SA710L
USER MANUAL

Preface

Thanks for choosing the SA710L Vector frequency converter .

Before using the products, please read the manual first to make sure the performance and specification of the products are fully understood, so that the products can be installed and operated safely and achieve the best value for the customer. Specifically, the manual describes the demands for maintenance and reconditioning of the products, please read the manual or download relevant materials from our website when needed.

Only professional electrical engineer is allowed to install or debug the product wherever high voltage is applied.

In the manual, some information is marked with  (Caution) or  (Danger) to warn of the safety demands for moving, installing, operating and testing the products. Please follow the demands. If any question, please contact us for professional advices.

To fulfil more and more demands from the customer, we may upgrade our products and the manual as well, you may not receive the notification if no special agreement is made. Please keep attention to our website or consult us if any change happens

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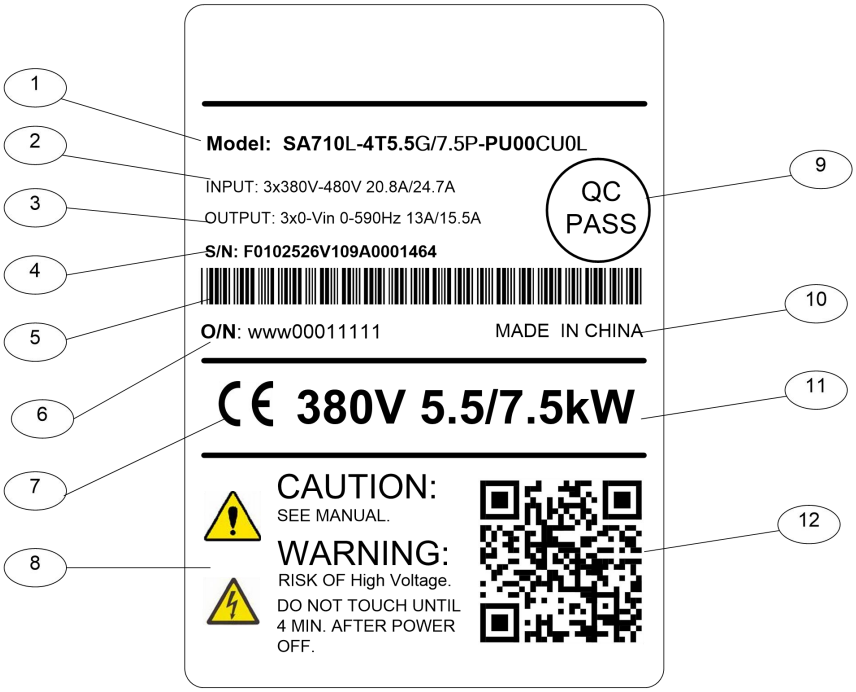
Chapter 1 SA710L Model and Specification

1.1 Nameplate of SA710L



Item	Description
1	Type code
2	Power input specification
3	Power output specification
4	Sales number
5	Bar code
6	Order number
7	Certification logo:RoHS CE UL WEEE etc.
8	Warning information
9	QC Pass
10	Country of origin
11	Voltage/Power
12	QR code

Explanation of the Type Code:

No.		Description
1	SA710	SA710 family
2	4T	Line in voltage, 4T:3phase380V ;2T:3phase220V or single phase 220V
3	5.5G	Power size. 5.5 means 5.5kW, G means for Heavy load;
4	7.5P	7.5 means 7.5kW, P means for Light load. For Models not supporting dual rating, this will be null
5	PU00	Type of Power Unit
6	CU0L	Type of control Unit

Note:(“/” and “-” are not counted in the number of digits)

1.2 Models for SA710L

Model Type	Power (kW)	Voltage (V)	Heavy Load		Light Load		Air (m^3/h)
			Input (A)	Output (A)	Input (A)	Output (A)	
SA710L-4T4.0G/5.5P-PU00CU0L	4.0/5.5	3×380-440	15	9.6	18.6	11.2	45.5
		3×440-480	12.9	8.8	18.1	11.0	
SA710L-4T5.5G/7.5P-PU00CU0L	5.5/7.5	3×380-440	20.8	13.0	24.7	15.5	90
		3×440-480	19.1	11.8	21.4	14.2	
SA710L-4T7.5G/11P-PU00CU0L	7.5/11	3×380-440	27.1	17.0	33.1	22.0	90
		3×440-480	23.4	15.5	30.2	21.0	
SA710L-4T11G/15P-PU00CU0L	11/15	3×380-440	35.9	25.0	42.5	31.0	124
		3×440-480	31.4	22.7	39.8	28.5	
SA710L-4T15G/18.5P-PU00CU0L	15/18.5	3×380-440	43.4	32.0	50.2	36.0	170
		3×440-480	40.2	29.1	45.8	34.0	
SA710L-4T18.5G/22P-PU00CU0L	18.5/22	3×380-440	51.5	38.0	58.5	42.5	230
		3×440-480	46.1	34.5	54.0	40.0	
SA710L-4T22G/30P-PU00CU0L	22/30	3×380-440	61	45.0	79.0	56.0	272
		3×440-480	54.5	40.9	73.0	51.0	

1.3 Specification

Item		Specification
Line in	Voltage	3 Phase 380~480V -15%~+10%;
	Frequency	50/60Hz±5%
	Unbalance	3%
Out put	Voltage	3 Phase 0~100% Line in voltage
	Frequency	0~590Hz
Main Control	Control algorithm	V/F control,Vector Control
	Start Torque	0.5Hz 150%
	Overload	150% 60s, 180% 3s
	Speed accuracy	±0.5% of Nominal speed at SOL; ±0.1% of Nominal speed at SCL
Basic Functions	Speed open loop/speed close loop, Motor auto tuning, Load compensation, auto DC voltage regulation, DC brake/AC brake, speed limit, current/torque limit, fly start etc. Note:Speed close loop is OK only when a control unit and PG card are installed.	
Application Functions	Lift application function, S ramp, Mechanic brake, UPS etc.	
Protection Functions	Short circuit, Ground fault, line phase loss, under voltage, over voltage, over current, overload, over temperature, motor thermal protection, motor phase loss, control wire broken etc.	

Item		Specification
Control terminals	RUN, F/R, DI1, DI2, DI3, DI4	Digital inputs:Input type:NPN and PNP mode
	DO1	Digital Output:Open Collector; 0~40mA; 0~30V
	RS+, RS-	RS485 Communication:Max Baud Rate:38400bit/s
	FA-FB-FC KA-KB	Relay Output:Resistive Load:250VAC 3A/30VDC 3A; Inductive Load:250VAC 0.2A/24VDC 0.1A (cosφ=0.4);
	AI1, AI2	Be configured to Digital inputs default, Input type:NPN and PNP mode; also can be configured to analog inputs by parameter P17.55.
	AO1	Analogue Output:0~10V or 0~20mA
	VDD	24V Power Supply:Max 200mA
	+10V	10V signal power supply:Max 30mA
	GND	Signal Ground
	PE	Safety Ground
Operation Environment	Protection Level	IP20
	Operation Ambient Temperature	Operating range:-10℃ ~ 60℃ Nominal current to 50°C, derate from 50°C
	Operation Ambient Humidity	5%-85%(No condensing at 95%)
	Vibration	1.14g
	Altitude	1000m, derate from 1000m
	Motor cable length	Shielded Cable:50m; Un-shielded cable:100m
Others	Brake Chopper	Built in as default up to 22kW

