Preface

Thank you for choosing **ARTENGO AT610 Compact Series AC Motor Drives**. This user manual presents a detailed description of AT610 series with respect to product features, structural characteristics, functions, installation, parameter setting, troubleshooting, etc. Make sure to read the safety precautions carefully before use, and use this product on the premise that personnel and equipment safety is ensured.

ARTENGO

ARTINGO ELECTRONIC INVERTER CO.

IMPORTANT NOTES
● Please assure the intactness of product enclosure and all safety covers before installation .Operation must conform to the requirements of this manual and local industrial safety regulations and/or electrical codes. ● Contents of this manual may be subject to appropriate modification as a result of product upgrade, specification change and update of the manual. ● In the event of damage or loss of user manual, users may ask local distributors, offices or our Technical Service Department for a new one. ● If any item as stated in this manual is not clear, please contact our Technical Service Department. ● If any anomaly occurs after power up or during the operation, it is essential to stop the machine and identify the fault or seek technical services as soon as possible.

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Chapter 1 Safety Precautions

Safety Precautions

Safety signs in this manual:

⚠ **WARNING**: indicates the situation in which the failure to follow operating requirements may result in fire or serious personal injury or even death.

⚠ **ATTENTION**: indicates the situation in which the failure to follow operating requirements may cause moderate or slight injury and damage to equipment.

Users are requested to read this chapter carefully when installing, commissioning and repairing this product and perform the operation according to safety precautions as set forth in this chapter without violation. ARTENGO bears no responsibility for any injury and loss as a result of any violation operation.

1.1 Safety Considerations

1.1.1 Prior to Installation

⚠ **WARNING**
● Do not touch control terminals, circuit boards and any other electronic parts and components with bare hands. ● Do not use the drive whose component(s) is/are missing or damaged. Failure to comply may result in more faults and/or personal injury even death.

⚠ **ATTENTION**
● Check if the product information indicated on the nameplate is consistent with the order requirements. If not, do not install it. ● Do not install the drive in the event that the packing list does not match the real equipment.

1.1.2 Installation

⚠ **WARNING**
● Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should plan or implement the installation. Failure to comply may result in equipment damage and/or personnel injury even death.

- This equipment must be mounted on metal or other flame retardant objects. Failure to comply may result in fire.
- This equipment must be mounted in an area which is away from combustibles and heat sources. Failure to comply may result in fire.
- This equipment must in no case be mounted in the environment exposed to explosive gases. Failure to comply may result in explosion.
- Never adjust mounting bolts of this equipment, especially the ones with red marks. Failure to comply may result in equipment damage.

ATTENTION

- Handle the equipment gently and take hold of its sole plate so as to avoid foot injury or equipment damage.
- Mount the equipment where its weight can be withstood. Failure to comply may result in equipment damage and/or personnel injury if falling happens.
- Make sure the installation environment conforms to the requirements as stated in Section 2.4. If not, de-rating is necessary. Failure to comply may result in equipment damage.
- Prevent drilling residues, wire ends and screws from falling into the equipment during installation. Failure to comply may result in faults or equipment damage.
- When mounted in a cabinet, this equipment should be provided with appropriate heat dissipation. Failure to comply may result in faults or equipment damage.

1.1.3 Run

WARNING

- Drives which have been stored for more than 2 years should be used with voltage regulator to gradually boost the voltage when applying power to the drives. Failure to comply may result in equipment damage.
- Be sure to implement the wiring as per requirements before applying power to the drive. Failure to comply may result in equipment damage and/or electric shock hazard.
- Be sure to confirm the completion and correctness of the drive wiring and close the cover before applying power to the drive. Do not open the cover after applying power. Failure to comply may result in electric shock hazard.
- After applying the power, never touch the drive and peripheral circuits no matter what state the drive is under, otherwise there will be electric shock hazard.
- Prior to running the drive, make sure there is no person in surrounding area who can reach the motor so as to prevent personal injury.
- When the drive is running, foreign bodies should be prevented falling into the equipment. Failure to comply may result in faults and/or equipment damage.
- Only qualified technicians familiar with adjustable frequency AC drives are allowed to

perform signal test during operation. Failure to comply may result in equipment damage and/or personal injury.

- Never change the drive parameters at will. Failure to comply may result in equipment damage.

ATTENTION

- Make sure the number of phases of power supply and rated voltage are consistent with product nameplate. If not, contact the seller or ARTENGO.
- Check there are no short circuits in peripheral circuits connected with the drive, and make sure the connection is tight. Failure to comply may result in equipment damage.
- Make sure the motor and associated machinery are within allowable range of service prior to operation. Failure to comply may result in equipment damage.
- Never touch fans, heat sink and braking resistor with bare hands. Failure to comply may result in equipment damage and/or personal injury.
- It is not allowed to start & stop the drive frequently via direct switching power on or off. Failure to comply may result in equipment damage.
- Make sure the drive is in a non-output status before switch-on/switch-off of the drive output and/or contactor. Failure to comply may result in equipment damage.

1.1.4 Maintenance

WARNING

- Only qualified technicians are allowed to implement the maintenance, and troubleshooting.
- Never implement the maintenance, and troubleshooting before power supply has been turned off and discharged completely. Failure to comply may result in equipment damage and/or personal injury.
- To avoid an electric shock hazard, wait at least 10 minutes after the power has been turned off and make sure the residual voltage of the bus capacitors has discharged to 0V before performing any work on the drive.
- After the replacement of the drive, be sure to perform the same procedures in strict accordance with the above-noted rules.

ATTENTION

- Do not touch the electric components with bare hands during maintenance, and troubleshooting. Failure to comply may result in component damage due to ESD.
- All pluggable components can be inserted or pulled out only when power has been turned off.

1.2 Other Considerations

1.2.1 Input Power Supply

This series of drives are not applicable to applications out the range of operating voltage as set forth in this manual. If necessary, please use booster to rise or drop the voltage to regulated voltage range.

This series of drives support common DC bus input. Users are suggested to consult ARTENGO technical personnel before use.

1.2.2 Surge Protection

This series of drives are furnished with surge suppressor that has certain resistance to lightning induction. However, users in areas where lightning occurs frequently need to mount an external surge suppressor in front of power input side of the drive.

1.2.3 Operation of Contactor

As to the configuration of peripheral devices recommended by this manual, it is necessary to mount a contactor between the power supply and input side of the drive. Such a contactor should not be used as a control device to start and stop the drive, as frequent charging & discharging shall reduce the service life of internal electrolytic capacitors.

When it is necessary to mount a contactor between the drive output and the motor, it should be ensured the drive is in a non-output status before switch-on/switch-off of such a contactor. Failure to comply may result in damage to the drive.

1.2.4 Output Filter

Since the drive output is PWM high frequency chopping voltage, mounting filter devices such as an output filter and an output AC reactor between the motor and the drive shall effectively reduce output noise, avoiding interference to other surrounding equipment.

If the length of cable between the drive and the motor exceeds 100m, an output AC reactor is recommended to use with the purpose of preventing drive fault as a result of overcurrent caused by excessive distributed capacitance. An output filter is optional depending on the field requirements.

Be sure not to mount phase-shifting capacitor or surge absorber at output side of the drive since this may cause damage to the drive as a result of over-temperature.

1.2.5 Insulation of the Motor

In view of the fact that the drive output is PWM high frequency chopping voltage accompanied by higher harmonics, the noise, temperature rise and vibration of the motor is higher compared with sinusoidal voltage. Particularly this debases motor insulation. Therefore, the motor should be subjected to insulation inspection before initial use or reuse after being stored for a long period of time. The motor in regular service should also be subjected to regular insulation inspection so as to avoid damage to the drive as a result of motor insulation damage. A 500V voltage mode mega-ohmmeter is recommended to use for the measurement of the motor insulation, during which, it is essential to disconnect the motor from the drive. Normally, the insulation resistance of the motor should be bigger than 5MΩ.

1.2.6 Derating

Due to the thin air in high-altitude areas, the radiating performance of the drive with forced air cooling may degrade while the electrolyte of electrolytic capacitors is more volatile, which can result in reduction in product life. Drive should be derated when used in an area at the altitude above 1000 meters. It is recommended to derate 1% for every 100m when the altitude is above 1000 meters.

Chapter 2 Product Information

2.1 Model Explanation

Model shown on product nameplate indicates the series name, applicable type of power supply, power class and the version of software and hardware, etc. via the combination of numbers, symbols and letters.

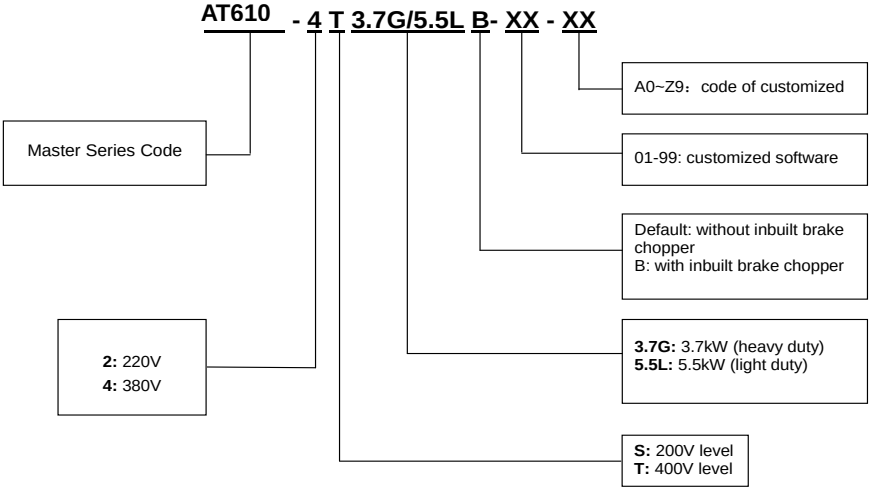


Fig. 2-1 Product model explanation

2.2 Nameplate Information

Fig. 2-2 Nameplate information

2.3 Information of Product Model

Table 2-1 Product model and technical data

AT610-2T□□□B single phase 220V

Drive model	Power rating (kW)	Rated output current (A)	Rated input current (A)	Applicable motor (kW)	Brake chopper
AT610-2S0.4B	0.4	2.6	5.5	0.4	Inbuilt
AT610-2S0.75B	0.75	4.5	9.2	0.75	
AT610-2S1.5B	1.5	7.5	18	1.5	
AT610-2S2.2B	2.2	10	23	2.2	

AT610-4T□□□G□□□L□ three phase 400V heavy duty/light duty

Drive model	Power rating (kW)	Rated output current (A)	Rated input current (A)	Applicable motor (kW)	Brake chopper
AT610-4T0.75G/1.5LB	0.75G	0.75	2.5	0.75	Inbuilt
	1.5L	1.5	3.8	1.5	
AT610-4T1.5G/2.2LB	1.5G	1.5	3.8	1.5	
	2.2L	2.2	4.8	2.2	
AT610-4T2.2G/3.7LB	2.2G	2.2	5.5	2.2	
	3.7L	3.7	8.0	3.7	
AT610-4T3.7G/5.5LB	3.7G	3.7	9	3.7	
	5.5L	5.5	11	5.5	
AT610-4T5.5G/7.5LB	5.5G	5.5	13	5.5	
	7.5L	7.5	16	7.5	
AT610-4T7.5G/11LB	7.5G	7.5	17	7.5	
	11L	11	21	11	

2.4 Technical Features of AT610

Table 2-2 Technical Features of AT610

Power input	Rated input voltage & frequency	Single phase: 220V 50/60Hz
		Three phase: 380V 50/60Hz
	Voltage range	220V voltage level: 170V~240V; 380V voltage level: 330V~440V; Continuous voltage fluctuation ±10%, short fluctuation -15%~+10%,

		Voltage out-of-balance rate <3%; i.e. 200V: 170V~240V, 380V: 330V~440V
	Rated current (A)	3-phase: 0~ rated input voltage, error < ±3%
	Output frequency (Hz)	0.00~ 600.00Hz; unit: 0.01Hz
	Overload capacity	150% - 1min, 180% - 10s, 200% - 0.5s every 10 min
Control Features	V/f patterns	V/f control Sensor-less vector control 1 Sensor-less vector control 2 Synchronous motor sensor-less vector control
	Range of speed regulation	1:100 (V/f control, sensor-less vector control 1) 1:200 (sensor-less vector control 2, synchronous motor sensor-less vector control)
	Speed accuracy	±0.5% (V/f control) ±0.2% (sensor-less vector control 1 & 2, synchronous motor sensor-less vector control)
	Speed fluctuation	±0.3% (sensor-less vector control 1 & 2, synchronous motor sensor-less vector control)
	Torque response	< 10ms (sensor-less vector control 1 & 2, synchronous motor sensor-less vector control)
	Starting torque	0.5Hz: 180% (V/f control, sensor-less vector control 1) 0.25Hz: 180% (sensor-less vector control 2, synchronous motor sensor-less vector control)
Basic Functions	Start frequency	0.00~600.00Hz
	Accel/ Decel time	0.00~60000s
	Switching frequency	0.7kHz~16kHz
	Frequency setting	Digital setting + keypad ∧/∨ Digital setting + terminal UP/DOWN potentiometer Communication Analog setting (AI1) Terminal pulse setting
	Frequency setting	Started from starting frequency DC brake start-up Flying start
	Motor start-up methods	Ramp to stop Coast to stop Ramp stop + DC brake
		Brake chopper working voltage:

	Motor stop methods	220V voltage level: 325~375V; 380V voltage level: 650~750V
		Service time: 0.0~100.0s
	DC brake capacity	DC brake start frequency: 0.00~600.00Hz DC brake current: 0.0~100.0% DC brake time: 0.0~30.00s
	Input terminals	4 digital inputs, one of which can be used for high-speed pulse input, and compatible with active open collectors NPN, PNP and dry contact input. 1 analog input, voltage/current programmable
	Output terminals	1 digital output 1 relay output
		1 analog output, voltage/current output programmable; can output signals such as frequency setting, or output frequency, etc.
Features	Parameter copy, parameter backup, common DC bus, free switchover between two motors' parameters, flexible parameter displayed & hidden, various master & auxiliary setting and switchover, flying start, a variety of Accel/Decel curves optional, automatic correction of analog, brake control, 16-step speed control programmable (2-step speed supports flexible frequency command), wobble frequency control, fixed length control, count function, three history faults, over excitation brake, over voltage stall protection, under voltage stall protection, restart on power loss, skip frequency, frequency binding, four kinds of Accel/Decel time, motor thermal protection, flexible fan control, process PID control, simple PLC, droop control, autotuning, field-weakening control, high-precision torque restraint, V/f separated control.	
Environ-ment	Place of operation	Indoors, no direct sunlight, free from dust, corrosive gases, flammable gases, oil mist, water vapor, water drop or salt, etc.
	Altitude	0-2000m. De-rate 1% for every 100m when the altitude is above 1000 meters
	Ambient temperature	-10℃-40℃. The rated output current should be derated 1% for every 1℃ when the ambient is 40℃-50℃
	Relative humidity	0~95%, no condensation
	Vibration	Less than 5.9m/s^2 (0.6g)
	Storage temperature	-40℃~+70℃
Others	Efficiency	At rated power≥93%
	Installation	Wall-mounted, din-rail
	IP Grade	IP20
	Cooling method	Forced air

2.5 Appearance, Mounting Dimensions and Weight

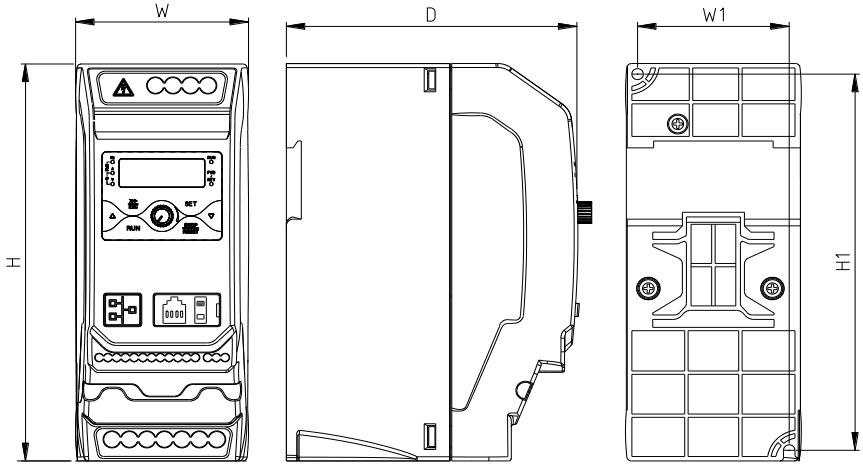


Fig. 2-3 Parts drawing

Table 2-3 Appearance, Mounting Dimensions and Weight

Model	External and installation dimensions (mm)						Weight (kg)
	W	H	D	W1	H1	Mounting hole dia	
AT610-2S0.4B	75	180	133	66	170.5	5	1.1
AT610-2S0.75B							
AT610-2S1.5B							
AT610-2S2.2B							
AT610-4T0.75G/1.5LB							
AT610-4T1.5G/2.2LB							
AT610-4T2.2G/3.7LB							
AT610-4T3.7G/5.5LB							
AT610-4T5.5G/7.5LB	100	224.5	152.5	88	214.5	5	1.8
AT610-4T7.5G/11LB							

Chapter 3 Installation and Wiring

3.1 Installation Environment

1) Ambient temperature should be in the range of -10℃~ 50℃.
2) Drive should be installed on surface of flame retardant object, with adequate surrounding space for heat dissipation.
3) Installation should be performed where vibration is less than 5.9m/s^2 (0.6g).
4) No moisture and direct sunlight.
5) Do not install in areas with grease dirt, dust, metal particles, or salty substances
6) Do not expose to an atmosphere with flammable gases, corrosive gases, explosive gases or other harmful gases.
7) During installation, avoid dropping drilling residues, wire ends, and screws into the inverter; otherwise it may cause the inverter to malfunction or be damaged.
8) For occasions where the on-site installation environment is very harsh (such as the textile industry with a lot of fly, the chemical industry with corrosive gas, etc.), it is recommended to install the radiator outside the cabinet.

