant Power Control

This control mode, known as "speed changes with load", automatically calculates the frequency limit based on load, achieving "high speed for a light load, low speed for a heavy load" to enhance hoisting mechanism efficiency. It is ideal for use without weight limiters. In this mode, the relevant parameters are as follows:

Code	Name	Description	Default
FE.82	Hoisting Control	Thousands-bit: Constant power control 0: OFF 1: ON	0
FE.83	Load Calculation Frequency	This code computes the load when the target frequency exceeds it, so as to achieve the current load torque. Range: 0.00Hz~50.00Hz	20.00Hz
FE.84	Load Calculation Time	In constant power control, it refers to the holding time of FE.83 [Load Calculation Frequency]. Range: 0.000s~3.000s	0.500s
FE.85	Light Load Torque	Define the working conditions of light load,100.0% corresponding to the rated motor torque. The frequency limit is FE.A3 when the load calculation torque is less than this value. Range: 0.0%~50.0%	15.0%
FE.A1	UP Hoisting Power Limit	Automatically calculates the frequency limit by load calculation torque, power limit (FE.A1~FE.A2) and correction factor (FE.A4~FE.A7). Range: 0.0%~150.0%	90.0%
FE.A2	DW Hoisting Power Limit		80.0%
FE.A3	Max. Frequency in Constant Power Control	100.0% of it corresponds to the motor rated frequency. Range: 0.0%~300.0%	200.0%
FE.A4	UP Power Coefficient in FVC	Defined as a power correction coefficient, with which frequency limit increases accordingly.	100%

FE.A5	DW power coefficient in FVC	Range: 0%~120%	90%
FE.A6	UP Power Coefficient in SVC		80%
FE.A7	DW power coefficient in SVC		70%

5.5 Stable Hoisting

During tower crane hoisting, if the AC drive senses the wire rope transitioning from slack to taut, it initiates low-speed hoisting, followed by acceleration once the load stabilizes, to prevent jib "nodding" caused by the rope's overextension.

5.5.1 Function Description

1. This function is valid in FVC (closed-loop vector control) mode (F0.00.00=4);
2. Load calculation begins after UP brake release. In stable hoisting, the current load torque is calculated after drive operation at a target frequency of FE.90 [Tension Frequency] for FE.84 [Load Calculation Time]. If it is below FE.85 [Light Load Torque], tension detection is ON; otherwise, it's deemed a loaded startup and exits stable hoisting mode.
3. During tension detection, the output frequency varies according to gear frequency. Upon detecting rope tension, motor acceleration decreases and then the drive operates at FE.90 [Tension Frequency] once the decrease meets the FE.88 [Speed Change Threshold].
4. After the drive operates at tension frequency for FE.92 [Tension Frequency Holding Time], it exits stable hoisting and enter normal operation mode.

Note:

1. Tension detection is timed, so that the drive exits stable hoisting if it surpasses FE.93 [Max. Time for Tension Detection].
2. The drive exits stable hoisting mode with a deceleration or stop command during tension detection and frequency holding.

5.5.2 Relevant Parameters

Code	Name	Description	Default
FE.82	Hoisting Control	Ones-bit: Stable hoisting 0: OFF 1: ON	0
FE.84	Load Calculation Time	In stable hoisting and anti-snag control, it refers to the holding time of FE.90 [Tension Frequency]. Range: 0.000s~3.000s	0.500s
FE.85	Light Load Torque	Define the working conditions of light load,100.0% corresponding to the rated motor torque. Used for empty hook judgment in stable hoisting and anti-snag control. Range: 0.0%~50.0%	15.0%
FE.88	Speed Change Threshold	Upon detecting rope tension, the drive operates at FE.90 [Tension Frequency] once the decrease of motor acceleration meets this value. Range: 0.00Hz~5.00Hz	2.00Hz

FE.90	Tension Frequency	Used for load judgment in stable hoisting Range: 0.00Hz~10.00Hz	3.00Hz
FE.91	Max. Frequency in Stable Hoisting	Range: 0.00Hz~100.00Hz	100.00Hz
FE.92	Tension Frequency Holding Time	Holding time of tension frequency operation. Range: 0.000s~20.000s	6.000s
FE.93	Max. Time for Tension Detection	Tension detection time, after which no tension detection will be carried out. Range: 0.000s~40.000s	15.000s

5.6 Anti-snag Control

If the main hook is hung up by an external object during upward hoisting, the AC drive reports a fault or alarm.

5.6.1 Working Process

1. Load calculation begins after UP brake release. The current load torque is calculated after drive operation at a target frequency of FE.90 [Tension Frequency] for FE.84 [Load Calculation Time]. If load torque exceeds FE.85 [Light Load Torque], record the initial load; otherwise, it is considered an empty hook startup and the drive continues torque detection until it obtains the initial load.
2. During constant speed mode, if the detected torque exceeds FE.98 [Anti-snag Torque Increase] and the detection persists beyond FE.A0 [Anti-snag Detection Time], the drive will issue an alarm or fault as the tens-bit setting of FE.82 [Hoisting Control].

5.6.2 Relevant Parameters

Code	Name	Description	Default
FE.82	Hoisting Control	**Tens-bit: Anti-snag mode** 0: OFF 1: Report a fault [E.059] 2: Alarm and continue running [A.079]	0
FE.84	Load Calculation Time	In stable hoisting and anti-snag control, it refers to the holding time of FE.90 [Tension Frequency]. Range: 0.0s~3.000s	0.500s
FE.85	Light Load Torque	Define the working conditions of light load,100.0% corresponding to the rated motor torque. Used for empty hook judgment in stable hoisting and anti-snag control. Range: 0.0%~50.0%	15.0%
FE.90	Tension Frequency	Used for load judgment in stable hoisting and anti-snag control. Range: 0.00Hz~10.00Hz	3.00Hz
FE.98	Anti-snag Torque Increase	0.0%~100.0%	20.0%
FE.99	Anti-snag Torque Change Rate Threshold	Consider the load stable if the torque change rate is below this value and the holding time exceeds 1200ms. Range: 0.0%~100.0%	1.5%

FE.A0	Anti-snag Detection Time	When a heavy load is detected, an alarm or fault is reported after this setting. Range: 0.000s~20.000s	2.000s

5.7 Anti-swing Luffing

5.7.1 Function Description

Using FVC (closed-loop vector control) (F0.00=4), the hoisting drive sends rope length calculations to the luffing drive via communication. The luffing drive then executes anti-sway control based on the real-time received rope length. See the operation guide for details.

With the fixed rope length function enabled in the luffing drive, an anti-swing effect can be achieved to some extent without adjusting the hoisting drive—simply by setting FE.68 [Fixed Rope Length] and activating the anti-swing feature. See the 4th point in the operation guide for details.

5.7.2 Operation Guide

1. Master-slave communication connection and setting

Connect hoisting drive A+ with luffing drive A+, hoisting drive B- with luffing drive B-;
Hoisting drive: FD.00=0001, FD.02=0003, FD.09=000d
(FD.09=000d for sending the rope length to the luffing drive)
Luffing drive: FD.02=0003

2. Rope length calculation

A. Set auto-tuning mode (F5.20=2) in hoisting motor parameters;

B. Set the directions of the hoisting motor and encoder speed detection;

See Flow A and Flow B in “4.2 Trial Operation Guide” for details.

C. Identify the transmission ratio of hoisting mechanism as the following steps,
and all relevant parameters refer to those of hoisting drive:

a. Down the hook to a specified position and stop the luffing mechanism after 3 seconds of its operation to cause the hook swing. Then, observe and record the swing cycle. Start timing at the hook's front limit swing and count one cycle when it returns to that point. Record the time taken for 5 cycles (to minimize error), calculate the average to find the swing period T1; use rope length formula L=T^2*0.2485 to calculate L1 in meters (retain two decimal places), then enter L1 into FE.64 [Rope Length Estimation 1].

b. Run the hoist upward in Gear 1 for 15 seconds, stop, then luff for 3 seconds and stop to swing the hook. Calculate swing period T2 similarly, derive L2 with L=T^2*0.2485 (in meters, two decimals), and enter L2 into FE.65 [Rope Length Estimation 2].

D. Calculate the rope length equivalent to the hoist upper limit position;
The objective is to eliminate accumulated error and correct the rope length. See the method as below:

a. Connect the UP limit position to the drive multifunction input terminal (X) and write the terminal function number 89 to the corresponding parameter (F2.00~F2.06);

b. If the rope length at the upper limit is known, enter it into FE.63 [UP Limit Equivalent Rope Length] (in meters, to two decimal places). If not, raise the hoist in Gear 1 to the upper limit, luff for 3 seconds, stop to initiate swing, calculate swing period T3, derive L3 using

the rope length formula (in meters, two decimals) in the C point above, and input L3 into FE.63.

E. Check the hoisting drive's C-08 to see the real-time rope length; if no, rework is needed;

F. The luffing drive C-08 is the data sent by the master. When the communication is normal, Luffing drive C-08=Hoisting drive C-08.

Note: If the anti-swing performance gets less effective over time, operate the hoist to the upper limit for automatic rope length correction, which can enhance the anti-swing function.

3. Estimate the distance between the lifting weight and the main hook

Enter the lift weight's equivalent rope length into the luffing drive's FE.66 which refers to the distance from the weight's center of gravity to the main hook. This ensures anti-swing effectiveness and must be considered for the anti-swing luffing function.

Actual rope length for anti-swing luffing C-09=C-08+FE.66

4. Turn the anti-swing luffing switch on

Set the following parameters in the luffing drive:

Set the ones-bit of FE.67 to 1 and enable anti-swing luffing through multi-function terminal of 90;

5.7.3 Relevant Parameters

Code	Name	Description	Default
FE.60	Min. Runtime for Hoist Transmission Ratio Identification	0.000s~30.000s	10.000s
FE.61	High Hoist Transmission Ratio Coefficient	0~65535	0
FE.62	Low Hoist Transmission Ratio Coefficient	0~65535	0
FE.63	Upper Limit Equivalent Rope Length	0.00m~25.00m	4.00m
FE.64	Rope Length Estimation 1	0.00m~300.00m	0.00m
FE.65	Rope Length Estimation 2	0.00m~300.00m	0.00m
FE.66	Lifting Weight Equivalent Rope Length	The height from the center of weight to the main hook. Range: 0.00m~20.00m	2.00m
FE.67	Anti-swing Control	Ones-bit: Anti-swing switch 0: OFF 1: ON Tens-bit: Fixed rope length 0: OFF For OFF, anti-swing control will be performed with the rope length obtained from the hoisting drive. 1: ON For ON, the anti-swing control will be performed using the rope length set in FE.68. If	0001

		the rope length is known, check the anti-swing performance here.	
FE.68	Fixed Rope Length	0.00m~300.00m	10.00m

5.8 Ant-Speed (Slow Positioning)

Antspeed function, also called slow positioning, is for precise inching need in tower crane operations.
Set FC.51 to1 or 2, and enable the antspeed function via the multi-function input terminal with number of 87.
For FC.51=1, Target frequency=Current gear frequency*FC.52 (ant-speed proportional gain);
For FC.51 = 2, Target frequency=FC.53.

Related parameters:

Code	Name	Description	Default
FC.46	Antspeed Gear 1	0.00Hz~50.00Hz	3.00Hz
FC.47	Antspeed Gear 2	0.00Hz~50.00Hz	4.00Hz
FC.48	Antspeed Gear 3	0.00Hz~50.00Hz	5.00Hz
FC.49	Antspeed Gear 4	0.00Hz~50.00Hz	6.00Hz
FC.50	Antspeed Gear 5	0.00Hz~50.00Hz	7.00Hz
FC.51	Antspeed Selection	0: For integrated tower crane (FC.46~FC.50) 1: Single drive antspeed 1 (Gear frequency*FC.52) 2: Single drive antspeed 2 (FC.53)	0
FC.52	Antspeed Proportional Gain	0.0%~100.0%	20.0%
FC.53	Antspeed Frequency	0.00Hz~50.00Hz	5.00Hz

5.9 Slewing Control

The AC70T series provides two slewing control schemes, with/without eddy current control, as shown in the following table:

Name	Motor	Mode
Without eddy control (recommended)	General motor	SVC/FVC
With eddy control	Special motor, General motor with eddy current brake	SVC1+Eddy Control

Note: Some slewing mechanisms use general motors with eddy current brakes; however, “without eddy control” scheme is preferable, and the motor-side eddy current coil can remain unwired.

5.9.1 Without Eddy Control

1. Debugging Method

See “4.2 Trial Operation Guide”.

2. Relevant Parameters

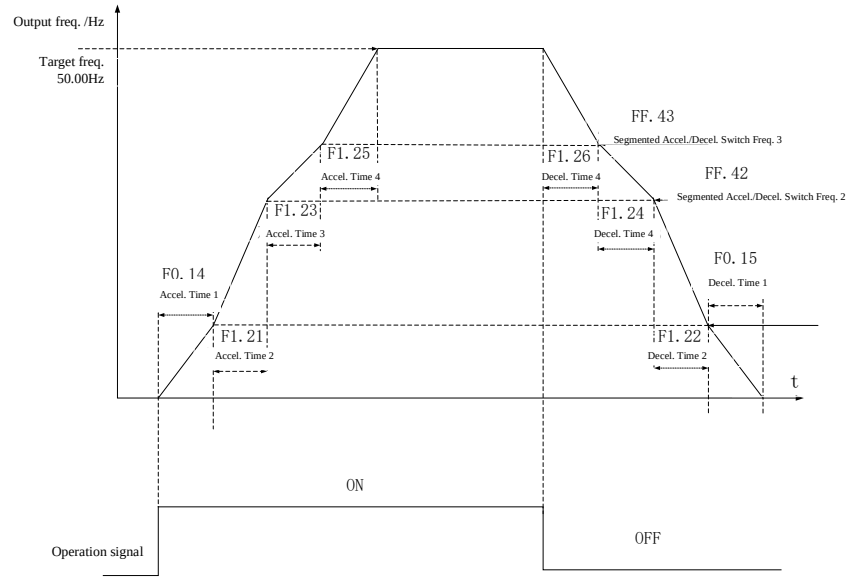
Code	Name	Description	Default
FF.36	Slewing Control 1	Thousand-bits: Eddy-free frequency control 0: OFF 1: ON	1101
FE.55	Stable Control Gain	Increase when there is rebound during stop. Range: 0.00~50.00	8.00
FE.57	Stop Frequency Base	Increase when there is rebound during stop. Keep at or below 1.00 Hz to prevent issues with long jog distance. Range: 0.00Hz~10.00Hz	0.50Hz
FF.84	Slewing Jib Length	Up to actual crane jib length. Range: 0m~200m	60m
FF.85	Slewing Acceleration Gain	Increase for longer acceleration time and jib length.	110%
FF.86	Slewing Deceleration Gain	Increase for longer deceleration time and jib length. Range: 50%~500%	90%
FF.87	Slewing Control 2	Ones-bit: Reserved Tens-bit: Reserved Hundredths-bit: REV gear for deceleration 0: OFF 1: ON Set the deceleration time for slewing in REV gear in FF.97. Thousands-bit: Eddy-free stable slewing control 0: OFF Others: ON	4100
FF.97	REV Gear for Deceleration Coefficient	If REV Gear for Deceleration is ON (FF.87 hundreds-bit=1), Actual decel. time=FF.97*Original decel. time Range: 0.0%~100.0%	70.0%

5.9.2 With Eddy Control

“With Eddy Control” scheme includes frequency control and eddy control, and the motor control mode should be set as SVC1 (F0.00=0), and “eddy-free frequency control” should be OFF (FF.36 thousands=0).

1. Frequency Control

In SVC1, the acceleration and deceleration time is used by default of set 1 to 4, with curve shown below:



Related parameters:

Code	Name	Description	Default
F0.14	Acceleration Time 1	0.01s~650.00s	8.00s
F0.15	Deceleration Time 1	0.01s~650.00s	20.00s
F1.21	Acceleration Time 2	0.01s~650.00s	20.00s
F1.22	Deceleration Time 2	0.01s~650.00s	20.00s
F1.23	Acceleration Time 3	0.01s~650.00s	25.00s
F1.24	Deceleration Time 3	0.01s~650.00s	15.00s
F1.25	Acceleration Time 4	0.01s~650.00s	25.00s
F1.26	Deceleration Time 4	0.01s~650.00s	10.00s
FF.41	Segmented Accel./Decel. Switching Frequency 1	0.00Hz~Max. frequency	9.00Hz
FF.42	Segmented Accel./Decel. Switching Frequency 2	0.00Hz~Max. frequency	21.00Hz
FF.43	Segmented Accel./Decel. Switching Frequency 3	0.00Hz~Max. frequency	36.00Hz

5.10 Eddy Control

Slewing eddy current control brakes the operating motor by applying DC voltage from the eddy current module to the slewing motor's eddy coil, which produces a magnetic field. Eddy control contributes to the stable operation of the tower jib and functions as follows:

At the same motor speed, higher eddy output voltage results in greater braking force;

At the same eddy output voltage, higher motor speed results in greater braking force.

For stable tower jib operation, it follow the principle that “higher the output frequency, lower the eddy output voltage”. Set the relevant parameters as below.

5.10.1 Step 1: Set Eddy Control Mode

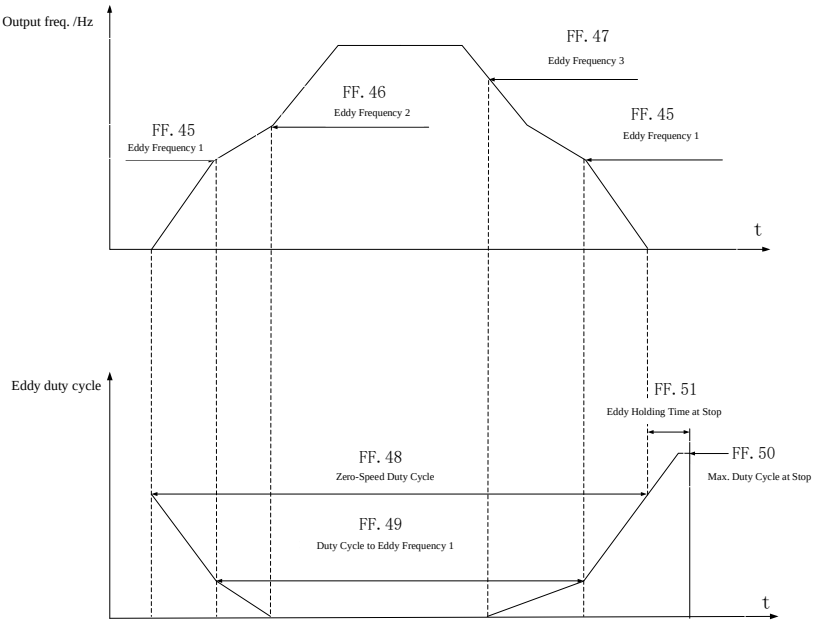
Mode	Controlled variable	Setting
Method 1	The controlled variable of eddy module is a 0V~10V DC voltage, and does not involve the eddy duty cycle (F3.53/F3.54≠20).	Available for AO1 or AO2; Set F3.53 ones- or tens-bit to 0; see Step 2 for polarity setting.
Method 2	The controlled variable of eddy module is pulse signal (PWM+, PWM-).	AO2 only; Set F3.53 tens-it to 4; see Step 2 for polarity setting.
Method 3	The controlled variable of eddy module is a 0V~10V DC voltage, and involves the eddy duty cycle (F3.53/F3.54=20).	Available for AO1 or AO2; Set F3.53 ones- or tens-bit to 0; see Step 2 for polarity setting.

5.10.2 Step 2: Set Eddy Control Polarity

Determine the eddy current module's polarity based on the principle “higher the motor speed, lower the eddy current voltage”. Adjust control polarity as needed for the eddy control mode.
Method 1: Set F3.53 hundreds- or thousands-bit to 1;
Method 2 or Method 3: Set FF.53 to 0.

5.10.3 Step 3: Adjust Eddy Control

Method 1: Overall adjustment via F3.56 [AO1 Gain] or F3.59 [AO2 Gain];
Method 2 or Method 3: Eddy duty cycle control as figure below:



Eddy Duty Cycle Control Diagram

In Operation: Upon receiving an operation command, output the eddy duty cycle as set in FF.48; at the output frequency of FF.45, follow FF.49's setting; and reduce the duty cycle to zero at FF.46.

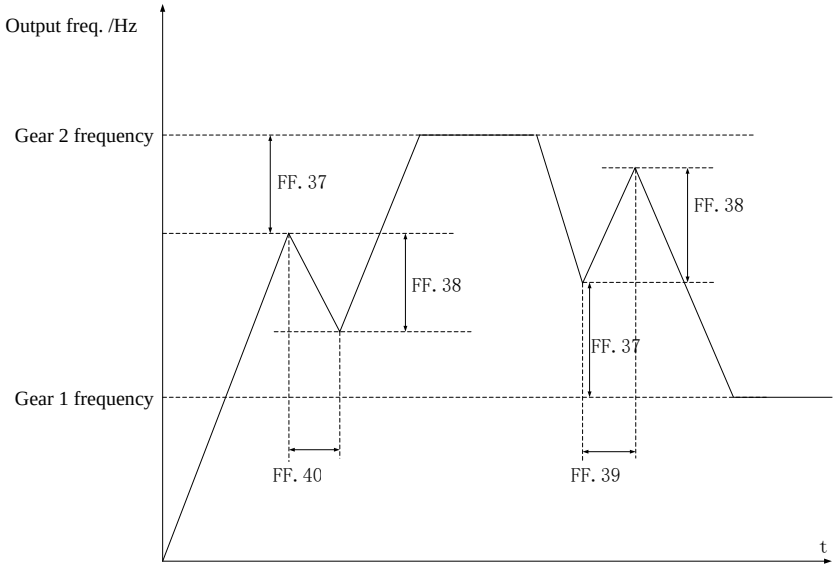
In Stop Progress: As the output frequency below FF.47, the eddy duty cycle begins to increase; at FF.45, it equals to FF.49; below 0Hz, it aligns with FF.48. Upon stopping, the duty cycle increase (or decrease) to FF.54 at a rate set by FF.50. **After Stop:** The eddy current duty cycle holds at FF.51 until it times out. See related parameters as table below:

Code	Name	Description	Default
FF.45	Eddy Frequency 1	0.00Hz~Max. frequency	20.00Hz
FF.46	Eddy Frequency 2	0.00Hz~Max. frequency	40.00Hz
FF.47	Eddy Frequency 3	0.00Hz~Max. frequency	40.00Hz
FF.48	Zero-Speed Duty Cycle	0.0%~100.0%	0.0%
FF.49	Duty Cycle to Eddy Frequency 1	0.0%~100.0%	0.0%
FF.50	Max. Duty Cycle at Stop	0.0%~100.0%	80.0%

FF.51	Eddy Holding Time at Stop	0.0s~3000.0s	60.0s
FF.52	Eddy Output Carrier	0.20kHz~4.00kHz	0.20kHz
FF.53	Duty Cycle Polarity	0: Positive 1: Negative	1
FF.54	Duty Cycle Change Rate at Stop	0.0%~50.0% Time unit is 100ms	0.5%

5.11 Slewing Flexible Control

Flexible control aims to improve the "stuttering" issue for tower jib slewing.
When FF.36 ones-bit=1, slewing flexible control is ON;
FF.36 tens-bit=1, the accel./decel. time of flexible control is determined by FF.39 and FF.40 respectively. The following figure shows the the flexible control for accel. and decel. in Gear 2.