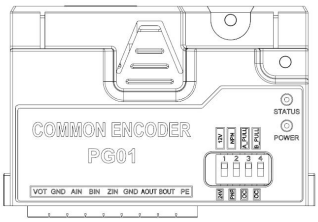
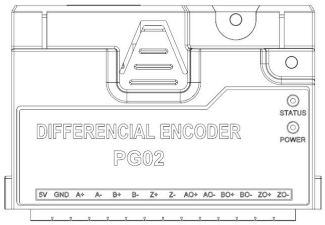
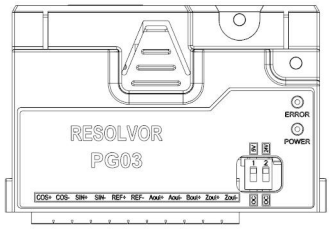
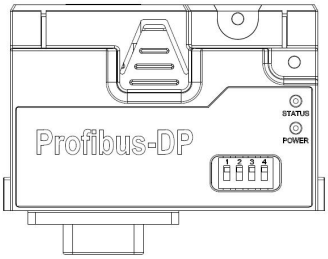
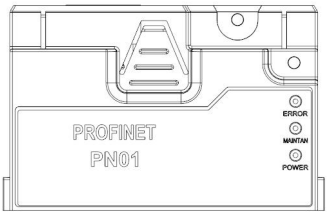
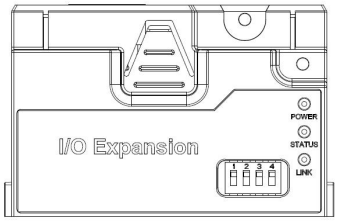
1.4 Derating Requirement

Derating with temperature:when used as heavy load type, derating is required from temperature higher than 50°C. 2.0% per degree is demanded. when used as heavy load type, derating is required from temperature higher than 40°C. 3.0% per degree is demanded.

Derating with altitude:derating is required from altitude higher than 1000m. 1% load per 100m or 0.5°C ambient ambient temperature is demanded.

1.5 Other Options Supported in SA710L

Main specification and Models of option cards.

Model type		Main Specification	Appearance
PG card	AD-PG01	Power supply:12V/24V; 150mA; Input:A/B/Z, Voltage/OC/OE/push-pull,50KHz Divider Output:A1 B1(divider multiple:1~255)	
	AD-PG02	Power supply:5V, 200mA; Input:A+/A-,B+/B-,Z+/Z-differential signal, 200KHz Divider Output:A+/A-;B+/B-(divider multiple:1~255)	
	AD-PG03	Resolver Power supply:REF+/REF;(VRMS:5V~7V) Stimulation frequency:10KHZ Inputs:SIN+/SIN-; COS+/COS- Number of pole pair:2, 4, 6, 8	
Bus communication	AD-DP01	Protocol:Profibus DPV0/DPV1 Terminal:DB9 with DP+, DP-, RTS, 5V, GND Baud rate:9.6Kbps~12Mbps GSD file:available	
	AD-PN01	Protocol:Profinet RT, IRT, ProfiDrive Terminal:RJ45	
IO extension	AD-IO01	Digitals(3DI+2DO) 4Analogs(2AI+2AO) 1Resister(1RI) 10V-1	

Chapter 2 Operation Instruction for SA710L

2.1 Safety Instruction

Definition of Safety:

In the manual, the do's and don'ts of safety announcements are classified into two categories as below:

⚠ Caution:Not following the safety announcements may lead to damage of the product or equipment

⚠ Warning:Not following the safety announcements may lead to death or hurt to the humane body

2.1.1 Before Power On

⚠ Caution

The power supply must be within the specification of product.

Please install the product in a safe environment. Please operate the product within the specified ambient temperature and humidity, avoid direct sunlight to the product. Please prevent the product from dripping water because the protection level of product is IP20. Installing the product in an unsafe environment may lead to fire, explosion or electric shock.

If the product is installed in a cabinet, please ensure a good air conduct. Cooling fans to take the heat out of the cabinet is demanded especially when there are some other components that generates heat. The ambient temperature inside the cabinet should be controlled within specification of all the parts to avoid over temperature protection or fire.

You should NOT RUN/STOP the product by switching on/off the input power to the product, e.g. with a contactor. This operation may lead to damage of the product. Keypad, IO terminal or bus communication command is recommended to run/stop the product.

Installing contactor or air switch at the output side of the product is not recommended. If you have to do so, please make sure that the output current of the product is stopped when operating the contactor or switch.

It is prohibited to connect any capacitor or varistor directly at the output side of the product. Doing so may lead to unexpected failure of damage of the product.

High distortion over the standards in the power supply, including harmonics and unbalance, may lead to failure or damage of the product. Please avoid connecting to the common-connection-point directly with equipment which generate strong distortion in the grid, e.g. electric welding machine.

Make sure all the power ports (R/S/T/+/-/BR/U/V/W) are connected correctly, otherwise the product will be damaged when power on or start.

In factory default set up, motor thermal protection is disabled. If this function is demanded, please set the parameter according to the manual.

Isolation tests to the product or internal components could be destructive and damage the product. Please consult us if you need to do so.

Electronic components is sensitive to ESD, do not touch the PCBAs without ESD protection.

The product is designed for high voltage operation, only qualified electrical engineers can be responsible for the installation, commissioning, tests and maintenance for the product.

Do NOT move the product via the front cover of the product to avoid dropping hazard. Please use the bottom of the product or the specifically designed construction.

Warning

Make sure the power is off for enough time before connecting the wires

Please install the product on fire-proof material to avoid any fire hazard.

Do not install the product in the environment with explosive gases, otherwise there will be explosion hazard.

Connect the PE terminal to the safe ground. NEVER use the null line as ground, otherwise it may lead to electric shock.

It is strictly prohibited to disassemble the products and change the parts, components, connections or setup of the products without permission. Doing so may lead to electric shock, explosion etc.

Please install the product cover correctly before power on.

2.1.2 With Power On

Warning

NEVER plug or remove any part of the product when the product is powered except for the detachable keypad. Doing so may lead to product damage or humane injury or death.

Keep children and irrelevant person away from the product when it is powered on.

2.1.3 Running

Caution

Do Not switch in/off the motor to the product during running. Doing so may lead to failure or damage of the product.

Motor cable length exceeding the specification will reduce the life time of the products or lead to failure. If multi-motor is connected to the product, the total motor cable length should be within 50% of the specification. If motor cable length exceeds the limitation, please install filter at the output of the product.

Pay attention to the speed limitation for the motor bearing and other mechanical device.

Warning

Do NOT touch or detect the circuit with detector of multimeter, oscilloscope or any other equipment.

Do NOT open the front cover of the product during running.

If the Fault-Auto-Restart function is enabled by parameter setup, the motor may rotate again after failure. Please stay away from any moving part including the motor.

2.1.4 Power Off

Warning

Before touch the power terminals or any part inside the product, please make sure all the connections which can power the product have been removed, including AC line in, DC inputs.

Even all the connections which can power the product have be removed, there could still be residual voltage inside. Please wait for enough time according to the specification before touch the power terminals or any internal parts.

2.2 Mechanical and Electrical Installation

2.2.1 Installation Environment

The operation ambient temperature should be within -10℃~60℃;

Install the product on fire-proof material;

Installation vibration should be not higher than 1.14g. Make sure the product is fixed properly to the installation surface;