3.2 Minimum Mounting Clearances

To ensure favorable heat dissipation, mount the drive upright on a flat, vertical and level surface as per Fig. 3.1.

When being installed inside of the cabinet, the inverter shall be mounted side by side to the greatest extent while adequate surrounding space shall be preserved for favorable heat dissipation.

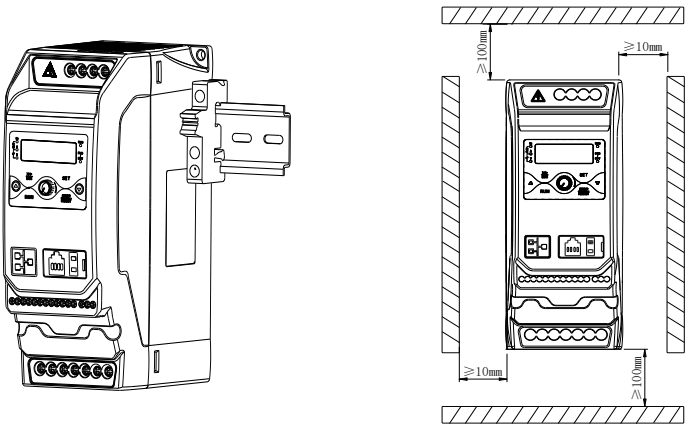


Fig. 3-1 Minimum mounting clearance of AT610

ATTENTION:

If several drives are mounted in one cabinet, parallel side-by-side mounting is recommended.

3.3 Selection of Peripheral Devices

Table 3-1 Selection of peripheral devices

Model		Circuit breaker (A)	Contactor (A)	Brake resistor /Brake chopper*	
				Power (W)	Resistance (Ω)
AT610-2S0.4B		16	10	70	≥35
AT610-2S0.75B		25	16	70	≥35
AT610-2S1.5B		32	25	260	≥35
AT610-2S2.2B		40	32	260	≥35
AT610-4T0.75G/1.5LB	0.75G	10	9	150	≥67
	1.5L	10	9		
AT610-4T1.5G/2.2LB	1.5G	10	9	300	≥67
	2.2L	10	9		
AT610-4T2.2G/3.7LB	2.2G	10	9	400	≥67
	3.7L	16	12		
AT610-4T3.7G/5.5LB	3.7G	16	12	500	≥67
	5.5L	20	18		
AT610-4T5.5G/7.5LB	5.5G	20	18	550	≥50
	7.5L	32	25		
AT610-4T7.5G/11LB	7.5G	32	25	550	≥50
	11L	40	32		

* The selection of the braking resistor needs to be determined according to the power rating of the motor in the actual application system, and is related to the system inertia, deceleration time, and the energy of the potential energy load, and user needs to choose according to the actual situation.

3.4 Terminal Configuration

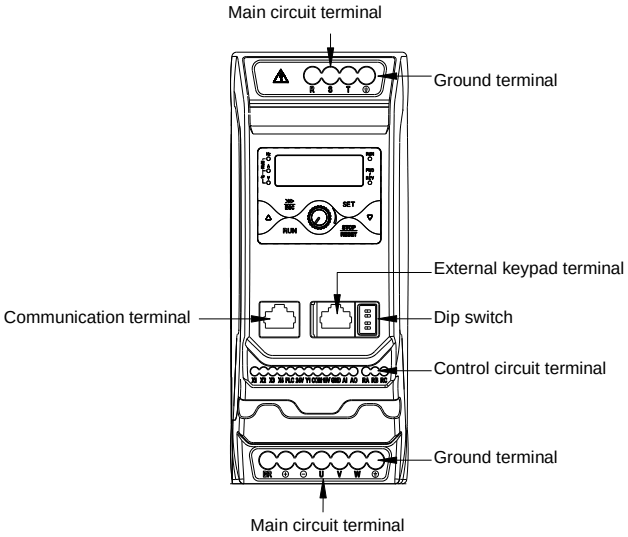


Fig. 3-2 Terminal Configuration

3.5 Main Circuit Terminals and Wirings

⚠ WARNING

- Only qualified personnel familiar with AC motor drives are allowed to implement wiring. Failure to comply may result in equipment damage and/or personnel injury even death.
- Wiring should be in strict accordance with this manual, otherwise hazard of electric shock or equipment damage exists.
- All wiring operations and lines should comply with EMC and national and local industrial safety regulations and/or electrical codes. The conductor diameter should be in accordance with recommendations of this manual. Otherwise, hazard of equipment damage, fire, and/or personnel injury exists.
- Since leakage current of the drive may exceed 3.5mA, for safety's sake, the drive and the motor must be grounded so as to avoid hazard of electric shock.
- Be sure to perform wiring in strict accordance with the drive terminal marks. Never connect three-phase power supply to output terminals U, V and W. Failure to comply will result in equipment damage.
- Only mount braking resistors at terminals ⊕ and BR when need. Failure to comply will result in equipment damage.
- Signal wires should be far away from main power lines to the best of possibility. If this cannot be ensured, vertical cross-arrangement shall be implemented, otherwise interference noise to control signal may occur.
- If motor cables are longer than 50m, it is recommended output AC reactor be used. Failure to comply may result in faults.

ATTENTION

- Signal wires should to the best of possibility be away from main power lines. In the event that this cannot be ensured, vertical cross arrangement should be adopted, reducing EMI interference to the signal wires as much as possible.
- In case the motor cable exceeds 50m, an appropriate output reactor should be mounted.

3.5.1 Main Circuit Terminals

Fig. 3-3 Terminal Name Explanation

Terminal marks	Specification
R, S, T	Uniphase/Triphase AC power supply input (connect to R& T terminals when the input is uniphase)
BR , ⊕	Brake resistor wiring terminals
⊕ , ⊖	DC power supply input terminals
U, V, W	Triphase AC output terminals
⏚	Ground terminal PE

3.5.2 Terminal Screw and Wiring Requirement

Fig. 3-4 Terminal screw and wiring requirement

Model	Power terminal			Ground terminal		
	Cable (mm^2)	Screw	Cable (mm^2)	Screw	Cable (mm^2)	Screw
AT610-2S0.4B	2.5	M3.5	8.05±0.5	2.5	M3.5	8.05±0.5
AT610-2S0.75B	2.5	M3.5	8.05±0.5	2.5	M3.5	8.05±0.5
AT610-2S1.5B	4	M3.5	8.05±0.5	2.5	M3.5	8.05±0.5
AT610-2S2.2B	6	M3.5	8.05±0.5	4	M3.5	8.05±0.5
AT610-4T0.75G/1.5LB	2.5	M3.5	8.05±0.5	2.5	M3.5	8.05±0.5
AT610-4T1.5G/2.2LB	4	M3.5	8.05±0.5	4	M3.5	8.05±0.5
AT610-4T2.2G/3.7LB	6	M3.5	8.05±0.5	4	M3.5	8.05±0.5
AT610-4T3.7G/5.5LB	6	M3.5	8.05±0.5	6	M3.5	8.05±0.5
AT610-4T5.5G/7.5LB	6	M3.5	8.05±0.5	4	M3.5	8.05±0.5
AT610-4T7.5G/11LB	6	M3.5	8.05±0.5	6	M3.5	8.05±0.5

3.6 Control Terminal Wiring

Warning

- Wiring should be in strict accordance with this manual, otherwise hazard of electric shock or equipment damage exists.
- Make sure input power supply has been completely disconnected before wiring operation. Failure to comply will result in personnel injury even death.

- All wiring operations and lines should comply with EMC and national and local industrial safety regulations and/or electrical codes. The conductor diameter should be in accordance with recommendations of this manual. Otherwise, hazard of equipment damage, fire, and/or personnel injury exists.
- Screws or bolts for terminal wiring must be screwed tightly.
- AC 220V signal is prohibited from connecting to other terminals than control terminals RA, RB and RC.

ATTENTION

- Signal wires should to the best of possibility be away from main power lines. If this cannot be ensured, vertical cross arrangement should be adopted, reducing EMI interference to the signal wires as much as possible.

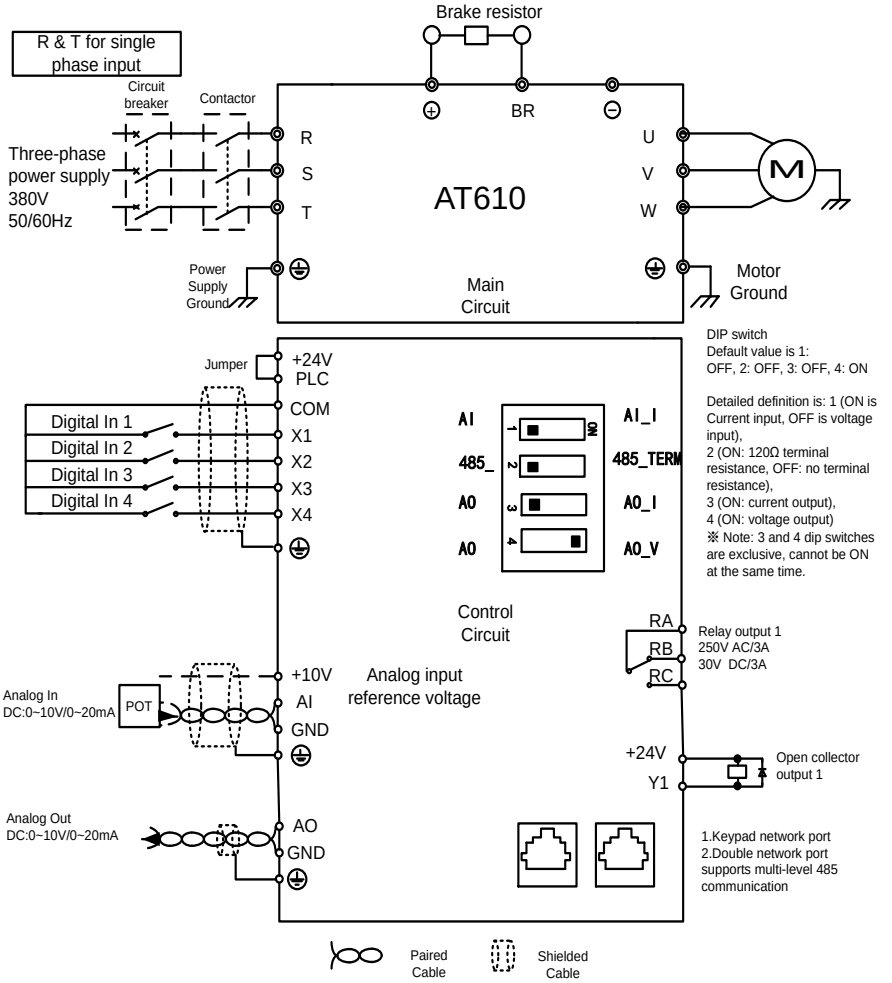


Fig. 3-5 Wiring diagram

3.7 Control Terminal Specification

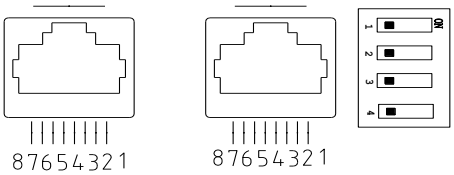
Table 3-2 Control terminal specification

Category	Terminal	Terminal designation	Specification
Analog input	+10V	Analog input reference voltage	Maximum output current 5mA

Category	Terminal	Terminal designation	Specification
			The resistance of external potentiometer should be larger than 2kΩ
	GND	Analog ground	Isolated from COM interiorly
	AI	Analog input	0~20mA: input impedance 500Ω, maximum input current 25mA; 0~10V: input impedance 22kΩ, maximum input voltage 10V; Switch on control board for jumping from 0~20mA and 0~10V, factory default: 0~10V
Analog output	AO	Analog output	0~20mA: impedance 200Ω~500Ω 0~10V: input impedance ≥10kΩ, Switch on control board for jumping from 0~20mA and 0~10V, factory default: 0~10V
	GND	Analog ground	Isolated from COM interiorly
Digital input	+24V	+24V	24V±10%, Isolated from GND interiorly Maximum load: 200mA
	PLC	Digital input Common terminal	Used for switching between high and low levels, short-circuited with +24V when delivery, i.e. low value of digital input valid
	COM	+24V ground	Isolated from GND interiorly
	X1~X3	Digital input Terminals 1~3	Input: 24VDC, 5mA Range of frequency: 0~200Hz Range of voltage: 10V~30V
	X4	high-speed pulse input	Pulse input: 0.1Hz~20kHz Range of voltage: 10V~30V
Digital output	Y1	Open collector output	Range of voltage: 0~24V; Range of current: 0~50mA
Relay output	RA/RB/RC	Control board relay output	RA-RB: NC; RA-RC: NO
			Contact capacity: 250VAC/3A, 30VDC/3A
Communication 485 terminal	CN6/CN7	Communication 485	Standard network cable, maximum communication distance 3M recommended

3.7.1 485 Communication terminal definition

Pin	Signal Definition
1	+5V
2	GND
3	485+
4	485-
5	485+
6	485-
7	GND
8	+5V



Attention:
The pin definitions of the two network ports are the same. If connecting to a 120Ω terminal resistor is needed, turn the DIP switch No. 2 to the ON side; a common network cable can be used to connect, and shielded network cables are highly recommended.

3.8 Control terminal description

3.8.1 Control terminal orders

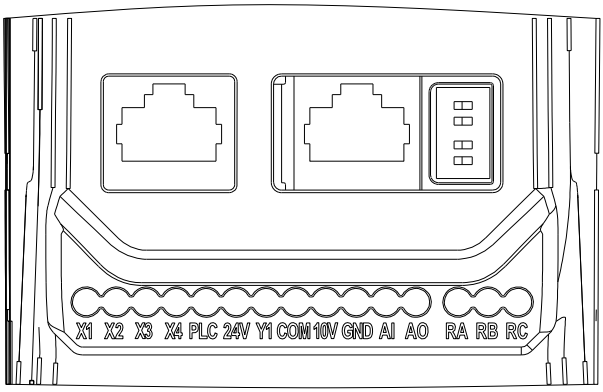


Fig. 3-6 Control terminal orders

3.8.2 Terminal screw and wiring specification

Table 3-3 Terminal screw and wiring specification

Cable type	Cable requirement (mm^2)	Screw	Torque (kgf·cm)
Shielded cable	1.0	M2	2.3±0.5

3.8.3 Instructions of Analog Input/Output Terminals

Being particularly vulnerable to noise, analog input & output signals cables should be as short as possible, shielded, and their shielded layers should be properly grounded close to the side of drive. The cables should not exceed 20m.

Control cables shall be kept no less than 20cm away from main circuit and strong current lines (e.g. power lines, motor lines, relay lines and contactor lines) and should not be arranged in parallel with strong current lines. In case it is inevitable to intersect strong current line, vertical wiring is recommended to avoid drive faults as a result of noise.

Where analog input & output signals are severely interfered, the side of analog signal source should be provided with filter capacitor or ferrite core.

3.8.4 Instructions of Digital Input/Output Terminals

Digital input & output signals cables should be as short as possible, shielded, and their shielded layers should be properly grounded close to the side of drive. The cables should not exceed 20m. When active drive is selected, take necessary filtering measures against power crosstalk, for which dry contact control is recommended.

Control cables shall be kept no less than 20cm away from main circuit and strong current lines (e.g. power lines, motor lines, relay lines and contactor lines) and should not be arranged in parallel with strong current lines. In case it is inevitable to intersect strong current line, vertical wiring is recommended to avoid drive faults as a result of noise. Operating instructions for switching value input terminal.

➢ **Instructions of digital input terminal**

◆Dry Contract

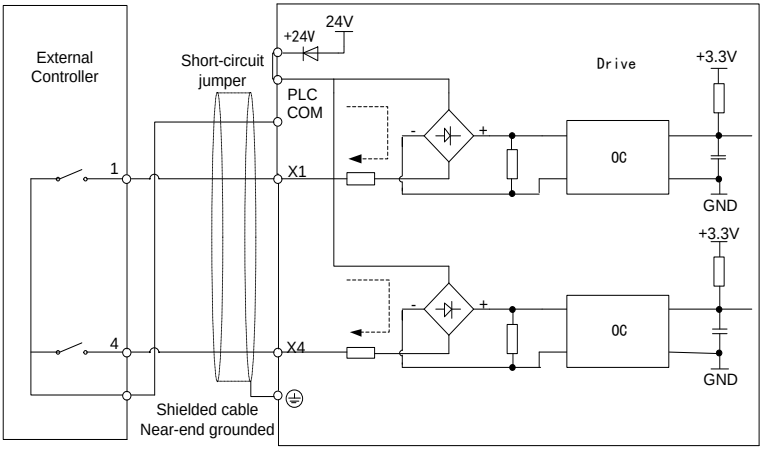


Fig 3-5 *Internal power supply dry contact*

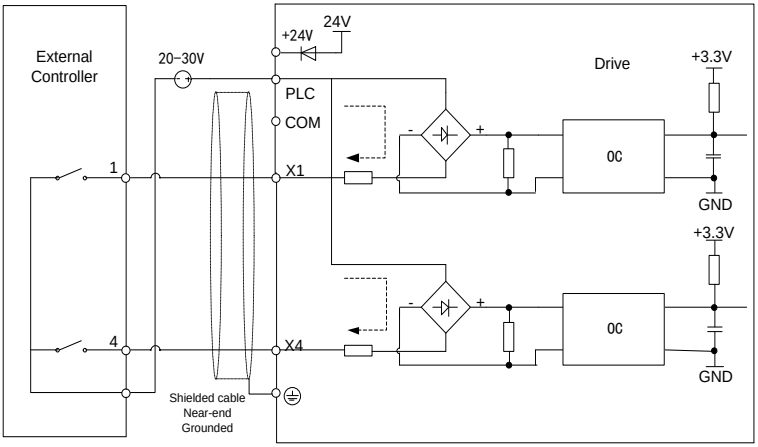


Fig. 3-7 *External power supply dry contact*

🕮 ATTENTION:

- When external power supply is used, the jumper between +24V and PLC must be removed. Otherwise, it may result in equipment damage.
- The voltage range of external power supply should be DC20~30V. Otherwise, normal operation could not be assured and/or result in equipment damage.