Flexible Control Diagram

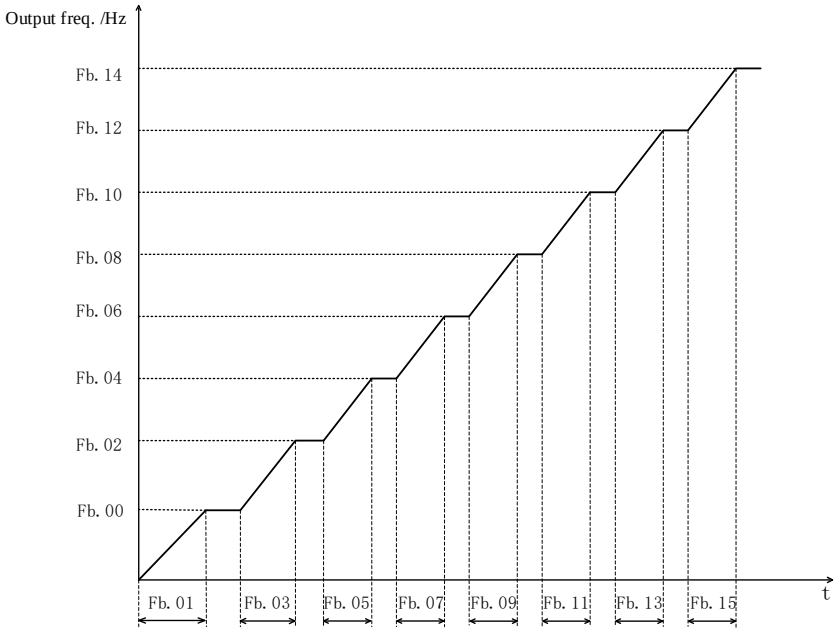
Relevant parameters:

Code	Name	Description	Default
FF.36	Slewing Control 1	Ones-bit: Flexible control 0: OFF 1: ON To address tower jib "stuttering" issue, see flexible control description for details. Tens-bit: Flexible control accel./decel. time 0: OFF 1: ON	1101
FF.37	Flexible Control Start Deviation Frequency	0.00Hz~20.00Hz	2.50Hz
FF.38	Flexible Control Direction Change Deviation Frequency	0.00Hz~20.00Hz	2.50Hz
FF.39	Flexible Control Acceleration Time 1	0.00Hz~650.00s	20.00s
FF.40	Flexible Control Deceleration Time 2	0.00Hz~650.00s	20.00s

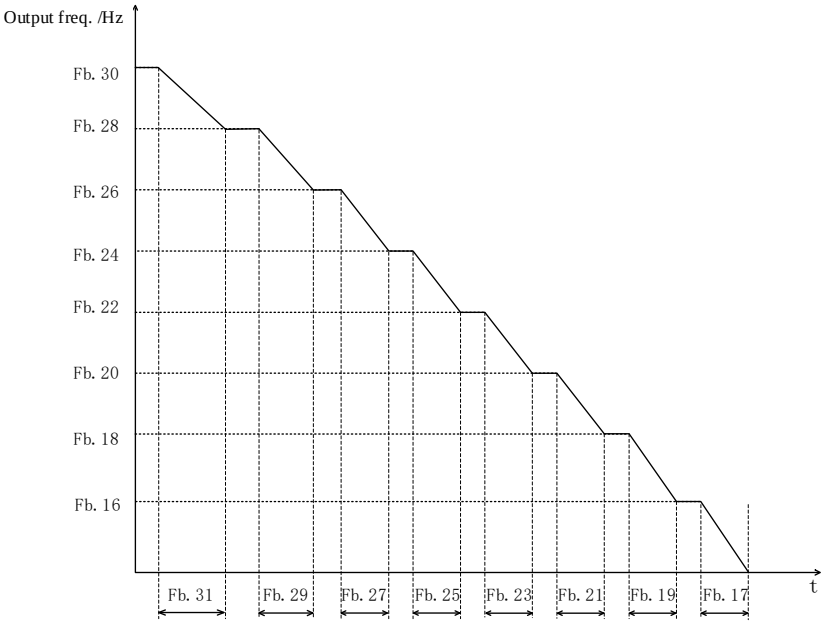
5.12 Slewing-Specific Acceleration/Deceleration

Code	Name	Description	Default
FF.36	Slewing Control 1	Hundreds-bit: Slewing-specific acceleration/deceleration 0: OFF 1: ON The accel. and decel. time of slewing is determined by parameter group FB.	1101
FB.00	Acceleration Section 1	0.1%~FB.02	10.0%
FB.01	Step Acceleration Time 1	0.00s~30.00s	0.50s
FB.02	Acceleration Section 2	FB.00~FB.04	20.0%
FB.03	Step Acceleration Time 2	0.00s~30.00s	0.70s
FB.04	Acceleration Section 3	FB.02~FB.06	30.0%
FB.05	Step Acceleration Time 3	0.00s~30.00s	0.90s
FB.06	Acceleration Section 4	FB.04~FB.08	40.0%
FB.07	Step Acceleration Time 4	0.00s~30.00s	1.10s
FB.08	Acceleration Section 5	FB.06~FB.10	50.0%
FB.09	Step Acceleration Time 5	0.00s~30.00s	1.30s
FB.10	Acceleration Section 6	FB.08~FB.12	60.0%

FB.11	Step Acceleration Time 6	0.00s~30.00s	1.50s
FB.12	Acceleration Section 7	FB.10~FB.14	80.0%
FB.13	Step Acceleration Time 7	0.00s~30.00s	3.40s
FB.14	Acceleration Section 8	FB.12~300.0%	100.0%
FB.15	Step Acceleration Time 8	0.00s~30.00s	3.80s
FB.16	Deceleration Section 1	0.1%~FB.18	10.0%
FB.17	Step Deceleration Time 1	0.00s~30.00s	3.00s
FB.18	Deceleration Section 2	FB.16~FB.20	20.0%
FB.19	Step Deceleration Time 2	0.00s~30.00s	2.40s
FB.20	Deceleration Section 3	FB.18~FB.22	30.0%
FB.21	Step Deceleration Time 3	0.00s~30.00s	2.00s
FB.22	Deceleration Section 4	FB.20~FB.24	40.0%
FB.23	Step Deceleration Time 4	0.00s~30.00s	1.80s
FB.24	Deceleration Section 5	FB.22~FB.26	50.0%
FB.25	Step Deceleration Time 5	0.00s~30.00s	1.60s
FB.26	Deceleration Section 6	FB.24~FB.28	60.0%
FB.27	Step Deceleration Time 6	0.00s~30.00s	1.50s
FB.28	Deceleration Section 7	FB.26~FB.30	80.0%
FB.29	Step Deceleration Time 7	0.00s~30.00s	2.40s
FB.30	Deceleration Section 8	FB.28~300.0%	100.0%
FB.31	Step Deceleration Time 8	0.00s~30.00s	2.00s



Acceleration Period Schematic



Deceleration Period Schematic

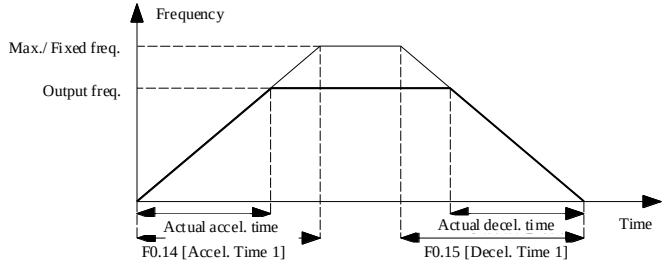
6 Parameter List

"●": the parameter can be modified when AC drive is operating;
"○": the parameter can't be modified when AC drive is operating;
"×": the parameter is read-only and cannot be modified.

6.1 Group F0: Basic Settings

Code	Name	Description	Default	Property	Address
F0.00	Motor Control Mode	Asynchronous motor (AM) control: 0: SVC1 3: SVC2; 4: FVC	0	○	0x000
F0.01	Reserved				
F0.02	Command Channel	0: Keyboard control 1: Terminal control 2: RS485 communication control 3: Optional card	1	●	0x002
F0.03	Frequency Source A	0: Via keyboard 1: Via keyboard potentiometer 2: Via VS (voltage analog) 3: Via current/voltage AI 4: Via AS (current analog) 5: Reserved 6: Via RS485 communication 7~9: Reserved 10: Via optional card 11: Via multi-segment speed	0	●	0x003
F0.04	Frequency Source B		1	●	0x004
F0.05	Reference of Source B	0: Max. output frequency 1: Channel A	0	●	0x005
F0.06	Frequency Source	0: Channel A 1: Channel B 2: Channel A + Channel B 3: Channel A - Channel B 4: Max (A, B) 5: Min (A, B)	0	●	0x006
F0.07	Reserved				
F0.08	Frequency Given via Keyboard	0.00Hz~Upper limit frequency	10.00Hz	●	0x008

F0.09	Max. frequency	Upper limit frequency~600.00Hz	100.00Hz	○	0x009
F0.10	Upper Limit Frequency Source	0: Via keyboard-given upper limit frequency Set by F0.11	0	●	0x00A
F0.11	Upper Limit Frequency via Keyboard	F0.12~F0.09	100.00 Hz	●	0x00B
F0.12	Lower Limit Frequency	0.00Hz~Upper limit frequency	0.00Hz	●	0x00C
F0.13	Lower Limit Frequency Operation	0: Stop the output, and enter halt mode 1: Run at lower limit frequency	1	○	0x00D
F0.14	Acceleration Time 1	0.01s~650.00s	6.00s	※	0x00E
F0.15	Deceleration Time 1	0.01s~650.00s	2.00s	※	0x00F



Acceleration and Deceleration Time Schematic

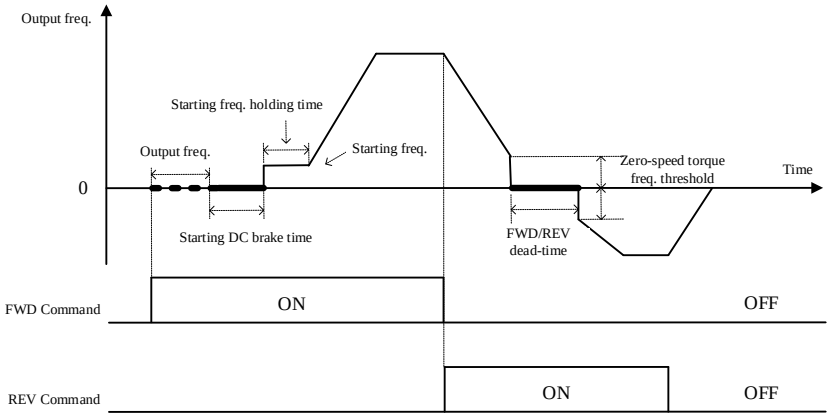
Acceleration time is the duration for output frequency to increase from 0.00Hz to the reference frequency; deceleration time is the duration to slow from the reference frequency to 0.00Hz. Choose the time reference frequency from [F1.16] options: maximum frequency, fixed 50Hz, or set frequency.

F0.16	Rotation Direction	**Ones-bit: REV direction** 0: Keep the direction 1: Invert the direction **Tens-bit: Direction disable** 0: FWD/REV allowed 1: Only FWD allowed 2: Only REV allowed **Hundreds-bit: Reserved** **Thousands-bit: Reserved**	0000	○	0x010
F0.17~F0.18		Reserved			
F0.19	Parameter	0: OFF	0	○	0x013

	Initialization	1: Restore the factory default (not include motor parameters) 1: Restore the factory default (include motor parameters) 3: Clear fault records			

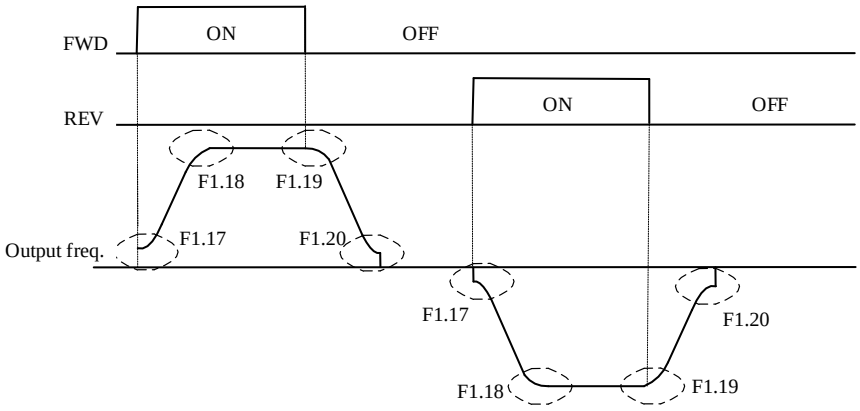
6.2 Group F1: Operation Control

Code	Name	Description	Default	Property	Address
F1.00	Start Mode	0: Start at starting frequency 1: Start from DC braking and then at starting frequency	0	○	0x100
F1.01	Pre-excitation Start Time	Range: 0.00s~60.00s	0.00s	○	0x101
F1.02	Starting Frequency	Initial frequency at which the AC is started. Range: 0.00Hz~60.00Hz	0.50Hz	○	0x102
F1.03	Starting Frequency Holding Time	Refer to the holding time when the AC drive receives the command and runs at the starting frequency, and then enters the normal acceleration and deceleration. Range: 0.0s~50.0s	0.0s	○	0x103
F1.04	Braking Current before Startup	It refers to the current flowing through the motor during DC braking, which 100.0% corresponds to the motor rated current. Range: 0.00Hz~60.00Hz	60.0%	○	0x104
F1.05	Braking Time before Startup	It refers to DC braking retention at startup, and is invalid if sets to 0.0s. Range: 0.0s~60.0s	0.0s	○	0x105
Startup and FWD/REV Switching Process					



F1.06~F1.09		Reserved			
F1.10	Stop Mode	**0: Deceleration stop** Stop as the set deceleration time. If DC brake is ON (F1.14 not set to 0.0s), when the output frequency is less than F1.11 [DC Braking Start Frequency at Stop], the AC drive enters DC braking mode and holds for F1.14 [DC Braking Time at Stop] before stopping. **1: Free stop** The AC drive blocks the output immediately upon receiving the stop command, and the motor runs freely until it stops.	0	●	0x10A
F1.11	DC Braking Start Frequency before Stop	DC braking is ON when the frequency is reached. Range: 0.00Hz~50.00Hz	0.50Hz	○	0x10B
F1.12	DC Braking Current before Stop	It refers to the current flowing through the motor during DC braking, which 100.0% corresponds to the rated motor current. Range: 0.0%~150.0%	80.0%		0x10C
F1.14	DC Braking Time before Stop	It refers to DC braking holding time, which is invalid if sets to 0.0s. Range: 0.0s~60.0s	0.5s	○	0x10E

F1.15	Stop Detection Frequency	In deceleration stop mode, the drive blocks the output when the output frequency is lower than this value, then stops. Range: 0.00Hz~50.00Hz	0.50Hz	•	0x10F
F1.16	Acceleration/Deceleration	**Ones-bit: Time reference** 0: Max. frequency 1: Fixed frequency of 50.00Hz 2: set frequency **Tens-bit: Accel./decel. type** 0: Linear line The output frequency is accelerated and decelerated according to the linear line. 1: S-curve The output frequency is accelerated and decelerated according to the S curve. **Hundreds-bit: Reserved** **Thousands-bit: Reserved**	0011	○	0x110
F1.17	Accel. S-Curve Start Time	The holding time of S-curve before the acceleration starts. Range: 0.00s~10.00s	0.00s	○	0x111
F1.18	Accel. S-Curve End Time	The holding time of S curve before acceleration reaches the set frequency and ends. Range: 0.00s~10.00s	0.00s	○	0x112
F1.19	Decel. S-Curve Start Time	The holding time of S-curve before the deceleration starts. Range: 0.00s~10.00s	0.00s	○	0x113
F1.20	Decel. S-Curve End Time	The holding time of S curve before deceleration reaches the 0Hz and ends. Range: 0.00s~10.00s	0.20s	○	0x114
See the S-curve characteristics during FWD/REV as below:					



F1.21	Acceleration Time 2	0.01s~650.00s	20.00s	●	0x115
F1.22	Deceleration Time 2	0.01s~650.00s	20.00s	●	0x116
F1.23	Acceleration Time 3	0.01s~650.00s	25.00s	●	0x117
F1.24	Deceleration time 3	0.01s~650.00s	15.00s	●	0x118
F1.25	Acceleration Time 4	0.01s~650.00s	25.00s	●	0x119
F1.26	Deceleration Time 4	0.01s~650.00s	10.00s	●	0x11A
F1.27	Emergency Stop Decel. Time	Deceleration time of AC drive upon receiving an emergency stop command. Range: 0.01s~650.00s	1.00s	●	0x11B
F1.28	FWD/REV Deadtime	The hold time at 0.0Hz when the AC drive switches between FWD and REV. Range: 0.0s~120.0s	0.0s	○	0x11C
F1.29	Zero-Servo Torque Frequency Threshold	0.00Hz~10.00Hz	0.50Hz	●	0x11D
F1.30	Zero-Servo Torque Hold Coefficient	0.0%~150.0%	60.0%	●	0x11E
F1.31	Zero-Servo Torque Hold Time	When set to 6000.0s, it has been held. Range: 0.0s~6000.0s	0.0s	●	0x11F
F1.32~F1.34		Reserved			
F1.35	Power-Down Restart	0: OFF The AC drive will run only after receiving a new operation command upon power-up. 1: ON	0	○	0x123

		If the AC drive was running before power loss, it will auto-restart in "By speed tracking" mode after power-on and F1.36 [Power-Down Restart Waiting Time]. During the wait, it doesn't accept operation command; however, a stop command during this time can cancel the restart. **Note:** The "Power-Down Restart" function make the drive start automatically upon power-on. Please use it carefully for personal and equipment safety.			
F1.36	Power-Down Restart Waiting Time	The waiting time before operation after power-on. Range: 0.00s~60.00s	0.50s	○	0x124
F1.37	Reserved				
F1.38	JOG Frequency	0.00Hz~Max. frequency	5.00Hz	●	0x126
F1.39	JOG Accel. Time	0.01s~650.00s	10.00s	●	0x127
F1.40	JOG Decel. Time	0.01s~650.00s	10.00s	●	0x128
F1.41~F1.44		Reserved			

6.3 Group F2: Switch Terminal

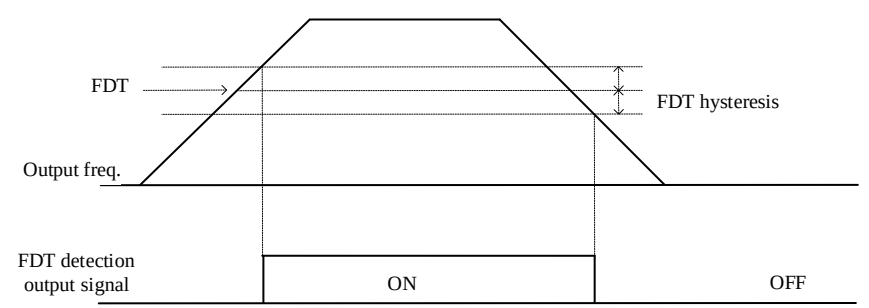
Code	Name	Description	Default	Property	Communication Address
F2.00	Input Terminal 1 (X1)	0: none 1: Forward operation 2: Reverse operation 3: Three-line operation (Xi) 4: Forward jogging 5: Reverse jogging 6: Free stop 7: Emergency stop 8: Fault reset	1	○	0x200
F2.01	Input Terminal 2 (X2)		2	○	0x201
F2.02	Input Terminal 3 (X3)		16	○	0x202

F2.03	Input Terminal 4 (X4)	9: External fault input 10~12: Reserved 13: Channel A to Channel B 14: Combined frequency channel to A 15: Combined frequency channel to B 16: Multi-segment speed terminal 1 17: Multi-segment speed terminal 2 18: Multi-segment speed terminal 3 19: Multi-segment speed terminal 4 20~31: Reserved 32: Accel./decel. time selection terminal 1 33: Accel./decel. time selection terminal 2 34: Accel./decel. pause 35~39: Reserved 40: Timer triggering terminal 41: Timer reset terminal 42: Counter clock input terminal 43: Counter reset terminal 44: DC brake command 45: Pre-excitation command terminal 46: Reserved 47: Reserved 48: Command channel to keyboard 49: Command channel to terminal 50: Command channel to communication 51: Command channel to expansion card 52: Operation disabled 53: Forward operation disabled 54: Reverse operation disabled 55~79: Reserved 80: Weight alarm switch terminal 81: Empty cage weighing correction terminal 82: Brake torque detection 83: Input phase loss detection blocked 84: Decel. optimization lower limit 85: Decel. optimization upper limit 86: DO OFF delay interruption 87: Ant-speed (slow positioning) switch 88: Pre-brake for slewing 89: Lifting upper limit 90: Anti-swing switch 91: Brake feedback	17	○	0x203
F2.04	Input Terminal 5 (X5)		18	○	0x204
F2.05	Input Terminal 6 (X6)		19	○	0x205
F2.06	Input Terminal 7 (X7)		8	○	0x206
F2.07	Reserved				

F2.08	X1~X4 Terminal Characteristics	It is used to set the polarity of the input terminal. 0: ON; 1: OFF Ones-bit: X1 Tens-bit: X2 Hundreds-bit: X3 Thousands-bit: X4	0000	•	0x208
F2.09	X5~X7 Terminal Characteristics	It is used to set the polarity of the input terminal. 0: ON; 1: OFF Ones-bit: X5 Tens-bit: X6 Hundreds-bit: X7 Thousands-bit: Reserved	0000	•	0x209
F2.10	X1 ON Detection Delay	ON: Delay time for terminal X1~X7 from OFF to ON. OFF: Delay time for terminal X1~X7 from ON to OFF. Range: 0.010s~6.000s	0.010s	•	0x20A
F2.11	X1 OFF Detection Delay		0.010s	•	0x20B
F2.12	X2 ON Detection Delay		0.010s	•	0x20C
F2.13	X2 off detection delay		0.010s	•	0x20D
F2.14	X3 ON Detection Delay		0.010s	•	0x20E
F2.15	X3 OFF Detection Delay		0.010s	•	0x20F
F2.16	X4 ON Detection Delay		0.010s	•	0x210
F2.17	X4 OFF Detection Delay		0.010s	•	0x211
F2.18	X5 ON Detection Delay		0.010s	•	0x212
F2.19	X5 OFF Detection Delay		0.010s	•	0x213