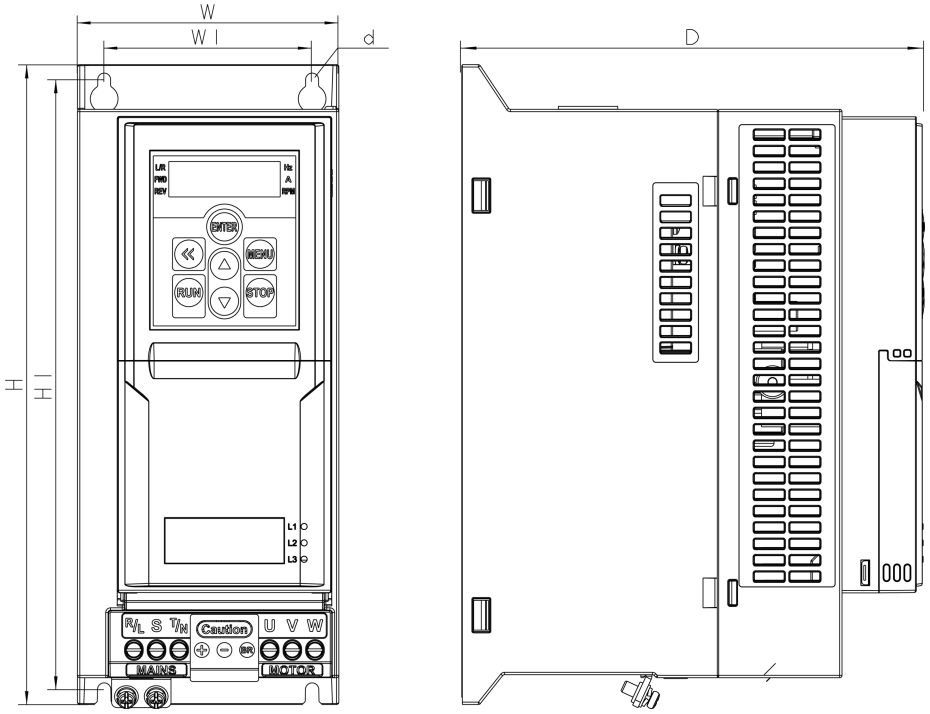
Ensure enough space around the product for heat dissipation;

Avoid direct sunlight, water dripping, condensing and humidity over limit;

Do NOT install the product in environment with corrosive gas, inflammable gas or explosive gas;

Do NOT install the product in environment with oil contamination, dusty air or metal dust.

2.2.2 Outline and Installation Dimensions



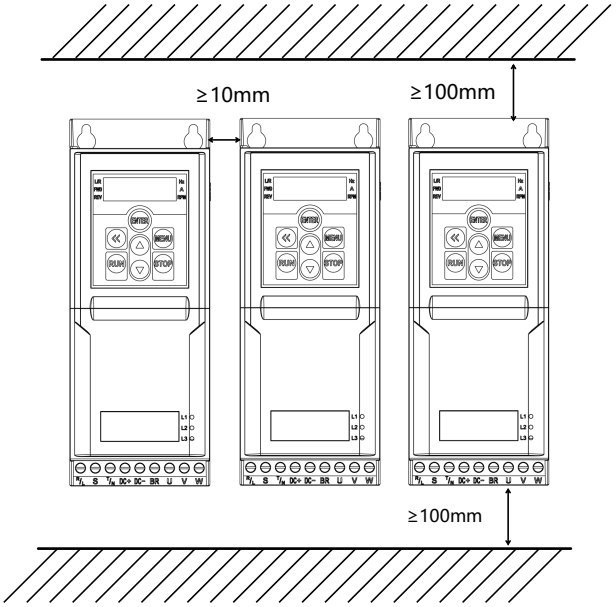
Frame Sizes:

Frame	Rated Power	Dimensions (mm)					
	3×380-480V	W	H	D	W1	H1	d
D2	4.0kW	88	215	155	70	205	4.5
D3	5.5-7.5kW	100	250	161	80	240	4.5
D4	11-22kW	170	370	179	145	355	6.5

2.2.3 Product Installation

2.2.3.1 Single mounting and side-by-side mounting

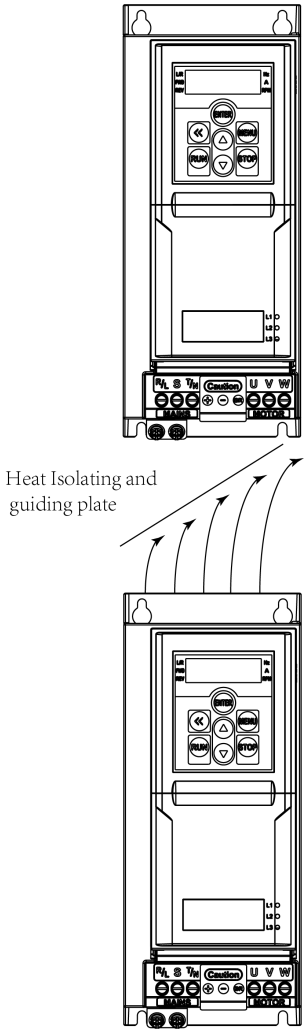
SA710L support side-by-side mounting as well as single mounting. Enough space around the product should be kept to ensure the heat dissipation, as stated below:



Note:If the demanded space cannot be guarantee, please date the product or lower down the ambient temperature

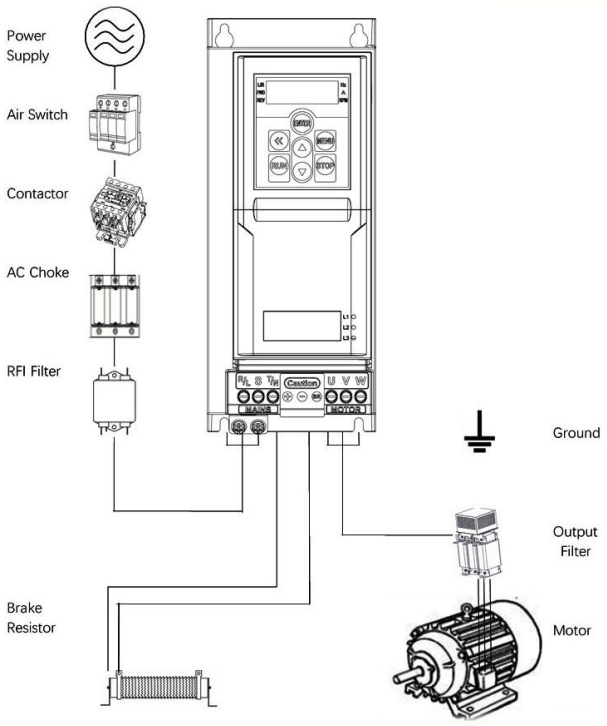
2.2.3.2 Above-underneath installation

When install products on top of another, the heat generated by the product underneath could increase the temperature of the product above. In this case a plate for heat isolating and guiding is necessary as shown in below picture.



2.2.4 Auxiliary Components Installation

Most possible auxiliary components installed as options for running the product are shown as below:



Name	Connect Point	Functions
Air Switch	First to the power supply	Cut the power automatically at high current to protect the product from further damage and limit the failure impact to other equipment
Contactor	Between the air switch and input port	Power on or power off for the product. Please limit the on-off frequency within 2 times per minute, otherwise the product may be damaged. Do NOT run/stop the motor by switching the power with contactor. Doing so may damage the product.
Input Choke	At the input port	To restrain harmonics to the line in current, or to protect the product in harsh grid with voltage distortion or unbalance, AC choke can be connected between the power supply and input port of the product. Please be aware of that AC choke will increase the voltage drop so that reduce the maximal load capacity.
RFI filter	At the input port	In order to achieve higher level of EMC performance especially for conducted emission to the grid, RFI filter should be connected between the power supply and the input port of the product.
Brake Resistor/ Brake Chopper	P and BR terminal for Brake Resistor, P and N terminal for Brake Chopper	Brake resistor can be used to consume the electric power generated by the motor when the motor is running at generator mode. Please be aware of that, NOT use brake resistor to protect the product at high grid voltage. Energy feedback unit should be used instead of brake resistor in case that the motor will run in generator mode for long duration or high power will be generated.
Output choke, Sine filter	At the output port	Dv/dt choke can be installed to protect the motor from damage by voltage spike in case long motor cable or traditional motor designed for grid direct connection is used. In case of very long motor cable or the motor has specific demands to limit the power loss of harmonic current, sine filter can be used.