◆ Open collector NPN connection

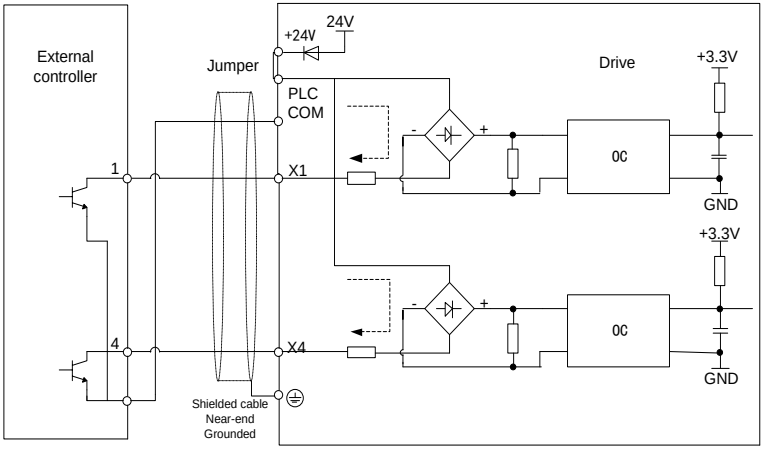


Fig. 3-8 *Internal power supply open collector NPN connection*

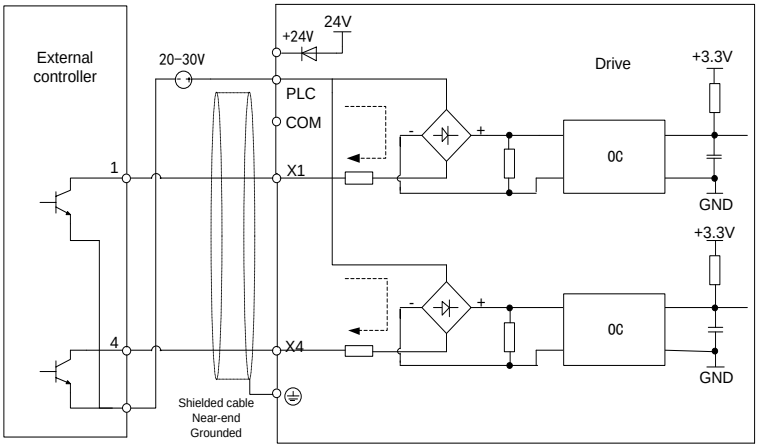


Fig. 3-9 *External power supply open collector NPN connection*

ATTENTION:

When external power supply is used, the jumper between +24V and PLC must be removed. The voltage range of external power supply should be between DC20 and 30V, otherwise normal operation could not be assured and/or hazard of equipment damage exists.

◆ **Open collector PNP connection**

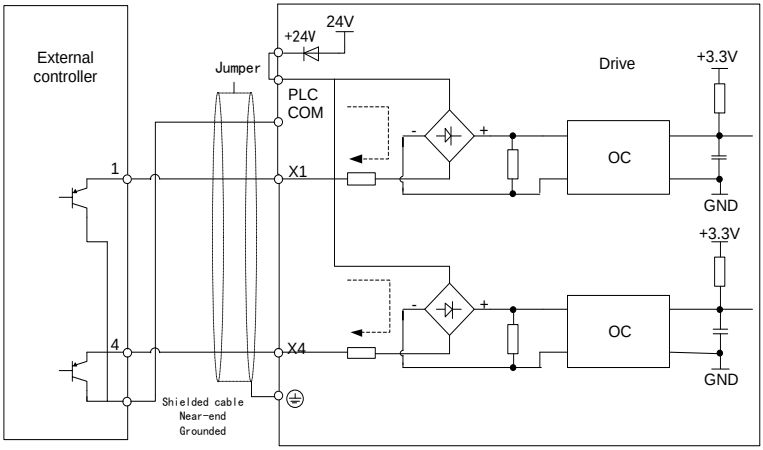


Fig. 3-10 *Internal power supply open collector PNP connection*

ATTENTION:

When PNP connection is adopted, it is a must to remove the jumper between +24V and PLC, and connect the jumper to PLC and COM.

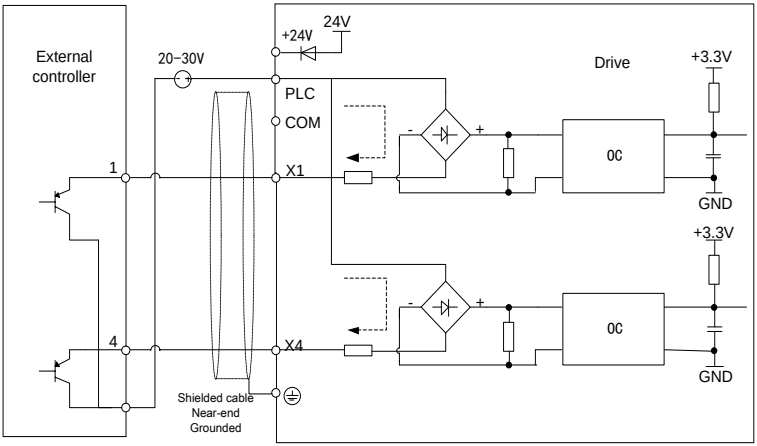


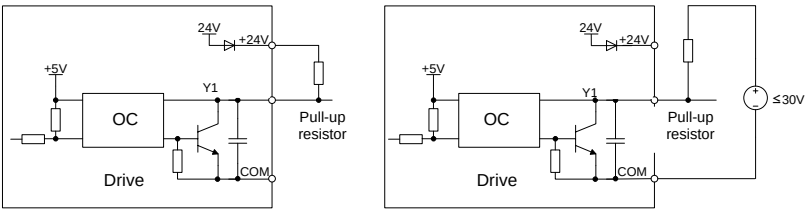
Fig. 3-11 *External power supply open collector PNP connection*

📖 **ATTENTION:**

When external power supply is used, the jumper between +24V and PLC must be removed. The voltage range of external power supply should be DC20~30V. Otherwise, normal operation could not be assured and/or hazard of equipment damage exists.

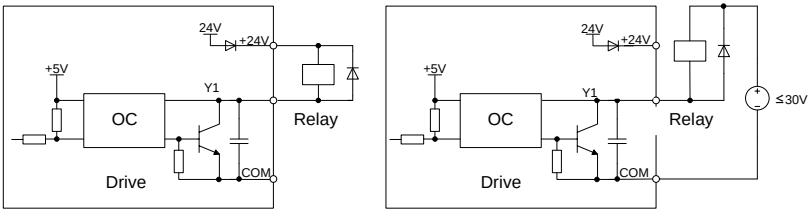
- **Instructions of digital output terminal**

◆ **Instructions of Y1 output terminals**



a) Internal power supply b) External power supply

Fig. 3-12 *Wiring when Y1 output with pull-up resistor*



a) Internal power supply b) External power supply

Fig. 3-13 *Y1 drive replay*

📖 **ATTENTION:**

When relay coil voltage is lower than 24V, a resistor as voltage divider should be mounted between relay and output terminal, based on coil impedance.

◆ **Wiring instruction of relay output terminal**

Control board of AT610 series drive is provided with a group of programmable relay dry contact outputs. RA/RB/RC are relay contacts. RA and RB are normally closed, while RA and

RC are normally open. See parameter C1-02 for details.

ATTENTION:

In case inductive load (e.g. electromagnetic relay or contactor) is to be driven, a surge voltage absorbing circuit such as RC absorbing circuit (note that its leakage current shall be less than holding current of controlled contactor or relay), piezoresistor or fly-wheel diode etc. shall be mounted (be sure to pay close attention to polarity in case of DC electromagnetic circuit). Absorbing devices should be mounted close to the ends of relay or contactor.

3.9 EMI Solutions

Due to its working principle, the drive will inevitably produce certain noise that may influence and disturb other equipment. Moreover, since the internal weak electric signal of drive is also susceptible to the interference of drive itself and other equipment, EMI problems shall be inevitable. In order to reduce or avoid the interference of drive to external environment and protect drive against interference from external environment, this section makes a brief description of noise abatement, ground handling, leakage current suppression and the application of power line filters.

3.9.1 Noise Abatement

When peripheral equipment and drive share the power supply of one system, noise from the drive may be transmitted to other equipment in this system via power lines and result in misoperation and/or faults. In such a case, the following measures could be taken:

- Mount input noise filter at input terminal of the drive;
- Mount power supply filter at power input terminal of affected equipment;
- Use isolation transformer to isolate the noise transmission path between other equipment and the drive.

As the wiring of peripheral equipment and the drive constitutes a circuit, the unavoidable earthing leakage current of the drive will cause equipment misoperation and/or faults. Disconnect the grounding connection of equipment may avoid this misoperation and/or faults

Sensitive equipment and signal lines shall be mounted as far away from the drive as possible. Signal lines should be provided with shielded layer and reliably grounded. Alternatively, signal cable could be put into metallic conduits between which the distance shall be no less than 20cm, and shall be kept as far away from the drive, its peripheral devices, and cables as possible. Never make signal lines in parallel with power lines or bundle them up.

Signal lines must orthogonally cross power lines if this cross is inevitable. Motor cables shall be placed in thick protective screen like more than 2mm-thick pipelines or buried in cement groove, also, power lines can be put into metallic conduit and grounded well with shielded cables.

Use 4-core motor cables of which one is grounded at close side of the drive and the other side is connected to motor enclosure.

Input and output terminals of the drive are respectively equipped with radio noise filter and linear noise filter. For example, ferrite common mode choke can restrain radiation noise of power lines.

3.9.2 Grounding

Recommended ground electrode is shown in the figure below:

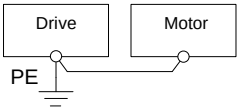


Fig. **3-14** *Grounding*

Use to the fullest extent the maximum standard size of grounding cables to reduce the impedance of grounding system.

Grounding wires should be as short as possible. Grounding point shall be as close to the drive as possible.

One wire of 4-core motor cables shall be grounded at the drive side and connected to grounding terminal of motor at the other side. Better effect will be achieved if motor and drive are provided with dedicated ground electrodes.

When grounding terminals of various parts of system are linked together, leakage current turns into a noise source that may influence other equipment in the system, thus, grounding terminals of the drive and other vulnerable equipment should be separated. Grounding cable shall be kept away from inlet & output of noise-sensitive equipment.

3.9.3 Leakage Current Suppression

Leakage current passes through the line-to-line and ground distributed capacitors at input & output sides of drive, and its size is associated with the capacitance of distributed capacitor and the switching frequency. Leakage current is classified into ground leakage current and line-to-line leakage current.

Ground leakage current not only circulates inside drive system, but may also influence other equipment via ground loop. Such a leakage current may result in malfunction of RCD and other equipment. The higher the switching frequency of drive is, the bigger the ground leakage current will be. The longer the motor cables and the bigger the parasitic capacitance are, the bigger the ground leakage current will be. Therefore, the most immediate and effective method for suppression of ground leakage current is to reduce the switching frequency and minimize the length of motor cables.

The higher harmonics of line-to-line leakage current that passes through between cables at output side of drive will accelerate the aging of cables and may bring about malfunction of other equipment. The higher the switching frequency of drive is, the bigger the line-to-line leakage current will be. The longer the motor cables and the bigger the parasitic capacitance are, the bigger the line-to-line leakage current will be. Therefore, the most immediate and effective method for suppression of ground leakage current is to reduce the switching frequency and minimize the length of motor cable. Line-to-line leakage current can also be effectively suppressed by mounting additional output reactors.

3.9.4 Use of Power Supply Filter

Since AC drives may generate strong interference and are also sensitive to outside interference, power supply filters are recommended. Pay close attention to the following instructions during the use:

- Enclosure of the filter needs to be reliably grounded;
- Input lines of the filter shall be kept as far away from output lines as possible so as to avoid mutual coupling;
- Filter shall be as close to the drive side as possible;
- Filter and drive must be connected to the same common ground.

Chapter 4 Operation and Run Instructions

4.1 Operation of Keypad

As a human-machine interface, keypad is the main part for the drive to receive command and display parameters.

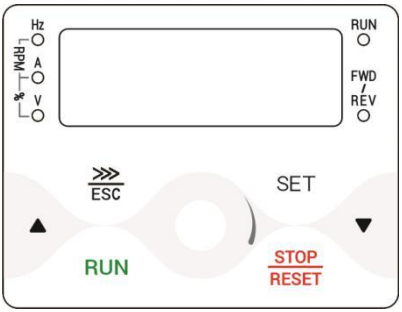


Fig. 4-1 Keypad

4.2 Key Functions on Keypad

On the keypad there are 6 keys whose functions are as shown in Table 4-1.

Table 4-1 Key functions on keypad

Symbol	Key name	Meaning
ESC	Shift/Escape	1) Selection of parameter bit 2) Selection of parameter value bit 3) Selection of stop/run status display parameter value 4) Fault status switches to parameter value display status 5) return function (Note: Press for 1 second)
SET	Enter	1) Parameter edition enter 2) Confirmation of parameter settings
RUN	Run	Run
STOP RESET	Stop/Reset	1) Stop 2) Fault reset

Symbol	Key name	Meaning
▲	Increase	1) Increase of selected bit of parameter value 2) Increase of selected bit of parameter value 3) Increase of set frequency
▼	Decrease	1) Decrease of selected bit of parameter 2) Decrease of selected bit of parameter value 3) Decrease of set frequency
	Potentiometer	1) Frequency set source 2) Process PID setting

4.3 Keypad Indicators

Keypad is furnished with 5 indicators whose descriptions are as below.

Table 4-2 Description of indicators

Indicator		Designation	Meaning
Unit	Hz	Frequency indicator	ON: currently displayed parameter value is running frequency or the current parameter unit is frequency Flash: currently displayed parameter value is set frequency
	A	Current indicator	ON: currently displayed parameter value is current
	V	Voltage indicator	ON: currently displayed parameter value is voltage
	Hz+A	Running speed indicator	ON: currently displayed parameter value is running speed Flash: currently displayed parameter value is setting speed
	A+V	Percentage indicator	ON: currently displayed parameter value is a percentage value
	All OFF	No unit	No unit
Status	RUN	Run status indicator	ON: Run OFF: Stop Flash: Stopping
	FWD/ REV	Forward indicator	ON: If the drive in stop status, forward command enabled. If the drive in run status, the drive is running forward
		Reverse indicator	ON: If the drive in stop status, reverse command enabled. If the drive in run status, the drive is running

Indicator		Designation	Meaning
			reversely.

4.4 Potentiometer Setting

Potentiometer could be frequency setting source or process PID setting programmed by related parameters. When b0-01 is set to 3, potentiometer is source of master frequency setting. When b0-03 is set to 4, potentiometer is source of auxiliary frequency setting. When ones place, tens place, or hundreds place of b1-01 is set to 4, potentiometer would be working as frequency setting source of corresponding run command source. Please set F0-00 to 2 when potentiometer is working as process PID setting.

.

4.5 Prompt Message Status

Prompt message status shall be displayed upon the completion of some operations. For instance, the "bASIC" prompt message would be displayed upon the completion of parameter initialization.

Fig. 4-2 Prompt message status

Prompt message characters and their meanings are shown as specified in Table 4-3.

Table 4-3 Prompt characters

Prompt symbol	Meaning	Prompt symbol	Meaning
bASIC	When A0-01 is set to 0	CPyb1	Backup parameter value
dISP1	When A0-01 is set to 1	LoAd	Parameter upload to keypad
USEr	When A0-01 is set to 2	dnLd1	Parameter download from keypad (motor parameter excluded)

ndFLt	When A0-01 is set to 3	dnLd2	Parameter download from keypad (motor parameter included)
LoC-1	Keypad locked 1 (full locked)	P-SEt	Password has been set
LoC-2	Keypad locked 2 (all locked except RUN, STOP/RESET)	P-CLr	Password cleared
LoC-3	Keypad locked 3 (all locked except STOP/RESET)	TUNE	Motor parameter identification in process
LoC-4	Keypad locked 4 (all locked except shift >>)	LoU	Drive undervoltage
PrtCt	Keypad protection	CLr-F	Clear fault record
UnLoC	Keypad lock cleared	dEFt1	Restore to factory default parameters (motor parameter excluded)
rECy1	Read the backup parameter value to parameter	dEFt2	Restore to factory default parameters (motor parameter included)

Table 4-4 shows meanings of the characters displayed on keypad.

Table 4-4 Meanings of displayed characters

Displayed character	Character Meaning	Displayed character	Character Meaning	Displayed character	Character Meaning	Displayed character	Character Meaning
	0		A		I		T
	1		b		J		t
	2		C		L		U
	3		c		N		v
	4		d		n		y
	5		E		o		-

Displayed character	Character Meaning	Displayed character	Character Meaning	Displayed character	Character Meaning	Displayed character	Character Meaning
	6		F		P		8.
	7		G		q		.
	8		H		r		
	9		h		S		

4.6 Setting Methods of Parameters

4.6.1 Parameter System

AT610 series drive parameter group: A0~A1, b0~b2, C0~C4, d0~d5, E0~E1, F0~F5, H0, L0~L1, U0~U1. Each parameter group contains a number of parameters. Parameters are identified by the combination "parameter group character + parameter subgroup number + parameter number". For instance, " b0-02" indicates the second parameter at subgroup 2, group b.