F2.20	X6 ON Detection Delay		0.010s	•	0x214
F2.21	X6 OFF Detection Delay		0.010s	•	0x215
F2.22	X7 ON Detection Delay		0.010s	•	0x216
F2.23	X7 OFF Detection Delay		0.010s	•	0x217
F2.24~F2.25		Reserved			
F2.26	Terminal-Controlled Operation Mode	**0: Two-wire control 1** Operation and direction are set at the same time. This is the most commonly used two-wire mode. Default: X1 (FWD) and X2 (REV) terminal control the motor to run forward or reverse. **1: Two-wire control 2** Operation and direction are respectively controlled. The forward running terminal X1 (FWD) defined in this mode is used to enable motor running. The direction is defined by the status of the reverse running terminal X2 (REV). **2: Three-line control 1** The three-line control terminal (Xi) of this mode is a stop terminal and the operation command is sent by X1 (FWD) and the direction is controlled by X2 (REV). The three-line operation control terminal (Xi) is a valid input. **3: Three-line control 2** The three-line control terminal (Xi) of this mode is a stop terminal and the operation command is sent by X1 (FWD) or X2 (REV), and the two control the direction simultaneously.	0	○	0x21A
F2.27	Terminal Start Protection	When the drive stops due to abnormality in operation, if protection is OFF, it restarts directly after the issue cleared; with protection ON, the start command must be reset post-clearance before restarting.	0111	○	0x21B

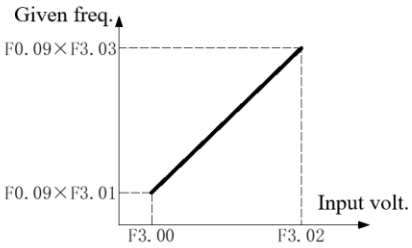
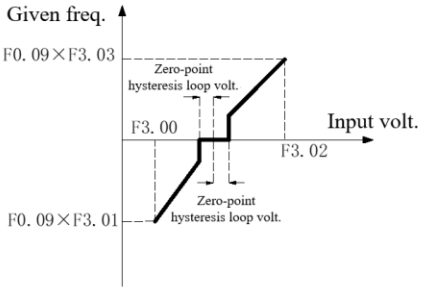
		0: OFF 1: ON **Ones-bit:** Terminal start protection in case of abnormal exit **Tens-bit:** JOG terminal start protection in case of abnormal exit **Hundreds-bit:** Start protection when command channel is switched to terminal **Thousands-bit:** Reserved			
F2.28~F2.43		Reserved			
F2.44	Output Terminal Polarity	Used to set the polarity of output terminal. 0: Positive 1: Negative **Ones-bit: Y terminal output** **Tens-bit: Relay output 1** **Hundreds-bit: Relay output 2** **Thousands-bit: Reserved**	0000	•	0x22C
F2.45	Y Terminal Output	0: No output 1: Drive in operation 2: Drive in reverse operation 3: Drive in forward operation 4: Fault trip alarm 1 (alarm during auto recovery from failure) 5: Fault trip alarm 2(no alarm during auto recovery from failure) 6: Drive undervoltage	33	•	0x22D
F2.46	RO1 (TA1/TB1 -TC1)	8: Drive ready for operation 9: output frequency level detection 1 (FDT1) 10: output frequency level detection 2 (FDT2) 11: Given frequency reached 12: Zero-speed operation in progress 13~23: Reserved 24: Dynamic brake in progress 25: PG disconnection feedback 26: Emergency stop in progress 27: Load warning output 1 28: Load warning output 2 29~32: Reserved	4	•	0x22E
F2.47	RO2 (TA2/TB2 -TC2)	33: Brake control 34: Input phase loss 35: Brake failure protection in progress	33	•	0x22F

		36: Insufficient Brake torque error detection 37: Slewing-specific brake control			
F2.48	Y ON Delay Time	Timing begins when the corresponding controlled output terminal switches from OFF to ON, and an ON status is output only when the timing meets the set value. Range: 0.010s~6.000s	0.010s	•	0x230
F2.49	Relay1 ON Delay Time		0.010s	•	0x231
F2.50	Relay2 ON Delay Time		0.010s	•	0x232
F2.51	Output Frequency Level 1 (FDT1)	During acceleration, a valid (ON) signal is output after the hysteresis time of F2.52/F5.54 once the drive's output frequency surpasses F2.51/F5.53. During deceleration, an invalid (OFF) signal is output after the hysteresis time of F2.52/F5.54 once the drive's output frequency lower than F2.51/F5.53. Range: 0.00Hz~Max. frequency	2.00Hz	•	0x233
F2.52	FDT1 Hysteresis		1.00Hz	•	0x234
F2.53	Output Frequency Level 2 (FDT2)		2.00Hz	•	0x235
F2.54	FDT2 Hysteresis		1.00Hz	•	0x236
Frequency Level Detection Schematic  					
F2.55	Given Frequency Arrival Detection	When the output frequency of the AC drive meets or is near the set frequency, select output terminals (Y/TA1-TB1-TC1, TA2-TB2-TC2) to ON signal of which "set frequency is reached." This function adjusts the detection range's upper and lower deviations. Range: 0.00Hz~50.00Hz	2.00Hz	•	0x237

F2.56	Y OFF Delay Time	Timing begins when the corresponding controlled output terminal switches from ON to OFF, and an OFF status is output only when the timing meets the set value. Range: 0.000s~6.000s	0.010s	•	0x238
F2.57	(TA1/TB1 -TC1) Relay1 Output OFF Delay		0.010s	•	0x239
F2.58	(TA2/TB2 -TC2) Relay2 Output OFF Delay		0.010s	•	0x23A
F2.59~F2.99		Reserved			

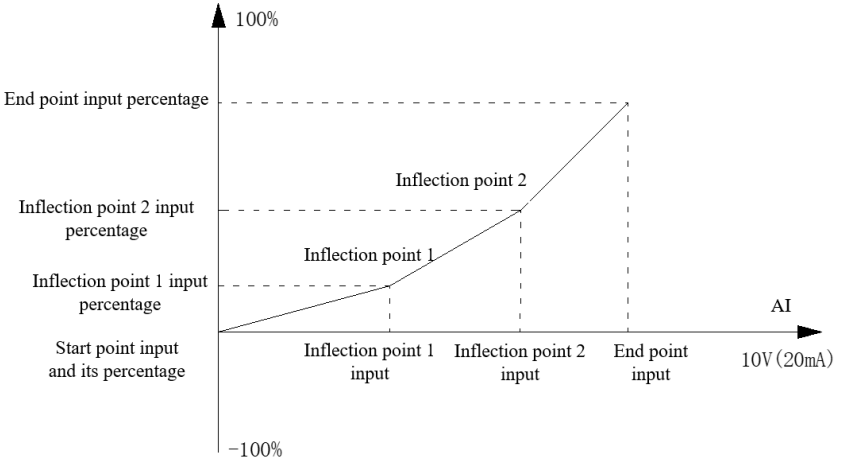
6.4 Group F3: Analog Terminal

Code	Name	Description	Default	Property	Communication Address
F3.00	VS Lower Limit	Define the signal received by the AI terminal (VS), and the voltage signal below this value is processed as the VS lower limit. Range: 0.00V~10.00V	0.00V	•	0x300
F3.01	VS Lower Limit Percentage	Set the percentage of the value corresponding to the VS lower limit. Range: -100.00%~100.00%	0.00%	•	0x301
F3.02	VS Upper Limit	Define the signal received by the AI terminal (VS), and the voltage signal greater than this value will be processed by AC drive as VS upper limit. Range: 0.00V~10.00V	10.00V	•	0x302
F3.03	VS Upper Limit Percentage	Set the percentage of the VS upper limit. Range: -100.0%~100.0%	100.00%	•	0x303

F3.04	VS Filter Time	Define the size of the filter applied to the AI (VS) signal to remove interference signals. The longer the filter time, the stronger the anti-interference ability, but the response becomes slower; the shorter the filter time, the weaker the anti-interference ability, but the response becomes faster. Range: 0.000s~6.000s	0.010s	●	0x304
F3.05	VS Zero Hysteresis Voltage	0.00V~10.00V	0.00V	●	0x305
Analog Giving Frequency Schematic  					
F3.06	AI(VS) Lower Limit	0.00V~10.00V	0.00V	●	0x306
F3.07	AI(VS) Lower Limit Percentage	0.00%~100.00%	0.00%	●	0x307
F3.08	AI(VS) Upper Limit	0.00V~10.00V	10.00V	●	0x308
F3.09	AI(VS) Upper Limit Percentage	0.00%~100.00%	100.00%	●	0x309
F3.10	AI Filter Time	0.000s~6.000s	0.010s	●	0x30A
F3.11	AS Lower Limit	0.00mA~20.00mA	4.00mA	●	0x30B
F3.12	AS Lower Limit Percentage	0.00%~100.00%	0.00%	●	0x30C
F3.13	AS Upper Limit	0.00mA~20.00mA	20.00 mA	●	0x30D
F3.14	AS Upper Limit Percentage	0.00%~100.00%	100.00%	●	0x30E
F3.15	AS Filter Time	0.000s~6.000s	0.010s	●	0x30F
F3.16	AI(AS) Lower Limit	0.00mA~20.00mA	4.00mA	●	0x310

F3.17	AI(AS) Lower Limit Percentage	0.00%~100.00%	0.00%	●	0x311
F3.18	AI(AS) Upper Limit	0.00mA~20.00mA	20.00 mA	●	0x312
F3.19	AI(AS) Upper Limit Percentage	0.00%~100.00%	100.00%	●	0x313
F3.20	VS Terminal Function (as X Terminal)	See terminal functions.	0	○	0x314
F3.21	VS High Level	0.00%~100.00%	70.00%	●	0x315
F3.22	VS Low Level	0.00%~100.00%	30.00%	●	0x316
F3.23	AI Terminal Function (as X Terminal)	See terminal functions.	0	○	0x317
F3.24	AI High Level	0.00%~100.00%	70.00%	●	0x318
F3.25	AI Low Level	0.00%~100.00%	30.00%	●	0x319
F3.26	AS Terminal Function (as X Terminal)	See terminal functions.	0	○	0x31A
F3.27	AS High Level	0.00%~100.00%	70.00%	●	0x31B
F3.28	AS Low Level	0.00%~100.00%	30.00%	●	0x31C
F3.29	Analog Giving Terminal Status	Set the polarity of the input terminal. 0: Low level 1: High level **Ones-bit: VS** **Tens-bit: AI** **Hundreds-bit: AS** **Thousands-bit: Reserved**	0000	●	0x31D
F3.30	AI Curve	**Ones-bit: VS** 0: Linear line (default) 1: Curve 1 2: Curve 2 **Tens-bit: AI (select voltage/current input via jumper)** **Hundreds-bit: AS** **Thousands-bit: Reserved**	0000	●	0x31E
F3.31	Reserved				
F3.32	Curve 1 lower limit	0.00V~10.00V	0.00V	●	0x320
F3.33	Curve 1 Lower Limit Percentage	0.00%~100.00%	0.00%	●	0x321

F3.34	Curve 1 Inflection Point1 Input Voltage	0.00V~10.00V	3.00V	●	0x322
F3.35	Curve 1 Inflection Point1 Percentage	0.00%~100.00%	30.00%	●	0x323
F3.36	Curve 1 Inflection Point2 Input Voltage	0.00V~10.00V	6.00V	●	0x324
F3.37	Curve 1 Inflection Point2 Percentage	0.00%~100.00%	60.00%	●	0x325
F3.38	Curve 1 Upper Limit	0.00V~10.00V	10.00V	●	0x326
F3.39	Curve 1 Upper Limit Percentage	0.00%~100.00%	100.00%	●	0x327
F3.40	Curve 2 Lower Limit	0.00V~10.00V	0.00V	●	0x328
F3.41	Curve 2 Lower Limit Percentage	0.00%~100.00%	0.00%	●	0x329
F3.42	Curve 2 Inflection Point1 Input Voltage	0.00V~10.00V	3.00V	●	0x32A
F3.43	Curve 2 Inflection Point1 Percentage	0.00%~100.00%	30.00%	●	0x32B
F3.44	Curve 2 Inflection Point2 Input Voltage	0.00V~10.00V	6.00V	●	0x32C
F3.45	Curve 2 Inflection Point2 Percentage	0.00%~100.00%	60.00%	●	0x32D
F3.46	Curve 2 Upper Limit	0.00V~10.00V	10.00V	●	0x32E
F3.47	Curve 2 Upper Limit Percentage	0.00%~100.00%	100.00%	●	0x32F
Multi-point Curve Schematic					



F3.48~F3.52		Reserved			
F3.53	AO Signal Selection	**Ones-bit: AO1** 0: 0V~10V 1: 4.00mA~20.00mA 2: 0.00mA~20.00mA **Tens-bit: AO2** 0: 0V~10V 1: 4.00mA~20.00mA 2: 0.00mA~20.00mA 3: FM frequency pulse output 4: PWM frequency pulse output **Hundreds-bit: AO1 voltage polarity** 0: Positive 1: Negative **Thousands-bit: AO2 voltage polarity** 0: Positive 1: Negative	0040	●	0x335

Note: After setting the output mode, set the ON/OFF status of the control board's switches J1, J2, and J3 as follows:

1. For frequency pulse output (tens-bit set to 3 or 4), switch to J1;
2. For 0.00mA~20.00mA or 4.00mA~20.00mA output, switch to J2;
3. For 0V~10V output, switch to J3;

The AC drive defaults to 0V~10V output; modify both software and hardware simultaneously according to the actual output signal if changes are needed.

Switch	Position	Legend	Description
	J1		Output 0kHz~50kHz frequency
	J2		Output 0mA~20mA current Output 4mA~20mA current
	J3		Output 0V~10V voltage

F3.54	AO1 Selection	0: Target frequency 1: Output frequency 2: Output current 3: Input voltage 4: Output voltage 5: Mechanical speed 6: Given torque 7: Output torque 8: PID given 9: PID feedback 10: Output power 11: Bus voltage 12: VS input 13: AI 14: AS input 15: PUL input 16: Module temperature 1 17: Module temperature 2 18: RS485 setting 19: Reserved 20: Eddy duty cycle control	0	●	0x336
F3.55	A02 Selection		1	●	0x337
F3.56	AO1 Gain	25.0%~200.0%	100.0%	●	0x338
F3.57	AO1 Signal Deviation	-10.0%~10.0%	0.0%	●	0x339
F3.58	AO1 Filter	0.000s~6.000s	0.010s	●	0x33A
F3.59	AO2 gain	25.0%~200.0%	100.0%	●	0x33B
F3.60	AO2 Signal Deviation	-10.0%~10.0%	0.0%	●	0x33C

F3.61	AO2 Filter	0.000s~6.000s	0.010s	●	0x33D
F3.62	AO2 FM Frequency Lower Limit	0.00kHz~100.00kHz	0.20kHz	●	0x33E
F3.63	AO2 FM Frequency Upper Limit	0.00kHz~100.00kHz	50.00 kHz	●	0x33F
F3.64~F3.79		Reserved			

6.5 Group F4: System Parameters

Code	Name	Description	Default	Property	Address
F4.00	Parameter/Key Lock	**0: Lock OFF** **1: Parameter locked** Parameter modification locked **2: Parameter and key locked (except FWD/STOP/JOG)** Parameter modification locked, as well as all keys on the keyboard except FWD/STOP/JOG/PRG. **3: Parameters and all keys locked** Parameter modification locked, as well as all keys on the keyboard except PRG. Note: 1. Unlock double-line keyboard: Press "PRG" and see "Code" on the first line. Enter the user password (F4.01) using UP/DW and press "SET" to unlock. 2. Unlock single-line keyboard: Press "PRG" and "Code" is displayed. Press "SET" for a blinking cursor, then enter the password (F4.01) via UP/DW, and press "SET" again to confirm and unlock. 3. The user password protects against unauthorized changes to AC drive parameters. Record it securely to avoid issues when parameter adjustments are needed.	1	●	0x400
F4.01	User Passwords	Set the user password. When F4.00 [Parameter/Key Lock] is ON (when it is not "0"), this password must be entered for unlocking. The factory default password is 0. Please keep the set password safe.	****	●	0x401

		Range: 0~9999			
F4.04	Reserved				
F4.05	Parameter Copy	0: OFF 1: AC drive parameters are transmitted to the keyboard and saved 2: parameters saved in the keyboard are transmitted to the AC drive **Note:** 1. When AC drive is in operation or faulty status or there is no parameter saved in the keyboard, the parameter value saved in the keyboard cannot be transmitted to AC drive. 2. When AC drive parameter values are transmitted to the keyboard and saved, if the keyboard is disconnected it will not complete the copying and the parameter copying operation needs to be performed again. 3. When the parameter values saved in the keyboard are transmitted to the AC drive, if the keyboard is disconnected, it will appear that the previous part of the parameters are modified and the latter part of the parameters are not modified, so it is necessary to carry out this operation again. 4. When the AC drive parameters are transmitted to the keyboard, the current operating status of the AC drive will not be maintained, that is, all keys will be invalid when the parameters saved in the keyboard are transmitted to the AC drive. 5. If an error occurs during parameter copying, the keyboard displays E.CPE [Parameter Copy Abnormality], the copy is aborted,	0		0x405

		and the parameter copying operation needs to be resumed by pressing the PRG key to exit the the interface that displays E.CPE and return to the monitoring interface.			
F4.06	Reserved				
F4.07	REV/JOG Key Selection	Select the function of REV/JOG. 0: REV As a reverse key (with the REV/JOG indicator off). Press it for reverse running in the keyboard control mode. 1: JOG As a JOG key (with the REV/JOG indicator on). Press it for jogging in the keyboard control mode .	0	○	0x407
F4.08	STOP Key Selection	0: Non-keyboard control OFF 1: Non-keyboard stop works as stop mode 2: Non-keyboard stop works as free stop mode	0	○	0x408
F4.09	UP/DW Key Selection	**Ones-bit: UP/DW modification** 0: OFF 1: Adjust F0.08 2: Adjust FB.01 **Tens-bit: Stored in power-down** 0: Power-down frequency storage off 1: Power-down frequency storage on **Hundreds-bit: Action limit** 0: Modify during running and stop 1: Modify during running, stay during stop 2: Modify during running, reset after stop	0010	○	0x409
F4.10	Keyboard Potentiometer Lower Limit	0.00V~5.00V	0.50V	●	0x40A
F4.11	Keyboard Potentiometer	0.00%~100.00%	0.00%	●	0x40B

	Lower Limit Percentage				
F4.12	Keyboard Potentiometer Upper Limit	0.00V~5.00V	4.50V	●	0x40C
F4.13	Keyboard Potentiometer Upper Limit Percentage	0.00%~100.00%	100.00%	●	0x40D
F4.14	1st-line Keyboard Display in Operation	In operation status: Monitoring parameters are cyclically displayed on the keyboard's first line, and are editable with the “SET” key, changing one item with each press. Power-down storage function is not available for the changed cyclic monitoring parameters, so the keyboard will display values ones- and tens-bit upon power-up. In stop status: Monitoring parameters are cyclically displayed on the keyboard's first line, and are editable with the "SET” key, changing one item with each press. Power-down storage function is not available for the changed cyclic monitoring parameters, so the keyboard will display values ones- and tens-bit upon power-up. Ones- to thousands-bit aligns with the C monitoring serial number, where C=Thousands-bit×10+Hundreds-bit, and C=Tens-bit×10+Ones-bit. **Please refer to the monitoring code table for details.** **Ones- and tens-bit:** First group display: 0000~6969 **Hundreds- and thousands-bit:** Second group display: 0000~6969	1101	●	0x40E
F4.15	1st-line Keyboard Display in Operation		0402	●	0x40F
F4.16	1st-line Keyboard Display at Stop		1100	●	0x410
F4.17	1st-line Keyboard Display at Stop		1100	●	0x411
F4.18	2nd-line Keyboard Display in Operation	Only available for dual-line keyboard, see description of F4.14~F4.17 for details	0201	●	0x412

F4.19	2nd-line Keyboard Display in Operation		1004	•	0x413
F4.20	2nd-line Keyboard Display at Stop		1100	•	0x414
F4.21	2nd-line Keyboard Display at Stop		1100	•	0x415
F4.22	Keyboard Display Setting	**Ones-bit: Output frequency display selection** 0: Target frequency (of the controlled motor) 1: Synchronized frequency (calculated drive output frequency) **Tens-bit: Reserved** **Hundreds-bit: Power display** Set the unit of C-10 [Output Power] 0: Power display in percentage (%) Display output power percentage, 100.0% corresponding to motor rated power. 1: Power display in kilowatt (kW) Display the actual output power. **Thousands-bit: Reserved**	0000	•	0x416
F4.23	Monitor Display Selection	**Ones-bit: C-00~C-39** 0: Normal 1: Debugging **Thousands-bit: C-40~C-69** 0: Drive internal parameter (staff only) 1: Drive internal parameter (staff only) 2: V/F internal parameter 3: V/C internal parameter 4: TUNE internal parameter 5: Control parameters for lifter 6: Control parameters for tower crane Hundreds-bit: Reserved Thousands-bit: Reserved	0050	•	0x417

F4.24	RPM Display Coefficient	Display coefficient for keyboard monitoring code C-05 [Mechanical Speed]. Range: 0.0%~500.0%	100.0%	•	0x418
F4.25	Power Display Coefficient	Display coefficient used to correct the keyboard monitoring code C-10 [Output Power]. Range: 0.0%~500.0%	100.0%	•	0x419
F4.26	Alarm Selection 1	**Ones-bit: E.EEP fault (EEPROM storage failure)** 0: alarm and free stop 1: alarm and continue running	0000	○	0x41A
F4.28	Fan	0: Fan runs after the drive is powered up 1: according to temperature after shutdown. 2: fan runs for the set the according to temperature after shutdown.	1	•	0x41C
F4.29	Dynamic Brake Enable	0: OFF The AC drive does not control the motor with dynamic braking regardless of the bus voltage. 1: ON When the bus voltage exceeds the dynamic braking action voltage, AC drive carries out dynamic braking control on the motor.	1	•	0x41D
F4.30	Dynamic Brake Voltage	When the AC drive DC bus voltage rises and exceeds [F4.30], the AC drive dynamic braking begins to act. Range: 115.0%~140.0%	128.0%	•	0x41E
F4.31	Dynamic Brake Utilization Rate	0.0%~100.0%	100.0%	•	0x41F
F4.32	PWM Carrier Frequency	Used to set the switching frequency of the drive's IGBT. Set this parameter to adjust electromagnetic noise and reduce leakage current. This function is mainly used to reduce the noise and vibration that may occur during AC drive operation. When the carrier frequency is higher, the	1.5kHz	※	0x420

		current waveform is more ideal and the motor noise is low. It is ideal for scenarios that require silence. Despite this, the switching loss of key components is up, which causes increased heat generation throughout the whole machine, decreased efficiency, and diminished output. At the same time radio interference is large, high carrier frequency operation increases capacitive leakage current. And false operation or overcurrent may be caused by the leakage protector installation. During low carrier frequency operation, it is the opposite of the above phenomenon. When the user uses more than the default carrier frequency, it needs to be derated, and the derated value is 5% for every 1kHz carrier frequency increase. Range: 0.7kHz~16.0kHz			
F4.33	PWM Control Mode	**Ones-bit: Carrier-temperature correlation** 0: Temperature uncorrelated 1: Temperature correlated When the AC drive overheats, it will automatically reduce the carrier frequency; this function reduces the switching loss of the power devices and prevents frequent alarms for overheating faults of the AC drive. **Tens-bit: Carrier-output frequency correlation** 0: Output frequency uncorrelated 1: Output frequency correlated When the association between carrier and output frequency is valid, AC drive can automatically adjust the carrier frequency	1000	•	0x421

		according to the output frequency, and this function can improve the low-frequency performance of AC drive and the mute effect of high frequency. **Hundreds-bit: Random PWM** 0: OFF Motor Fixed Noise Frequency 1: ON This method can make the harmonic frequency spectrum of the output voltage of the frequency converter evenly distributed in a wide frequency range, and can effectively suppress the high frequency noise of the motor. **Thousands-bit: PWM modulation mode** Select the PWM mode of the AC drive. 0: Only three-phase modulation 1: Two-phase/three-phase modulation automatic switching			
F4.34~F4.37		Reserved			