2.2.4.1 Selection guide for air switch, fuse and contactor

Below is the guide for air switch, fuse and contactor:

Product Type Code	Air Switch (A)	Fuse (A)	Contactor (A)
SA710L-4T4.0G/5.5P-PU00	25	25	25
SA710L-4T5.5G/7.5P-PU00	32	32	25
SA710L-4T7.5G/11P-PU00	40	40	32
SA710L-4T11G/15P-PU00	63	63	40
SA710L-4T15G/18.5P-PU00	63	63	63
SA710L-4T18.5G/22P-PU00	100	100	63
SA710L-4T22G/30P-PU00	100	100	100

2.2.4.2 Selection guide for brake resistor

The customer can select brake resistor with resistance and power as calculation below. Basically, the bigger system inertia, shorter deceleration time or more often the motor brakes, the bigger power and smaller resistance of the brake resistor are needed. Please be aware of the resistance cannot be smaller than the limitation as stated in below table, otherwise the product may be damaged.

Brake resistance selection:

The calculation of brake resistance:R = UDcB2 ÷ (KBF × PNOM)

UDCB --- the threshold DC voltage triggering the resistor brake function. (This value can be set in the parameter via control keypad or bus communication, normally 385Vdc for 200V product and 710Vdc for 380V product);

PNOM --- The rated power of motor; KBF --- Brake factor, the bigger inertia, shorter deceleration time, the bigger factor value is needed. KBF value is recommended in range of 0.8~2.0. 1.0 is recommended for general application, 1.5 is recommended for bigger inertia, 2.0 is recommended for steel works equipment;

Selection of brake resistor power:

Instant brake power calculation:PB = UDcB2 ÷ R

In theory, the power size of the brake resistor can be selected ad instant brake power, but a correction factor should be used based on brake frequency and brake duty to avoid wasting of cost and space. The correction factor is used as:Pr = KBt × PB

KBt = 0.12~ 0.9 is the correction factor. Normal selection is 0.12,the more frequent in acceleration/deceleration, the longer duration for deceleration, the bigger value of KBt is needed. Normally for escalator etc., a value of 0.9 is recommended, for Centrifugal equipment a value of 0.6 is recommended. (Please be ware of that the selection of power also depends on the cooling condition.

A recommendation for selection of brake resistor (For applications in which motor work in brake not very frequent and not long duration)

Line in Voltage (V)	Motor Power (kW)	Brake Resistance (Ohm)	Brake Power(W)
3×380-440	4	≥75	800
3×380-440	5.5	≥50	1200
3×380-440	7.5	≥35	1500
3×380-440	11	≥25	2500
3×380-440	15	≥20	3000
3×380-440	18.5	≥15	3600
3×380-440	22	≥12	5000

2.2.4.3 Selection for input/output AC choke

Selection guide for input AC choke:

Line in Voltage (V)	Motor Power (kW)	Choke Current (A)	Choke Inductance (2% voltage drop) (mH)
3×380-440	4	10.0	1.40
3×380-440	5.5	15.0	0.93
3×380-440	7.5	20.0	0.70
3×380-440	11	30.0	0.47
3×380-440	15	40.0	0.35
3×380-440	18.5	50.0	0.28
3×380-440	22	60.0	0.24

Note:a. AC choke is not recommended as a good solution to control the harmonic current

b. It's not recommended to add AC choke at input for products already has built-in choke.

Selection guide for output AC choke (≤200m motor cable, dv/dt < 500v/uS)

Line in Voltage (V)	Motor Power (kW)	Choke Current (A)	Choke Inductance /2% voltage drop (mH)
3×380-440	4	9.00	1.56
3×380-440	5.5	13.00	1.08
3×380-440	7.5	17.00	0.82
3×380-440	11	25.00	0.56
3×380-440	15	32.00	0.44
3×380-440	18.5	38.00	0.36
3×380-440	22	45.00	0.32

2.2.4.4 Selection for filters

RFI filter at input

With RFI filter as stated in below table or RFI filter with similar performance installed at the input side of the product, the product can achieve Class A1 EMC performance.

Voltage (V)	Motor Power (kW)	Rated Current for RFI filter (A)	Type of RFI Filter
380V	4	10	NFI-0010-SA
	5.5	20	NFI-0020-SA
	7.5	20	NFI-0020-SA
	11	36	NFI-0036-SA
	15	36	NFI-0036-SA
	18.5	50	NFI-0050-SA
	22	50	NFI-0050-SA

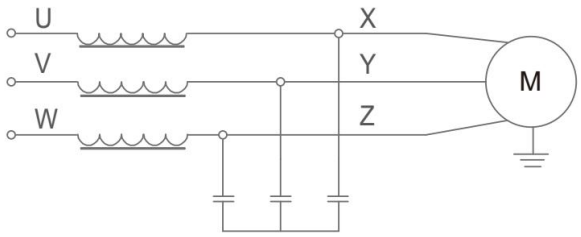
Note:The RFI filter types are recommended based on products from Shanghai Eagtop. Please find more information from website of Shanghai Eagtop http://www.eagtop.com/.

Sine Filter at Output

Below is the recommendation to select sine filter at output.

Voltage (V)	Motor Power (kW)	Rated Current (A)	Inductance (mH)	Capacitance C(uF)
380V	4	18	2.50	10.0
	5.5	18	1.50	16.0
	7.5	18	1.50	16.0
	11	30	0.78	32.0
	15	30	0.78	32.0
	18.5	60	0.38	64.0
	22	60	0.38	64.0
	220	450	0.066	600.0
	250	750	0.040	1000.0
	280	750	0.040	1000.0
	315	750	0.040	1000.0
	355	750	0.040	1000.0
	415	750	0.040	1000.0

The values (Inductance, Capacitance) are based on sine filter circuit.



Note:the recommended values are suitable for switching frequency not low than factory default set and motor running frequency not high than 200Hz. If the application conditions are beyond the limit, please update the selection, or consult us.

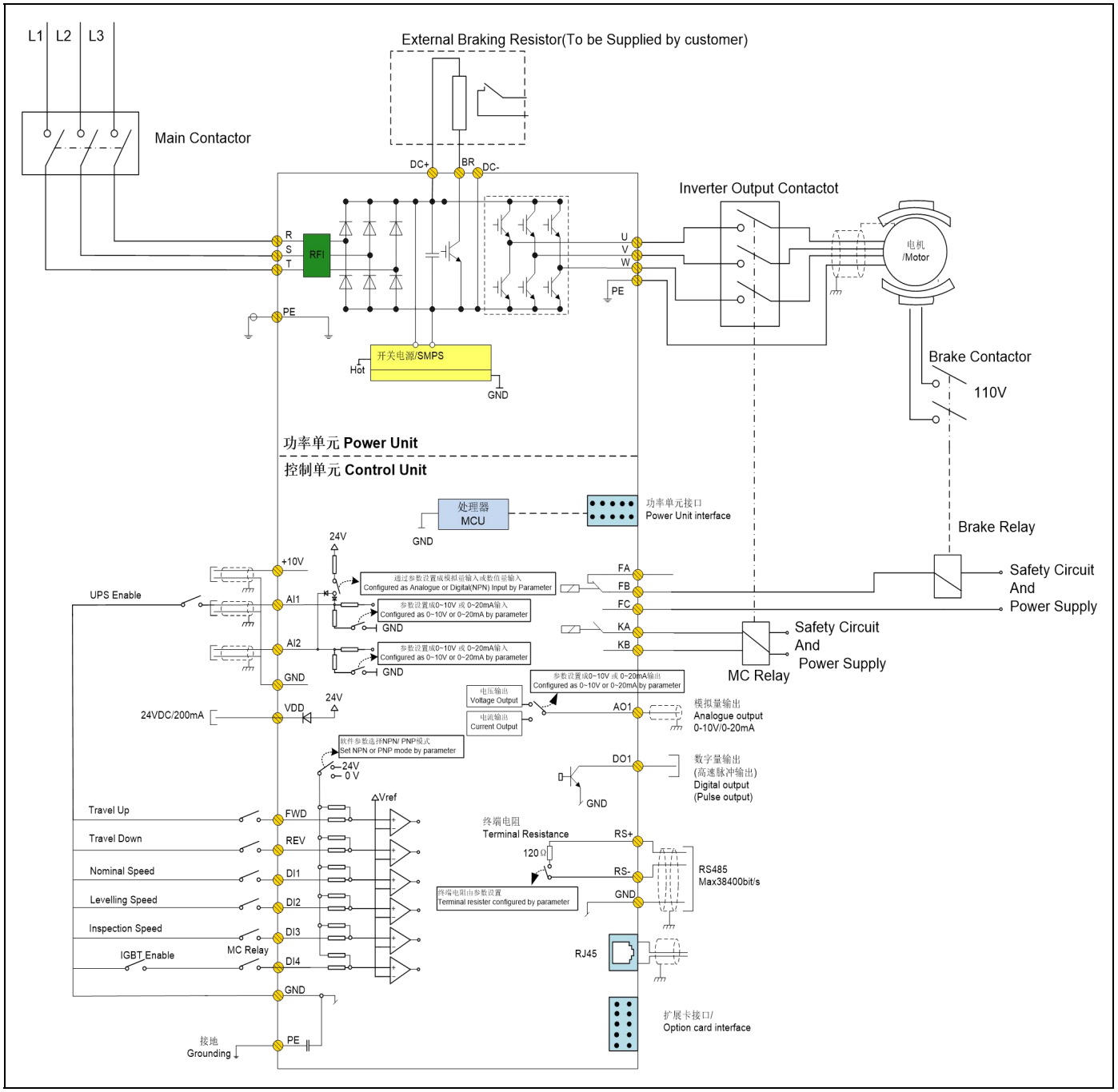
You can also select sine filter from other third part. Below is the recommendation based on products from Shanghai Eagtop.