4.6.2 Example of Setting of Parameter

- Password operation example
  - Password setting (set A0-00=1006)
    1. In the non-parameter edit status, press the SET key to display the current parameters of A0-00.
    2. Press the SET key, the parameter value 0000 corresponding to A0-00 will be displayed;
    3. Press the ▲ key six times to change the rightmost 0 to 6;
    4. Press the ESC key to move the flashing digit to the leftmost position;
    5. Press the ▲ key once to change the leftmost 0 to 1;
    6. Press the SET key to save the value of A0-00 and automatically display the next function code (display A0-01);
    7. Press the ▼ key to change A0-01 to A0-00;
    8. Repeat step 2 to step 6) once, and after displaying P-SEt on the keypad, display

A0-01 function code;

9. Press the ESC + SET + ▲ keys at the same time (the keypad displays PrtCt) for 5 minutes without operation or restart the inverter, any of these three methods can effect the user password protection.

The flowchart is shown in Figure 4-3.

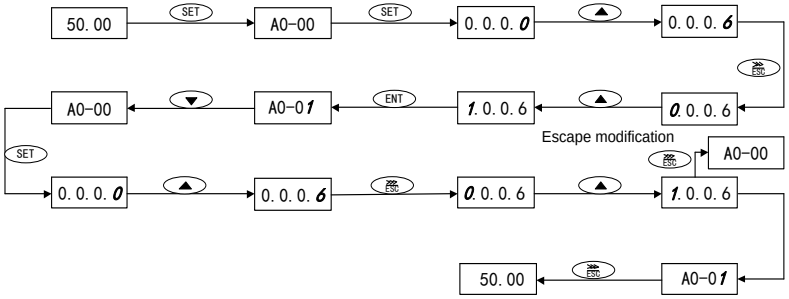


Fig. 4-3 User Password Setting Flowchart

ATTENTION:

◆ User's password is successfully set when step 8 finished, but will not take effect until the completion of step 9.

◆ **Password authentication**

In non-parameter edit status, press SET to enter first-tier display A0-00, then press SET to enter second-tier display 0.0.0.0. Keypad will implement the display of other parameters only when correct password entered.

◆ **Clear password**

After successful password authentication, it will access password setting code A0-00. Password can be cleared by writing value 0000 into A0-00 twice.

- **Example of parameter setting**

◆ **Example 1:** modify upper limit frequency from 600Hz to 50Hz (change b0-09 from 600.00 to 50.00)

1) In non-parameter edit status, press ESC to display current parameter A0-00;

2) Press ESC to move flashing digit to modification bit (A flashes);

3) Press ▲ once to change "A" to "b";

4) Press ESC to move flashing to modification bit (0 in ones place flashing);

5) Press ▲ nine times to change "0" to "9";

6) Press SET to view the parameter value (600.00) of b0-09;

7) Press ESC to move flashing digit to modification digit (6 flashing);

8) Press ▼ six times to change "6" to "0";

9) Press ESC once to move flashing digit rightwards by one bit;

10) Press ▲ for five times to change "0" to "5";

11) Press SET to save the value (50.00) of b0-09. Then the keypad will automatically switch to display the next function code (b0-10);

12) Press ESC for 1 second to exit parameter edit status.

Flow chart is shown below:

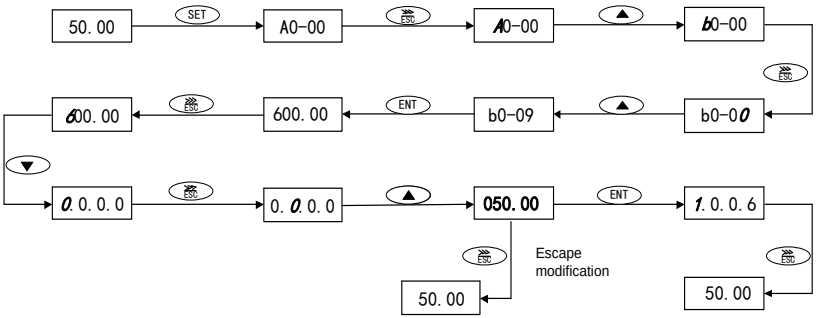


Fig. 4-4 Flow chart of upper limit frequency modification

Chapter 5 List of Parameters

AT610 parameter groups are listed below:

Category	Parameter group	Reference page
Group U: monitoring	U1: history fault	P68

🕮 **ATTENTION:**

Change attribute:

"△" means the value of this parameter can be modified in stop and run status of drive;

"×" means the value of this parameter cannot be modified when drive is running;

"◎" means this parameter is a measured value that cannot be modified;

Factory default: The value when restored to factory default. Neither measured parameter value nor recorded value will be restored.

Scope: the scope of setting and display of parameter values

Param	Designation	Scope	Factory default	Attr
Group A: System Parameters and Parameter Management				
Group A0: System Parameters				
A0-00	Setting of user password	0000~FFFF	0000	△
A0-01	Parameter display	0: Display all parameters 1: Only display A0-00 and A0-01 2: Only display A0-00, A0-01 and user-defined A1-00~A1-19 3: Only display A0-00, A0-01, and the parameters different from factory default	0	△
A0-02	Parameter protection	0: All parameter programming allowed 1: Only A0-00 and this parameter programming allowed	0	×
A0-03	Parameter restoration	0: No operation 1: Clear fault record 2: Restore all parameters to factory default (excluding motor parameters) 3: Restore all parameters to factory default (including motor parameters) 4: Restore all parameters to backup parameters	0	×
A0-04	Parameter backup	0: No operation 1: Backup all parameters	0	×

Param	Designation	Scope	Factory default	Attr
A0-05	Parameter copy	0: No operation 1: Parameter copied to keypad 2: Parameter copied (excluding motor parameters) to control board 3: Parameter copied (including motor parameters) to control board **Noted:** Only external keypad has this function;	0	×
A0-06	Type of drive	0: Type G (applicable to constant-torque load) 1: Type L (applicable to light-duty load)	0	×
A0-08	Motor 1 / motor 2 selection	0: Motor 1 1: Motor 2	0	×
A0-09	Motor control technique	Ones place: motor 1 control mode 0: V/f control 1: Sensor-less vector control 1 2: Sensor-less vector control 2 3: SVC control for sync. motor Tens place: motor 2 control mode 0: V/f control 1: Sensor-less vector control 1 2: Sensor-less vector control 2 3: SVC control for sync. motor	00	×
Group A1: User-defined Display Parameters				
A1-00 ~A1-19	1~20 User-defined display parameter 1 to 20	Setting range of thousands place: A, b, C, d, E, F, H, L, U Setting range of hundreds place: 0~9 Setting range of tens place: 0~9 Setting range of ones place: 0~9	A0-00	×
A1-20	Parameter group display/hide setting 1	0000~FFFF	FFFF	×
A1-21	Parameter group display/hide setting 2	0000~FFFF	FFFF	×
A1-22	Fault masking	0~FF Ones: binary Bit3Bit2Bit1Bit0 Bit set 0:unmask; 1: mask	08	△

Param	Designation	Scope	Factory default	Attr
		Bit0: GdP fault Bit1: SP1 fault Bit2: SP2 fault Bit3: CPU fault Tens: binary Bit3Bit2Bit1Bit0 Bit set 0:unmask; 1: mask Bit0: AIP fault Bit1: OL3 fault Bit2: oCR fault Bit3: reserved Example: if faults of GdP, SP1, SP2, CPU need to be masked, then set ones as hexadecimal F (set binary Bit3Bit2Bit1Bit0 as 1). And it is similar meaning for tens.		
Group b Run Parameter Setting				
Group b0 Frequency Setting				
b0-00	FREQ set mode	0: Master FREQ set 1: Master & auxiliary computation result 2: Switch between master and auxiliary set 3: Switch between master FREQ set, and master & auxiliary computation result 4: Switch between auxiliary FREQ set, and master & auxiliary computation result	0	×
b0-01	Master FREQ set	0: Digital setting (b0-02) + ∧/∨ adjustment on keypad 1: Digital setting (b0-02) + terminal UP/DOWN adjustment 2: Terminal analog input 3: Potentiometer analog input 4: Reserve 5: X4 pulse input 6: Process PID output 7: PLC 8: Multi-step speed 9: Communication	0	×

Param	Designation	Scope	Factory default	Attr
b0-02	Master FREQ digital setting	Lower limit freq ~ upper limit freq	50.00Hz	△
b0-03	Auxiliary FREQ set	0: No setting 1: Digital setting (b0-04) + ∧/∨ adjustment on keypad 2: Digital setting (b0-04) + terminal UP/DOWN adjustment 3: Analog input 4: Potentiometer analog input 5: Reserve 6: X4 pulse input 7: Process PID output 8: PLC 9: Multi-step speed 10: Communication	0	×
b0-04	Auxiliary FREQ digital setting	Lower limit frequency ~ upper limit frequency	0.00Hz	△
b0-05	Auxiliary frequency range	0: Relative to maximum frequency 1: Relative to master frequency	0	×
b0-06	Auxiliary frequency coeff	0.0%~100.0%	100.0%	×
b0-07	Computation of master and auxiliary frequency	0: Master + auxiliary 1: Master - auxiliary 2: Max {master, auxiliary} 3: Min {master, auxiliary}	0	×
b0-08	Maximum frequency	Upper limit frequency ~600.00Hz	50.00Hz	×
b0-09	Upper limit frequency	Lower limit freq ~ maximum freq	50.00Hz	×
b0-10	Lower limit frequency	0.00Hz~upper limit frequency	0.00Hz	×
b0-11	Operation when set frequency lower than lower limit frequency	0: Run at lower limit frequency 1: Run at 0 Hz 2: Stop	0	×
b0-12	Time-delay of stop when set frequency lower than lower limit frequency	0.0s~6553.5s	0.0s	×
b0-13	Lower limit of skip frequency band 1	0.00Hz~upper limit frequency	0.00Hz	×
b0-14	Upper limit of skip frequency band 1	0.00Hz~upper limit frequency	0.00Hz	×

Param	Designation	Scope	Factory default	Attr
b0-15 ~ b0-18	Lower limit and upper limit of skip frequency band 2, and 3	0.00Hz~upper limit frequency (Same as b0-13 and b0-14)	0.00Hz	×
b0-19	Jog frequency	0.00Hz~upper limit frequency	5.00Hz	△
b0-20	Zero clearing when master and auxiliary FREQ is switching	0~1 0: Zero clearing 1: Not zero clearing	0	△
Group b1 Start/Stop Control				
b1-00	Run command	0: Keypad control 1: Terminal control 2: Communication control	0	×
b1-01	Binding of run command and frequency setting	Ones place: frequency setting source bundled under keypad control: 0: No binding 1: Digital setting (b0-02) + ∧/∨ adjustment on keypad 2: Digital setting (b0-02) + terminal UP/DOWN adjustment 3: Terminal AI 4: Potentiometer AI 5: Reserve 6: X4 pulse input 7: Process PID output 8: PLC 9: Multi-step speed A: Communication input Tens place: frequency setting source bundled under terminal control (same as Ones place) Hundreds place: frequency setting source bundled under communication control (same as Ones place)	000	×
b1-02	Run direction	0: Forward 1: Reverse	0	△
b1-03	Reverse disabled	0: Reverse enabled 1: Reverse disabled	0	×
b1-04	Dead time between forward and reverse	0.0s~3600.0s	0.0s	△
b1-05	Start method	0: From start FREQ 1: DC braking start 2: Flying start 1	0	×

Param	Designation	Scope	Factory default	Attr
		3: Reserve 4. Flying start 3 5. Flying start 4 Note: Normally flying start 4 is used for SW search at best effect		
b1-06	Start FREQ	0.00Hz~upper limit FREQ	0.00Hz	×
b1-07	Holding time of start FREQ	0.0s~3600.0s	0.0s	△
b1-08	DC braking current at start	0.0%~200.0%	0.0%	△
b1-09	DC braking time at start	0.00s~30.00s	0.00s	△
b1-10	Flying start current	0.0~200.0%	100.0%	×
b1-11	Flying start Decel time	0.1s~20.0s	2.0s	×
b1-12	Flying start adjustment coeff	0.0~100.0%	1.0%	×
b1-13	Stop method	0: Ramp to stop 1: Coast to stop 2: Ramp to stop + DC brake	0	×
b1-14	Start FREQ of DC brake stop	0.00Hz~upper limit FREQ	0.00Hz	×
b1-15	DC brake current	0.0%~200.0%	0.0%	△
b1-16	DC brake time	0.00s~30.00s	0.00s	△
b1-17	Overexcitation brake	0: Disabled 1: Enabled	1	×
b1-18	Dynamic brake	0: Disabled 1: Enabled	0	×
b1-19	Dynamic brake threshold voltage	650V~750V	720V	×
b1-20	Auto restart when power up again after power loss	0: Disabled 1: Enabled	0	×

Param	Designation	Scope	Factory default	Attr
b1-21	Time delay of auto restart when power up again	0.0s~10.0s	0.0s	△
Group b2 Accel/Decel Parameters				
b2-00	Accel/Decel time resolution	0: 0.01s 1: 0.1s 2: 1s	1	×
b2-01	Accel time 1	0s~600.00s/6000.0s/60000s	6.0s	△
b2-02	Decel time 1	0s~600.00s/6000.0s/60000s	6.0s	△
b2-03~ b2-08	Accel time 2 to 4 Decel time 2 to 4	0s~600.00s/6000.0s/60000s (same as b2-01 and b2-02)	6.0s	△
b2-09	Decel time for emergency stop	0s~600.00s/6000.0s/60000s	6.0s	△
b2-10	Jog Accel time	0s~600.00s/6000.0s/60000s	6.0s	△
b2-11	Jog Decel time	0s~600.00s/6000.0s/60000s	6.0s	△
b2-12	Accel/Decel curve selection	0: Linear Accel/Decel 1: Broken-line Accel/Decel 2: S-curve Accel/Decel A 3: S-curve Accel/Decel B 4: S-curve Accel/Decel C	0	×
b2-13	Accel time switching frequency of broken-line Accel/Decel	0.00Hz~upper limit frequency	0.00Hz	△
b2-14	Decel time switching frequency of broken-line Accel/Decel	0.00Hz~upper limit frequency	0.00Hz	△
b2-15	Time of Accel S-curve first segment	0.00s~60.00s (S-curve A)	0.20s	△
b2-16	Time of Accel S-curve last segment	0.00s~60.00s (S-curve A)	0.20s	△
b2-17	Time of Decel S-curve first segment	0.00s~60.00s (S-curve A)	0.20s	△
b2-18	Time of Decel S-curve last segment	0.00s~60.00s (S-curve A)	0.20s	△
b2-19	Proportion of Accel S-curve first segment	0.0%~100.0% (S-curve B)	20.0%	△
b2-20	Proportion of Accel S-curve last segment	0.0%~100.0% (S-curve B)	20.0%	△

Param	Designation	Scope	Factory default	Attr
b2-21	Proportion of Decel S-curve first segment	0.0%~100.0% (S-curve B)	20.0%	△
b2-22	Proportion of Decel S-curve last segment	0.0%~100.0% (S-curve B)	20.0%	△
Group C Input and Output Terminals				
Group C0 Digital Input				
C0-00	Enabled condition of run command terminals when power up	0: Trigger edge detected + ON detected 1: ON detected	0	×
C0-01	Function of terminal X1	0: No function 1: JOG forward 2: JOG reverse 3: Run forward (FWD) 4: Run reverse (REV) 5: Three-wire control 6: Run suspended 7: External stop 8: Emergency stop 9: Stop command + DC brake 10: DC brake stop 11: Coast to stop 12: Terminal UP 13: Terminal DOWN 14: Clear UP/DOWN (including ∧/∨ key) adjustment 15: Multi-step FREQ terminal 1 16: Multi-step FREQ terminal 2 17: Multi-step FREQ terminal 3 18: Multi-step FREQ terminal 4 19: Accel/Decel time determinant 1 20: Accel/Decel time determinant 2 21: Accel/Decel disabled (ramp stop not inclusive) 22: External fault input 23: Fault reset (RESET) 24: Pulse input (valid only for X4) 25: Motor 1/2 switchover 26: Reserve	3	×
C0-02	Function of terminal X2		4	×
C0-03	Function of terminal X3		1	×
C0-04	Function of terminal X4		23	×
C0-08	Function of terminal AI (Digital enabled)		0	×

Param	Designation	Scope	Factory default	Attr
		27: Run command switched to keypad control 28: Run command switched to terminal control 29: Run command switched to communication control 30: Frequency set mode shift 31: Master FREQ set switched to digital setting b0-02 32: Auxiliary FREQ set switched to digital setting b0-04 33: PID adjustment direction 34: PID paused 35: PID integration paused 36: PID parameter switch 37: Count input 38: Count clear 39: Length count 40: Length clear 41~62: Reserve 63: Simple PLC paused 64: Simple PLC disabled 65: Simple PLC stop memory clear 66: Start wobble frequency 67: Clear wobble frequency status 68: Run prohibited 69: DC brake in run 70: Analog input curve switching 71~99: Reserve		
C0-11	Filtering time of digital input terminal	0.000s~1.000s	0.01s	△
C0-12	Delay time of terminal X1	0.0s~3600.0s	0.0s	△
C0-13	Delay time of terminal X2	0.0s~3600.0s	0.0s	△
C0-14	Digital input terminal enabled status setting 1	Ones place: X1 0: Positive logic 1: Negative logic Tens place: X2 (same as ones place)	0000	×

Param	Designation	Scope	Factory default	Attr
		Hundreds place: X3 (same as ones place) Thousands place: X4 (same as ones place)		
C0-16	Digital input terminal enabled status setting 3	Ones place: AI 0: Positive logic 1: Negative logic Tens place/Hundreds place/Thousands place: Reserve	0000	×
C0-17	Terminal UP/DOWN FREQ adjustment action	Ones place: at stop 0: Cleared 1: Maintained Tens place: on power loss 0: Cleared 1: Maintained Hundreds place: integral function 0: No integral function 1: Integral function enabled Thousands place: run direction 0: Changing run direction prohibited 1: Changing run direction allowed	0000	△
C0-18	Terminal UP/DOWN frequency change step size	0.00Hz/s~100.00Hz/s	0.03 Hz/s	△
C0-19	FWD/REV terminal control mode	0: Two-wire mode 1 1: Two-wire mode 2 2: Three-wire mode 1 3: Three-wire mode 2	0	×
C0-20	Option of virtual input terminal	000~30F 0: Actual terminal in effect 1: Virtual terminal in effect Ones place: BIT0~BIT3: X1~X4 Tens place: Reserve Hundreds place: BIT8~BIT9: AI~potentiometer input	000	×
C0-21	Enabled condition of run command terminal after fault reset (RESET)	0: Trigger edge detected + ON detected 1: ON detected	0	△
Group C1 Digital Output				
C1-00	Y1 output function	0: No output 1: Drive undervoltage 2: Drive run preparation completed	0	△
C1-02	Control board relay output function		14	△