6.6 Group F5: Motor Parameters

Code	Name	Description	Default	Property	Address
F5.00	Motor Type	0: Asynchronous motor (AM) 1: Permanent magnet synchronous motor (PM)	0	×	0x500
F5.01	Motor Pole No.	2~98	4	○	0x501
F5.02	Motor Rated Power	0.1kW~1000.0kW	Up to	※	0x502
F5.03	Motor Rated Frequency	0.01Hz~Max. frequency	Up to model	※	0x503
F5.04	Motor Rated Speed	1rpm~65000rpm	Up to	※	0x504
F5.05	Motor Rated	1V~1500V	Up to	※	0x505
F5.06	Motor Rated Current	0.1A~3000.0A	Up to model	※	0x506

F5.07	AM No-load Current	0.1A~3000.0A	Up to model	※	0x507
F5.08	AM Stator Resistance	0.01%~50.00%	Up to model	※	0x508
F5.09	AM Rotor Resistance	0.01%~50.00%	Up to model	※	0x509
F5.10	AM Stator Leakage Inductance	0.01%~50.00%	Up to model	※	0x50A
F5.11	AM Stator Inductance	0.1%~2000.0%	Up to model	※	0x50B
F5.20	Motor Parameter Auto-tuning	0: OFF 1: Dynamic auto-tuning 2: Static auto-tuning 3: Quick static auto-tuning	0	○	0x514
F5.21~F5.29		Reserved			
F5.30	Speed Feedback or Encoder Type	**Ones-bit: Encoder type** 0: Common ABZ encoder 1: Rotary transformer (RT) **Tens-bit: Encoder direction** 0: Same 1: Opposite direction **Hundreds-bit: Disconnection detection** 0: OFF 1: ON **Thousands-bit: Z-pulse correction** 0: OFF 1: ON	0000	○	0x51E
F5.31	ABZ Encoder Line No.	1~10000	1024	○	0x51F
F5.32	Disconnection Detection Time	0.100s~60.000s	0.500s	•	0x520
F5.33	Rotary Transformer Pole No.	Set it according to the actual selected RT, usually with 2 poles. Range: 2~128	2	○	0x521
F5.34	Encoder Ratio Numerator	To enable closed-loop vector function, motor speed and position can be derived indirectly via transmission ratio settings if the motor encoder is not directly mounted on the motor shaft. However, a rigid connection between the motor shaft and	1	○	0x522
F5.35	Encoder Ratio Denominator		1	○	0x523

		encoder is essential, and the encoder must have sufficient lines in synchronous motor control. Range: 1~32767			
F5.36	Encoder Speed Detection First-Order Filter Time	If the motor encoder feedback interference is large, the filter time of the speed measurement can be appropriately increased. But the increase of the filter time will reduce the response performance of the system. In some cases of high requirements on the response performance, long filter time will lead to system oscillation. Range: 0.0ms~100.0ms	1.0ms	•	0x524
F5.37~F5.38		Reserved			
F5.39	PG Feedback Frequency Control Word	Ones-bit: SVC speed measurement 0: OFF 1: ON Tens-bit: Reserved Hundreds-bit: Reserved Thousands-bit: Reserved	0001	•	0x527
F5.40~F5.49		Reserved			

6.7 Group F6: Motor Vector Control

Code	Name	Description	Default	Property	Address
F6.00	ASR Proportional Gain 1	auto-tuning to of proportional gain and integral time of ASR (speed loop): increasing the proportional gain can enhance the system's dynamic response, but an excessively high proportional gain may lead to system oscillation. Decreasing the integral time can accelerate the system's dynamic response;	10.00	•	0x600
F6.01	ASR Integral Time 1		0.100s	•	0x601

F6.02	ASR Filter Time 1	however, an excessively short integral time may lead to system overshoot and a tendency toward oscillation. Start by setting the proportional gain high enough to avoid oscillation; then adjust the integral time for a quick response with minimal overshoot. Note: If the proportional gain is too high and the integral time too short, an overvoltage fault may occur in the system (especially without an external braking resistor or unit) when the system is quickly started and accelerated to a high speed. This is due to energy feedback from regenerative braking during deceleration after overshooting the set speed. This can be avoided by turning down the proportional gain and increasing the integral time. Adjust ASR (speed loop) proportional gain and integral time for high and low-speed operations with load: For fast response requirements, set ASR switching frequencies [F6.03] and [F6.07]. When the system is operated at low frequency, usually, by increasing the proportional gain and decreasing the integral time relatively can improve the dynamic response characteristics. The speed regulator parameters are generally adjusted in the following order: Select the appropriate switching frequencies ([F6.03] and [F6.07]). The first group of ASR (speed ring) parameters is valid when the output frequency is above the	0.0ms	•	0x602
F6.03	ASR Switching Frequency 1		0.00Hz	•	0x603
F6.04	ASR Proportional Gain 2		10.00	•	0x604
F6.05	ASR Integral Time 2		0.100s	•	0x605
F6.06	ASR Filter Time 2		0.0ms	•	0x606
F6.07	ASR Switching Frequency 2		0.0Hz	•	0x607

		switching frequency 1 [F6.03]. The second group of ASR (speed loop) parameters is valid when the output frequency is below the switching frequency 2 [F6.07]. When the output frequency is between switching frequency 1 [F6.03] and switching frequency 2 [F6.07], the parameter transitions proportionally and linearly from the first group to the second group. Adjust the ASR (speed loop) proportional gain2 [F6.04] and ASR (speed loop) integral time2 [F6.05] at low speeds to prevent oscillations and achieve optimal dynamic response at low-frequency operations. Adjust the ASR (speed loop) proportional gain1 [F6.00] and ASR (speed loop) integral time1 [F6.01] at high speeds to prevent oscillations from the system and achieve optimal dynamic response. When switching frequency 1 [F6.03] is set to zero, only use the first group of speed loop parameters. Range: F6.00: 0.01~100.00 F6.01: 0.000s~6.000s F6.02: 0.0ms~100.0ms F6.03: 0.00Hz~F6.07 F6.04: 0.01~100.00 F6.05: 0.000s~6.000s F6.06: 0.0ms~100.0ms F6.06: 0.00Hz~Max. frequency F6.07: 0.00Hz~F6.03			
F6.08	Drive mode Torque Limit	Set the output upper limit of the motor torque. The percentage	180.0%	•	0x608

F6.09	Generation Mode Torque Limit	corresponds to the rated torque of the motor, valid for AM, PM in under SVC and FVC modes. The motor torque output is also limited by the AC drive output current limit point [FA.01] and the output power [F6.27]. Range: 0.0%~250.0%	180.0%	●	0x609
F6.10	Current Loop D-axis Proportional Gain	Set the PI parameters of the current loop for AM and PM vector controls. In vector control, if the speed and current oscillations and instability occur, the gains can be accordingly reduced for stability; on the other hand, increasing the gains helps to improve the dynamic response of the motor. Range: 0.001~4.000	1.000	●	0x60A
F6.11	Current Loop D-axis Integral Gain		1.000	●	0x60B
F6.12	Current Loop Q-axis Proportional Gain		1.000	●	0x60C
F6.13	Current Loop Q-axis Integral Gain		1.000	●	0x60D
F6.15	Drive Mode Vector Slip Compensation	When AM vector control is valid, the slip compensation coefficient is used to adjust the motor accuracy at a stable speed in the open-loop vector control. The value should be increased when the motor speed in the with-load cases is lower than the set value versa. For FVC mode, it is used to adjust the linearity of the motor output torque and output current. Please reduce it when the deviation of the the rated loads between motor's and the nameplate's is large, vice versa. Range: 0.0%~250.0%	100.0%	●	0x60F
F6.16	Vector Control Slip Compensation		0.0%	●	0x610
F6.18	Position Compensation Control	For FVC, with this function, the motor can realize zero servo function at zero speed, and the rigidity of the motor can be increased when running at non-zero speed. When the compensation control is enabled, the compensation gain is used to	0	○	0x612

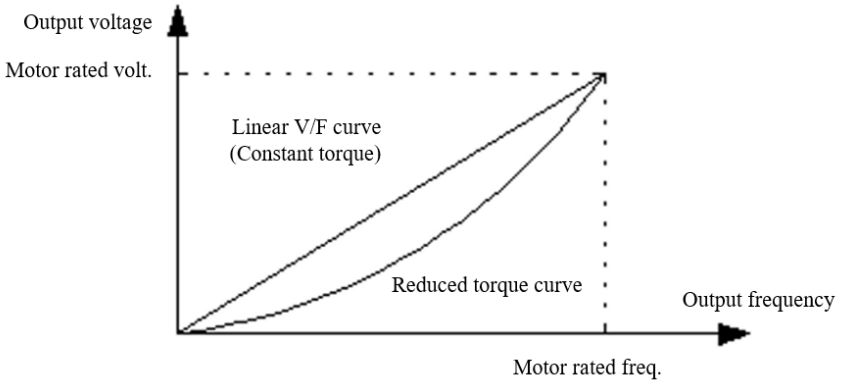
		adjust the compensation intensity, and the compensation clipping is used to limit the compensation amplitude, relative to the drive maximum output frequency and is effective below the compensation range frequency, relative to the drive maximum output frequency. 0: OFF 1: ON			
F6.19	Compensation Gain	For FVC, with this function, the motor can realize zero servo function at zero speed, and the rigidity of the motor can be increased when running at non-zero speed. When the compensation control is enabled, the compensation gain is used to adjust the compensation intensity, and the compensation clipping is used to limit the compensation amplitude, relative to the drive maximum output frequency and is effective below the compensation range frequency, relative to the drive maximum output frequency. Range: F6.19: 0.0%~250.0% F6.20: 0.0%~100.0% F6.21: 0.0%~100.0%	0.0%	○	0x613
F6.20	Compensation Limit		0.0%	○	0x614
F6.21	Compensation Range		10.0%	○	0x615
F6.22	Overexcitation Brake Gain	For AM in FVC , and faster deceleration control can be realized without reporting overvoltage through overexcitation function. The larger the overexcitation gain, the faster the control response. Compared with the rated excitation and limiting of motor, the larger the braking limit, the better the braking effect. However, excessive limit will increase the temperature rise when the motor decelerates, and	100.0%	○	0x616
F6.23	Overexcitation Brake Limit		100.0%	○	0x617

		the value can be appropriately increased when the heat dissipation of the motor is good. Range: 0.0%~500.0%			
F6.24	Vector Control ECO Function	For AM in vector control, the ECO function through the analysis of torque output, automatically reduce the output current, so as to reduce the motor heating loss, in order to achieve energy-saving effect. Range: F6.24: 0: OFF 1: ON F6.25: 0.0%~80.0% F6.26: 0.000s~6.000s	0	○	0x618
F6.25	Energy-saving Gain		50.0%	•	0x619
F6.26	Energy-saving Low-pass Filter		0.010s	•	0x61A
F6.27	Motor Constant Power Limit	It refers to the size of the controlled motor's shaft output power under vector control. When the motor is running at low and medium speeds, the motor output power is small, and at this time the motor torque is mainly limited by the torques in drive/power generation modes [F6.08~F6.09]. When it is running at high speed and above the rated speed, the output power is limited by [F6.27], and the motor torque output decreases inversely proportional to the speed. Range: 0.0%~250.0%	200.0%	•	0x61B
F6.28	Motor Flux-Weakening Current Upper Limit	For AM and PM vector control modes, if the motor running speed is above the rated speed, or if the bus voltage is low and the motor running speed is near the rated speed, the AC drive needs to adopt flux weakening control of the motor for the motor, so as to make the motor speed track the set speed. [F6.28] can be used to set the upper limit of demagnetization	60.0%	○	0x61C
F6.29	Motor Flux Weakening Feed-Forward Gain		10.0%	•	0x61D
F6.30	Motor Flux Weakening Gain		10.0%	•	0x61E

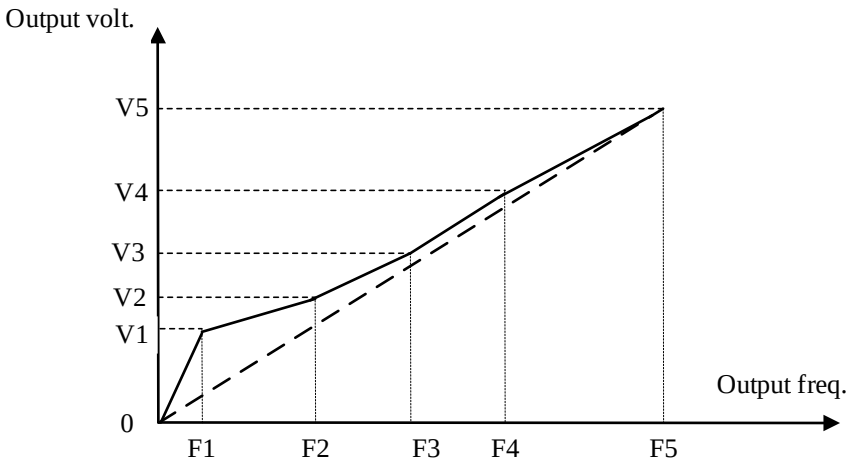
		current and is valid for PM. But an irreversible demagnetization of the motor will occur if the flux weakening current is too large. Normally, this will not happen if the field-weakening current is within the rated range. Set the flux-weakening control adjustment parameters [F6.29~F6.30] for debugging when instability occurs in the process. Range: F6.28: 0.0%~250.0% F6.29: 0.0%~200.0% F6.30: 0.0%~500.0%			
F6.31~F6.79		Reserved			

6.8 Group F8: Motor SVC1 Parameters

Code	Name	Description	Default	Property	Address
F8.00	Linear V/F Curve Selection	Select the type of V/F curve according to different load characteristics. 0: Linear V/F 1~9: 1.1~1.9 power V/F torque drop curves respectively, illustrated below: 10: Square V/F curve 11: Custom V/F curve Refer to F8.01~F8.10 and F8.25~F8.34; The linear V/F curve by default is suitable for most general-purpose applications. The multiple power curve and square V/F curve are generally used for fans or pumps. It can reduce the high-frequency current and achieve energy-saving effect.	0	○	0x800
The Schematic Diagram of Linear V/F And Falling Torque Curves					



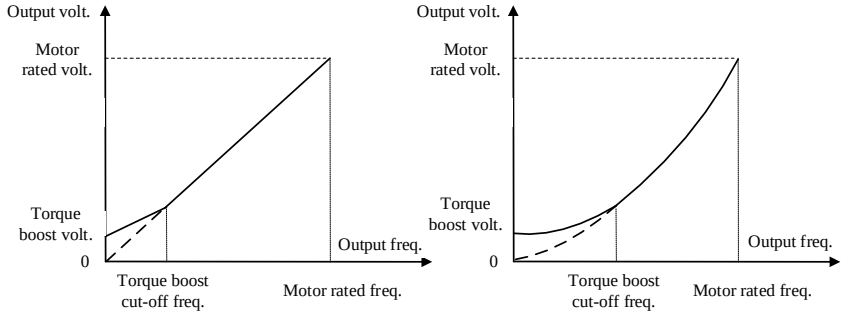
F8.01	V1 (Self-set Voltage)	Customize the V/F curve using [F8.01~F8.10]. If FF.02's hundreds-bit is set to 1, it specifies the forward operation curve only. The reverse operation curve is defined by [F8.25~F8.34]. Voltages V1-V5 in the custom curve (where 100.0% equals rated motor voltage) match frequency points F1-F5 (where 100.0% equals rated motor frequency). The group parameter settings must satisfy the following conditions: 0≤F1≤F2≤F3≤F4≤F5≤100.0%; 0≤V1≤V2≤V3≤V4≤V5≤100.0% Range: 0.0%~100.0%	4.5%	○	0x801
F8.02	F1 (Self-set Frequency)		0.0%	○	0x802
F8.03	V2 (Self-set Voltage)		5.6%	○	0x803
F8.04	F2 (Self-set Frequency)		1.0%	○	0x804
F8.05	V3 (Self-set Voltage)		15.6%	○	0x805
F8.06	F3 (Self-set Frequency)		10.0%	○	0x806
F8.07	V4 (Self-set Voltage)		24.0%	○	0x807
F8.08	F4 (self-setting frequency)		20.0%	○	0x808
F8.09	V5 self-setting voltage		100.0%	○	0x809
F8.10	F5 (Self-set Frequency)		100.0%	○	0x80A
Self-Set V/F Curve					



F8.11	Output Voltage Percentage	The output voltage regulation coefficient of the AC drive. This function is used to adjust the output voltage of the AC drive for different V/F characteristics. Range: 25.0%~120.0%	100.0%	○	0x80B
F8.12	Torque boost	Torque boost: when [F8.12] is set to 0.0, it is the automatic torque boost, which automatically compensates the output voltage according to the size of the load; when [F8.12] is set to any other value, it is the fixed torque boost, which compensates the output voltage according to the output frequency to improve the low-frequency torque characteristic of AC drive. Please select the torque boost according to the load size. If the torque boost is too high during low frequency operation, the motor may be overexcited and overheated after long time operation, and in some serious cases, the AC drive may be protected against overcurrent faults or the AC drive may not be able to start normally.	0.0%	•	0x80C
F8.13	Torque boost cutoff frequency		100.0%	•	0x80D

		Note: When parameter [F8.00] is set to "11" (customized V/F curve), the torque boost set in [F8.12] is invalid, and AC drive runs according to the customized V/F curve. Range: F8.12: 0.0%~30.0% F8.13: 0.0%~100.0%			

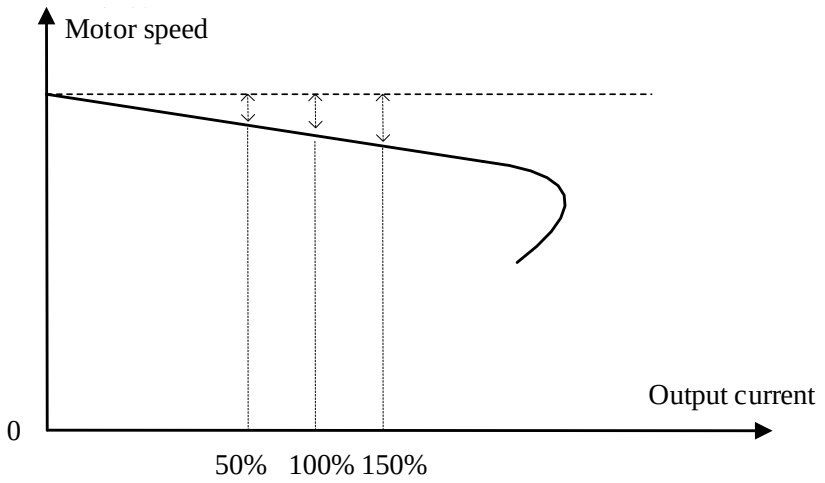
Torque Boost Schematic



F8.14	Slip Compensation Gain	This function enables the output frequency of the drive to automatically change with the motor load within the set range to dynamically compensate the motor slip frequency, so as to keep the motor at a constant speed, thus reducing the effect of load variation on the motor speed. The low frequency torque characteristics of the drive can be significantly improved when this function is used with the automatic torque boost function. The 100.0% of slip frequency compensation corresponds to the motor rated slip. But a too large setting may cause the motor speed to exceed the set value, so a limit needs to be set in [F8]. Slip compensation filter time Define the size of the filter applied to the slip compensation to remove interference signals. The longer the filter time, the stronger the anti-interference ability, but the response becomes slower; the shorter the filter time, the weaker the anti-interference ability, but the response becomes faster. Range: F8.14: 0.0%~200.0%	0.0%	•	0x80E
F8.15	Slip Compensation Range		100.0%	•	0x80F
F8.16	Slip Compensation Filter Time		0.200s	•	0x810

		F8.15: 0.0%~300.0% F8.16: 0.000s~6.000s			

Slip Compensation Schematic



F8.17	Oscillation Suppression Gain	0.0%~900.0%	100.0%	•	0x811
F8.18	Oscillation Suppression Filter Coefficient	0.0~100.0	1.0		0x812
F8.19	Automatic ECO control	0: OFF 1: ON	0	○	0x813
F8.20	Lower Limit of the Step-Down Frequency	0.00Hz~50.00Hz	15.00Hz	○	0x814
F8.21	Lower Limit of the Step-Down Voltage	20.0%~100.0%	50.0%	○	0x815
F8.22	Step-Down Voltage Regulation Rate	0.000V/ms~ 0.200V/ms	0.010 V/ms	•	0x816
F8.23	Step-Down Voltage Recovery Rate	0.000V/ms~2.000V/ms	0.200 V/ms	•	0x817
F8.24	Reserved				
F8.25	Reverse operation V1 (Self-set Voltage)	Use [F8.25~F8.34] to set the custom V/F curve for reverse operation. Define voltages V1-V5 (100.0% equals rated motor voltage) at frequency points F1-F5 (100.0% equals rated motor	5.6%	○	0x819
F8.26	Reverse Operation F1 (Self-set Frequency)		0.0%	○	0x81A

F8.27	Reverse Operation V2 (Self-set Voltage)	frequency). Set frequencies in the V/F curve to correspond to voltages V1-V5. The group parameter settings must satisfy the following conditions: 0≤F1≤F2≤F3≤F4≤F5≤100.0%; 0≤V1≤V2≤V3≤V4≤V5≤100.0% Range: 0.0%~100.0%	5.6%	○	0x81B
F8.28	Reverse Operation F2 (Self-set Frequency)		1.0%	○	0x81C
F8.29	Reverse Operation V3 (Self-set Voltage)		11.6%	○	0x81D
F8.30	Reverse Operation F3 (Self-set Frequency)		10.0%	○	0x81E
F8.31	Reverse Operation V4 (Self-set Voltage)		21.0%	○	0x81F
F8.32	Reverse Operation F4 (Self-set Frequency)		20.0%	○	0x820
F8.33	Reverse Operation V5 (Self-set Voltage)		100.0%	○	0x821
F8.34	Reverse Operation F5 (Self-set Frequency)		100.0%	○	0x822
F8.35	Stator Compensation Thermistor Factor	100.0%~150.0%	110.0%	●	0x823
F8.36	Compensation Initial	0.0%~2.0%	0.0%	●	0x824
F8.37	Auto Torque Boost Proportional Gain	0.00~1.00	0.06	●	0x825
F8.38	Auto Torque Boost Integral Gain	0.00~1.00	0.01	●	0x826
F8.39	Overcurrent Suppression Cut-off Frequency	0.00Hz~10.00Hz	2.00Hz	●	0x827