Motor Power (kW)	Rated Current (A)	Type of Sine Filter
5.5	15	OSF-0015-EISA-E4M0
7.5	20	OSF-0020-EISA-E3M0
11	30	OSF-0030-EISA-E2M0
15	40	OSF-0040-EISA-E1M4
18.5	50	OSF-0050-EISA-E1M2
22	60	OSF-0060-EISA-E1M0

Note:Please contact Shanghai Eagletop more the limitations for switching frequency, motor frequency and more information, or check in the website of Shanghai Eagletop:http://www.eagtop.com/.

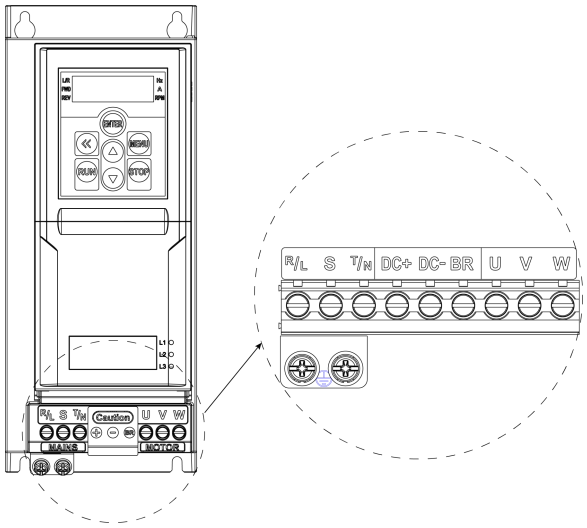
2.3 Electrical Instructions

2.3.1 Electrical Diagram

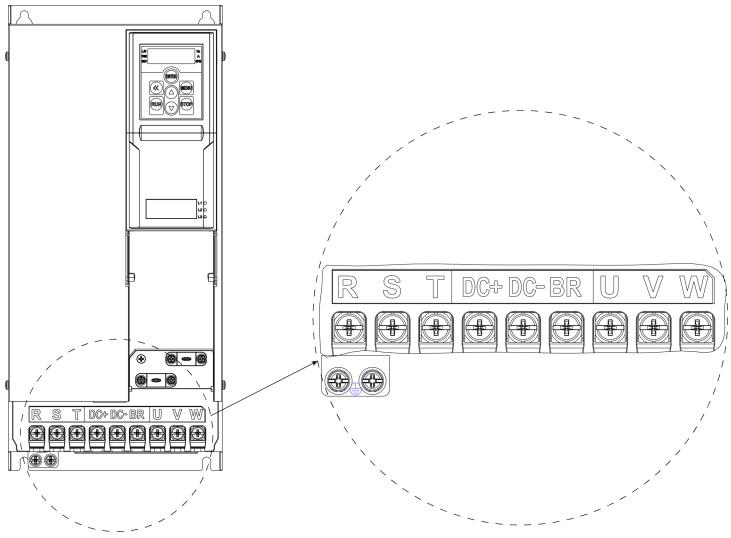


2.3.2 SA710L Terminals

2.3.2.1 Main circuit terminals:



Power Terminals for 4-7.5kW



Power Terminals for 11-22kW

Description for power terminals:

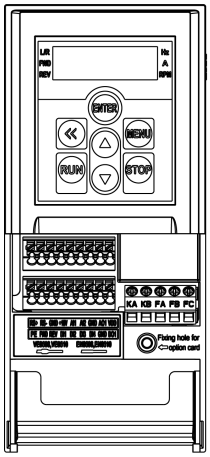
Terminal Name	Terminal Functions
R/L、S、T/N	Terminals for power inputs from grid
U、V、W	Terminals for Power output to motor
DC+、DC-	Terminals for DC link supply or Load sharing
DC+、BR	Terminals for Brake resistor
⏚	For ground connection

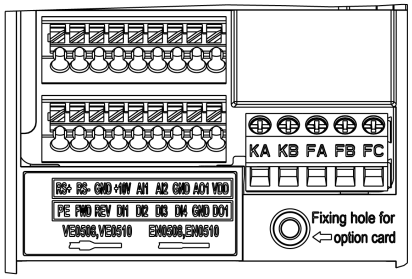
2.3.2.2 Recommended specifications for power circuits installation

Product Type	Input Wire (mm^2)	Output Wire (mm^2)	Power Terminal Screw	Power Terminal Torque (N·m)	Grounding Screw	Grounding Torque (N·m)
SA710L-4T4.0G/5.5P-PU00CU0L	1.5	1.5	M3	0.5-0.7	M4	1.0-1.2
SA710L-4T5.5G/7.5P-PU00CU0L	1.5	1.5	M3	0.5-0.7	M4	1.0-1.2
SA710L-4T7.5G/11P-PU00CU0L	2.5	1.5	M3	0.5-0.7	M4	1.0-1.2
SA710L-4T11G/15P-PU00CU0L	4	2.5	M5	1.6-2.0	M5	1.6-2.0
SA710L-4T15G/18P-PU00CU0L	6	4	M5	1.6-2.0	M5	1.6-2.0
SA710L-4T18G/22P-PU00CU0L	10	4	M5	1.6-2.0	M5	1.6-2.0
SA710L-4T22G/30P-PU00CU0L	10	6	M5	1.6-2.0	M5	1.6-2.0

Note:The recommended Specifications are based on 25℃ambient and heavy load type conditions when use VV type single conductor wire. Please reference to the IEC standards for other conditions.