Param	Designation	Scope	Factory default	Attr
		3: Drive is running 4: Drive running at 0Hz (there is no output at stop) 5: Drive running at 0Hz (there is output at stop) 6: Run direction 7: FREQ attained 8: Upper limit FREQ attained 9: Lower limit FREQ attained 10: Frequency detection FDT1 11: Frequency detection FDT2 12: Reserve 13: Torque limited 14: Fault output 15: Alarm output 16: Drive (motor) overloaded alarm 17: Drive overheat alarm 18: Zero current detection 19: X1 20: X2 21: Motor 1/ 2 indication 22: Set count value attained 23: Designated count value attained 24: Length attained 25: Consecutive run time attained 26: Accumulative run time attained 27: Brake control 28: Reserve 29: Reserve 30: PLC step completed 31: PLC cycle completed 32: Wobble frequency attains to upper or lower limit frequency 33: Upper/lower limit of set FREQ attained 34: Target FREQ attained (set by C2-29) 35~99: Reserve		
C1-04	Y1 output time delay	0.0s~3600.0s	0.0s	△
C1-06	Control board relay output time delay	0.0s~3600.0s	0.0s	△

Param	Designation	Scope	Factory default	Attr
C1-08	Enabled state of digital output	Ones place: Y1 0: Positive logic 1: Negative logic Tens place: Reserve Hundreds place: control board relay output (same as ones place) Thousands place: Reserve	0000	×
C1-09	Detected object of FREQ detection (FDT)	Ones place: FDT1 detected object 0: Speed set value (FREQ after Accel/Decel) 1: Detected speed value Tens place: FDT2 detected object 0: Speed set value (FREQ after Accel/Decel) 1: Detected speed value	00	△
C1-10	FDT1 upper value	0.00Hz~maximum FREQ	50.00Hz	△
C1-11	FDT1 lower value	0.00Hz~maximum FREQ	49.00Hz	△
C1-12	FDT2 upper value	0.00Hz~maximum FREQ	25.00Hz	△
C1-13	FDT2 lower value	0.00Hz~maximum FREQ	24.00Hz	△
C1-14	Detection width of FREQ attained	0.00Hz~maximum FREQ	2.50Hz	△
C1-15	Zero current detection value	0.0%~50.0%	5.0%	△
C1-16	Zero current detection time	0.01s~50.00s	0.50s	△
Group C2 Analog and Pulse Input				
C2-00	Analog input curve	Ones place: AI input curve 0: Curve 1 (2 points) 1: Curve 2 (4 points) 2: Curve 3 (4 points) 3: Curve 2 and curve 3 switchover Tens place: potentiometer input curve (same as ones place) Hundreds place/thousands place: Reserve	0000	×
C2-01	Curve 1 maximum input	Curve 1 minimum input ~ 110.0%	100.0%	△

Param	Designation	Scope	Factory default	Attr
C2-02	Corresponding set value of curve 1 maximum input	-100.0%~100.0%	100.0%	△
C2-03	Curve 1 minimum input	-110.0% ~ curve 1 maximum input	0.0%	△
C2-04	Corresponding set value of curve 1 minimum input	-100.0%~100.0%	0.0%	△
C2-05	Curve 2 maximum input	Range: input of curve 2 inflection point A~110.0%	100.0%	△
C2-06	Set value corresponding to curve 2 maximum input	Range: -100.0%~100.0%	100.0%	△
C2-07	Input of curve 2 inflection point A	Input of curve 2 inflection point B ~ curve 2 maximum input	0.0%	△
C2-08	Set value Cor. to input of curve 2 inflection point A	Range: -100.0%~100.0%	0.0%	△
C2-09	Input of curve 2 inflection point B	Range: Curve 2 minimum input ~ Input of curve 2 inflection point A	0.0%	△
C2-10	Set value corresponding to input of curve 2 inflection point B	Range: -100.0%~100.0%	0.0%	△
C2-11	Curve 2 minimum input	Range: -110.0%~ input of curve 2 inflection point B	-100.0%	△
C2-12	Set value corresponding to curve 2 minimum input	-100.0%~100.0%	-100.0%	△
C2-13 ~ C2-20	Curve 3 input and setting	Same as C2.05~C2.12	--	△
C2-21	AI terminal filtering time	0.000s~10.000s	0.1s	△
C2-22	Potentiometer input filter time	0.000s~10.000s	0.1s	△
C2-24	X4 pulse maximum input	C2-26~20.0kHz	20.0kHz	△

Param	Designation	Scope	Factory default	Attr
C2-25	Set value corresponding to X4 pulse maximum input	-100.0%~100.0%	100.0%	△
C2-26	X4 pulse minimum input	0.0kHz~C2-24	0.0kHz	△
C2-27	Set value corresponding to X4 pulse minimum input	-100.0%~100.0%	0.0%	△
C2-28	X4 pulse filter time	0.000s~1.000s	0.001s	△
C2-29	Target FREQ	0.00Hz~upper limit FREQ (enabled when C1-00 ~C1-02 is set to 34)	0.00Hz	△
Group C3 Analog and Pulse Output				
C3-00	AO output function	0: No output 1: Set FREQ 2: Output FREQ 3: Output current (to drive rated) 4: Output torque (absolute value) 5: Output voltage 6: Output power 7: Bus voltage 8: Reserve 9: Torque current 10: Magnetic flux current 11:AI 12:Potentiometer input 13-14:Reserve 15:X4 pulse input 16:Communication input percentage 17: Output FREQ before compensation 18:Output current (relative to motor rated current) 19:Output torque (direction hinted) 20:Set torque (direction hinted) 21~99: Reserve	2	△
C3-03	AO1 offset	-100.0%~100.0%	0.0%	×
C3-04	AO1 gain	-2.000~2.000	1.000	×
C3-05	AO1 filtering time	0.0s~10.0s	0.0s	△
Group C4 Automatic Correction of Analog Input				
C4-00	Analog correction	0: No correction 1:Correct AI	0	×

Param	Designation	Scope	Factory default	Attr
		2:Correct potentiometer		
C4-01	Sampling value of AI calibration point 1	0.00V~10.00V	1.00V	◎
C4-02	Input value of AI calibration point 1	0.00V~10.00V	1.00V	×
C4-03	Sampling value of AI calibration point 2	0.00V~10.00V	9.00V	◎
C4-04	Input value of AI calibration point 2	0.00V~10.00V	9.00V	×
C4-05 ~ C4-08	Sampling value of calibration point 1 of potentiometer (same as C4-01~C4-04)	-10.00V~10.00V	--	--
Group d Motor and Control Parameters				
Group d0 Motor Parameters				
d0-00	Type of motor 1	0: Ordinary asyn. motor 1: Variable frequency asyn. motor 2: Synchronous motor	1	×
d0-01	Power rating of motor 1	0.4kW~6553.5kW	Model depend	×
d0-02	Rated voltage of motor 1	0V~480V (for 380V level)	380V	×
d0-03	Rated current of motor 1	0.0A~6553.5A	Model depend	×
d0-04	Rated frequency of motor 1	0.00Hz~upper limit frequency	50.00Hz	×
d0-05	Pole number of motor 1	1~80	4	×
d0-06	Rated speed of motor 1	0~65535r/min	Model depend	×
d0-07	Stator resistance R1 of asyn. motor 1	0.001Ω~65.535Ω	Model depend	×
d0-08	Leakage inductance L1 of asyn. motor 1	0.1mH~6553.5mH	Model depend	×

Param	Designation	Scope	Factory default	Attr
d0-09	Rotor resistance R2 of asyn. motor 1	0.001Ω~65.535Ω	Model depend	×
d0-10	Mutual inductance L2 of asyn. motor 1	0.1mH~6553.5mH	Model depend	×
d0-11	No-load current of asyn. motor 1	0.0A~6553.5A	Model depend	×
d0-12	Flux weakening coeff 1 of asyn. motor 1	0.0000~1.0000	Model depend	×
d0-13	Flux weakening coeff 2 of asyn. motor 1	0.0000~1.0000	Model depend	×
d0-14	Flux weakening coeff 3 of asyn. motor 1	0.0000~1.0000	Model depend	×
d0-15	Stator resistance of syn. motor 1	0.001Ω~65.535Ω	0.500Ω	×
d0-16	D-axis inductance of syn. motor 1	0.01mH~655.35mH	9.00 mH	×
d0-17	Q-axis inductance of syn. motor 1	0.01mH~655.35mH	9.00 mH	×
d0-18	Back EMF voltage of syn. motor 1	0.0~1000.0	380.0V	×
d0-19	Autotuning current of syn. motor 1	0.0%~100.0% 100% is rated current of motor	35.0%	×
d0-22	Autotuning of motor 1	0: Disabled 1: Static autotuning of asyn. motor 2: Rotary autotuning of asyn. motor 3: Reserve 4: Static autotuning of syn. motor 5: No-load rotary autotuning of syn. motor	0	×
d0-23	Overload protection of motor 1	0: No protection 1: Judged by motor current 2: Judged by temperature transducer	1	×

Param	Designation	Scope	Factory default	Attr
d0-24	Overload protection detection time of motor 1	0.1min~15.0min	5.0min	×
d0-27	SW rotary speed track Kp	0.00~655.35	0.00	×
d0-28	SW rotary speed track Ki	0.00~655.35	2.00	×
Group d1 V/f Control Parameters of Motor 1				
d1-00	V/f curve setting	0: Linear V/f 1: Multi-stage V/f (d1-01~d1-08) 2: 1.2nd power 3: 1.4th power 4: 1.6th power 5: 1.8th power 6: 2.0nd power 7: V/f separated mode 1 8: V/f separated mode 2	0	×
d1-01	V/f FREQ value f3	0.00Hz~motor rated FREQ	50.00Hz	×
d1-02	V/f voltage value V3	0.0%~100.0%	100.0%	×
d1-03	V/f FREQ value f2	d1-05~d1-01	0.00Hz	×
d1-04	V/f voltage value V2	0.0%~100.0%	0.0%	×
d1-05	V/f FREQ value f1	d1-07~d1-03	0.00Hz	×
d1-06	V/f voltage value V1	0.0%~100.0%	0.0%	×
d1-07	V/f FREQ value f0	0.00Hz~d1-05	0.00Hz	×
d1-08	V/f voltage value V0	0.0%~100.0%	0.0%	×
d1-09	Torque boost	0.0%~30.0%	0.0%	△
d1-10	Slip compensation gain	0.0%~400.0%	100.0%	△
d1-11	Droop control	0.00Hz~maximum FREQ	0.00Hz	△
d1-12	Current limitation mode	0: Disabled 1: Set by d1-13 2: Set by AI 3 and 4: Reserve 5: Set by X4 pulse setting	1	×
d1-13	Digital setting of current limited value	20.0%~200.0%	160.0%	×
d1-14	Current limit coeff on flux weakening	0.001~1.000	0.500	△
d1-15	Energy saving	0%~40.0%	0.0%	△

Param	Designation	Scope	Factory default	Attr
d1-16	V/f oscillation suppression gain 1	0~3000	38	△
d1-17	V/f oscillation suppression gain 2	0~3000	0	△
d1-18	Voltage setting on V/f separated pattern	0: d1-19 digital setting 1: Set by AI 2-3: Reserve 4: Process PID output 5: AI + process PID output	0	×
d1-19	Digital set voltage on V/f separated pattern	0.0%~100.0%	0.0%	△
d1-20	Voltage variation time on V/f separated pattern	0.00s~600.00s	0.01s	△
Group d2 Vector Control Parameters of Motor 1				
d2-00	Reserve	Reserve	Reserve	×
d2-01	ASR high-speed proportional gain Kp1	0.0~20.0	2.0	△
d2-02	ASR high-speed integration time Ti1	0.000s~8.000s	0.200	△
d2-03	ASR low-speed proportional gain Kp2	0.0~20.0	2.0	△
d2-04	ASR low-speed integration time Ti2	0.000s~8.000s	0.200	△
d2-05	ASR switching FREQ 1	0.00Hz~d2-06	5.00Hz	△
d2-06	ASR switching FREQ 2	d2-05~upper limit	10.00Hz	△
d2-07	ASR input filtering time	0.0ms~500.0ms	5.0ms	△
d2-08	ASR output filtering time	0.0ms~500.0ms	0.3ms	△
d2-09	ACR proportion coeff Kp	0.000~4.000	1.000	△
d2-10	ACR integration coeff Ki	0.000~4.000	1.000	△
d2-11	Pre-excitation time	0.000s~5.000s	0.200s	△

Param	Designation	Scope	Factory default	Attr
d2-12	Driven torque restriction source	0: d2-14 digital setting 1: AI 2-3: Reserve 4: X4 pulse input 5: Communication	0	×
d2-13	Braking torque restriction source	0: d2-15 digital setting 1: AI 2-3: Reserve 4: X4 pulse input 5: Communication	0	×
d2-14	Digital set of driven torque	0.0%~200.0%	180.0%	△
d2-15	Digital set of braking torque	0.0%~200.0%	180.0%	△
d2-16	Torque limit coefficient in flux weakening	0.0%~100.0%	50.0%	△
d2-17	Driven slip compensation gain	10.0%~300.0%	100.0%	△
d2-18	Brake slip compensation gain	10.0%~300.0%	100.0%	△
d2-30	Bandwidth of current loop	0.0Hz~3200.0Hz	200.0Hz	×
dGroup d3 Parameters of Motor 2 (same as d0)				
Group d4 V/f Control Parameter of Motor 2 (same as d1)				
Group d5 Vector Control Parameters of Motor 2 (same as d2)				
Group E Enhanced Function and Protection Parameters				
Group E0 Enhanced Function				
E0-00	Switching FREQ	≤15kW: 0.7kHz~16.0kHz, factory default: 8.0kHz 18.5kW~45kW: 0.7kHz~10.0kHz, factory default: 4.0kHz 55kW~75kW: 0.7kHz~8.0kHz, factory default: 3.0kHz ≥90kW: 0.7kHz~3.0kHz, factory default: 2.0kHz	Model depend	△

Param	Designation	Scope	Factory default	Attr
E0-01	PWM optimization	Ones place: switching FREQ relation with temperature 0: Self-adaption 1: No adaption Tens place: PWM modulation mode 0: Five-segment and seven-segment self-switchover 1: Five-segment mode 2: Seven-segment mode Hundreds place: over-modulation adaption 0: Disabled 1: Enabled Thousands place: PWM switching FREQ relation with output frequency 0: Self-adaption 1: No adaption	0120	×
E0-02	Action when run time attained	Ones place: action when consecutive run time attained: 0: Run continued 1: Stop and fault reported Tens place: action when accumulative run time attained: 0: Run continued 1: Stop and fault reported Hundreds place: unit of run time 0: Second 1: Hour	000	×
E0-03	Consecutive run time setting	0.0s (h) ~6000.0s (h)	0.0s(h)	×
E0-04	Accumulative run time setting	0.0s (h) ~6000.0s (h)	0.0s(h)	×
E0-05	Mechanical brake control	0: Disabled 1: Enabled	0	×
E0-06	Mechanical brake open frequency	0.00Hz~10.00Hz	2.50Hz	×
E0-07	Mechanical brake open current	0.0%~200.0%	120.0%	×
E0-08	Accel delay time after brake open	0.0s~10.0s	1.0s	×
E0-09	Mechanical brake FREQ	0.00Hz~10.00Hz	2.00Hz	×

Param	Designation	Scope	Factory default	Attr
E0-10	Mechanical brake close waiting time	0.0s~10.0s	0.0s	×
E0-11	Mechanical brake close holding time	0.0s~10.0s	1.0s	×
Group E1 Protection Parameters				
E1-00	Overvoltage stall	0: Invalid in all process 1: Valid in all process 2. Valid only for decelerating	1	×
E1-01	Overvoltage stall protection voltage	120%~150%	130%	×
E1-02	Undervoltage stall	0: Disabled 1: Enabled	0	×
E1-03	Overload alarm	Ones place: detection option: 0: Always detect 1: Detect at constant speed only Tens place: compared with: 0: Motor rated current 1: Drive rated current Hundreds place: drive action 0: Alarm but run continued 1: Alarm and coast to stop	000	×
E1-04	Overload alarm threshold	20.0%~200.0%	180.0%	△
E1-05	Overload alarm activation time	0.1s~60.0s	5.0s	△
E1-06	Protection action 1	Ones place/Tens place: Reserve Hundred: EEPROM abnormal.(EPr) 0: Coast to stop 1: Alarm but run continued Thousands place: abnormal terminal communication (TrC): 0: Coast to stop 1: Alarm but run continued	0000	×
E1-07	Protection action 2	Ones place: abnormal power supply when running (SUE): 0: Coast to stop 1: Alarm but run continued Tens place: current detection circuit failed (CtC) 0: Coast to stop 1: Alarm but run continued	3001	×