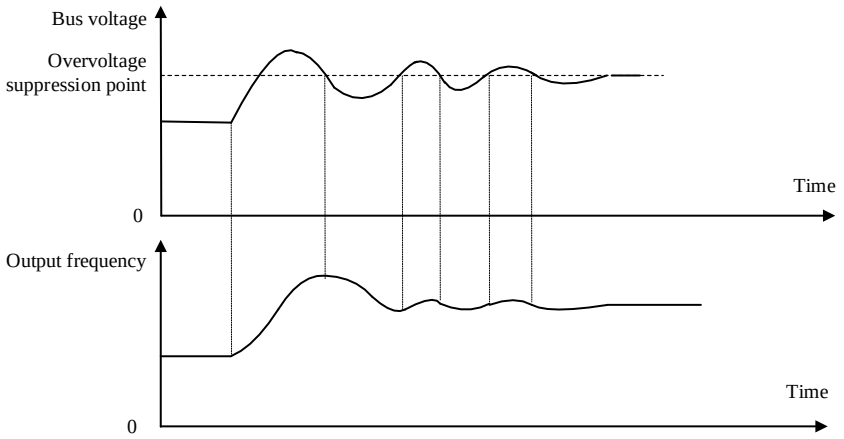
6.9 Group FA: Protection and Fault Parameters

Code	Name	Description	Default	Property	Address

FA.00	Overcurrent Suppression	function prevents fault tripping by capping the load current to a predetermined point by real-time monitoring on load current in operation, ideal for loads with large inertia or significant changes. 0: ON for whole process 1: Suppression on during acceleration and deceleration and off during constant speed 2: OFF	2	●	0xA00
FA.01	Overcurrent Suppression Point	It is the set current limit (AC drives control the size of the output current by stopping acceleration, deceleration, or lowering or raising the output frequency). Via this parameter, the response speed of the overcurrent suppression can be adjusted. **Note**: This function may prolong the acceleration and deceleration time. When AC drive is starting or stopping, if the output frequency can not reach the given frequency according to the desired acceleration and deceleration time in case of high current, it indicates that the current limiting function is on, then please reduce the load or adjust the related parameter. Range: FA.01: 0.0%~300.0% FA.02: 0.0%~500.0%	180.0%	●	0xA01
FA.02	Overcurrent Suppression Gain		100.0%	●	0xA02
FA.03	Current Hardware Protection	**Ones-bit: CBC current limiting** Through hardware protection, CBC current limiting can limit the rise of current to some extent, so that the current does not exceed the protection value of AC drive, avoiding overcurrent fault and shutdown. 0: OFF 1: ON	0000	○	0xA03

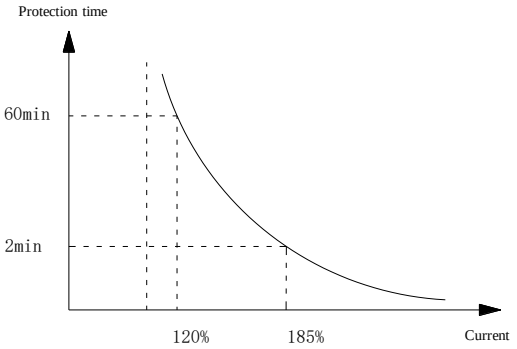
		Tens-bit: OC protection interference When this function is on, the AC drive will intelligently diagnose the E.OC alarm, exclude the interference, and only alarm the real fault signal. This function may delay the alarm time, so please use it with caution. 0: OFF 1: L1 interference suppression 2: L2 interference suppression **Tens-bit: SC protection interference** When this function is on, the AC drive will intelligently diagnose the E.SC alarm, exclude the interference, and only alarm the real fault signal. This function may delay the alarm time, so please use it with caution. 0: OFF 1: L1 interference suppression 2: L2 interference suppression			
FA.04	Reserved				
FA.05	Bus Overvoltage Hardware Protection	It is a backup and supplement to software protection to protect the bus voltage by hardware, which improves the reliability of equipment. 0: OFF 1: ON	0	○	0xA05
FA.06	Busbar Overvoltage Suppression	**Ones-bit: Overvoltage suppression** 0: OFF 1: ON only during deceleration 2: ON during both acceleration and deceleration Select whether to enable the voltage suppression function when the AC drive decelerates. If this function is on, the AC drive will slow down or stop decelerating when its bus voltage reaches or	0000	○	0xA06

		exceeds the value set in FA.07 during deceleration, so as to ensure that the AC drive does not trip the over-voltage protection due to the excessive bus voltage. Select whether to enable the voltage suppression function when the AC drive accelerates. When the AC drive acceleration bus voltage reaches or exceeds the value set in FA.07, the AC drive will automatically adjust the operation frequency to suppress the bus voltage increase, so as to ensure that the AC drive does not cause over-voltage protection due to the excessive bus voltage. This function is ideal for eccentric loads. **Tens-bit: Overexcitation** 0: OFF 1: ON **Hundreds-bit: Reserved** **Thousands-bit: Reserved** Range: 0000~0012			
FA.07	Busbar Overvoltage Suppression Point	when In AC drive operation, if the bus voltage reaches or exceeds the bus overvoltage suppression point set in FA.07, the AC drive will automatically adjust the operation frequency to suppress the bus voltage increase, so as to ensure that the AC drive does not trigger over-voltage protection due to the excessive bus voltage. FA.08 adjustment can enhance the overvoltage suppression function. Setting FA.08 to 0 turns off this function, which is valid for all motor control modes. Range: FA.07: 110.0%~150.0% FA.08: 0.0%~500.0%	128.0%	○	0xA07
FA.08	Bus Overvoltage Suppression Gain		100.0%	○	0xA08
Overvoltage Suppression Schematic Diagram					



FA.09	Bus Undervoltage Suppression	when In AC drive operation, if the bus voltage reaches or lowers than the bus undervoltage suppression point set in FA.10, the AC drive will automatically adjust the operation frequency to suppress the bus voltage reduction, thus, so as to ensure that the AC drive does not trigger undervoltage protection due to the low bus voltage. [FA.08] adjustment can enhance the undervoltage suppression function. Setting [FA.08] to 0 turns off this function, which is valid for all motor control modes. Range: FA.09: 0: OFF 1: ON FA.10: 60.0%~90.0% FA.11: 0.0%~500.0%	0	○	0xA09
FA.10	Busbar Undervoltage Suppression Point		80.0%	○	0xA0A
FA.11	Bus Undervoltage Suppression Gain		100.0%	○	0xA0B
FA.12	Busbar Undervoltage Protection Point	Bus undervoltage protection point: this parameter specifies the allowable lower limit of bus voltage when AC drive is working normally. For some occasions where the power grid is low, the undervoltage protection level can	60.0%	○	0xA0C

		be appropriately lowered to ensure that the AC drive works normally. **Note**: The output torque of the motor will drop when the grid voltage is too low. For constant power loads and constant torque loads, an excessively low grid voltage will increase the AC drive I/O currents, which will reduce the reliability of the AC drive operation. Range: 60.0%~90.0%			
FA.15	Phase Loss	**Ones-bit: Output phase loss protection** 0: OFF 1: ON E.oLF [Output phase failure] is reported when the motor runs with phase loss. **Tens-bit: Input phase loss protection** 0: OFF 1: Alarm (A.iLF) 2: Report error (E.iLF) 3: Alarm for stopping, report error for running **Hundreds-bit: Reserved** **Thousands-bit: Reserved**	0031	○	0xA0F
FA.16	Motor Overload Protection Coefficient	The current entering the protection curve = (actual motor current/motor overload protection coefficient) × 100%, so increasing [FA.16] can improve the overload capacity of the motor; [FA.16] sets the motor overload warning coefficient, and when the motor overload degree reaches the coefficient set in [FA.16], AC drive will alarm through the terminal outputs. Please refer to the function of Y-terminal for details. **Note**: When an AC drive with multiple motors runs in parallel, the thermal relay protection	100.0%	○	0xA10

		function of the AC drive will be invalid. In order to effectively protect the motors, please install a thermal protection relay at the inlet end of each motor. Range: 0.0%~250.0%			
Overload Protection Curve Schematic Figure  					
FA.17	Load Warning Setting	**Ones-bit: Detection selection (protection1)** 0: Detection off 1: Detect overload 2: Detect overload only at constant speed 3: Detect underload 4: Detect underload at constant speed only **Tens-bit: Alarm selection** 0: Report a warning and continue running 1: Report error **Hundreds-bit: Detection selection (protection2)** 0: Detection off 1: Detect overload 2: Detect overload only at constant speed 3: Detect underload 4: Detect underload at constant speed only **Thousands-bit: Alarm Selection** 0: report a warning and continue running	0000	○	0xA11

		1: report error			
FA.18	Load detection warning1	Motor output current serves as the load warning threshold, with 100.0% equivalent to the rated motor current. Compare it against threshold [FA.18/FA.20] within time [FA.19/FA.21], act as specified in [FA.17], and execute warnings through terminal outputs, detailed under Y-terminal functions. Range: FA.18: 0.0%~200.0% FA.19: 0.0s~60.0s FA.20: 0.0%~200.0% FA.21: 0.0s~60.0s	130.0%	○	0xA12
FA.19	Load detection warning time1		5.0s	○	0xA13
FA.20	Load warning detection level2		20.0%	○	0xA14
FA.21	Load warning detection time2		0.5s	○	0xA15
FA.22	Reserved				
FA.23	Excessive speed deviation protection	**Ones-bit: detection selection** 0: Detection off 1: Detect only at constant speed 2: keep detecting **Tens-bit: Alarm selection** 0: Report an error 1: Alarm and continue running **Hundreds-bit and thousands-bit: Reserved**	0001	○	0xA17
FA.24	Excessive Speed Deviation Detection Threshold	For vector control, when the deviation of the speed feedback and speed setting is greater than the detection threshold [FA.24] within the detection time [FA.25], the AC drive considers that the detection deviation is too large, and takes the corresponding action according to [FA.23]. The speed deviation detection threshold of 100.0% corresponds to the maximum frequency. Range: FA.24: 0.0%~60.0%	10.0%	○	0xA18
FA.25	Excessive Speed Deviation Detection Time		2.0s	○	0xA19

		FA.25: 0.0s~60.0s			
FA.26	Overspeed Protection Action	Ones-bit: Detection selection 0: Detection off 1: Detect only at constant speed 2: Detection on Tens-bit: Alarm selection 0: Report error 1: Report a warning and continue running Hundreds- and thousands-bit: Reserved	0002	○	0xA1A
FA.27	Overspeed Detection Threshold	When the speed feedback is greater than the detection threshold [FA.27] within the detection time [FA.28], the AC drive considers it as a motor overspeed error and takes the corresponding action according to [FA.26]. The overspeed detection threshold of 100% corresponds to the maximum frequency. Range: FA.27: 0.0%~150.0% FA.28: 0.000s~2.000s	110.0%	○	0xA1B
FA.28	Overspeed Detection Time		0.050s	○	0xA1C
FA.29	Current Imbalance Detection Threshold 1	If the ratio of the maximum phase current to the minimum current is greater than FA.29/FA.31 and the holding time reaches FA.30/FA.32, the output unbalance fault E.oLF (FA.29=1404) is reported It is invalid when the threshold setting is less than 110.0%. FA.29/30 for SVC1 and FA.31/32 for vector control. FA.29/FA.31 Range: 0.0%~400.0%	180.0%	•	0xA1D
FA.30	Current Imbalance Detection Times 1		30	•	0xA1E
FA.31	Current Imbalance Detection Threshold 2		125.0%	•	
FA.32	Current Imbalance Detection Times 2		10	•	

		FA.30/FA.32 Range: 0~50			
FA.33~FA.36		Reserved			
FA.37	Failure Self-Recovery Times	Failure self-recovery times: 0: OFF Automatic reset function is off, and it can only be reset manually. 1~5: ON The function is on, and 1~5 is the number of times of self-recovery after failure (defined as the maximum number of times self-recovery is possible after each failure); During operation, the AC drive may be malfunctioned and stopped due to load fluctuation, grid voltage fluctuation and other accidental factors. To maintain system operation continuity, the AC drive is allowed to automatically reset and recover from operational issues such as overload, overcurrent, system anomalies, overvoltage, and undervoltage. The AC drive resumes operation at the speed tracking start method in the self-recovery process. If the AC drive does not successfully resume operation within the set number of times, fault protection is enabled, and the output is stopped and the fault recovery counting times are automatically cleared. It is recommended to set the number of fault self-recovery times to 1 as multiple consecutive fault restarts may cause damage to the AC drive. Whether or not to enable the output terminal action during fault self-recovery can be selected, see [F2.45~F2.47] for details.	0	○	
FA.38	Failure Self-Recovery Interval		1.0	○	

		Failure self-recovery interval: this parameter represents the wait time between an AC drive failure and each subsequent reset. **Note:** 1. This function is only valid for faults such as overload, overcurrent, system abnormality, overvoltage, and undervoltage during operation, and is invalid for other faults; 2. The AC drive will not be reset until the fault is cleared. **Note**: It is crucial to consider the start-up characteristics of mechanical equipment before operation, especially in cases where it cannot be started with load, or when the AC drive requires an immediate alert in the absence of output. Please use this feature with caution. Range of FA.37: 0~5 Range of FA.38: 0.1s~100.0s			
FA.39	Diagnostic Information during Fault	See the fault diagnosis code table for details	--	×	0xA27
FA.40	Fault Type	See the fault diagnosis code table for details	--	×	0xA28
FA.41	Operation Frequency during Fault	0.00Hz~Max. frequency	--	×	0xA29
FA.42	Output Voltage during Fault	0V~1500V	--	×	0xA2A
FA.43	Output Current during Fault	0.1A~2000.0A	--	×	0xA2B
FA.44	Bus Voltage during Fault	0V~3000V	--	×	0xA2C
FA.45	Module Temperature during Fault	0℃~100℃	--	×	0xA2D
FA.46	Fault Drive Status	**Ones-bit: Operation direction** 0: FWD 1: REV **Tens-bit: Operating status**	--	×	0xA2E

		0: Stop 1: Acceleration 2: Deceleration 3: Constant speed **Hundreds-bit: Reserved** **Thousands-bit: Reserved**			
FA.47	Input Terminal X Status during Fault	See the input terminal status figure	--	×	0xA2F
FA.48	Output Terminal Status during Fault	See the output terminal status figure	--	×	0xA30
FA.49	Previous Fault Type	See the fault diagnosis code table for details	--	×	0xA31
FA.50	Previous Fault Operation Frequency	0.00Hz~Max. frequency	--	×	0xA32
FA.51	Previous Fault Output Voltage	0V~1500V	--	×	0xA33
FA.52	Previous Fault Output Current	0.1A~2000.0A	--	×	0xA34
FA.53	Previous Fault Bus Voltage	0V~3000V	--	×	0xA35
FA.54	Previous Fault Module Temp.	0℃~100℃	--	×	0xA36
FA.55	AC Drive Status during Previous Fault	**Ones-bit: Operation direction** 0: FWD 1: REV **Tens-bit: Operating status** 0: Stop 1: Acceleration 2: Deceleration 3: Constant speed **Hundreds-bit: Reserved** **Thousands-bit: Reserved**	--	×	0xA37
FA.56	Input Terminal Status at Previous Fault	See the input terminal status figure	--	×	0xA38
FA.57	Output Terminal at Previous Fault	See the output terminal status figure	--	×	0xA39
FA.58	Previous two fault type	See the fault diagnosis code table for details	--	×	0xA3A
FA.59	Previous three fault type	See the fault diagnosis code table for details	--	×	0xA3B

6.10 Group FB: Step Acceleration/Deceleration

Code	Name	Description	Default	Property	Address
FB.00	Acceleration Section 1	0.1%~FB.02	10.0%	•	0xB00
FB.01	Step Acceleration Time 1	0.00s~30.00s	0.50s	•	0xB01
FB.02	Acceleration Section 2	FB.00~FB.04	20.0%	•	0xB02
FB.03	Step Acceleration Time 2	0.00s~30.00s	1.00s	•	0xB03
FB.04	Acceleration Section 3	FB.02~FB.06	30.0%	•	0xB04
FB.05	Step Acceleration Time 3	0.00s~30.00s	1.50s	•	0xB05
FB.06	Acceleration Section 4	FB.04~FB.08	40.0%	•	0xB06
FB.07	Step Acceleration Time 4	0.00s~30.00s	1.10s	•	0xB07
FB.08	Acceleration Section 5	FB.06~FB.10	50.0%	•	0xB08
FB.09	Step Acceleration Time 5	0.00s~30.00s	1.30s	•	0xB09
FB.10	Acceleration Section 6	FB.08~FB.12	60.0%	•	0xB0A
FB.11	Step Acceleration Time 6	0.00s~30.00s	1.50s	•	0xB0B
FB.12	Acceleration Section 7	FB.10~FB.14	80.0%	•	0xB0C
FB.13	Step Acceleration Time 7	0.00s~30.00s	3.40s	•	0xB0D
FB.14	Acceleration Section 8	FB.12~300.0%	100.0	•	0xB0E
FB.15	Step Acceleration Time 8	0.00s~30.00s	3.80s	•	0xB0F
FB.16	Deceleration Section 1	0.1%~FB.18	6.0%	•	0xB10
FB.17	Step Deceleration Time 1	0.00s~30.00s	2.00s	•	0xB11
FB.18	Deceleration Section 2	FB.16~FB.20	20.0%	•	0xB12

FB.19	Step Deceleration Time 2	0.00s~30.00s	2.00s	•	0xB13
FB.20	Deceleration Section 3	FB.18~FB.22	30.0%	•	0xB14
FB.21	Step Deceleration Time 3	0.00s~30.00s	1.50s	•	0xB15
FB.22	Deceleration Section 4	FB.20~FB.24	40.0%	•	0xB16
FB.23	Step Deceleration Time 4	0.00s~30.00s	1.50s	•	0xB17
FB.24	Deceleration Section 5	FB.22~FB.26	50.0%	•	0xB18
FB.25	Step Deceleration Time 5	0.00s~30.00s	1.50s	•	0xB19
FB.26	Deceleration Section 6	FB.24~FB.28	60.0%	•	0xB1A
FB.27	Step Deceleration Time 6	0.00s~30.00s	1.50s	•	0xB1B
FB.28	Deceleration Section 7	FB.26~FB.30	80.0%	•	0xB1C
FB.29	Step Deceleration Time 7	0.00s~30.00s	2.40s	•	0xB1D
FB.30	Deceleration Section 8	FB.28~300.0%	100.0%	•	0xB1E
FB.31	Step Deceleration Time 8	0.00s~30.00s	2.00s	•	0xB1F

6.11 Group FC: Multi-Segment Speed

Code	Name	Description	Default	Property	Address
FC.00	PLC Multi-Segment Speed 1	0.00Hz~600.00Hz	25.00Hz	•	0xC00
FC.01	PLC Multi-Segment Speed 2	0.00Hz~600.00Hz	5.00Hz	•	0xC01
FC.02	PLC Multi-Segment Speed 3	0.00Hz~600.00Hz	40.00Hz	•	0xC02
FC.03	PLC Multi-Segment Speed 4	0.00Hz~600.00Hz	40.00Hz	•	0xC03
FC.04	PLC Multi-Segment Speed 5	0.00Hz~600.00Hz	50.00Hz	•	0xC04
FC.05	PLC Multi-Segment Speed 6	0.00Hz~600.00Hz	40.00Hz	•	0xC05

FC.06	PLC Multi-Segment Speed 7	0.00Hz~600.00Hz	60.00Hz	•	0xC06
FC.07	PLC Multi-Segment Speed 8	0.00Hz~600.00Hz	20.00Hz	•	0xC07
FC.08	PLC Multi-Segment Speed 9	0.00Hz~600.00Hz	10.00Hz	•	0xC08
FC.09	PLC Multi-Segment Speed 10	0.00Hz~600.00Hz	20.00Hz	•	0xC09
FC.10	PLC Multi-Segment Speed 11	0.00Hz~600.00Hz	30.00Hz	•	0xC0A
FC.11	PLC Multi-Segment Speed 12	0.00Hz~600.00Hz	40.00Hz	•	0xC0B
FC.12	PLC Multi-Segment Speed 13	0.00Hz~600.00Hz	5.00Hz	•	0xC0C
FC.13	PLC Multi-Segment Speed 14	0.00Hz~600.00Hz	40.00Hz	•	0xC0D
FC.14	PLC Multi-Segment Speed 15	0.00Hz~600.00Hz	80.00Hz	•	0xC0E
FC.15~FC.45		Reserved			
FC.46	Antspeed Gear 1	0.00Hz~50.00Hz	3.00Hz	•	0xC2E
FC.47	Antspeed Gear 2	0.00Hz~50.00Hz	4.00Hz	•	0xC2F
FC.48	Antspeed Gear 3	0.00Hz~50.00Hz	5.00Hz	•	0xC30
FC.49	Antspeed Gear 4	0.00Hz~50.00Hz	6.00Hz	•	0xC31
FC.50	Antspeed Gear 5	0.00Hz~50.00Hz	7.00Hz	•	0xC32
FC.51	Antspeed Selection	0: For integrated tower crane (FC.46~FC.50) 1: Single drive antspeed 1 (Gear frequency*FC.52) 2: Single drive antspeed 2 (FC.53)	0	○	0xC33
FC.52	Antspeed	0.0%~100.0%	20.0%	•	0xC34
FC.53	Antspeed Frequency	0.00Hz~50.00Hz	5.00Hz	•	0xC35

6.12 Group FD: Communication Control

Code	Name	Description	Default	Property	Address
FD.00	Master/Slave selection	See Appendix II for details on Modbus communication when	0000	○	0xD00

		selecting a drive to be a master or slave. **Ones-bit: Modbus communication** 0: Slave The drive acts as a slave, and the address is determined by [FD.01]. At this time, the drive receives the command from the master on the communication network and according to the [FD.08] by which set whether to reply to data when selecting write operation. The delay time of reply instruction is determined by [FD.05]. 1: Master As a master, the drive sends the master data to the communication network by broadcasting commands, and all the slave computers receive the master commands. The master sends data by [FD.09]. **Tens-bit: Reserved** **Hundreds-bit: Reserved** **Thousands-bit: Reserved** Note: When the AC drive functions as the network master, all connected network slaves must also be VEICHI AC drives to ensure proper network integration. The master sends the broadcast data through the customized free protocol. 19200bps [FD.03] 0: Data format (N, 8, 1), no parity, data bit: 8, stop bit: 1			
FD.01	485 Communication Address	This parameter defines the communication address of the machine when it is used as a Modbus communication slave. This parameter is invalid if the	1	○	0xD01

FD.02	Communication Baud Rate	Ones-bit: Modbus communication 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps Tens-bit: CAN communication 0: 20K 1: 50K 2: 100K 3: 125K 4: 250K 5: 500K 6: 1M **Repower-up is required after modification** Tens- to thousands-bit: Reserved	0005	○	0xD02
FD.03	Modbus Data Format	0: (N, 8, 1) no parity, Data bits: 8 Stop bit: 1 1: (E, 8, 1) even parity, Data bit: 8 Stop bit: 1 2: (O, 8, 1) odd parity, Data bits: 8 Stop bit: 1 3: (N, 8, 2) no parity, Data bits: 8 Stop bit: 2 4: (E, 8, 2) even parity, Data bits: 8 Stop bit: 2 5: (O, 8, 2) odd parity, Data bits: 8 Stop bit: 2	0	○	0xD03
FD.04	Communication Ratio	The data in the communication address 0x2000 or 0x3000 sent from the host computer multiplied by this parameter is used as the communication	1.00	•	0xD04