2.3.2.3 Control terminals





Specifications of Control terminals:

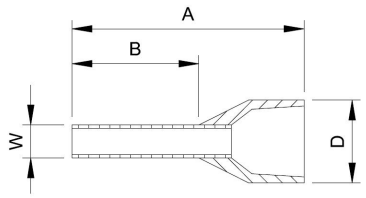
Name	Function	Specification
FWD,REV,DI1, DI2, DI3, DI4	Digital inputs	Input type: NPN PNP Input Voltage:0~30V; Input Impedance:3.6Kω; DI4 can be configured as pulse input
DI4	Pulse Input	Frequency Range:0.00~100.00kHz; Power Supply Range:24V ± 20%; Duty Cycle Range:40%~60%;
DO1	Digital Output	Output type:Open Collector; Output Current:0~40mA; Output Voltage:0~30V; Can be configured as pulse output: Load Capacity:Resistive>1kΩ, capacitive <10nf; Frequency Range:0.00~100.00kHz; Duty Cycle Range:40%~60%;

Name	Function	Specification
RS+, RS-	RS485 Communication	Max Baud Rate:38400bit/s; Configurable termination resistor, open in default
FA-FB-FC(Relay1) KA-KB(Relay2)	Relay Output	Resistive Load:250VAC 3A/30VDC 3A; Inductive Load:250VAC 0.2A/24VDC 0.1A (cosφ=0.4);
AI1, AI2	Analogue Inputs	Configurable as analogue voltage inputs, analogue current inputs as well as digital inputs. 1.As Analogue Voltage Inputs: Input Impedance:10kΩ; Input Voltage Range:0~10V; 2.As Analogue Current Inputs: Input Impedance:≤500Ω; Input Current Range:0~20mA; 3.As Digital Inputs: a) Input Type: NPN PNP b) Input Impedance:10kΩ; c) Input Voltage Range:0-30V
AO1	Analogue Output	Configurable as analogue voltage output or current output Output Range:0~10V or 0~20mA; Load Capacity: As Voltage Output:Impedance > 500Ω; As Current Output:Impedance < 500Ω;
VDD	24V Power Supply	Max 200mA
+10V	10V signal power supply	Max 30mA
GND	Signal Ground	
PE	Safety Ground	
Other Terminals:		
Connector for Option Card		Support one option card of different types, at the bottom of the Control Unit
Connect for External Keypad		RJ45 for external keypad, at the top of right side of the Control Unit

2.3.2.4 Guidance for connecting wires

Except for the relay outputs, Spring-Clip terminals are used for all the control signals.

Tope type terminal is recommended for the control wires with specification as below:



A	B	D(max)	W
14	8	3.5	1.4

Units:mm

Wire diameter specification:

Type	Minimal Diameter	Maximal Diameter
Single Conductor	0.52mm^2	0.82 mm^2
Multi-folded Wire	0.52mm^2	0.82 mm^2
Connector Lug	0.52mm^2	0.52mm^2

Push the wire tube into the terminal directly and the wire will be clamped automatically by the terminal spring;

To remove the wire, use a slot type screwdriver to push down the lock on the terminal then the wire will be released. The specification for the head of the screwdriver:Thickness 0.4mm, width 2.5mm;

Ideal length for the wire stripping is 9mm.

Screw fasten terminals are used for relay output:

Please select the right screwdriver to fasten the terminals. If a slot type screwdriver is used, below specification is recommended:head width 3.5mm, head thickness 0.6mm;

Ideal length fir wire stripping is 6~7mm;

Diameter specification for wires:0.4~1.0mm^2 , Torque specification for fastening the terminal:0.4 N·m；

2.3.3 EMC Guidance for Electrical Wiring

2.3.3.1 EMC standards

SA710L follow the IEC standards:IEC/EN61800-3 (Adjustable speed electrical power drive systems part 3:EMC requirements and specific test methods).

IEC/EN61800-3 defines the EMC demands from two aspects:EMC interference and EMC immunity. EMC interference includes radiated emission, conducted emission and low frequency current emission. EMC immunity includes radiated immunity, conducted immunity, surge, burst, ESD and immunity to low frequency disturbance from the grid power supply (voltage dips, notch, sag and fluctuation, unbalance, distortion and frequency variation). SA710L follow all the demands except for:

External AC choke is needed to achieve IEC 61000-3-2/IEC 61000-3-12 for drives below 30kW (refer to 2.2.2.3)

External RFI filter is needed to achieve class C1 or C2 (IEC 61800-3) level conducted emission performance (refer to 2.2.2.4). If no external RFI filter is installed, SA710L is not intended to be used on a low-voltage public network which supplies domestic premises directly.

2.3.3.2 Guidance for EMC noise handling

While used on a common supply with other equipment, even though an RFI filter is built in SA710L already too limited the conducted emission, depending on the sensitivity of equipment and the background of the environment, there is still certain possibility to disturb other equipment to malfunction. Below measures are recommended to avoid the EMC issue:

Install an RFI filter before the product

Install a power filter before the equipment sensitive to EMC noise

Isolate the power supply for the product from the equipment sensitive to EMC noise, normally with isolation transformer.

Use shielded wire for control signals and shielded cable for motor, ground the shielding properly

Avoid wiring the control signals in parallel with power circuits, especially, avoid tiring the control wires together with the power cables. If a cross between control wire and power cable cannot be avoided, please cross the wires perpendicularly.

If no reliable grounding point or no shielded motor cable available, please use an additional wire to connect the motor shell to the PE terminal and layout this wire together with the 3 motor phases as close and tight as possible.

Installing ferrite cores at the input or the output of the product as common choke helps a lot to solve the EMC issue in most cases.

2.3.3.3 Leakage current handling

As stated in 2.2.3.4, there are different reasons for leakage current. The leakage current issue should be handled properly to avoid any mis operation of the residual-current circuit breaker or interference to other equipment. Below are the recommendations:

Lower the switching frequency and use as short as possible motor cable to limit the high frequency leakage current;

Install AC choke or sine filter at the output of the product;

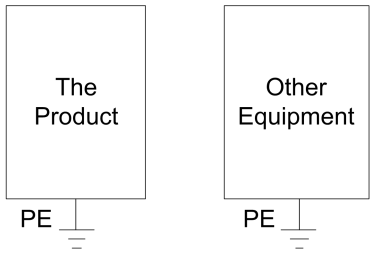
Take measures to limit the unbalance of the power supply.

2.3.3.4 Handling the induced voltage

In case there is no grounding point, there could be induced voltage on the motor shell or other metals connected to the motor shell. Connecting the motor shell to the PE terminal of the product helps to limit the induced voltage. But please be aware that, the only safe way is to ground the motor and product properly.

2.3.3.5 Grounding

Please ground the system as blow:



Use thick wire for ground to reduce the grounding impedance;

Use as short as possible grounding wire;

Grounding the product to the ground point as close as possible;

Use four-wire motor cable, and connect the motor shell to the PE terminal of the product with one of the four wires, and grounding this wire to the dedicated grounding point;

Put the grounding wires far away from the input/outputs of the equipment which are sensitive to EMC Nosie.

Chapter 3 Parameters

3.1 List of Parameters

Lift relative Parameters (Group 17)				
Parameters	Name	Range	Unit	Default
P17.40	Brake release forward running frequency threshold	0.0~50.0	Hz	0.3
P17.41	Brake release forward running current threshold	0.0~3000.0	A	1.5
P17.42	Brake release reverse running frequency threshold	0.0~50.0	Hz	0.3
P17.43	Brake release reverse running current threshold	0.0~3000.0	A	1.5
P17.44	Brake release delay time	0.0~3.0	S	0.1
P17.45	Brake close forward running frequency threshold	0.0~50.0	Hz	0.5
P17.46	Brake close reverse running frequency threshold	0.0~50.0	Hz	0.5
P17.47	Brake close delay time	0.0~3.0	S	0.5
P17.48	Brake close keep frequency delay time	0.0~3.0	S	0.2
P17.49	Drive run delay time	0.0~3.0	S	0.1
P17.51	Forward running stop delay time (for empty UP)	0.000~10.000	S	0.0
P17.52	Reverse running stop delay time (for full load Down)	0.000~10.000	S	0.0
P17.53	Forward running leveling compensation (for full load UP)	-1000~1000	%	0
P17.54	Reverse running leveling compensation (for empty Down)	-1000~1000	%	0
P17.55	Speed source select	0:Multi-speed (judged multi-speed select DI terminal) 1:AI1 (0~10V 0r 0~20MA) 2:AI2 (0~10V 0r 0~20MA)		0
P17.56	AI type select(if P17.55=0, AI1/AI2 forced to DI type, else AI1/AI2 are analog input and the type defined by P17.56)	Bit0:0 AI1 is voltage mode(0~10V) 1 AI1 is current mode(0~20MA) Bit1:0 AI2 is voltage mode(0~10V) 1 AI2 is current mode(0~20MA)		0
P17.60	Current threshold for UPS direction check	0.0~3000.0	A	0
P17.61	Multi-speed0	0.0~590.0	Hz	0.0
P17.62	Multi-speed1	0.0~590.0	Hz	2.0
P17.63	Multi-speed2	0.0~590.0	Hz	10.0