Param	Designation	Scope	Factory default	Attr
		Hundreds place: abnormal contactor (CCL): 0: Coast to stop 1: Alarm but run continued Thousands place: input supply fault /output phase loss (ISF, oPL): 0: Protection for neither input supply fault nor output phase loss 1: No protection for input supply fault, protection enabled for output phase loss 2: Protection enabled for input supply fault, no protection for output phase loss 3: Protection enabled both for input supply fault and output phase loss		
E1-08	Fault memory after power loss	0: Not memorized after power loss 1: Memorized after power loss	0	×
E1-09	Fault auto-reset times	0~20	0	×
E1-10	Auto-reset interval	2.0s~20.0s	2.0s	×
E1-11	Relay action on drive fault	Ones place: when undervoltage fault occurs 0: No action 1: Action enabled Tens place: when fault locked 0: No action 1: Action enabled Hundreds place: at interval of auto- reset 0: No action 1: Action enabled	010	×
E1-12	Cooling fan control	0: Auto run 1: Always run after power up	0	△
E1-13	Drive overheat alarm threshold	0.0℃~100.0℃	80.0℃	△
Group F Application				
Group F0 Process PID				
F0-00	PID setting	0: F0-01 digital setting 1: AI 2: Potentiometer input 3: Reserve	0	×

Param	Designation	Scope	Factory default	Attr
		4: X4 pulse input 5: Communication		
F0-01	PID digital setting	0.0%~100.0%	50.0%	△
F0-02	PID feedback	0: AI 1~6: Reserve 7: X4 pulse input 8: Communication	0	×
F0-03	PID adjustment	Ones place: output FREQ 0: Must be the same direction as the set run direction 1: Opposite direction allowed Tens place: integration selection 0: Integral continued when FREQ attains upper/lower limit 1: Integral stopped when FREQ attains upper/lower limit	11	×
F0-04	PID positive and negative adjustment	0: Positive adjustment 1: Negative adjustment	0	×
F0-05	Filtering time of PID setting	0.00s~60.00s	0.00s	△
F0-06	Filtering time of PID feedback	0.00s~60.00s	0.00s	△
F0-07	Filtering time of PID output	0.00s~60.00s	0.00s	△
F0-08	Proportional gain Kp1	0.0~200.0	50.0	△
F0-09	Integration time Ti1	0.000s~50.000s	0.500s	△
F0-10	Derivative time Td1	0.000s~50.000s	0.000s	△
F0-11	Proportional gain Kp2	0.0~200.0	50.0	△
F0-12	Integration time Ti2	0.000s~50.000s	0.500s	△
F0-13	Derivative time Td2	0.000s~50.000s	0.000s	△
F0-14	PID parameter switch	0: No switch, determined by parameters Kp1, Ti1 and Td1 1: Auto-switched on the basis of input offset 2: Switched by terminal	0	×
F0-15	Input offset under PID auto-switch	0.0%~100.0%	20.0%	△
F0-16	Sampling period T	0.001s~50.000s	0.002s	△
F0-17	PID offset limit	0.0%~100.0%	0.0%	△
F0-18	PID derivative limit	0.0%~100.0%	0.5%	△

Param	Designation	Scope	Factory default	Attr
F0-19	PID initial value	0.0%~100.0%	0.0%	×
F0-20	PID initial value holding time	0.0s~3600.0s	0.0s	△
F0-21	PID feedback loss detection value	0.0%~100.0%	0.0%	△
F0-22	PID feedback loss detection time	0.0s~30.0s	1.0s	△
F0-23	Cutoff FREQ when opposite to rotary set direction	0.00Hz~maximum FREQ	50.00Hz	△
F0-24	PID computation option	0: No computation in stop status 1: Computation continued in stop status	0	△
Group F1 Multi-step frequency				
F1-00	FREQ set source of multi-step 0	0: Digital setting F1-02 1: Digital setting b0-02 + keypad ∧/∨ adjustment 2: Digital setting b0-02 + terminal UP/DOWN adjustment 3: AI 4: Potentiometer input 5: Reserve 6: X4 pulse input 7: Process PID output 8: Communication	0	×
F1-01	FREQ set source of multi-step 1	0: Digital setting F1-03 1: Digital setting b0-04+ keypad ∧/∨ adjustment 2: Digital setting b0-04 + terminal UP/DOWN adjustment 3: AI 4: Potentiometer input 5: Reserve 6: X4 pulse input 7: Process PID output 8: Communication	0	×
F1-02 ~ F1-17	Multi-step FREQ 0 ~ Multi-step FREQ 15	-100.0%~100.0% Note: percentage against upper limit FREQ b0-09. Meaning of F1-03~F1-17 is the same with F1-02	0.0%	△
Group F2 Simple PLC				
F2-00	Simple PLC run mode	Ones place: PLC run mode 0: Stop after a single cycle	0000	×

Param	Designation	Scope	Factory default	Attr
		1: Continue to run in the last FREQ after a single cycle 2: Cycle repeated Tens place: power loss memory 0: No memory on power loss 1: Memorized on power loss Hundreds place: starting mode 0: Run from the first step "multi-step frequency 0" 1: Continue to run from the step of stop (or fault) 2: Continue to run from the step and FREQ at which run stopped (or fault occurred) Thousands place: unit of simple PLC run time 0: Second (s) 1: Minute (min)		
F2-01	Setting of multi-step 0	Ones place: FREQ setting 0: Multi-step FREQ 0 (F1-02) 1: AI 2: Potentiometer input 3: Reserve 4: X4 pulse input 5: Process PID output 6: Multi-step FREQ 7: Communication Tens place: run direction 0: Forward 1: Reverse 2: Determined by run command Hundreds place: Accel/Decel time 0: Accel/Decel time 1 1: Accel/Decel time 2 2: Accel/Decel time 3 3: Accel/Decel time 4	000	×
F2-02	Run time of step 0	0.0s (min) ~6000.0s (min)	0.0s	△
F2-03 ~ F2-32	Setting and run time of step 1 to 15	Same as F2-01 and F2-02 Note: If the Nth step of the freq. reference is multi-step, the setting value of multi-step freq. is n, (n is 0, 1….15).	--	--
Group F3 Wobble Frequency and Fixed Length Count				
F3-00	Wobble FREQ function setting	0: Wobble FREQ function disabled	0	×

Param	Designation	Scope	Factory default	Attr
		1: Wobble FREQ function enabled		
F3-01	Wobble FREQ run setting	Ones place: started method 0: Automatically 1: Started by terminal Tens place: amplitude control 0: Relative to center FREQ 1: Relative to maximum FREQ Hundreds place: wobble FREQ memorized when stop 0: Memory enabled 1: Memory disabled Thousands place: wobble FREQ memorized on power loss 0: Memory enabled 1: Memory disabled	0000	×
F3-02	Pre-wobble FREQ	0.00Hz~600.00Hz	0.00Hz	△
F3-03	Pre-wobble FREQ holding time	0.0s~3600.0s	0.0s	△
F3-04	Wobble FREQ amplitude	0.0%~50.0%	0.0%	△
F3-05	Hop FREQ	0.0%~50.0% (relative to F3-04)	0.0%	△
F3-06	Cycle of wobble FREQ	0.1s~999.9s	0.0s	△
F3-07	Triangular wave ramp-up time	0.0%~100.0% (of wobble FREQ cycle)	0.0%	△
F3-08	Length unit	0: m 1: 10m	0	△
F3-09	Length setting	0~65535	1000	△
F3-10	Pulse number per meter	0.1~6553.5	100.0	△
F3-11	Action when the length attained	0: Not stop 1: Stop	0	△
F3-12	Set count value	1~65535	1000	△
F3-13	Designated count value	1~65535	1000	△
Group F5 Vector control without PG for synchronous motor				

Param	Designation	Scope	Factory default	Attr
F5-00	Recognition of rotor initial magnetic pole position	0~2 0: Detecting forbidden 1: Recognition of pulse injection initial position 2: Reserve	0	△
F5-04	Initial pull-in current	0.0%~200.0%	50.0%	△
F5-05	Cut-off FREQ of pull-in current	0.00Hz~b0-09	0.00Hz	△
F5-09	Max. torque current ratio coefficient	0: forbid MTPA control Not 0: MTPA coefficient **Note:** generally 0, no need to modify	0.000	△
F5-12	Speed observer bandwidth coefficient	0.000~32.000	4.000	△
F5-13	Speed observer filter coeff.	0.000~32.000	0.200	△
F5-17	Open-loop vector mode selection	0000~1111 Ones: dead-time compensating enabled Tens: current loop feed forward enabled Hundreds: start step-out self-recovery enabled Thousands: speed loop integral separating enabled	0011	△
F5-20	Max. flux weakening current allowed	-8000~8000	-6000	△
F5-21	Max voltage utilization ratio	0~65535	31767	△
F5-24	Flux weakening loop proportional gain	0~65535	0	△
F5-25	Flux weakening loop integral gain	0~65535	800	△
Group H Communication Parameters				
Group H0 MODBUS Communication Parameters				
H0-00	485/Keypad selection	0: Local 485 1: Keypad	0	×
H0-01	SCI port communication configuration	Ones place: baud rate 0: 4800bps 1: 9600bps 2: 19200bps	0001	×

Param	Designation	Scope	Factory default	Attr
		3: 38400bps 4: 57600bps 5: 115200bps Tens place: data format 0: 1-8-2-N format, RTU 1: 1-8-1-E format, RTU 2: 1-8-1-O format, RTU 3: 1-7-2-N format, ASCII 4: 1-7-1-E format, ASCII 5: 1-7-1-O format, ASCII Hundreds place: connection type 0: Direct cable connection (232/485) 1: MODEM (232) Thousands place: communication data handling at power loss 0: Not saved at power loss 1: Saved at power loss		
H0-02	Local address of SCI port communication	0~247, 0 is broadcast address	1	×
H0-03	Time out detection of SCI port communication	0.0s~1000.0s	0.0s	×
H0-04	Time delay of SCI port communication	0ms~1000ms	0ms	×
H0-05	Master/Slave option	0: PC controls this drive 1: As master 2: As slave	0	×
H0-06	Parameter store address when this drive working as master	0: b0-02 1: F0-01	0	×
H0-07	Proportional factor of received FREQ	0.0~1000.0	100.0	△
Group L Keys and Display of Keypad				
Group L0 Keys of Keypad				
L0-00	MF key setting	0: No function 1: Forward jog 2: Reverse jog 3: Forward/reverse switchover 4: Emergency stop 1 (set Decel time by b2-09)	0	△

Param	Designation	Scope	Factory default	Attr
		5: Emergency stop 2 (coast to stop) 6: Run command sources shifted (Note: this function is available with external keypad)		
L0-01	Keys locked option	0: Not locked 1: All locked 2: Keys locked except RUN, STOP/RESET 3: Keys locked except STOP/RESET 4: Keys locked other than >>	0	△
L0-02	Function of STOP key	0: STOP key active only at keypad control 1: STOP key deactivated under any command source	0	△
L0-03	FREQ adjustment through keys ∧/∨	Ones place: option at stop 0: Clear at stop 1: Holding at stop Tens place: option at power loss 0: Clear at power loss 1: Holding at power loss Hundreds place: integrating option 0: Integrating disabled 1: Integrating enabled Thousands place: run direction 0: Direction changing prohibited 1: Direction changing permitted	0100	△
L0-04	Step size of FREQ adjustment through keys ∧/∨	0.00Hz/s~10.00Hz/s	0.03 Hz/s	△
Group L1 Keypad Display Setting				
L1-00	Display parameter setting 1 on run status	Binary system setting: 0: No display 1: Display Ones place: BIT0: Run FREQ (Hz) BIT1: Set FREQ (Hz) BIT2: Bus voltage (V) BIT3: Output current (A) Tens place: BIT0: Output torque (%) BIT1: Output power (kW) BIT2: Output voltage (V) BIT3: Motor speed (r/min)	080F	△

Param	Designation	Scope	Factory default	Attr
		Hundreds place: BIT0: AI (V) BIT1: Potentiometer input (V) BIT2: Reserve BIT3: Output sync FREQ (Hz) Thousands place: BIT0: X4 pulse input BIT1: External count value BIT2: Reserve BIT3: Reserve Note: when this parameter value is set to 0000, run FREQ (Hz) would be displayed as default		
L1-01	Display parameter setting 2 on run status	Binary system setting: 0: No display 1: Display Ones place: BIT0: Run linear speed (m/s) BIT1: Set linear speed (m/s) BIT2: Input terminal status BIT3: Output terminal status Tens place: BIT0: PID setting (%) BIT1: PID feedback (%) BIT2: Set length (m) BIT3: Actual length (m) Hundreds place: Reserve Thousands place: Reserve	0000	△
L1-02	Display parameter setting on stop status	Binary system setting: 0: No display 1: Display Ones place: BIT0: FREQ setting (Hz) BIT1: Bus voltage (V) BIT2: Input terminal status BIT3: Output terminal status Tens place: BIT0: AI (V) BIT1: Potentiometer input (V) BIT2: Reserve BIT3: Reserve Hundreds place: BIT0: PID setting (%) BIT1: PID feedback (%) BIT2: Set length (m) BIT3: Actual length (m)	0003	△

Param	Designation	Scope	Factory default	Attr
		Thousands place: BIT0: Run linear speed (m/s) BIT1: Set linear speed (m/s) BIT2: External count value BIT3: X4 pulse input Note: when this parameter value is set to 0000, the set FREQ would be displayed as default (Hz)		
L1-03	Linear speed COEFF	0.1%~999.9%	100.0%	△
Group U Monitoring				
Group U0 Status Monitoring				
U0-00	Run FREQ	0.00Hz~600.00Hz	0.00Hz	◎
U0-01	Set FREQ	0.00Hz~600.00Hz	0.00Hz	◎
U0-02	Bus voltage	0V~65535V	0V	◎
U0-03	Output voltage	0V~65535V	0V	◎
U0-04	Output current	0.0A~6553.5A	0.0A	◎
U0-05	Output torque	-300.0%~300.0%	0.0%	◎
U0-06	Output power	0.0%~300.0%	0.0%	◎
U0-07	Master FREQ set source	0: Digital setting + adjustment through ∧/∨ on keypad 1: Digital setting + terminal UP/DOWN adjustment 2: Analog input AI 3: Potentiometer input 4: Reserve 5: X4 pulse input 6: Process PID output 7: PLC 8: Multi-step FREQ 9: Communication	0	◎
U0-08	Auxiliary FREQ set source	0: No set 1: Digital setting + adjustment through ∧/∨ on keypad 2: Digital setting + terminal UP/DOWN adjustment 3: Analog input AI 4: Potentiometer input 5: Reserve 6: X4 pulse input 7: Process PID output 8: PLC 9: Multi-step FREQ 10: Communication	0	◎

Param	Designation	Scope	Factory default	Attr
U0-09	Master FREQ setting	0.00Hz~600.00Hz	0.00Hz	◎
U0-10	Auxiliary FREQ setting	0.00Hz~600.00Hz	0.00Hz	◎
U0-11	Drive status	Ones place: run status 0: Accelerating 1: Decelerating 2: Constant speed run Tens place: drive status 0: Stop 1: Running 2: Autotuning	00	◎
U0-12	AI input voltage	0.00V~10.00V	0.00V	◎
U0-13	Potentiometer input voltage	-10.00V~10.00V	0.00V	◎
U0-15	AO output	0.0%~100.0%	0.0%	◎
U0-17	X4 high freq. pulse freq.	0.0kHz~50.0kHz	0.0kHz	◎
U0-18	Digital input terminal status	00~7F	00	◎
U0-19	Digital output terminal status	0~7	0	◎
U0-20	PID set	0.0%~100.0%	0.0%	◎
U0-21	PID feedback	0.0%~100.0%	0.0%	◎
U0-22	PID input offset	-100.0%~100.0%	0.0%	◎
U0-23	PLC step	0~15	0	◎
U0-24	V/f separated target voltage	0.0%~100.0%	0.0%	◎
U0-25	V/f separated actual output voltage	0.0%~100.0%	0.0%	◎
U0-26 ~ U0-29	Reserve	Reserve	Reserve	◎
U0-30	Cumulative power-up time	0h~65535h	0h	◎
U0-31	Cumulative run time	0h~65535h	0h	◎
U0-33	Heat sink temperature	-40.0℃~100.0℃	0.0℃	◎
U0-35	Terminal count value	0~65535	0	◎
U0-36	Run command log at LoU	0~1	0	◎

Param	Designation	Scope	Factory default	Attr
U0-37	Fault code log at LoU	0~100	0	◎
U0-38	Reserve	Reserve	Reserve	◎
U0-39	CtC fault source	0: No fault 1: U-phase current detection circuit fault 2: V-phase current detection circuit fault 3: W-phase current detection circuit fault	0	◎
U0-40	Higher-bit numbers of actual length	0~65	0	◎
U0-41	Lower-bit numbers of actual length	0~65535	0	◎
U0-42	Higher-bit numbers of keypad ∧/∨ stored value	-1~1	0	◎
U0-43	Lower-bit numbers of keypad ∧/∨ stored value	0.00~655.35 Hz	0.00Hz	◎
U0-44	Higher-bit numbers of terminal UP/DOWN stored value	-1~1	0	◎
U0-45	Lower-bit numbers of terminal UP/DOWN stored value	0.00~655.35 Hz	0.00Hz	◎
U0-52	Center FREQ of wobble FREQ	0.00Hz~600.00Hz	0.00Hz	◎
U0-53	Initial position angle	0.0~6000.0	0.0	◎
Group U1 History Fault				
U1-00	History fault 1 (latest)	0~48	0	◎
U1-01	Run frequency at fault 1	0.00Hz~600.00Hz	0.00Hz	◎
U1-02	Output current at fault 1	0.0A~6553.5A	0.0A	◎
U1-03	Bus voltage at fault 1	0V~1000V	0V	◎
U1-05	Temperature of heat sink at fault 1	-40.0℃~100.0℃	0.0℃	◎
U1-06	Input terminal status at fault 1	0000~FFFF	0000	◎

Param	Designation	Scope	Factory default	Attr
U1-07	Output terminal status at fault 1	0000~FFFF	0000	◎
U1-08	Cumulative run time at fault 1	0h~65535h	0h	◎
U1-09 ~ U1-17	History fault 2	Same as U1-00~ U1-08	--	◎
U1-18 ~ U1-26	History fault 3	Same as U1-00~ U1-08	--	◎

Chapter 6 Troubleshooting

Fault Causes and Troubleshooting

Once drive fault occurs, please identify the causes carefully and make a detailed record of fault symptom. To seek service, please contact distributors. Parameters U1-00, U1-09, and U1-18 are used to view fault 1, fault 2 and fault 3. Faults are recorded with numeric codes (1~48), while the fault information that corresponds to each numeric fault code is specified in the table below.