FD.05	Modbus Response Delay	This parameter defines the interval time between the end of data reception and the end of sending response data to the host computer when the AC drive is used as a Modbus communication slave. If the response delay time is less than the system processing time, the	0ms	•	0xD05
FD.06	Modbus Timeout Time	If the interval between communications exceeds the timeout period, it's deemed a communication disconnection fault, with a disconnection	1.0s	•	0xD06
FD.07	Modbus Failure Processing	Modbus failure processing: 0: Timeout detection off The AC drive does not perform fault detection and always operates according to the last communication command. 1: Report error When the communication given command set by the AC drive does not receive the next frame command or any other communication command after the time set by [FD.06], the AC drive reports the fault E.074 and stops. 2: Report a warning and continue running When the AC drive operation command is given by the communication, after the duration set by [FD.06] is exceeded, and the AC drive still does not receive a new communication command, the AC drive reports the alarm A.074 and operates according to the last received communication command; 3: Forced stop	0000	•	0xD07

		After the communication given command set by the AC drive has exceeded the duration set by [FD.06] and the next frame command is still not received or there is no any other communication command, the AC drive stops according to the stopping mode.			
FD.08	Modbus Transmission	0: Write operation responds 1: Write operation does not	0	•	0xD08
FD.09	Master Sending Selection	It is the data that is sent to the slave when the AC drive is set as a Modbus communication master. At this point, the master AC drive sends a broadcast command, and all slaves will received the command sent by the master. The master can send up to 4 frames of data in polling mode, which correspond to the setting values of LED ones, tens, hundreds, and thousands bits, respectively. When it is set to invalid, no data is sent. **Ones-bit: The first group transmitting selection** 0: OFF 1: Master running command	000d	•	0xD09
FD.10	RS485 Configuration	0: As Modbus communication 1: As serial communication 2: Reserved	0	•	0xD0A
FD.11	Reserved				
FD.12	CAN Node No,	0~127 Set the node number, and repower-up after modification	0	•	0xD0C
FD.13	Reserved				

6.13: Group FE: Crane Function Parameters

Code	Name	Description	Default	Property	Address
FE.00	Low Speed Gear	0.00Hz~50.00Hz	15.00Hz	•	0xE00
FE.01	High Speed Gear	0.00Hz~50.00Hz	50.00Hz	•	0xE01
FE.02	Control Box	0.00Hz~50.00Hz	25.00Hz	•	0xE02
FE.03~FE.06		Reserved			
FE.07	Load Function	0: ON 1: OFF	0	•	0xE07
FE.08	Load Calibration	0: None 1: Empty cage calibration 2: With load calibration	0	○	0xE08
FE.09	Empty Cage Reference	0kg~2000kg	800kg	○	0xE09
FE.10	Empty Cage Reference Weight	0kg~500kg	70kg	○	0xE0A
FE.11	Load Calibration Weight	0kg~10000kg	2000kg	○	0xE0B
FE.12	Load Coefficient	0.0%~500.0%	150.0%	○	0xE0C
FE.13	Rated Load Capacity	0kg~10000kg	2000kg	○	0xE0D
FE.14	Load Display Coefficient	0.0%~150.0%	100.0%	○	0xE0E
FE.15	Load Alarm Coefficient	50.0%~200.0%	105.0%	○	0xE0F
FE.16	Pin Roll Disconnection	Ones-bit: Disconnection detection 0: OFF 1: Only detect 1# 2: Only detect 2# 3: ON Tens-bit: Brake failure protection 0: OFF 1: ON Hundreds-bit: Low input voltage voice prompt 0: OFF 1: ON Thousands-bit: Auto empty cage calibration 0: OFF	0	○	0xE10

		1: ON			
FE.17	Reserved				
FE.18	Power-on Voice	0~1000	0	○	0xE12
FE.19~FE.34		Reserved			
FE.35	Cyclic Test Mode	0: OFF 1: ON	0	•	0xE23
FE.36	Test Cumulative Runtime	0.0h~48.0h	4.0h	•	0xE24
FE.37	Test Run Cycle	0.0s~600.0s	30.0s	•	0xE25
FE.38	Test Motor Operation Mode	0%~100%	80%	•	0xE26
FE.39~FE.44		Reserved			
FE.45	Operating Acceleration Limit 1	0.0%~100.0%	30.0%	•	0xE2D
FE.46	Operating Acceleration Limit 2	0.0%~100.0%	20.0%	•	0xE2E
FE.47	Tower Jib Vibration Cycle	0.000s~50.000s	14.000s	○	0xE2F
FE.48	Stop Acceleration Limit 1	0.0%~100.0%	30.0%	•	0xE30
FE.49	Stop Acceleration Limit 2	0.0%~100.0%	20.0%	•	0xE31
FE.50	Accel./Decel. Coefficient 1	0.0%~1000.0%	200.0%	•	0xE32
FE.51	Accel./Decel. Coefficient 2	0.0%~1000.0%	70.0%	•	0xE33
FE.52	Accel./Decel. Coefficient 3	0.0%~1000.0%	75.0%	•	0xE34
FE.53	Accel./Decel. Coefficient 4	0.0%~1000.0%	100.0%	•	0xE35
FE.54	Stable Control Torque Threshold	0.0%~50.0%	2.0%	•	0xE36
FE.55	Stable Control Gain	Increase when there is rebound	8.00	•	0xE37

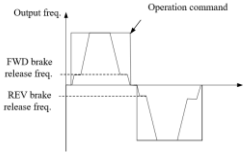
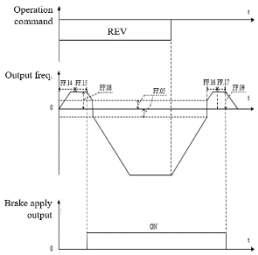
		during stop. Range: 0.00~50.00			
FE.56	Stable Control Frequency Limit	0.00Hz~20.00Hz	10.00Hz	•	0xE38
FE.57	Stop Frequency Base	Increase when there is rebound during stop. Keep at or below 1.00 Hz to prevent issues with long jog distance. Range: 0.00Hz~10.00Hz	0.50Hz	•	0xE39
FE.58	Stop Holding Frequency	0.00Hz~10.00Hz	0.00Hz	•	0xE3A
FE.59	Stop Frequency Holding Time	0.000s~60.000s	1.000s	•	0xE3B
FE.60	Min. Runtime for Hoist Transmission Ratio Identification	0.000s~30.000s	10.000s	○	0xE3C
FE.61	High Hoist Transmission Ratio Coefficient	0~65535	0	○	0xE3D
FE.62	Low Hoist Transmission Ratio Coefficient	0~65535	0	○	0xE3E
FE.63	Upper Limit Equivalent Rope Length	0.00m~25.00m	4.00m	○	0xE3F
FE.64	Rope Length Estimation 1	0.00m~300.00m	0.00m	○	0xE40
FE.65	Rope Length Estimation 2	0.00m~300.00m	0.00m	○	0xE41
FE.66	Lifting Weight Equivalent Rope Length	The height from the center of weight to the main hook. Range: 0.00m~20.00m	2.00m	•	0xE42
FE.67	Anti-swing Control	**Ones-bit: Anti-swing switch** 0: OFF 1: ON **Tens-bit: Fixed rope length** 0: OFF For OFF, anti-swing control will	0001	•	0xE43

		be performed with the rope length obtained from the hoisting drive. 1: ON For ON, the anti-swing control will be performed using the rope length set in FE.68. If the rope length is known, check the anti-swing performance here.			
FE.68	Fixed Rope Length	0.00m~300.00m	10.00m	•	0xE44
FE.69	Reserved				
FE.70	Decel. Optimization Function	0: OFF 1: ON	0	○	0xE46
FE.71	Lifter Linear Speed	1.0m/min~200.0m/min	34.0m/min	○	0xE47
FE.72	Frequency as Linear Velocity	1.00Hz~100.00Hz	50.00Hz	○	0xE48
FE.73	Decel. Stop Distance	0.000m~10.000m	0.400m	○	0xE49
FE.74	Decel. Optimization Mode	**Ones-bit: Greater than the lower limit holding frequency** 0: Segmented deceleration stop 1: Direct deceleration stop **Tens-bit: Less than the lower limit holding frequency** 0: Segmented deceleration stop 1: At FE.75 frequency **Hundreds-bit: Terminal for UP command when the upper limit position is valid** 0: Free stop 1: Deceleration stop **Thousand bits: DW function for lower limit position after deceleration** 0: ON, at FE.75 frequency 1: OFF, until it exits the lower limit position mode	1000	○	0xE4A
FE.75~FE.81		Reserved			
FE.82	Hoisting Control	**Ones-bit: Stable hoisting mode** 0: OFF 1: ON	0000	•	0xE52

		Tens-bit: Anti-snag mode 0: OFF 1: Report a fault [E.059] 2: Alarm and continue running [A.079] **Hundreds-bit: Reversed** **Thousands-bit: Constant power mode** 0: OFF 1: ON			
FE.83	Load Calculation Frequency	This code computes the load when the target frequency exceeds it, so as to achieve the current load torque. Range: 0.00Hz~50.00Hz	20.00Hz	○	0xE53
FE.84	Load Calculation Time	In stable hoisting and anti-snag control, it refers to the holding time of FE.90 [Tension Frequency]; in constant control, it refers to the holding time of FE.83 [Load Calculation Frequency]. Range: 0.000s~3.000s	0.500s	○	0xE54
FE.85	Light Load Torque	Define the working conditions of light load,100.0% corresponding to the rated motor torque. The frequency limit is FE.A3 when the load calculation torque is less than. Used for empty hook judgment in stable control. Range: 0.0%~50.0%	15.0%	•	0xE55
FE.86~FE.87		Reserved			
FE.88	Speed Change Threshold	0.00Hz~5.00Hz	2.00Hz	•	0xE58
FE.89	Reserved				
FE.90	Tension Frequency	Used for load judgment in stable hoisting and anti-snag control. Range: 0.00Hz~10.00Hz	3.00Hz	•	0xE5A
FE.91	Max. Frequency in	0.00Hz~120.00Hz	100.00Hz	•	0xE5B
FE.92	Tension Frequency	0.000s~20.000s	6.000s	•	0xE5C
FE.93	Max. Time for	0.000s~40.000s	15.000s	•	0xE5D

FE.94~FE.97		Reserved			
FE.98	Anti-snag Torque Increase	0.0%~100.0%	20.0%	•	0xE62
FE.99	Anti-snag Torque Change Rate Threshold	0.0%~100.0%	1.5%	•	0xE63
FE.A0	Anti-snag Detection Time	0.000s~20.000s	2.000s	•	0xE64
FE.A1	UP Hoisting Power Limit	0.0%~150.0%	90.0%	•	0xE65
FE.A2	DW Hoisting Power Limit	0.0%~150.0%	80.0%	•	0xE66
FE.A3	Hoisting Max. Frequency Limit	0.0%~300.0%	200.0%	•	0xE67
FE.A4	UP Power Coefficient in FVC	0%~120%	100%	•	0xE68
FE.A5	DW Power Coefficient in FVC	0%~120%	90%	•	0xE69
FE.A6	UP Power Coefficient in SVC	0%~120%	80%	•	0xE6A
FE.A7	DW Power Coefficient in SVC	0%~120%	70%	•	0xE6B
FE.A8	UP Detection in FVC	0%~100%	90%	•	0xE6C
FE.A9	DW Detection in FVC	0%~100%	80%	•	0xE6D
FE.b0	UP Detection in SVC	0%~100%	90%	•	0xE6E
FE.b1	DW Detection in SVC	0%~120%	80%	•	0xE6F

6.14 Group FF: Crane-Specific Parameter Group 2

Code	Name	Description	Default	Property	Address
FF.00	Application Type	0: Reserved 1: Single drive for lifter 2: Travel mechanism 3: Rotation mechanism 4: Lifting integrated machine 5: Hoisting mechanism 6: Reserved	5	○	0xF00
FF.01	Brake Control	**Ones-bit: Release torque condition** 0: Frequency reached 1: Frequency and current arrives at the same time 2: Output torque arrival (valid in vector control mode) **Tens-bit: Release torque direction** 0: Same as operation  1: Forward **Hundreds-bit: Apply torque direction** 0: Same as operation 1: Forward  **Thousands-bit: Reserved**	1001	○	0xF01
FF.02	Command Control	**Ones-bit: Reverse running command control**	0010	○	0xF02

		0: OFF REV is not allowed during operation. 1: ON REV is allowed during operation. **Tens-bit: Zero-crossing frequency jump** 0: OFF 1: ON Switching from forward to reverse jumps the frequency from forward FF.05 to reverse FF.05 and vice versa. During this, acceleration and deceleration times are [FF.73] and [FF.74], respectively. **Hundred digits: FDW/REV V/F curve separation** **0: OFF** Customize V/F curve up to [F8.01~F8.10]. **1: ON** The customized V/F curve for forward operation is determined by F8.01~F8.10; The customized V/F curve for reverse operation is determined by F8.25~F8.34; **Thousands-bit: Brake feedback** 0: Not enabled 1: Enable brake release feedback only 2: Enable brake apply feedback only 3: Enable both			
FF.03	Command Interval	After completing the braking and the time set in this parameter, the drive will respond to a running command received during braking and shutdown. Range: 0.00s~10.00s	0.30s	○	0xF03
FF.04	Brake Release Current Coefficient	0.0%~100.0%	20.0%	○	0xF04
FF.05	Zero-Crossing Jumping Frequency	0.00Hz~10.00Hz	1.00Hz	○	0xF05

FF.06	Forward Brake Release Frequency	0.00Hz~10.00Hz	2.00Hz	○	0xF06
FF.07	Forward Brake Apply Frequency	0.00Hz~10.00Hz	2.00Hz	○	0xF07
FF.08	Reverse Brake Release Frequency	0.00Hz~10.00Hz	2.00Hz	○	0xF08
FF.09	Reverse Brake Apply Frequency	0.00Hz~10.00Hz	2.00Hz	○	0xF09
FF.10	Pre-delay of Forward Brake	0.00s~1.00s	0.20s	○	0xF0A
FF.11	Post-delay of Forward Brake Release	0.00s~1.00s	0.10s	○	0xF0B
FF.12	Pre-delay of Forward Brake Apply	0.00s~1.00s	0.00s	○	0xF0C
FF.13	Post-delay of Forward Brake Apply	0.00s~1.00s	0.50s	○	0xF0D
FF.14	Pre-delay of Reverse Brake Release	0.00s~1.00s	0.20s	○	0xF0E
FF.15	Post-delay of Reverse Brake Release	0.00s~1.00s	0.10s	○	0xF0F
FF.16	Pre-delay of Reverse Brake Apply	0.00s~1.00s	0.00s	○	0xF10
FF.17	Post-delay of Reverse Brake Apply	0.00s~1.00s	0.30s	○	0xF11
FF.18	Lifting Function	**Ones-bit: Reserved** **Tens-bit: Reserved** **Hundreds-bit: Emergency stop alarm and fault display** 0: Display ON 1: Display OFF **Thousands-bit: reserved**	1100	○	0xF12
FF.19	Reserved	Range: 0.00Hz~10.00Hz	4.50Hz	○	0xF13
FF.20	Reserved	**Ones-bit: V/F release optimization** 0: OFF Others: ON	0000	○	0xF14

		Tens-bit: Independent modification for motor 0: OFF 1: ON			
FF.21~FF.24		Reserved			
FF.25	Output Abnormality Protection	While the drive runs, the output current is monitored. If it falls below [FF.26] (100% being the motor's rated current) for longer than [FF.27], an output abnormality is registered and a fault (E.063) is reported. FF.25 0: OFF 1: ON FF.26: 0%~50% FF.27: 0.000s~1.000s	1	○	0xF19
FF.26	Output Current Anomaly Detection Threshold		5%	○	0xF1A
FF.27	Output Current Abnormality Detection Time		0.400s	○	0xF1B
FF.28	Light Load Step-up Frequency	0: OFF 1: Up to current 2: Up to torque	0	○	0xF1C
FF.29	Load Calculation Time	0.000S~5.000s in anti-snag mode	1.000s	○	0xF1D
FF.30	UP Step-up Frequency Judgment Threshold	0.0%~80.0%	60.0%	○	0xF1E
FF.31	UP Step-up Frequency Upper Limit	0.00Hz~Max. frequency	65.00Hz	•	0xF1F
FF.32	DW Step-up Frequency Judgment Threshold	0.0%~80.0%	40.0%	○	0xF20
FF.33	DW Step-up Frequency Upper Limit	0.00Hz~Max. frequency	65.00Hz	•	0xF21
FF.34	Step-down Frequency up to Voltage	0: OFF 1: ON	0	○	0xF22
FF.35	Coefficient of Step-down Frequency up to Voltage	80%~100%	90%	○	0xF23
FF.36	Slewing Control 1	**Ones-bit: Flexible control**	1101	○	0xF24

		0: OFF 1: ON To address tower jib "stuttering" issue, see flexible control description for details. **Tens-bit: Flexible control accel./decel. time** 0: OFF 1: ON To address tower jib "stuttering" issue, see flexible control description for details. **Hundreds-bit: Slewing-specific acceleration/deceleration** 0: OFF 1: ON The accel. and decel. time of slewing is determined by parameter group FB. **Thousand-bits: Eddy-free frequency control** 0: OFF 1: ON			
FF.37	Flexible Control Start Deviation Frequency	0.00Hz~20.00Hz	1.00Hz	•	0xF25
FF.38	Flexible Control Direction Change Deviation Frequency	0.00Hz~20.00Hz	2.50Hz	•	0xF26
FF.39	Flexible Control Acceleration Time	0.00s~50.00s	20.00s	•	0xF27
FF.40	Flexible Control Deceleration Time	0.00s~50.00s	20.00s	•	0xF28
FF.41	Segmented Accel./Decel.	0.00Hz~Max. frequency	0.00Hz	•	0xF29
FF.42	Segmented Accel./Decel. Switching Frequency 2	0.00Hz~Max. frequency	0.00Hz	•	0xF2A
FF.43	Segmented Accel./Decel. Switching Frequency 3	0.00Hz~Max. frequency	0.00Hz	•	0xF2B

FF.44		Reserved			
FF.45	Eddy Frequency 1	0.00Hz~Max. frequency	20.00Hz	●	0xF2D
FF.46	Eddy Frequency 2	0.00Hz~Max. frequency	40.00Hz	●	0xF2E
FF.47	Eddy Frequency 3	0.00Hz~Max. frequency	40.00Hz	●	0xF2F
FF.48	Zero-Speed Duty Cycle	0.0%~100.0%	0.0%	●	0xF30
FF.49	Duty Cycle to Eddy Frequency 1	0.0%~100.0%	0.0%	●	0xF31
FF.50	Max. Duty Cycle at Stop	0.0%~100.0%	80.0%	●	0xF32
FF.51	Eddy Holding Time at Stop	0.0s~3000.0s	60.0s	○	0xF33
FF.52	Eddy Output Carrier	0.20kHz~4.00kHz	0.20kHz	○	0xF34
FF.53	Duty Cycle Polarity	0: Positive 1: Negative	1	●	0xF35
FF.54	Duty Cycle Change Rate at Stop	0.0%~50.0% Time unit is 100ms	0.5%	●	0xF36
FF.55	Brake Torque Detection	0: OFF 1: ON	1	○	0xF37
FF.56	Braking Torque Detection No.	0~10	3	○	0xF38
FF.57	Brake Torque Detection Torque	0.0%~150.0%	100.0%	○	0xF39
FF.58	Brake Torque Detection Frequency Threshold	0.00Hz~5.00Hz	2.00Hz	○	0xF3A
FF.59	Brake Torque Detection Filter Time	0.000s~2.000s	0.200s	○	0xF3B
FF.60	Brake Failure Protection	0: OFF 1: ON	1	○	0xF3C
FF.61	Brake Failure Protection Threshold	0.00Hz~5.00Hz	0.50Hz	○	0xF3D
FF.62	Brake Failure Protection Hold Time	0.0s~3000.0s	60.0s	○	0xF3E
FF.63	Brake Failure Filter Time	0.000s~2.000s	0.050s	○	0xF3F

FF.64	Brake Failure UP Frequency Limit	0.00Hz~100.00Hz	0.00Hz	•	0xF40
FF.65	Brake Failure Downward Frequency Limit	0.00Hz~100.00Hz	50.00Hz	•	0xF41
FF.66	Reserved	0.0%~200.0%	15.0%	•	0xF42
FF.67	Reserved	0.0%~200.0%	15.0%	•	0xF43
FF.68	Reserved	0.0%~100.0%	8.0%	•	0xF44
FF.69	Brake Apply Feedback Detection Delay	0.00s~5.00s	0.30s	•	0xF45
FF.70	Reserved	0~60000	0	•	0xF46
FF.71	PG Disconnection Detection Filter time	10ms~3000ms	50ms	○	0xF47
FF.72	PG Disconnection Detection Selection	**Ones-bit: A/B disconnection detection** 0: OFF 1: ON **Tens-bit: Z disconnection detection** 0: OFF 1: ON **Hundreds-bit: Reserved** **Thousands-bit: Reserved**	0001	○	0xF48
FF.73	Zero Crossing Jump Acceleration Time	0.00s~600.00s	0.01s	•	0xF49
FF.74	Zero Crossing Jump Deceleration Time	0.00s~600.00s	0.01s	•	0xF4A
FF.75	Stop Command Lock Frequency	0.00Hz~600.00Hz	6.00Hz	•	0xF4B
FF.76	Fan Stop Delay	0s~3600s	60s	•	0xF4C
FF.77	Slewing Pre-brake Frequency Threshold	When it is ON (the corresponding DI terminal number is set to 88 to which the slewing brake signal is connected), drive stops outputting in the case of given frequency is less than the value. Range: 0.00Hz~50.00Hz	5.00Hz	○	0xF4D
FF.78	Reserved	0.0%~200.0%	20.0%	•	0xF4E

FF.79	Reserved	0.0%~200.0%	50.0%	•	0xF4F
FF.80	Post-delay of Slewing Brake Apply	0ms~60000ms	1000ms	○	0xF50
FF.81	Bus Voltage Filter Depth	0~9	6	•	0xF51
FF.82	Lifting Undervoltage Point	0.0%~90.0%	72.0%	•	0xF52
FF.83	Buffer Resistor Bypass Delay	0ms~6000ms	1500ms	•	0xF53
FF.84	Tower Jib Length	Up to actual crane jib length. Range: 0m~200m	60	○	0xF54
FF.85	Slewing Acceleration Gain	Increase for longer acceleration time and jib length. Range: 50%~500%	110%	•	0xF55
FF.86	Slewing Deceleration Gain	Increase for longer deceleration time and jib length. Range: 50%~500%	90%	•	0xF56
FF.87	Slewing Control 2	**Ones-bit: Reserved** **Tens-bit: Reserved** **Hundredths-bit: REV gear for deceleration** 0: OFF 1: ON Set the deceleration time for slewing in REV gear in FF.97. **Thousands-bit: Eddy-free stable slewing control** 0: OFF Others: ON	4100	○	0xF57
FF.88~FF.89		Reserved			
FF.90	Starting Stable Frequency	0.00Hz~10.00Hz	6.00Hz	•	0xF5A
FF.91	Reserved	0.0%~200.0%	10.0%		
FF.92	Starting Stable Time	0ms~5000ms	1500ms	•	0xF5C
FF.93	Reserved				
FF.94	REV Gear Response Frequency	0.00Hz~10.00Hz	3.00Hz	•	0xF5E
FF.95	REV Gear Filter Time	0.000s~5.000s	1.500s	•	0xF5F