Lift relative Parameters (Group 17)				
Parameters	Name	Range	Unit	Default
P17.64	Multi-speed3	0.0~590.0	Hz	10.0
P17.65	Multi-speed4	0.0~590.0	Hz	50.0
P17.66	Multi-speed5	0.0~590.0	Hz	50.0
P17.67	Multi-speed6	0.0~590.0	Hz	50.0
P17.68	Multi-speed7	0.0~590.0	Hz	50.0
P17.69	Speed in UPS mode	0.1~590.0	Hz	10.0
P17.70	RUN Input Function	0:No function 1:Forward RUN 2:Reverse RUN 3:Multi- speed bit0 4:Multi- speed bit1 5:Multi- speed bit2 6:Drive enable 7:UPS enable 8:Fault Reset		1
P17.71	F/R Input Function			2
P17.72	DI1 Input Function			3
P17.73	DI2 Input Function			4
P17.74	DI3 Input Function			5
P17.75	DI4 Input Function			6
P17.76	AI1 input Function(used as DI)			7
P17.77	AI2 input Function(used as DI)			0
P17.78	DO1 Function	0:No function; 1:Brake Output 2:MC (magnetic contactor) output 3:Fault output		0
P17.79	RL1 Function (FA FB FC)			1
P17.80	RL2 Function (KA KB)			2
P17.81	DI mode select	0:NPN type 1:PNP type		0
P17.82	AI1 Min input value	0.000~10.000V/0.000~20.000MA	V/mA	0.000
P17.83	AI1 Max input value	0.000~10.000V/0.000~20.000MA	V/mA	10.000
P17.84	Speed reference versus AI1 Min input value	0.0~590.0	Hz	0.0
P17.85	Speed reference versus AI1 Max input value	0.0~590.0	Hz	50.0
P17.86	AI2 Min input value	0.000~10.000V/0.000~20.000MA	V/mA	0.000
P17.87	AI2 Max input value	0.000~10.000V/0.000~20.000MA	V/mA	10.000
P17.88	Speed reference versus AI2 Min input value	0.0~590.0	Hz	0.0
P17.89	Speed reference versus AI2 Max input value	0.0~590.0	Hz	50.0
P17.92 (Read-only)	DI terminal status	0~32767		
P17.93 (Read-only)	DO/RL terminal status	0~32767		
P17.98 (Read-only)	AI1 input value	0.000~10.000V/0.000~20.000MA	V/mA	
P17.99 (Read-only)	AI2 input value	0.000~10.000V/0.000~20.000MA	V/mA	

SA710L Platform Parameters				
Parameter Group 0:General Control Mode and Commands				
Parameters	Name	Range	Unit	Default
*P00.01	Control Mode	0:Speed Mode Speed Sensor less 1:Speed Mode with Speed Sensor		0
*P00.02	Motor Control Principle	0:V/F 1:Vector Control 1 2:Vector Control 2		1
*P00.03	Macro-program	0:Invalid 1:Pump Control 2:Simple PLC		0
*P00.04	Torque Characteristics	0:CT		0
*P00.05	Motor Speed Direction	0:Clockwise 1:Anticlockwise 2:Bidirectional		2
*P00.06	Dual Rating Selection	0:Heavy Load 1:Light Load		0
P00.15	Speed Set Range	0:0~P00.16 1:-P00.16~P00.16		0
P00.16	Base Value for Speed Set	0.0~590.0		50.0
P00.18	Selection of Communication Control Source	0:Null 1:Local RS485 2:Bus from Option Card		1
P00.49	Ramp Time Resolution	0:0.1s 1:0.01s		1
P00.50	Ramp 1 Type	0:Linear 1:S ramp		0
P00.51	Ramp 1 Ramp Up Time	0.05~655.35	s	*
P00.52	Ramp 1 Ramp Down Time	0.05~655.35	s	*
P00.53	UPS mode Ramp Type	0:Linear 1:S ramp		0
P00.54	UPS mode Ramp Up Time	0.05~655.35	s	*
P00.55	UPS mode Ramp Down Time	0.05~655.35	s	*
P00.63	S Ramp Up Initiate Period	0.05~655.35	s	*
P00.64	S Ramp Up Termination Period	0.05~655.35	s	*
P00.65	S Ramp Down Initiate Period	0.05~655.35	s	*
P00.66	S Ramp Down Termination Period	0.05~655.35	s	*
P00.80	Local Address	1~127		1
P00.81	Baud Rate	0:2400 1:4800 2:9600 3:19200 4:38400 5~9:Reserved		2
P00.82	Communication Data Format (Parity/Stop Bits)	0:Even parity (1 stop bit) 1:Odd parity (1 stop bit) 2:No parity (1 stop bit) 3:No parity (2 stop bit)		0

SA710L Platform Parameters				
Parameter Group 0:General Control Mode and Commands				
Parameters	Name	Range	Unit	Default
P00.83	Min. Communication Response Delay	0.000~0.500	s	0.002
P00.84	Max. Communication Response Delay	0.010~10.000	s	5.000
P00.85	Message Response	0:Normal Reponses 1:Only Response Exceptional Message 2:Not Response		0
P00.86	Parameter (Set by Communication) Saving at Power Down	0:Not Save Parameter at Power Down 1:Save Parameter at Power Down		0
P00.87	Communication terminal resistance selection	0:Open 1:Close		0
P00.88	Communication Timeout Time	0.01~650.00	s	1.00
P00.89	Communication Timeout Response Function	0:No Function 2:Stop Motor 3:Jogging 4:Run with Max Frequency P05.03 5:Alarm Fault and Trip to stop 6:Warning		0
P00.90	Reset Communication Timeout	0:No Action 1:Reset the Timeout		0

Parameter Group 1:Basics for Inverter and Motor Control				
Parameters	Name	Range	Unit	Default
P01.00	Switching Frequency	2~16:2~16 kHz		*
*P01.01	Grid Type	2~122		*
*P01.02	Motor Type	0:Induction Motor 1:SPM 2:IPM without Saturation 3:IPM with Saturation		0
*P01.03	Rated Motor Power	0.12~450	kW	*
*P01.04	Rated Motor Voltage	50~1000	V	*
*P01.05	Rated Motor Frequency	20~400	Hz	*
*P01.06	Rated Motor Current	0.1~1200	A	*
*P01.07	Rated Motor Speed	100~24000	rpm	*
*P01.08	Rated Motor Torque	0.1~6553.5	N·m	*
*P01.13	Autotuning for Motor Parameters	0:No Function 1:Simple Static Motor Auto Tuning 2:Complete Static Motor Auto Tuning		0
*P01.14	Stator Resistance (Rs)	0.001~65.535	Ω	*
*P01.15	Rotor Resistance (Rr)	0.001~65.535	Ω	*
*P01.16	Stator Leakage Reactance (X1)	0.001~65.535	Ω	*