Fault code	Fault display	Fault description	Causes	Solutions
1	oC1	Accel overcurrent	Torque boost is too big under V/f control	Reduce torque boost value
			Start frequency is too high	Drop start frequency
			Accel time is too short	Prolong the Accel time
			Motor parameters are improperly set	Set the parameters correctly according to motor nameplate
			Overload is too heavy	Reduce the load
			Inappropriate V/f curve under V/f control	Set V/f curve correctly
			Restart the rotating motor	Reduce current limit value or try flying start
2	oC2	Canst-speed overcurrent	Overload is too heavy	Reduce the load
			Power rating of the drive is relatively small	Select appropriate drive power rating
			Input voltage is too low	Check power grid voltage
3	oC3	Decel overcurrent	Load inertia is too big	Use dynamic brake
			Decel time is too short	Prolong the Decel time
			Input voltage is too low	Check power grid

				voltage
4	ov1	Accel overvoltage	Load inertia is too big	Use dynamic brake
			Abnormal input voltage	Check power grid voltage
5	ov2	Constant-speed overvoltage	Load variation is too big	Check the load
			Abnormal input voltage	Check power grid voltage
			Improper parameter setting of regulator under SVC control	Properly set regulator parameters
6	ov3	Decel overvoltage	Load inertia is too big	Use dynamic braking
			Abnormal input voltage	Check power grid voltage
			Improper parameter setting of regulator under SVC control	Properly set regulator parameters
			Decel time is too short	Prolong the Decel time
8	tUN	Autotuning failed	Bad motor connection	Check motor connection
			Autotuning during rotation of the motor	Autotuning in stationary status of the motor
			Big error between real motor parameters and the setting	Set the parameters correctly according to motor nameplate
9	oL1	Drive overloaded	Torque boost is too big under V/f control	Reduce torque boost value
			Start FREQ is too high	Drop start frequency
			Accel/Decel time is too short	Prolong the Accel/Decel time
			Motor parameters are improperly set	Set the parameters correctly according to motor nameplate
			Load is too heavy	Reduce the load

			Inappropriate V/f curve under V/f control	Set V/f curve correctly
			Restart the rotary motor	Reduce current limited value or flying start
10	oL2	Motor overloaded	Torque boost is too big under V/f control	Reduce torque boost value
			Inappropriate V/f curve under V/f control	Set V/f curve correctly
			Motor parameters are improperly set	Set the parameters correctly according to motor nameplate
			Improper setting of motor overloaded protection time	Properly set the motor overloaded protection time
			Motor stalled or sharp variation of load	Identify the causes of motor stalling or check the load condition
			Long-time running of ordinary motor at low speed with heavy load	Select variable frequency motor
11	CtC	Current detection abnormal	Abnormal connection between control board and drive board	Check and re-connection
			Abnormal current detection circuit	Seek services
12	GdP	Output ground short-circuit protection	Output connection ground short circuit	Check motor connection and output ground impedance
			Motor insulation abnormal	Check the motor
13	ISF	Input power supply abnormal	Severe voltage imbalance among power supply phases	Check power grid voltage

			Abnormal bus capacitance	Seek services
14	oPL	Output phase loss	Motor cable connection abnormal	Check motor connection
			Imbalance among motor three phases	Check or replace the motor
			Incorrect setting of vector control parameters	Correctly set vector control parameters
16	oH1	Module thermal protection	Ambient temperature is too high	Drop ambient temperature
			Fan failed	Replace the fan
			Air duct blocked	Clear air duct
			Temperature sensor abnormal	Seek services
18	oH3	Module temperature detection disconnected	Temperature sensor not well connected with socket	Pull out and re-insert
			Ambient temperature is too low	Raise ambient temperature
			Module detection circuit failed	Seek services
			Thermistor failed	Seek services
23	TEr	Function conflict between analog terminals	Analog input terminals are set to the same function	Do not set analog inputs to the same function
24	PEr	External equipment error	External fault terminal is enabled	Check the status of external fault terminal
			Stall condition lasts too long	Check if the load is abnormal
26	to2	Consecutive run time attained	Consecutive run time attained" enabled	See specification of Group E0
27	to3	Cumulative run time attained	Cumulative run time attained" enabled	See specification of Group E0

28	SUE	Power supply abnormal at run	DC bus voltage fluctuation is too big or the power is lost	Check input power grid voltage and load
29	EPr	EEPROM read/write fault	Parameter read/write abnormal at control board	Seek services
31	TrC	Port communication abnormal	Improper setting of baud rate	Set properly
			Communication port disconnected	Reconnected
			Upper computer/device does not work	Make upper computer/device work
			Drive communication parameter error	Set properly
32	PdC	Keypad communication abnormal	Keypad disconnected	Reconnected
			Severe EMI	Check peripheral equipment or seek services
33	CPy	Parameter copy failure	Parameter uploading or downloading abnormal	Seek services
			No parameters stored at keypad	Seek services
35	SFt	Software version compatibility failure	Version of keypad is not consistent with that of control board	Seek services
36	CPU	Abnormal power loss	Abnormal power loss in last operation	RESET the fault
			Faulty control board	Seek services
37	oCr	Overcurrent benchmark error	SMPS failed	Seek services
			Control board failed	Seek services
38	SP1	5V supply out-of-limit	SMPS failed	Seek services
			Control board failed	Seek services
39	bEF	EMF abnormal	Not PMSM	Confirm motor type
			PMSM demagnetizing	Change motor
40	AIP	AI input out-of-limit	Control board failed	Seek services
			AI input is too high or low	Set AI input within correct range

41	LoU	Undervoltage protection	DC bus voltage is too low	Check input voltage if it is too low or the drive is the process of power loss
45	Plo	PID feedback lost	Abnormal PID feedback channel abnormal	Check the feedback channel
			Inappropriate setting of PID parameters	Set properly
47	Oc4	Overcurrent protection	Short circuit between output phases or short circuit to ground	Check the motor wiring and output impedance to ground
			The inverter module is damaged	Seek service
48	Ov4	Overvoltage protection	Abnormal input voltage	Check the grid voltage
			The control board voltage detection circuit is abnormal	Seek service

ATTENTION:

When a fault occurs, please identify the causes and seek solutions according the guidance in the table. If the fault fails to be solved, do not apply power to the drive again. Contact the supplier for service in time.

Chapter 7 Maintenance

Ambient temperature, humidity, salt mist, dust, vibration, aging and wear of internal components may result in drive faults. Routine maintenance shall be performed during the use and storage.

ATTENTION:

◆ Please make sure the power supply of the drive has been cut off, and DC bus voltage has discharged to below 36V before the maintenance.

7.1 Routine Inspection

Please use the drive in the environment recommended by this manual, and perform routine inspection in accordance with the table below.

Inspection items	Inspection aspects	Inspection methods	Criteria
Operating environment	Temperature	Thermometer	-10℃~40℃
	Humidity	Hygrometer	5%~95%, condensation not allowed
	Dust, oil stains, moisture and water-drop	Visual inspection	No filthy mud, oil stains and water drop
	Vibration	Observation	Smooth running. No abnormal vibration
	Gas	Smell, visual inspection	No peculiar smell and abnormal smoke
Drive	Noise	Listen	No abnormal noise
	Gas	Smell, visual inspection	No peculiar smell and abnormal smoke
	Appearance	Visual inspection	No defect and deformation
	Heat dissipation and temperature rise	Visual inspection	No dust and/or fiber particles in air duct, normal working of fans, normal air speed and volume, no abnormal temperature rise

7.2 Regular Maintenance

Users should perform regular inspection of the drive every 3~6 months, so as to eliminate the potential faults.

🕮 ATTENTION:

- Please make sure power supply of the drive has been cut off, and DC bus voltage has been discharged below 36V prior to maintenance.
- Never leave screws, gaskets, conductors, tools and other metal articles inside the drive. Failure to comply may result in equipment damage.
- Never modify the interior components of the drive in any condition. Failure to comply may result in equipment damage.

Inspection items	Measures
Check if control terminal screws are loose	Tighten
Check if main circuit terminal screws are loose	Tighten
Check if ground terminal screws are loose	Tighten
Check if copper bar screws are loose	Tighten
Check if drive mounting screws are loose	Tighten
Check if there are defect on power cables and control cables	Replace the cables
Check if there is dust on circuit board	Clear it up
Check if air duct is blocked	Clear it up
Check if drive insulation is failed	Test the ground terminal with 500V megameter after all input and output terminals are short-circuited via conductors. Ground test on individual terminals is strictly prohibited since this may cause damage to inverter.
Check if motor insulation is failed	Remove input terminals U/V/W of motor from drive and test the motor alone with 500V megameter. Failure to comply may result in drive failure.
Check if the storage period of the drive is over two years	Carry out power-on test, during which, the voltage should be boosted to rated value gradually using a

Inspection items	Measures
	voltage regulator; be sure to run at no load for more than 5 hours.

7.3 Replacement of Vulnerable Parts

Vulnerable parts of drive include cooling fan, electrolytic capacitor, relay or contactor etc. The service lives of these parts are subject to environment and working conditions. To maintain a favorable operating environment is conducive to improving the service life of parts and components; routine inspection and maintenance also contributes to effective improvement of parts' service life. To prolong the service life of entire drive, the cooling fan, electrolytic capacitor, relay or contactor and other vulnerable parts should be subjected to routine inspection according to the table below. Please replace the abnormal parts (if any) in time.

Vulnerable parts	Service life	Cause of damage	Criteria
Fan	30,000~40,000h	Wear of bearing and aging of blade	Check if fan blades have cracks Check if there is abnormal vibration and noise on working
Electrolytic capacitor	40,000~50,000h	Excessively high ambient temperature and excessively low air pressure result in electrolyte volatilization; aging of electrolyte capacitor	Check if there is liquid leakage Check if safety valve projects Check if capacitance value is out of allowable range Check if insulation resistance is abnormal
Relay/contactor	50,000~100,000 times	Corrosion and dust impairs the contacting effect of contact; excessively frequent contact action	Open/close failure False alarm of CCL fault

7.4 **Storage**

Storage environment should meet the requirements as set forth in the table below.

Items	Requirements	Recommended storage method and environment
Storage temperature	-40~+70℃	In case of long-term storage, areas with an ambient temperature of less than 30℃ are recommended Avoid the storage in areas where temperature shock may result in condensation and freezing
Storage humidity	5~95%	Product could be sealed with plastic film and desiccant
Storage environment	A space with low vibration and low content of salt where there is no direct exposure to sunlight, dust, no corrosive or flammable gas, oil stain, vapor and water drop	Product could be sealed with plastic film and desiccant

ATTENTION:

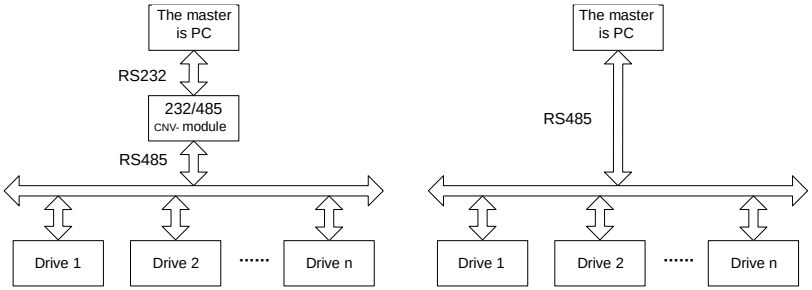
Since long-term storage may lead to the deterioration of electrolytic capacitor, the inverter must be powered up once in case storage period exceeds 2 years. After applying the power, input voltage must be boosted to rated value gradually using a voltage regulator, and be sure to have the inverter operated at no load for more than 5 hours.

◆

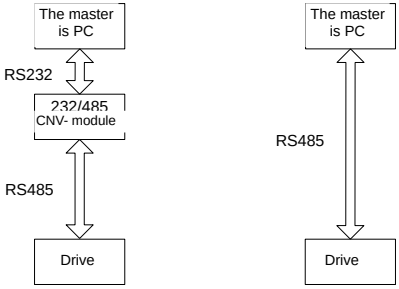
Appendix Communication Protocol

1. Networking Mode

The drives have two networking modes, single master/multiple slaves networking and single master/single slave networking.



Single master/multiple slaves networking diagram



Single master/single slave networking diagram

2. Interface Mode

RS485 or RS232 interface: asynchronous, half-duplex.

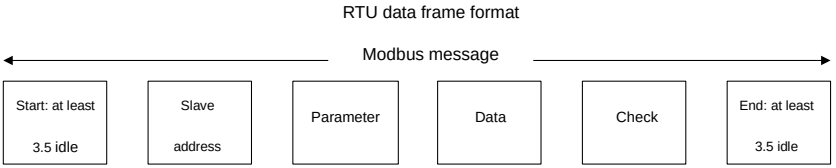
Default data format: 8-N-2 (8 data bits, no check, two stop bits), 9600 bps. See parameters of Group H0 for parameter setting.

3. Communication Mode

1） Drive is used as a slave for master-slave station-to-station communication. When master sends commands using broadcast address, the slave does not respond;
2） Native address, baud rate and data format of inverter are set through slave operating panel or serial communication;
3） Slave reports the current fault information in the latest response frame for master polling;
4） Drive employs RS-485 interface or extended RS-232 interface.

4. Protocol Format

Modbus protocol supports both RTU and ASCII mode.
RTU data frame format is shown as the figure below:



RTU:
In RTU mode, idle time between frames can be set through function code or comply with Modbus internal convention, for which the minimum interframe idle is as follows:

1） Frame header and end define the frame by making bus idle time equal to or longer than 3.5-byte time;
2） After the start of frame, the clearance between characters must be less than 1.5-character communication time, or the newly received characters will be treated as the header of the new frame;
3） Data check employs CRC-16 and the whole information participates in the check; the high and low bytes of check sum shall be sent after exchange. Please refer to examples at the end of protocol for details of CRC check;
4） The bus idle time of at least 3.5 characters (or set minimum bus idle time) shall be maintained between frames and needs not to accumulate the starting and ending idle time.

The data frame of which the request frame is "reading parameter value of b0-02 from slave 0x01" is as below:

Appendix Table 1

Address	Function code	Register address	Read words	Check sum

01	03	02 02	00 01	24 72

Response frame of slave 0x01 is as below:

Appendix Table 2

Address	Function code	Register address	Read words	Check sum
01	03	02	13 88	B5 12

ASCII:

1） Frame header is "0x3A" while the default frame end is "0x0D" "0x0A"; also, frame end can be configured and defined by user;

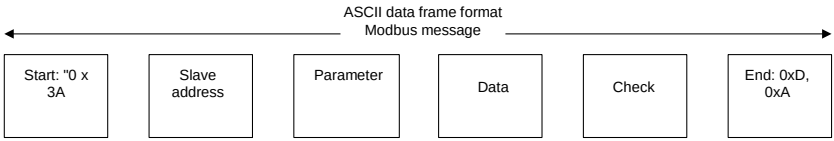
2） In ASCII mode, all data bytes other than frame header and end are sent in the form of ASCII code; high-4-bit byte and low-4-bit byte are sent successively;

3） In ASCII mode, the data is 7-bit long. For 'A'~'F', their uppercase ASCII codes are used;

4） Data is subjected to LRC check which covers the information portion from slave address to data;

5） Check sum is equal to the complement of sum of characters that participate in data check (abort the feed bit).

In ASCII mode, data frame format is as follows:



Examples of Modbus data frame in ASCII mode are as follows.

The writing of 4000 (0xFA0) into internal register 02 02 of slave 0x01 is shown in the table below.

LRC check = complement of (01+06+02+02+0x0F+0xA0) = 0x46

Appendix Table 3

	Header	Address		Parameter		Register address				Write-in content				LRC check		End	
Character	:	0	1	0	6	0	2	0	2	0	F	A	0	4	6	CR	LF
ASCII	3A	30	31	30	36	30	32	30	32	30	46	41	30	34	36	0D	0A

Different response delays can be set for drive through parameters so as to adapt to specific application requirements of various master stations; in RTU mode, the actual response delay is not less than 3.5 characters, while in ASCII mode, the actual response delay shall not be less than 1ms.

5. Protocol Function

The uppermost function of Modbus is to read and write parameters, and different parameters determine different operation requests. Parameters operations supported by inverter Modbus protocol are as shown in the table below:

Appendix Table 4 Parameters

Parameter	Meaning of parameter
0x03	Read drive functional parameters and run status parameters
0x06	Over-write individual drive functional parameters or control parameters, which are not saved on power loss
0x08	Line diagnosis
0x10	Over-write multiple drive functional parameters or control parameters, which are not saved on power loss
0x41	Write individual drive functional parameters or control parameters, and save them to non-volatile storage unit
0x42	Parameter management

Functional parameters, control parameters and status parameters of the drive are all mapped to read-write register of Modbus. Read-write characteristics and range of parameters comply with the instructions of user manual of the drive. Group numbers of drive parameters are mapped as high byte of register address, while in-group indexes are mapped as low byte of register address. Drive control parameters and status parameters are all virtualized as drive parameter groups. The corresponding relations between parameter group numbers and their high bytes of register address are as shown in table below:

Appendix Table 5 High-byte register addresses mapped from parameter group numbers

Parameter group	Mapping register address, high byte	Parameter group	Mapping register address, high byte
A0	0x00	E1	0x12
A1	0x01	F0	0x13
b0	0x02	F1	0x14
b1	0x03	F2	0x15
b2	0x04	F3	0x16
C0	0x05	F4	0x17
C1	0x06	F5	0x18

Parameter group	Mapping register address, high byte	Parameter group	Mapping register address, high byte
C2	0x07	F6	0x19
C3	0x08	H0	0x1A
C4	0x09	H1	0x1B
d0	0x0A	H2	0x1C
d1	0x0B	L0	0x1D
d2	0x0C	L1	0x1E
d3	0x0D	U0	0x1F
d4	0x0E	U1	0x20
d5	0x0F	U2	0x21
d6	0x10	Drive control parameter group	0x62
E0	0x11	Drive status parameter group	0x63

For example, the register address of drive parameter b0-02 is 0x0202 while that of E0-07 is 0x1107.