FF.96	REV Gear Torque Gain	0.0%~200.0%	80.0%	•	0xF60
FF.97	REV Gear for Deceleration Coefficient	If REV Gear for Deceleration is ON (FF.87 hundreds-bit=1), Actual decel. time=FF.97*Original decel. time. Range: 0.0%~100.0%	70.0%	•	0xF61
FF.98	Reserved	0.01s~50.00s	4.00s	•	0xF62
FF.99	Reserved	0.01s~50.00s	2.00s	•	0xF63
FF.A0	Stop Frequency Threshold	0.00Hz~20.00Hz	10.00Hz	•	0xF64
FF.A1	Stop Torque Threshold	0.0%~50.0%	10.0%	•	0xF65
FF.A2~FF.A5		Reserved			
FF.A6	Slewing Failure Brake Apply Delay	0.000s~50.000s	10.000s	•	0xF6A
FF.A7~FF.b9		Reserved			

7 Terminal Function

X	Description	X	Description	X	Description
0	No functions	32	Accel./decel. time selection terminal 1	53	Forward operation off
1	Forward operation	33	Accel./decel. time selection terminal 2	54	Reverse operation off
2	Reverse operation	34	Acceleration/ deceleration pause	55~79	Reserved
3	Three-wire operation (Xi)	35~39	Reserved	80	Weight alarm switch terminal
4	Forward jogging	40	Timer triggering terminals	81	Empty cage weighing correction terminal
5	Reverse jogging	41	Timer reset terminals	82	Brake torque detection
6	Free stop	42	Counter clock input terminal	83	Input phase loss detection blocked
7	Emergency stop	43	Counter reset terminal	84	Decel. optimization lower limit
8	Fault reset	44	DC brake command	85	Decel. optimization upper limit
9	External fault input	45	Pre-excitation command terminal	86	DO OFF delay interruption
10~12	Reserved	46~47	Reserved	87	Ant-speed (slow positioning) switch
13	Channel A to Channel B	48	Command channel to keyboard	88	Pre-brake for slewing
14	Combined frequency channel to A	49	Command channel to terminal	89	Lifting upper limit
15	Combined frequency channel to B	50	Command channel to communication	90	Anti-swing switch

16~19	Multi-segment speed terminal 1~4	51	Command channel to expansion card	91	Brake feedback
20~31	Reserved	52	Operation off		
Y	**Description**	**Y**	**Description**	**Y**	**Description**
0	No output	12	Zero-speed operation in progress	37	Slewing-specific brake control
1	Drive in operation	13~23	Reserved	38~40	Reserved
2	Drive in reverse operation	24	Dynamic brake in progress	41	X1 status mapping
3	Drive in forward operation	25	PG disconnection feedback	42	X2 status mapping
4	Fault trip alarm 1 (alarm during auto recovery from failure)	26	Emergency stop in progress	43	X3 status mapping
5	Fault trip alarm 2 (no alarm during auto recovery from failure)	27	Load warning output 1	44	X4 status mapping
6	Shutdown due to external faults	28	Load warning output 2	45	X5 status mapping
7	Drive undervoltage	29~32	Reserved	46	X6 status mapping
8	Drive ready for operation	33	Brake control	47	X7 status mapping
9	Output frequency level detection 1 (FDT1)	34	Input phase loss		
10	Output frequency level detection 2 (FDT2)	35	Brake failure protection in progress		

11	Given frequency reached	36	Insufficient brake torque error detection		

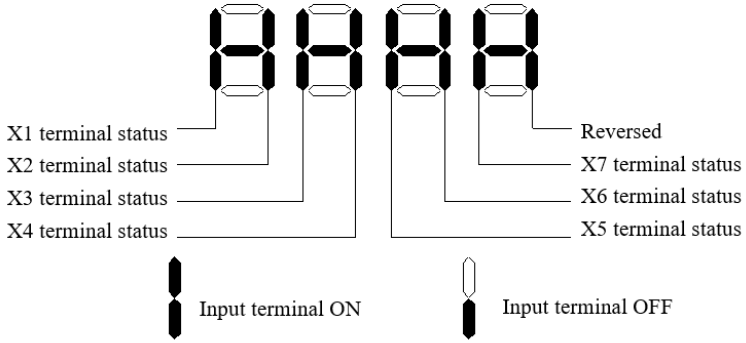
8 Monitoring Parameter

Enter Parameter group "C" by pressing PRG key for more than 2s to view the current status of the AC drive.

Code	Name	Definition	
C-00	Given Frequency	0.01Hz	2100H
C-01	Output Frequency	0.01Hz	2101H
C-02	Output Current	0.1A	2102H
C-03	Input Voltage	0.1V	2103H
C-04	Output Voltage	0.1V	2104H
C-05	Mechanical Speed	1RPM	2105H
C-06	Given Torque	0.1%	2106H
C-07	Output Torque	0.1%	2107H
C-08	Rope Length	0.1m	2108H
C-09	Reserved		2109H
C-10	Output Power	0.1%	210AH
C-11	Bus Voltage	0.1V	210BH
C-12	Module Temperature 1	0.1℃	210CH
C-13	Module Temperature 2	0.1℃	210DH
C-14	Input terminal X ON	See the input terminal status	210EH
C-15	Output terminal Y ON	See the output terminal	210FH
C-16	VS Value	0.001V	2110H
C-17	AI Value	0.001V/0.001mA	2111H
C-18	AS Value	0.001mA	2112H
C-19	Reserved		2113H
C-20	AO1	0.01V	2114H
C-21	AO2	0.01V/0.01mA/0.01kHz	2115H
C-22	Counter Value		2116H
C-23	Runtime	0.1h	2117H
C-24	Cumulative Runtime	Hour	2118H
C-25	Drive Power Rating	kW	2119H
C-26	Drive Rated Voltage	V	211AH
C-27	Drive Rated Current	A	211BH
C-28	Software Version		211CH
C-29	PG Feedback Frequency	0.01Hz	211DH
C-30	Decel. Optimization		211EH
C-31	Decel. Optimization	See the output terminal	211FH
C-32	Reserved		2120H
C-33	Reserved		2121H

C-34	Reserved		2122H
C-35	Reserved		2123H
C-36	Fault Alarm		2124H
C-37	Cumulative Power	1~9999	2125H
C-38	Cumulative Power	1~9999	2126H
C-39	Power Factor Angle	1	2127H

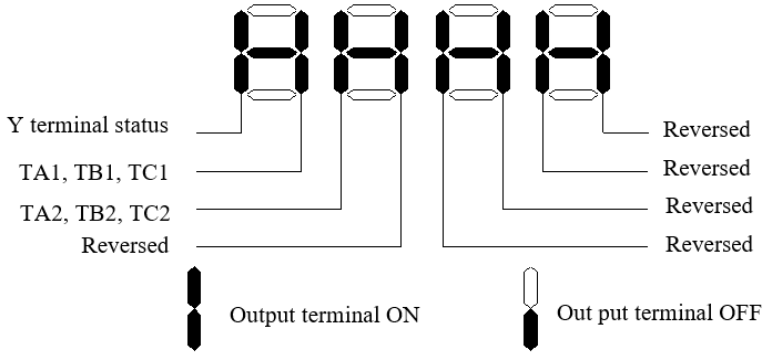
Input Terminal ON/OFF Status:



Input Terminal ON/OFF Status Schematic

Note: C-30 monitoring extended input terminal D0~D5 wiring diagram is the same as this, but only shows that the first six bits are valid.

Output Terminal X ON/OFF Status:



Output Terminal ON/OFF Status Schematic

9 Troubleshooting

This chapter details AC drive faults, alarms, errors in operation, display, and solutions, as well as minor problems due to AC drive and motor malfunctions and their remedies.

It also includes a debugging guide for the AC drive during trial operation.

9.1 Fault Type

Type	Response
Drive Fault	See the actions as below upon fault detected in the drive: ● Fault code appears on the keyboard; ● Drive output is cut off and the motor stops freely; ● With [F2.45] set to 4 (Fault trip alarm 1), Y outputs valid collector open circuit switch value; ● With [F2.46]/[F2.47] set to 4 (Fault Trip Alarm)1), TA1-TC1 and TA2-TC2T output closed passive switch value, TB1-TC1 and TB2-TC2 output disconnected passive switch value.
External Fault	In certain applications, external device fault signals are connected to the AC drive control system. If a multi-function input terminal is defined as an "external fault" for monitoring, protection, or control, the drive will enter "report fault and stop" mode when it detects a valid fault signal.

9.2 Fault Details

Display	Code	Name	Cause	Solution
	64	Undervoltage	● Supply voltage is too low; ● Circuit for detecting voltage is abnormal;	● Check the input power supply; ● Seek support from the manufacturer.
	10	Undervoltage in Operation	● Supply voltage is too low; ● The grid capacity is too low, or a large impact current is in the grid; ● The DC main contactor inside the drive is not closed.	● Check the input power supply; ● Improve the power supply system; ● Seek support from the manufacturer.

	7	Overvoltage in Acceleration	● Supply voltage fluctuation is above limit; ● Start a running motor;	● Check the grid voltage; ● Wait for the motor to stop completely before restarting, then set [F1.00] to 1 or 2.
	8	Overvoltage in Deceleration	● Deceleration time is set too short; ● Load potential energy or inertia is too large; ● Supply voltage fluctuation is above limit.	● Increase the deceleration time properly; ● Reduce load inertia, increase the drive capacity, or add a braking unit; ● Check the input power supply.
	9	Overvoltage in Constant Speed Operation	● Supply voltage fluctuation is above limit.	● Check the input power supply; ● Install an input reactor.
	28	Overvoltage during Stop	● Supply voltage fluctuation is above limit.	● Check the input power supply; ● Seek support from the manufacturer.
	4	Overcurrent in Acceleration	● Acceleration time is set too short; ● Start a running motor; ● V/F curve setting is not correct or the torque boost is too high; ● Drive capacity is low.	● Increase the acceleration time properly; ● Wait for the motor to stop completely before restarting, then set [F1.00] to 1 or 2. ● Reset V/F curve or torque boost; ● Choose a drive with matching capacity.
	5	Overcurrent in Deceleration	● Deceleration time is set too short; ● Potential energy load or load inertia is large; ● Drive capacity is low.	● Increase the deceleration time properly; ● Connect with a external brake resistor or braking unit; ● Choose a drive with matching capacity.
	6	Overcurrent in Constant Running	● Load changes suddenly; ● Grid voltage is low;	● Troubleshoot for the load change and address it; ● Check the input power supply.
	11	Motor Overload	● V/F curve setting is not suitable or the torque boost is too high; ● Grid voltage is low; ● Motor overload protection coefficient setting is improper; ● The motor is blocked during operation or the load is too heavy;	● Reset V/F curve or torque boost; ● Check the input power supply; ● F5.06/FA.16 setting is improper; ● Adjust the load, or choose a drive with matching capacity; ● Choose a specific motor for long-term low-speed operation.

			● The general-purpose motor runs at low speed for a long time.	
	12	Drive Overload	● Load is too large; ● Acceleration time is set too short; ● Start a running motor; ● V/F curve setting is not correct or the torque boost is too high.	● Choose a drive with matching capacity; ● Increase the acceleration time properly; ● Wait for the motor to stop completely before restarting, then set [F1.00] to 1 or 2. ● Reset V/F curve or torque boost.
	1	Abnormal System	● Acceleration time is set too short; ● The drive output is shorted between phases or to ground; ● Module damaged; ● Electromagnetic interference.	● Increase the acceleration time properly; ● Check peripheral equipment and restart after troubleshooting; ● Seek support from the manufacturer; ● Check system wiring, grounding, shielding, etc. and deal with them as required.
	16	Drive Overheat	● Working environment is overtemperature; ● Air duct is blocked; ● The fan connection plug-in is loose; ● Fan damaged; ● Temperature detection circuit is faulty.	● Ensure the drive's operating environment meets specifications; ● Clear the air duct; ● Check and reconnect; ● Replace with a fan with the same model; ● Seek support from the manufacturer.
	15	Rectifier Bridge Overheat	● Working environment is overtemperature; ● Air duct is blocked; ● The fan connection plug-in is loose; ● Fan damaged; ● Temperature detection circuit is faulty.	● Ensure the drive's operating environment meets specifications; ● Clear the air duct; ● Check and reconnect; ● Replace with a fan with the same model; ● Seek support from the manufacturer.

	20	Motor Detection Fault	● Motor detection timeout; ● Start static detection during motor operation; ● Motor and drive capacities are mismatched; ● The motor parameter setting is improper.	● Check motor connection; ● Detect after the motor stops completely; ● Detect after the motor stops completely; ● Change to a matching drive model; ● Reset according to the motor nameplate.
	21/69	Storage Failure	● With EMI during storage; ● EEPROM damaged.	● Re-enter the parameter and store it; ● Seek support from the manufacturer.
	30	Reserved		● An expanded error code.
	13/65	Input Phase Loss	● The drive's three-phase input power supply is out of phase.	● Check the three-phase input power supply voltage and the number of phases; ● Check the three-phase input power wiring.
	14	Output Phase Loss	● The drive's three-phase output power supply is out of phase.	● Check the three-phase output voltage and current; ● Check the motor wiring.
	E.Gnd	Output Grounding	● A part on the AC drive output side is short circuited to ground.	● Check the wiring, motor insulation.
	19	Current Detection Failure	● Abnormal detection circuit; ● Motor phase imbalance.	● Seek for technical support; ● Check the motor and the wiring.
	17	Drive External Error	● Protection action for external equipment failure.	● Check external equipment.
	E.PAn	Keyboard Connection Error	● Abnormal keyboard wiring; ● Damaged keyboard component.	● Check keyboard wring; ● Seek support from the manufacturer.
	18	RS485 Communication Abnormality	● Improper setting of baud rate; ● Communication wiring disconnected; ● Mismatched communication format with host.	● Set to a matching baud rate; ● Check communication wring; ● Set to a matching communication format.
	26	Parameter Copy Abnormality	● Parameter copy communication error; ● Abnormal keyboard wiring.	● Check the wring; ● Seek support from the manufacturer.

	E.ECF	Expansion card connection abnormality	● Communication timeout between the expansion card and drive. ● Mismatched expansion card and drive.	● Check the connector and reconnect it; ● Choose the specified expansion card.
	27	PG Card Connection Abnormality	● The connection between the PG card and the drive is abnormal.	● Check the wring.
 	29/66	PID Feedback Error	● Incorrect setting of PID disconnection warning upper limit; ● Incorrect setting of PID disconnection warning lower limit; ● PID feedback wiring abnormality; ● Feedback sensor malfunction; ● Feedback input circuit malfunction.	● Check the status of the sensor, and replace it if damaged; ● Correct the wiring; ● Check the setting of [FB.27] and [FB.28].
	31	Initial Position Angle Failure	● Check the motor parameter.	● Check the motor parameter; ● Retuning when the motor is still; ● Seek support from the manufacturer.
 	32/70	Excessive Speed Deviation	● Improper settings of detection time or threshold; ● Improper motor parameter settings.	● Check the motor parameters, and rerun auto-tuning; ● Check the settings of FA.24 and FA.25; ● Seek support from the manufacturer.
 	33/71	Stall Protection Error	● Improper settings of [FA.27]/[FA.28]; ● Improper motor parameter settings; ● Check Group F6 (vector control parameters).	● Check the motor parameters, and rerun auto-tuning; ● Check the settings of FA.27 and FA.28;
 	34/67	Load Protection 1	● Improper settings of detection time or threshold.	● Check the settings of FA.18 and FA.19;
	35/68	Load Protection 2	● Improper settings of detection time or threshold.	● Check the settings of FA.20 and FA.21.

				
	36	CPU Timeout	● CPU timer timeout.	● Seek support from the manufacturer.
E.042	42	PG Card AB Phase Disconnection	● Encoder phases A and B are disconnected.	● Check the wiring between encoder and PG card.
E.043	43	PG Card B-Phase Disconnection	● Disconnected encoder B-phase.	● Check the wiring between encoder and PG card.
E.044	44	PG Card A-Phase Disconnection	● Disconnected encoder A-phase.	● Check the wiring between encoder and PG card.
E.045	45	PG Card Z-Phase Disconnection	● Disconnected encoder Z-phase.	● Check the wiring between encoder and PG card.
E.061	61	Brake Failure Detection Error	● Insufficient brake torque.	● Check whether the brake torque is insufficient.
E.062	62	Pre-Brake Release Current/Torque Detection Error	● If the brake release detection current is below its judgment current, report this fault.	● Check whether the drive's motor parameters match the actual values; ● Check whether the drive's output to the motor is reliably wired.
E.063	63	In-Operation Current Detection Error	● The current in operation is less than FF.26.	● Check whether the drive's motor parameters match the actual values; ● Check whether the drive's output to the motor is reliably wired.

9.3 Fault Alarm

Display	Code	Name
A.072	72	Agent GPRS Lockout Alarm
A.073	73	Non-agent GPRS Lockout Alarm
A.074	74	485 Communication Alarm
A.075	75	PG Card AB Phase Disconnection
A.076	76	PG Card B-Phase Disconnection
A.077	77	PG Card A Phase Disconnection
A.078	78	Load Slipping from Hook
A.079	79	Weight Alarm

10 Accessory Selection

10.1 Braking Resistor Selection

For braking resistor selection, it requires considering the motor-generated power, influenced by factors like inertia, deceleration time, and potential energy load, as well as customers' specific needs. Higher system inertia, shorter deceleration times, and more frequent braking necessitate a braking resistor with higher power and lower resistance.

Drive model	Rated current	Brake unit	Hoisting mechanism resistor power	Rotary and luffing mechanism resistor power	Resistance	Set
AC70T-T3-R75-B	2.3A	Built-in	≥300W	≥150W	≥300Ω	1
AC70T-T3-1R5-B	3.7A	Built-in	≥750W	≥300W	≥250Ω	1
AC70T-T3-2R2-B	5A	Built-in	≥1.1kW	≥550W	≥200Ω	1
AC70T-T3-004-B	8.5A	Built-in	≥2kW	≥750W	≥120Ω	1
AC70T-T3-5R5-B	13A	Built-in	≥3kW	≥1.1kW	≥80Ω	1
AC70T-T3-7R5-B	17A	Built-in	≥4kW	≥1.5kW	≥65Ω	1
AC70T-T3-011-B	25A	Built-in	≥5.5kW	≥2.2kW	≥43Ω	1
AC70T-T3-015-B	32A	Built-in	≥7.5kW	≥3kW	≥32Ω	1
AC70T-T3-018-B	38A	Built-in	≥10kW	≥3.6kW	≥20Ω	1
AC70T-T3-022-B	45A	Built-in	≥11kW	≥4.4kW	≥18Ω	1

AC70T-T3-030-B	60A	Built-in	≥15kW	≥6kW	≥15Ω	1
AC70T-T3-037-B	75A	Built-in	≥19kW	≥7.4kW	≥12Ω	1
AC70T-T3-045-B	90A	Built-in	≥23kW	≥9kW	≥10Ω	1
AC70T-T3-055-B	110A	Built-in	≥28kW	≥11kW	≥8Ω	1
AC70T-T3-075-B	150A	Built-in	≥38kW	≥15kW	≥6Ω	1
AC70T-T3-090-B	180A	Built-in	≥23kW	≥9kW	≥12Ω	2
AC70T-T3-110	210A	BU30-3-100*2	≥28kW	≥11kW	≥10Ω	2
AC70T-T3-132	250A	BU30-3-100*2	≥33kW	≥13kW	≥9Ω	2
AC70T-T3-160	310A	BU30-3-100*2	≥40kW	≥16kW	≥8Ω	2
AC70T-T3-185	340A	BU30-3-100*2	≥45kW	≥18kW	≥7Ω	2
AC70T-T3-200	380A	BU30-3-100*2	≥48kW	≥20kW	≥6Ω	2

10.2 PG Card Selection

1. Overview

The AC70T series (vector-controlled AC drive) is equipped with various feedback cards to detect the motor speed and direction signal for precise control. Please select a suitable PG card according to the encoder.

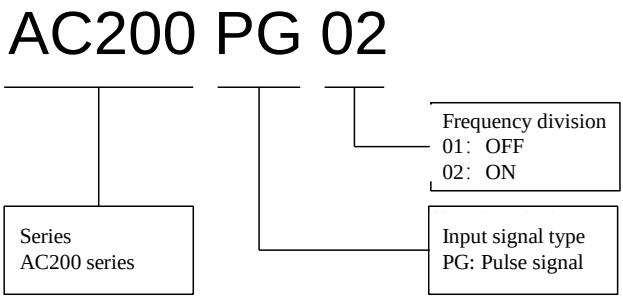
2. PG Card Selection and Classification

The AC200PG01/02 feedback card, mainly used in the QT series and AC70T series crane drives, offers motor speed and direction feedback in FVC mode, enhancing functions like lifting mechanism load slippage prevention.

PG card type	Encoder signal type	PG card output signal	Motor type
Incremental encoder PG card	1. Differential signal input 2. Collector signal input 3. Push-pull signal input	1. Open collector output (frequency division on/off) 2. Collector signal output (frequency division on/off)	AM/PM

3. PG Card Model

Model Description



Notice:

In China, encoders typically require 5V or 12V power supplies, while in some countries, encoders mostly require 5V. Please select the appropriate power supply according to the encoder model.

Resolution, defined as the pulse count per revolution from the encoder, should align with the intended design accuracy. Please set the frequency division function based on the pulse signal receiving frequency.

Choose the PG card output signal receiving device based on actual needs: OC output for PLC monitoring equipment, and differential output for specialized, interference-resistant applications.

Note:

The recommended model for incremental encoder PG card is PG01-ABZ-05-C1, please refer to the ordering notice for other products.

The recommended model for the rotary encoder PG card is PG01-RT, please refer to the ordering notice for other products.

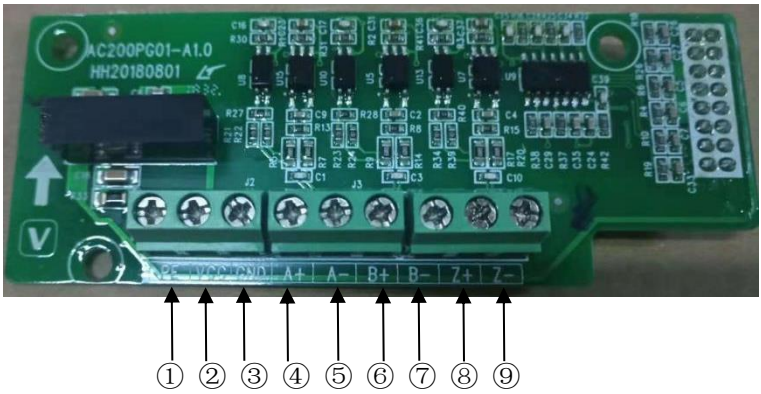
4. Incremental Encoder PG Card Use Guide

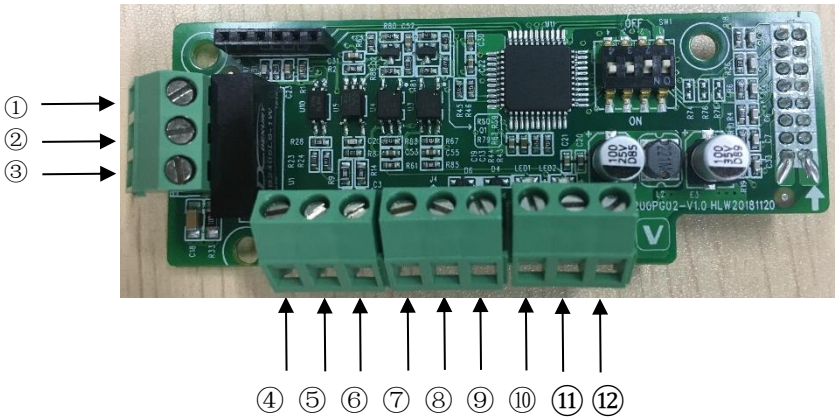
Technical specifications

Product Model	Supply	Function	Input signal characteristics		Output signal characteristics	
			Response frequency range	Input impedance	Output Frequency range	Output current
AC200PG01	5V±5% 200mA	Disconnection Detection	Differential 0kHz~80kHz	About 1kΩ	0kHz~80kHz,	≤100mA
AC200PG02		Disconnection Detection Frequency Dividing Output			0kHz~80kHz, Frequency dividable	

Terminal function introduction

The incremental encoder PG card terminal arrangement is shown as below:





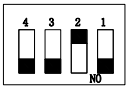
Main signal terminal function description

Definition	Name	Function
①	PE	Grounding
②	VCC	+5V output power supply (for encoder)
③	GND	Output signal power supply reference
④	A+	Differential input A+ signal
⑤	A-	Differential input A- signal
⑥	B+	Differential input B+ signal
⑦	B-	Differential input B- signal
⑧	Z+	Differential input Z+ signal
⑨	Z-	Differential input Z- signal
⑩	OA	OC frequency dividing output A
⑪	OB	OC frequency dividing output B
⑫	COM	OC frequency dividing output common reference

Note: The above description is for AC200PG01 and AC200PG02.

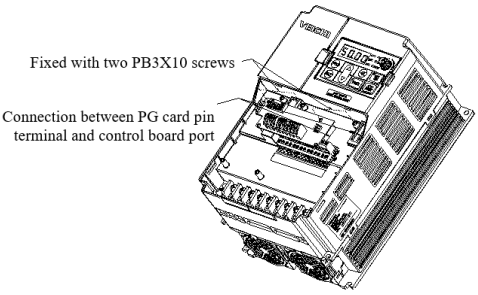
K5 DIP switch description (for AC200PG02 only): OFF-the shield ground off, ON-the shield ground on.

Terminal function selection description

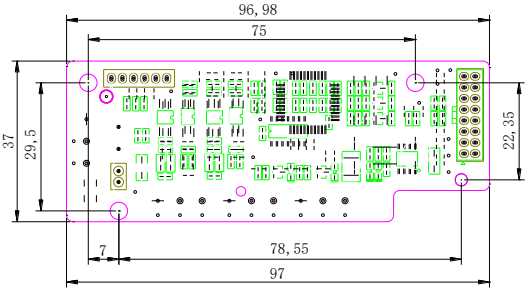
Function	Position	Illustration	Description
PG card signal frequency division coefficient selection terminal	SW1		fo=fi
			fo=fi/2
			fo=fi/4
			fo=fi/6
		...	
			fo=fi/28
			fo=fi/30

5. Installation and Dimensions

- Installation schematic



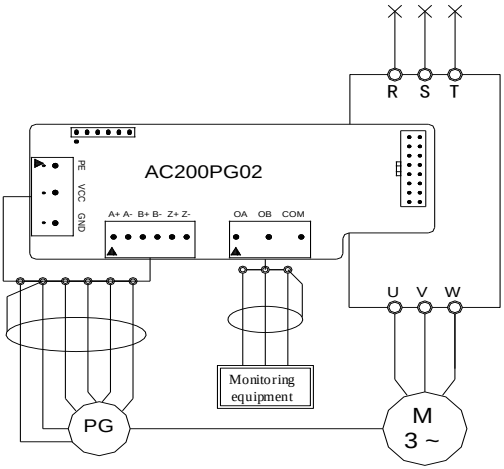
- Installation dimensions



6. Electrical Connection and Use Guide

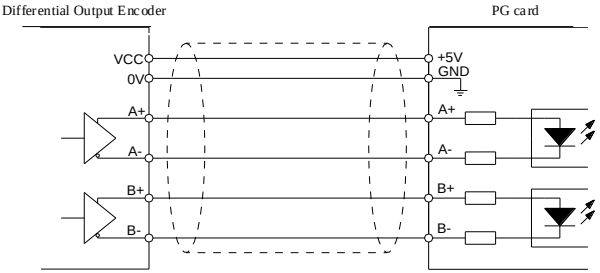
Electrical connection diagram

- Integrated Wiring Diagram



Integrated wiring diagram

- Wiring for application



Differential output encoder wiring

Use Guide

A. Install the PG card according to the “Installation schematic”;

B. Connect the PG card to the encoder according to “Electrical connection diagram”;

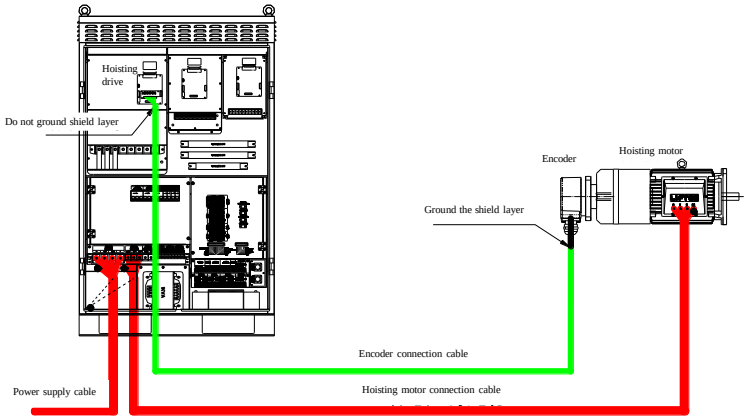
C. Set the drive related parameters according to the actual use. The following parameters are specifically addressed:

Code	Name	Description	Default	Property	Address
F0.00	Motor Control Mode	Asynchronous motor (AM) control: 0: SVC1 3: SVC2 4: FVC	0	○	0x000
F5.30	Speed Feedback or Encoder Type	**Ones-bit: Encoder type** Set the encoder type according to the actual setting of the selected encoder. 0: Common ABZ encoder 1: Rotary transformer (RT) **Tens-bit: Encoder direction** When the motor speed and the encoder speed detection direction are not consistent, change the direction by setting this parameter. 0: Same direction 1: Opposite direction **Hundreds-bit: Disconnection detection** With disconnection detection is ON, the AC drive will report an encoder fault and stops when the encoder is found disconnected. 0: OFF 1: ON **Thousands-bit: Z-pulse correction** 0: OFF 1: ON	0000	○	0x51E
F5.31	ABZ Encoder Line No.	Used to set the number of ABZ encoder lines, please	1024	○	0x51F

		set according to the sensor specifications. Range: 1~10000			
FF.71	PG Disconnection Detection Time	Range: 10ms~3000ms	50ms	○	0xF47
FF.72	PG Disconnection Detection Selection	**Ones-bit: A/B disconnection detection** 0: OFF 1: ON **Tens-bit: Z disconnection detection** 0: OFF 1: ON **Hundreds-bit: Reserved** **Thousands-bit: Reserved**	0001	○	0xF48

Gound Description

In FVC mode, the shield layer of encoder cable to the motor side should be grounded reliably, so as to shield feedback signals from EMI. But, do not ground the encoder cable shield to the drive PG card side (as illustrated below).



Appendix I: RS485 Communication

● Communication protocol

The AC70T series drive is equipped with RS485 communication interface as standard, and its communication adopts international standard Modbus protocol. Via PC/PLC or master AC drive, centralized control (which allows for AC drive commands setting, operational frequency setting, function parameters adjustment, and AC drive status and faults monitoring) can be realized to satisfy unique application requirements.

● Application mode

1. The AC70T series drive is connected to a "single-master multi-slave" control network with an RS485 bus. For a broadcast message sent by the master, the slaves will not reply (slave address is 0).

2. The AC70T series provides only RS485 interface for asynchronous half-duplex communication. If the communication port of external equipment is RS232, please add an RS232/RS485 converter.

3. Modbus protocol defines the content and format of asynchronous transmission in serial communication, which can be divided into RUT and ASCII mode. And the AC70T series is in RTU (Remote Terminal Unit) mode.

● Communication frame structure

The format of communication frame is shown below:

Byte components: start bit, 8 data bits, parity bit and stop bit.

Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Bit8	Parity bit	Stop bit

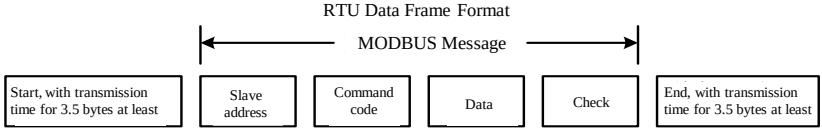
The entire message must be transmitted as as a continuous stream. If a silent interval of more than 1.5 bytes occurs before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message. Similarly, if a new message begins earlier than 3.5 character times following a previous message, the receiving device will consider it a continuation of the previous message. This will set an error, as the value in the final CRC field is not correct.

Standard structure of an RTU frame:

Frame header	Transmission time for 3.5 bytes
Slave address	Communication address:

	0~247 (0 is the broadcast address)
Command code	03H: Read slave parameters 06H: Write slave parameters 08H: Circuit self-detection
Data field	Parameter address, number of parameters, parameter value,
CRC CHK low byte	Check value: 16-bit CRC value
CRC CHK high byte	
End of the frame	Transmission time for 3.5 bytes

In RTU mode, a new frame requires to start with a transmission pause interval of at least 3.5 character. Then data fields are sent sequentially: slave address, command code, data, and CRC checksum, with each field's transmission byte in hex format, ranging from 0~9 and A~F. The network devices keep monitoring the network bus, even during the silent interval. After receiving the first field (address field), each device decodes the field to determine whether itself is the destination device. After the final byte of these words has been transmitted, there is a minimum of a 3.5-byte transmission pause interval to indicate the end of this frame. And a new message is sent after this interval.



● Command code and communication data description

Command code: 03H, it allows for reading N words, up to 5 words consecutively.

Example: If an AC drive with a slave address of 01H and a memory starting address of 2100H (C-00) that reads three consecutive words, the framing is described as follows:

RTU master command

START	Transmission time for 3.5 bytes
Slave address	01H
Command code	03H
Starting address high byte	21H
Starting address low byte	00H
No. of data high byte	00H
No. of data low byte	03H
CRC CHK low byte	0FH

CRC CHK high byte	F7H
END	Transmission time for 3.5 bytes

RTU slave response (normal)

START	Transmission time for 3.5 bytes
Slave address	01H
Command code	03H
Byte count low position	06H
Data address 2100H high position	13H
Data address 2100H low position	88H
Data address 2101H high position	00H
Data address 2101H low position	00H
Data address 2102H high position	00H
Data address 2102H low position	00H
CRC CHK low byte	90H
CRC CHK high byte	A6H
END	Transmission time for 3.5 bytes

RTU slave response (abnormal)

START	Transmission time for 3.5 bytes
Slave address	01H
Command code	83H
Fault code	04H
CRC CHK low byte	40H
CRC CHK high byte	F3H
END	Transmission time for 3.5 bytes

Command code: 06H, write one word.

Function: It allows for writing one word into the designated address, which can be used to modify the AC drive parameters.

Example: Write 5000 (1388H) to the address 3000H of the AC drive at slave address 1. The description for the fame format is as below:

RTU master command

START	Transmission time for 3.5 bytes
Slave address	01H

Command code	06H
Write data address high position	30H
Write data address low position	00H
Data content high byte	13H
Data content low byte	88H
CRC CHK low byte	8BH
CRC CHK high byte	9CH
END	Transmission time for 3.5 bytes

RTU slave response (normal)

START	Transmission time for 3.5 bytes
Slave address	01H
Command code	06H
Write data address high position	30H
Write data address low position	00H
Data content high byte	13H
Data content low byte	88H
CRC CHK low byte	8BH
CRC CHK high byte	9CH
END	Transmission time for 3.5 bytes

RTU slave response (abnormal)

START	Transmission time for 3.5 bytes
Slave address	01H
Command code	86H
Fault code	01H
CRC CHK low byte	83H
CRC CHK high byte	A0H
END	Transmission time for 3.5 bytes

Command code: 08H, circuit self-detection.

Function: It sends back the same slave response information as the command information of the master, which is applied to check whether the signal transmission between the master and the slave is normal or not. The check code and data can be set arbitrarily.

RTU master command

START	Transmission time for 3.5 bytes
Slave address	01H
Command code	08H
Check code high byte	00H
Check code low byte	00H
Data high byte	13H
Data low byte	88H
CRC CHK low byte	EDH
CRC CHK high byte	5DH
END	Transmission time for 3.5 bytes

RTU slave response (normal)

START	Transmission time for 3.5 bytes
Slave address	01H
Command code	08H
Check code high byte	00H
Check code low byte	00H
Data high byte	13H
Data low byte	88H
CRC CHK low byte	EDH
CRC CHK high byte	5DH
END	Transmission time for 3.5 bytes

RTU slave response (abnormal)

START	Transmission time for 3.5 bytes
Slave address	01H
Command code	88H
Fault code	03H
CRC CHK low byte	06H
CRC CHK high byte	01H
END	Transmission time for 3.5 bytes

Communication frame parity mode

Standard Modbus serial communication adopts two kinds of error checking methods. Parity check is for each characteristic and the Cyclical redundancy check (CRC) is for a frame.

1. Parity Check

Users can configure controllers for odd or even parity check, or for no parity check. This will determine how the parity bit is set in each character.

If either even or odd parity is specified, the quantity of "1 " bits will be counted in the data portion of each character (7 data bits for ASCII mode, or 8 for RTU). For example, the RTU character frame contains the following 8 data bits: 11000101.

And the total quantity of "1" is 4. If even parity is making sets the, the frame's parity bit will be a 0, making the total quantity of "1" remains 4. If odd parity check is making sets the, the frame's parity bit will be a 1, making the total quantity of "1" is 5.

If no parity bit is specified, no parity bit is transmitted and no parity check can be made. An additional stop bit is transmitted to fill out the character frame.

2. CRC-16 (Cyclical Redundancy Check)

In RTU mode, messages include an error–checking field that is based on a CRC method. The CRC field checks the contents of the entire message. The CRC field is two bytes, containing a 16–bit binary value. The CRC value is calculated by the transmitting device. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error results.

The CRC is started by first storing 0xFFFF. Then a process begins of applying successive 6–bit bytes of the message to the current contents of the register. Only the 8Bit data in each character is valid for CRC. Start and stop bits, and the parity bit are invalid.

During the generation of the CRC, each 8–bit character is exclusive ORed (XOR) with the register contents. Then the result is shifted in the direction of the least significant bit, with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (8^{th}) shift, the next 8–bit byte is exclusive ORed with the register's current value. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

This calculation of CRC adopts the international standard CRC checksum rule. When editing the CRC algorithm, users can refer to the relevant standard CRC algorithm to write a CRC calculation program that truly meets the requirements.

Here is a simple CRC function for user reference (programming in C language):

```
unsigned int crc_chk_value(unsigned char *data_value,unsigned char length)
{
unsigned int crc_value = 0xFFFF;
int i;
while (length--)
{
crc_value^=*data_value++;
for(i=0;i<8;i++)
{
if(crc_value&0x0001)
{
crc_value=(crc_value>>1)^0xa001;
}
else
{
crc_value=crc_value>>1;
}
}
}
return(crc_value);
}
```

● Data Address Definition

This section describes the communication data used to control the operation, status, and parameter setting of the AC drive.

A. AC70T Series Parameter Address Definition

The AC drive function parameter serial number is used as the register address, which is divided into two parts: the high byte and the low byte. The high byte indicates the serial number of the function parameter group, and the low byte indicates the serial number of the function parameter in the group, which needs to be converted to hexadecimal.

Address field high byte:

Parameter group	Corresponding first parameter address
F0 basic parameters	0x0000 (not stored in EEPROM)

	0x1000 (stored in EEPROM)
F1 motion control parameters	0x0100 (not stored in EEPROM) 0x1100 (stored in EEPROM)
F2 switch terminal parameters	0x0200 (not stored in EEPROM) 0x1200 (stored in EEPROM)
F3 analog terminal parameters	0x0300 (not stored in EEPROM) 0x1300 (stored in EEPROM)
F4 keyboard parameters	0x0400 (not stored in EEPROM) 0x1400 (stored in EEPROM)
F5 motor parameters	0x0500 (not stored in EEPROM) 0x1500 (stored in EEPROM)
F6 vector control parameters	0x0600 (not stored in EEPROM) 0x1600 (stored in EEPROM)
F7 torque control parameters	0x0700 (not stored in EEPROM) 0x1700 (stored in EEPROM)
F8 V/F control parameters	0x0800 (not stored in EEPROM) 0x1800 (stored in EEPROM)
F9 tension control parameters	0x0900 (not stored in EEPROM) 0x1900 (stored in EEPROM)
FA fault protection parameters	0x0A00 (not stored in EEPROM) 0x1A00 (stored in EEPROM)
FB process PID control parameters	0x0B00 (not stored in EEPROM) 0x1B00 (stored in EEPROM)
FC multi-speed, PLC and swing frequency parameters	0x0C00 (not stored in EEPROM) 0x1C00 (stored in EEPROM)
FD communication control parameters	0x0D00 (not stored in EEPROM) 0x1D00 (stored in EEPROM)
FE reserved	0x0E00 (not stored in EEPROM) 0x1E00 (stored in EEPROM)
FF reserved	0x0F00 (not stored in EEPROM) 0x1F00 (stored in EEPROM)
C monitoring parameters	0x2100
Communication control parameters	0X3000 or 0x2000

Note: There is a possibility of frequent rewriting of parameter values for communication. And the service life of EEPROM can be reduced due to excessive write operations. Users do not need to save specific function codes in communication mode; adjusting the values in the on-chip RAM is adequate for their requirements. The AC70T protocol dictates that for the write command (06H), if the highest bit in the function code's address field is 0, it is only written in AC drive's RAM, namely, data will not be stored in power loss, if the high nibble is 1, it is written to EEPROM, namely, data will be stored in power loss.

Take rewriting the function parameter [F0.14] as an example, if it is not stored in the EEPROM, the address is 000EH, and if it is stored in the EEPROM, the address is 100EH.

B. Communication Control Group Address

Function	Address	Description			R/W
Communication given frequency	0x3000 or 0x2000	0~32000 corresponds to 0.00Hz~320.00Hz			W/R
Communication given command	0x3001 or 0x2001	0000H: none			W
		0001H: forward operation			
		0002H: reverse operation			
		0003H: forward jogging			
		0004H: reverse jogging			
		0005H: deceleration stop			
		0006H: free stop			
		0007H: fault reset			
AC drive status	0x3002 or 0x2002	Bit0	0: stop	1: running	R
		Bit1	0: non-	1: accelerating	
		Bit2	0: non-	1: decelerating	
		Bit3	0: forward	1: reverse	
		Bit4	0: AC drive	1: AC drive faulty	
AC Drive fault code	0X3000 or 0x2003	Current fault code (see fault code table)			R/W
Communication given upper limit frequency	0X3004 or 0x2004	0~32000 corresponds to 0.00Hz~320.00Hz			W
Communication given torque	0X3000 or 0x2005	0~2000 corresponds to 0.0%~200.0%			W
Torque-controlled FWD max. frequency	0x3006 or 0x2006	0~32000 corresponds to 0.00Hz~320.00Hz			W
Torque-controlled REV max. frequency	0x3007 or 0x2007	0~32000 corresponds to 0.00Hz~320.00Hz			W
Communication given PID	0x3008 or 0x2008	0~1000 corresponds to 0.0%~100.0%			W

Communication given PID feedback	0x3009 or 0x2009	0~1000 corresponds to 0.0%~100.0%	W
Communication given tension	0x300A or 0x200A	0~Max. Tension [F9.04]	W
Communication given roll diameter	0x300B or 0x200B	0~Max. roll diameter [F9.12]	W
Communication given linear speed	0x300C or 0x200C	0~Max. linear speed [F9.26]	W
Communication given thickness	0x300D or 0x200D	0~Max. thickness [F9.38]	W

Slave Abnormal Response Code Description:

Error	Description
1	Command code error
2	Reserved
3	CRC parity error
4	Wrong address
5	Wrong data
6	Parameters cannot be changed during operation
7	Reserved
8	Drive busy (EEPROM storage in progress)
9	Parameter value overrun
10	Reserved parameters not for modification
11	Error in reading parameter bytes

Appendix II: EMC Compliance

The EMC product standard (EN 61800-3:2004) illustrates EMC requirements for AC drives.

Environment Classification:

First Environment: Domestic premises. This includes applications directly connected without intermediate transformers to a low-voltage power supply network for domestic purposes.

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

Drive Category:

Category C1: Drive with rated voltage below 1000V, intended for use in the first environment.

Category C2: Drive with rated voltage below 1000V, which is neither a plug-in device/socket nor a movable device. When used in the first environment, it must be installed and operated by professional personnel.

Note: The EMC standard IEC/EN 61800-3 no longer restricts the drIverson distribution, but defines use, installation and commission. Professionals or organizations tasked with installing or commissioning electrical drive systems must possess essential skills and knowledge of EMC.

AC70T series: Technical data

Category C3: Drive with rated voltage below 1000V, intended for use in the second environment and not applicable to the first environment.

Category C4: Drive with rated voltage over 1000V, or rated current no less than 400A, or intended for use in complex systems in the second environment.

For C2

Conducted disturbance limits adhere to the following standards:

1. Select the optional EMC filter according to "Peripheral Options" and install it according to the instructions in the EMC filter manual.
2. Select the motor and control cable according to the instructions in this manual.
3. Install the drive according to the method described in this manual.

This product may generate radio interference, requiring the additional mitigation measures.

For C3

The drive's interference resistance complies with IEC/EN 61800-3 standards for the second environment.

Conducted disturbance limits adhere to the following standards:

1. Select the optional EMC filter according to "Peripheral Options" and install it according to the instructions in the EMC filter manual.

2. Select the motor and control cable according to the instructions in this manual.

3. Install the drive according to the method described in this manual.

C3 drive cannot be used in a domestic low-voltage public grid. Otherwise, it will produce radio frequency electromagnetic interference.