In the following paragraphs, we present the formats and meanings of Modbus protocol parameters and data portion hereafter, i.e. to introduce the "parameter" and "data" related contents in above-noted data frame format. These two parts constitute the application layer protocol data unit of Modbus. The application layer protocol data unit mentioned below refers to these two parts. We take RTU mode for example to describe frame format below. The length of application layer protocol data unit should be doubled in ACSII mode.

Application layer protocol data units of various parameters are as follows:
Parameter 03: read register content
Request format is shown in appendix table 6.

Appendix Table 6

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x03
Register address	2	0x0000~0xFFFF
Number of registers	12	0x0001~0x000C
Check	LRC or CRC	

Response format is shown in appendix table 7.

Appendix Table 7

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x03
Number of read bytes	1	2* number of registers
Register content	2* number of registers	
Check	LRC or CRC	

Parameter 0x06 (0x41) : write register content (0x41 saved at power loss)
Request format is shown in appendix table 8.

Appendix Table 8

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x06
Register address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF
Check	LRC or CRC	

Response format is shown in appendix table 9.

Appendix Table 9

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x06
Register address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF
Check	LRC or CRC	

□ Some parameters of the drive are reserved and cannot be modified by communication setting. The list of these parameters is shown in appendix table 10.

Appendix Table 10

□	□ Parameters	□ Remarks
□ (Parameter identification)	□ d0-22 d3-22	□ Communication not operable
□ (Parameter passing)	□ A0-05	□ Communication not operable

□ (User password)	□ A0-00	□ User password can not be set by communication, but the user password set by keypad can be unlocked by writing the same password from upper computer/device communication. Upper computer/device can view and modify parameters.

□ Parameter 0x08: communication line diagnosis.

□ Request format is shown in appendix table 11.

Appendix Table 11

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x08
Sub-parameter	2	0x0000~0x0030
Data	2	0x0000~0xFFFF
Check	LRC or CRC	

Response format is shown in appendix table 12.

Appendix Table 12

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x08
Sub-parameter	2	0x0000~0x0030
Data	2	0x0000~0xFFFF
Check	LRC or CRC	

Sub-parameters supported by line diagnosis are as set forth in the table below.

Appendix Table 13 Line diagnosis sub-parameter

Sub-PARA	Data (request)	Data (response)	Meaning of subfunction
0x0001	0x0000	0x0000	Reinitialize communication: make no-response mode disable.
	0xFF00	0xFF00	Reinitialize communication: make no-response mode disable.

0x0003	“New frame end” 00	“New frame end” 00	Set the frame end of ASCII mode and this "new frame end" will replace the original line feed symbol.(Note: new frame end shall not be greater than 0x7F and shall not be equal to 0x3A)
0x0004	0x0000	No response	Set no-response mode. Only response to reinitialization communication request. This is mainly used for isolating faulty equipment.
0x0030	0x0000	0x0000	Make slave no-response to invalid command and error command
	0x0001	0x0001	Make slave response to invalid command and error command

Parameter 0x10: write parameters continuously
Request format is shown in appendix table 14.

Appendix Table 14

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x10
Register address	2	0x0000~0xFFFF
Number of registers	2	0x0001~0x0004
Number of bytes of register content	1	2* number of operation registers
Register content	2* number of operation registers	
Check	LRC or CRC	

Response format is shown in appendix table 15.

Appendix Table 15

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x10
Register address	2	0x0000~0xFFFF
Number of registers	2	0x0001~0x0004
Check	LRC or CRC	

Parameter 0x42: parameter management

Request format is shown in appendix table 16.

Appendix Table 16

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x42
Sub-parameter	2	0x0000~0x0007
Data	2 (high byte is parameter group number, while low byte is parameter in-group index)	
Check	LRC or CRC	

Response format is shown in appendix table 17.

Appendix Table 17

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x42
Sub-parameter	2	0x0000~0x0007
Data	2	0x0000~0xFFFF
Check	LRC or CRC	

Sub-parameters supported by parameter management are set forth in the table 18.

Appendix Table 18 Parameter management sub-parameters

Sub-PARA	Data (request)	Data (response)	Meaning of subfunction
0x0000	Parameter group number and in-group index respectively possess high and low bytes	Upper limit of parameter	Read the upper limit of parameter
0x0001	Parameter group number and in-group index respectively possess high and low bytes	Lower limit of parameter	Read the lower limit of parameter

Sub-PARA	Data (request)	Data (response)	Meaning of subfunction
0x0002	Parameter group number and in-group index respectively possess high and low bytes	See specification below for details of parameter characteristics	Read the characteristics of parameter
0x0003	Parameter group number possesses high byte, while the lower byte is 0.	Maximum value of in-group index	Read the maximum value of in-group index
0x0004	Parameter group number possesses high byte, while the lower byte is 0.	The next parameter group number possesses high byte, while the lower byte is 0.	Read the next parameter group number
0x0005	Parameter group number possesses high byte, while the lower byte is 0.	The previous parameter group number possesses high byte, while the lower byte is 0.	Read the previous parameter group number

Status parameter group should not be modified and does not support the reading of upper and lower limits. Parameter characteristic is 2-byte long, and the bit definition is shown in the table below:

Appendix Table 19 Parameter characteristics

Characteristic parameter (BIT)	Value	Meaning
BIT1~BIT0	00B	Changeable in run
	01B	Not changeable in run, but changeable in stop
	10B	Read only
	11B	Factory parameters
BIT4~BIT2	000B	Accuracy: 1
	001B	Accuracy: 0.1
	010B	Accuracy: 0.01
	011B	Accuracy: 0.001
	100B	Accuracy: 0.0001
	Others	Reserved
BIT7~BIT5	000B	The unit is A
	001B	The unit is Hz

Characteristic parameter (BIT)	Value	Meaning
	010B	The unit is Ω
	011B	The unit is r/min
	100B	The unit is S
	101B	The unit is V
	110B	The unit is %
	111B	No unit
BIT8	0: decimal; 1: hexadecimal	Display format
BIT9	0: non-quick menu; 1: quick menu	Quick menu or not
BIT10	0: not uploaded; 1: uploaded	Uploaded to keypad or not
BIT13~BIT11	001B	Data width: 1
	010B	Data width: 2
	011B	Data width: 3
	100B	Data width: 4
	101B	Data width: 5
	110B	Data width: 6
	111B	Data width: 7
BIT14	Number of symbols available/not available	0: unsigned number; 1: directed number
BIT15	Reserved	Reserved

The response format is shown as table 20 when an error occurs.

Appendix Table 20

Application layer protocol data unit	Data length (number of bytes)	Range
Parameter	1	0x80 + parameter
Error code	1	
Check	LRC or CRC	

Error codes supported by Modbus protocol are listed in the table below:

Appendix Table 21 Error codes

Error codes	Meanings of error codes
0x01	Illegal parameter
0x02	Illegal register address
0x03	Data error, i.e. data are out of upper limit or lower limit

0x04	Slave operation failed, including errors caused by invalid data although there are in the range
0x05	Command is valid and being processed, mainly used for storing data to non-volatile storage
0x06	Slave is busy, please try again later; mainly used for storing data into non-volatile storage
0x18	Message frame error: including message length error and check error
0x20	Parameter is not changeable
0x21	Parameter is not changeable during the running
0x22	Parameter is under password protection

Drive control parameters are used for start, stop and run frequency setting. By detecting drive status parameters, run status and run mode can be obtained. Drive control parameters and status parameters are shown in appendix table 22.

Appendix Table 22 Control parameters

Register address	Parameter name	Save at power loss
0xAT6100	Control command word	No
0xAT6101	Master frequency setting	Yes
0xAT6102	Auxiliary frequency setting	Yes
0xAT6103	Master frequency setting	No
0xAT6104	Auxiliary frequency setting	No
0xAT6105	Multi-step frequency setting	No
0xAT6106	Simple PLC frequency setting	No
0xAT6107	PID digital setting percentage (0~100.0%)	No
0xAT6108	PID feedback percentage (0~100.0%)	No
0xAT6109	Electric driven torque limit (0~200.0%)	No
0xAT610A	Brake torque limit (0~200.0%)	No
0xAT610B	Reserved	No
0xAT610C	Reserved	No
0xAT610D	Reserved	No
0xAT610E	AO channel setting	No
0xAT610F	Reserved	No

Register address	Parameter name	Save at power loss
0x6210	Reserved	No
0x6211	Setting of slave frequency setting proportion (0~100.0%)	No
0x6212	Virtual terminal communication setting	No
0x6213	Accel time 1	Yes
0x6214	Decel time 1	Yes

Appendix Table 23 Status parameters

Register address	Parameter name
0x6300	Run status word 1
0x6301	Current run frequency
0x6302	Output current
0x6303	Output voltage
0x6304	Output power
0x6305	Rotary speed
0x6306	Bus voltage
0x6307	Output torque
0x6308	External counter
0x6309	High-bit words of actual length
0x630A	Low-bit words of actual length
0x630B	Status of digital input terminal
0x630C	Status of digital output terminal
0x630D	Setting of run frequency
0x630E	PID setting
0x630F	PID feedback
0x6310	Set length
0x6311	Set Accel time 1
0x6312	Set Decel time 1
0x6313	AI (unit: V)
0x6314	Potentiometer input (Unit: V) (Negative value indicates the corresponding digital complement)
0x6315	Reserved

Register address	Parameter name
0x6316	X4 pulse input (Unit: kHz)
0x6317	Fault 1
0x6318	Fault 2
0x6319	Fault 3 (the latest)
0x631A	Run display parameter
0x631B	Stop display parameter
0x631C	Setting of drive control mode
0x631D	Frequency setting mode
0x631E	Master frequency setting
0x631F	Digital setting of master frequency
0x6320	Auxiliary frequency setting
0x6321	Digital setting of auxiliary frequency
0x6322	Drive status word 2
0x6323	Current fault of the drive

Drive control bits are defined as below table 24.

Appendix Table 24 Control bits

Control bit	Value	Meaning	Function description
BIT0	0	Run command disabled	Stop the drive
	1	Run command enabled	Start the drive
BIT1	1	Reverse	Set the run direction when run command enabled
	0	Forward	
BIT2	1	Jog	
	0	Jog disabled	
BIT3	1	Reset command enabled	
	0	Reset command disabled	
BIT4	1	Coast to stop enabled	
	0	Coast to stop disabled	
BIT15~BIT5	000000B	Reserved	

ATTENTION:

When BIT0 and BIT2 coexist, jog takes precedence.

Drive status bits are shown in appendix table 25.

Appendix Table 25 Status word 1 bits

Status bit	Value	Meaning	Remarks
BIT0	1	Run	
	0	Stop	
BIT1	1	Reverse	
	0	Forward	
BIT3~BIT2	00B	Constant speed	
	01B	Accel	
	10B	Decel	
BIT4	0	Main setting not attained	
	1	Main setting attained	
BIT7~BIT5	Reserved		
BIT15~BIT8	0x00~0xFF	Fault code	0: drive normal. Non-0: drive at fault; Refer to relative specification of the fault codes in Chapter 7 in this user manual

Appendix Table 26 Status word 2 bits

Status bit	Value	Meaning	Remarks
BIT0	1	Jog	
	0	Non-jog	
BIT1	1	PID run	
	0	Non-PID run	
BIT2	1	PLC run	
	0	Non-PLC run	
BIT3	1	Run at multi-step frequency	
	0	Run at non-multi step frequency	
BIT4	1	Ordinary run	
	0	Non-ordinary run	
BIT5	1	Wobble frequency	
	0	Non-wobble frequency	

Status bit	Value	Meaning	Remarks
BIT6	1	Undervoltage	
	0	Normal voltage	
BIT7	1	Sensor-less vector control	
	0	Non-sensor-less vector control	
BIT8	0	Reserved	
BIT9	0	Reserved	
BIT10	1	Autotuning	
	0	Non-autotuning	
Others	0	Reserved	

6. Operation Instructions

0x03 reads multiple (including one) registers (default address is 0x01). Master enquiry:

Appendix Table 27

Address	Parameter	Register address	Number of registers	Check code
01	03	XX XX	000X	XX XX

Slave response:

Appendix Table 28

Address	Parameter	Total number of bytes	Data	Check code
01	03	2* number of registers	Bn~B0	XX XX

Register address: 0x00 00~0x63 22;
Number of registers: 0x00 01~0x00 0C;
Data: n is equal to (2 x the number of registers -1).
Application example:
Note: before using communication controlling drive, please check if hardware is properly connected; in addition, be sure to properly set the communication data format, baud rate and address.
Parameter 0x03 is used here to read values of 0x01 slave's control parameters b0-00, b0-01, b0-02 and b0-03. At this moment, b0-00 = 0, b0-01 = 0, b0-02 = 50.00, b0-03 = 0.

Appendix Table 29

	Address	PARAM	Register address	Number of registers	Number of data bytes	Data	Check sum
Request	01	03	02 00	00 04	None	None	44 B1
Response	01	03	None	None	08	0000,0000, 1388, 0000	11 79

Management of parameter 42H
Master enquiry:

Appendix Table 30

Address	Parameter	Sub-parameter	Data	Check code
01	42	XX XX	XX XX	XX XX

Slave response:

Appendix Table 31

Address	Parameter	Sub-parameter	Data	Check code
01	42	XX XX	B1~B0	XX XX

Register address: 0x00 00~0x21 06 and 0x62 00~0x63 22.
Sub-parameter: refer to the table of parameter managing sub-parameter.
Data: refer to the values of data as set forth in the table of parameter managing sub-parameter.
Example:
Parameter 0x42 is used here to read the upper limit value of 0x01 slave's control parameter b0-02 which is 600.00:

Appendix Table 32

	Address	Parameter	Sub-PARA	Data	Check sum
Request	01	42	00 00	02 02	F9 64
Response	01	42	00 00	EA 60	36 8D

0x06 (0x41 data storage) writes that individual parameter data is not saved.
Master enquiry:

Appendix Table 33

Address	Parameter	Register address	Data	Check code
01	06	62 00	B1 B0	XX XX

Slave response:

Appendix Table 34

Address	Parameter	Register address	Data	Check code
01	06	62 00	B1 B0	XX XX

Example:

Parameter 0x06 is used here to write 0x01 slave's control command (forward), i.e. to write 1 to register address 0xAT6100:

Appendix Table 35

	Address	Parameter	Register address	Number of registers	Number of data bytes	Data	Check sum
Request	01	06	62 00	None	None	00 01	57 B2
Response	01	06	62 00	None	None	00 01	57 B2

10H writes that the data of multiple registers are not saved.

Master enquiry:

Appendix Table 36

Address	Parameter	Register address	Number of registers	Number of data bytes	Data	Check code
01	10	XX XX	0001~0004	Number of 2* registers	XX XX	XX XX

Slave response:

Appendix Table 37

Address	Parameter	Register address	Number of registers	Check code
01	10	XX XX	Number of 2* registers	XX XX

Register address: 0x00 00~0x1E 04, 0x62 00~0x62 14

Number of registers: 0x00 01~0x00 04

Number of data bytes: 0x02~0x08

Data: n is equal to (2 x the number of registers -1).

Example:

Parameter 0x10 is used here to write the corresponding write data 1, 6 and 0 in control registers 0xAT6100, 0xAT6101 and 0xAT6102 of slave 0x01:

Appendix Table 38

	Address	Parameter	Register address	Number of registers	Number of data bytes	Data	Check sum
Request	01	10	62 00	00 03	06	0001,0006,0000	CE F8
Response	01	10	62 00	00 03	None	None	9F B0

08H: communication line diagnosis
Master enquiry:

Appendix Table 39

Address	Parameter	Sub-parameter	Data	Check code
01	08	XX XX	XX XX	XX XX

Slave response:

Appendix Table 40

Address	Function code	Subfunction code	Data	Check code
01	08	XX XX	Bn~B0	XX XX

Sub-parameter: table of line diagnosis sub-parameter.

Example:
Parameter 0x08 is used here to set the communication no-response mode of 0x01 slave:

Appendix Table 41

	Address	Parameter	Sub-PARA	Data	Check sum
Request	01	08	00 04	00 00	A1 CA
Response	01	08	00 04	00 00	A1 CA

Read error or warning
In case illegal parameter, illegal register address, data errors and other anomalies are detected during communication, slave response communication anomaly will occur. In such a case, the slave response will be in the following formats:
Slave response:

Appendix Table 42

Address	Parameter	Data	Check code
01	0x80+parameter	Error code	XX XX

Example:

Parameter 0x10 is used here to write the corresponding write data 1, 11, 4 and 100.00 in control registers 0xAT6100, 0xAT6101, 0xAT6102 and 0xAT6103 of 0x01 slave:

Appendix Table 43

	Address	Parameter	Register address	Number of registers	Number of data bytes	Data	Check sum
Request	01	10	62 00	00 04	08	0001,000B 0004 2710	DE 64
Response	01	90	None	None	None	20	0C 01

7. LRC/CRC Generation

In consideration of the demand for speed improvement, CRC-16 is usually realized in form mode. C-language source codes for realization of CRC-16 are given below. Please note that the high and low bytes have been exchanged in final result, that is to say, the result is the CRC check sum to be sent:

```
/* The function of CRC16*/
Uint16 CRC16(const Uint16 *data, Uint16 len)
{
    Uint16 crcValue = 0xffff;
    Uint16 i;
    while (len--)
    {
        crcValue ^= *data++;
        for (i = 0; i <= 7; i++)
        {
            if (crcValue & 0x0001)
            {
                crcValue = (crcValue >> 1) ^ 0xa001;
            }
            else
            {
                crcValue = crcValue >> 1;
            }
        }
    }
    return (crcValue);
}
```