Parameter Group 1:Basics for Inverter and Motor Control				
Parameters	Name	Range	Unit	Default
*P01.17	Main Reactance (Xh)	0.01~655.35	Ω	*
*P01.18	Ld, PM D-axis Inductance	0.01~655.35	mH	*
*P01.19	Lq, PM Q-axis Inductance	0.01~655.35	mH	*
*P01.20	Ld-s,PM D-axis Inductance Saturated	0.01~655.35	mH	*
*P01.21	Lq-s,PM Q-axis Inductance Saturated	0.01~655.35	mH	*
*P01.22	Saturation Current at D-axis for Ld-s	20~200	%	100
*P01.23	Saturation Current at Q-axis for Lq-s	20~200	%	100
*P01.24	Number of Motor Poles	2~100	P	4
*P01.25	BEMF at Rated Speed for PM	0~9000	V	*
*P01.26	Motor Cable Length	0~150	m	10
*P01.27	System Inertia	0.00~655.35	kg·m2	*
P01.32	Load Compensation Gain for Low Speed	0~199	%	100
P01.33	Load Compensation Gain for High Speed	0~199	%	100
P01.34	Motor Magnet Current at 0 Speed	0~300	%	100
P01.35	Cut in Speed for Normal Magnet Current	0.0~10.0	Hz	0.0
P01.36	Min Motor Current at Low Speed	0~120	%	80
P01.37	Slip Compensation Gain	-400~399	%	*
P01.38	Slip Compensation Time Constant	0.05~5.00	s	*
P01.39	Resonance Damping Gain	0~3000	%	*
P01.40	Time Constant for Resonance Damping Filter	0.005~0.050	s	0.005
P01.41	Damping Coefficient for PM	0~250	%	120
P01.42	Damping Time Constant for Low Speed range (PM)	0.01~20.00	s	0.8
P01.43	Damping Time Constant for High Speed range (PM)	0.01~20.00	s	0.8
P01.44	Time Constant for Current Filter (PM)	0.001~1.000	s	0.5
P01.45	Min Torque at Torque Mode Start	-100~100	%	5
P01.46	Min Torque Cut Out Speed at Torque Mode Start	0.1~50.0	Hz	3.0
P01.53/ P01.55/ P01.57/ P01.59/ P01.61	Voltage for V/F curve points	0.0~999.9	V	*
P01.54/ P01.56/ P01.58/ P01.60/ P01.62	Frequency for V/F curve Points	0.0~590.0	Hz	*

Parameter Group 1:Basics for Inverter and Motor Control				
Parameters	Name	Range	Unit	Default
P01.63	PM Start Method	0:Initial Position Detection (IPD) 1:Parking		1
*P01.64	IM Start Method	0:Direct Start 1:Fly start		0
P01.67	Min Valid Speed Set	0.00~50.00	Hz	0.00
P01.68	Bypass Range for IM Low Speed	0.0~20.0	Hz	0.0
P01.70	Delay Time at Start	0.0~10.0	s	0.0
P01.71	Delay Function at Start	0:Free Coast 1:DC Hold		0
P01.72	DC Hold Current	0~150	%	50
P01.79	Stop Method at Torque Control Mode	0:Stop with Torque Mode 1:Stop with Speed Mode		0
P01.80	Function at Stop	0:Free Coast 1:DC hold		0
P01.81	Cut in Speed for Function at Stop	0.0~400.0	Hz	0.0
P01.82	DC Brake Current (IM)	0~150	%	50
P01.83	DC Brake Time	0.0~60.0	s	2
P01.84	DC Brake Cut in Speed	0.0~400.0	Hz	0.0
P01.85	Demagnetizing Rate at DC Cut in	0~100	%	100
P01.86	Parking Current (PM Start)	0~150	%	80
P01.87	Parking Time (PM Start)	0.1~60.0	s	3.0
P01.91	Brake Function	0:No Function 1:Resistor Brake 2:AC Brake		0
P01.92	Max AC Brake Current	0~150	%	100
P01.93	AC Brake Gain	1.0~2.0		1.4
P01.94	Threshold Voltage for Brake Function	Grid Dependent	V	*
P01.95	Resistor Brake Resistance	5~65535	Ω	*
P02.70	Encoder Resolution	0~4096		1024
P02.71	Encoder Rotation Direction	0:Forward 1:Reverse		0

Parameter Group 4:Process PID and Other Controllers				
Parameters	Name	Range	Unit	Default
P04.30	Speed PID Proportional Gain	0.000~1.000		0.010
P04.31	Speed PID Integral Time	2.0~2000.0	ms	8.0
P04.32	Speed PID Differencing Time	0.0~200.0	s	30.0
P04.33	Speed PID Differential Limit	1.000~20.000		5.000
P04.34	Speed PID Speed Signal Filter Time	1.0~100.0		10.0
P04.40	Torque PI Proportional Gain	0~500	%	100
P04.41	Torque PI Integration Time	0.002~2.000	s	0.020
P04.51	PM Current Limit Controller Feedforward Gain	0~400	%	100

Parameter Group 4:Process PID and Other Controllers				
Parameters	Name	Range	Unit	Default
P04.52	Proportional Gain - Current Limit Controller	0~500	%	100
P04.53	Integration Time - Current Limit Controller	0.000~2.000	s	0.020
P04.54	Filter Time - Current Limit Control	2.0~100.0	ms	*

Parameter Group 5:Limitation, Protection and Failure Detection				
Parameters	Name	Range	Unit	Default
*P05.02	Motor Low Speed Limit	0.0~590.0	Hz	0.0
*P05.03	Motor High Speed Limit	0.0~590.0	Hz	65.0
P05.04	Torque Limit at Motor Mode	0~1000	%	160
P05.05	Torque Limit at Generator Mode	0~1000	%	160
P05.06	Source Selection for Speed Limit at Torque Mode	0:No Function		0
P05.07	Max Current Limit	0~300	%	*
*P05.08	Max Output Frequency Limit	0.0~590.0	Hz	65.0
*P05.17	Enable Motor Phase Loss Protection	0:Disable 1:Enable		1
P05.18	Enable Current Limit/Torque Limit Warning	0:Disable 1:Enable		1
P05.19	Motor Speed Feedback Loss Function	0:No Function 3:Jog and Warning 4:Run to Max Speed P05.03 and Warning 5:Alarm Fault and Trip to stop 11:Switch to Speed Sensor less Mode		5
P05.20	Speed Error for Speed Feedback Loss Detection	1~6000	rpm	300
P05.21	Time for Speed Feedback Loss Detection	0.00~60.00	s	2.00
P05.22	Threshold for Communication with CU Timeout	0.10~60.00	s	1.00
P05.23	Communication with CU Timeout Function	0:No Function 2:Stop and Warning 3:Jog and Warning 4:Run to Max Speed P05.03 and Warning 5:Alarm Fault and Trip to stop 6:Warning		5
P05.26	Motor Thermal Protection Function	0:No Function 1:ETR Warning 2:ETR Alarm Fault 3:ETR Warning for Self-cooled Motor		0

Parameter Group 5:Limitation, Protection and Failure Detection				
Parameters	Name	Range	Unit	Default
		4:ETR Alarm Fault for Self-cooled Motor		
P05.27	Motor Overload Protection Time	0.1~60.0	min	2.0
P05.28	Threshold for Motor Overload Protection	100~160	%	150
P05.29	Function at Mains Phase Loss	0:No Action 1:Only Waring 2:Trip to stop and Alarm Fault (Heavy Load) 3:Trip to stop and Alarm Fault (Mid Load) 4:Trip to stop and Alarm Fault (Light Load)		3
P05.30	Alarm/Fault Lock Handling	0:Not Lock, Alarm/Fault Resettable without Re-Power On 1:Lock, Alarm/Fault Lock Resettable only after Re-Power On		1
P05.31	Delay Time to Alarm Current Limit Fault	0~60	s	60
P05.32	Delay Time to Alarm Torque Limit Fault	0~60	s	60
P05.33	Action at Warning	0:Trip to stop and Alarm Fault directly 1:Warning and Re-catch Motor after Failure Disappear		1
P05.34	Method to Re-catch Motor at Warning	0:Speed Track(IM/PM) and Angle Track (Fly start) 1:Direct Re-catch		0
P05.60	Motor Loss detection function	0:Disable 1:Enable		0
P05.61	Motor Loss detection current threshold	0.1~200.0	%	5.0
P05.62	Motor Loss detection filter time	0.1~600.0	S	1.0

Parameter Group 6:Keypad Operation and Display				
Parameters	Name	Range	Unit	Default
P06.03	Customer Defined Value for 0 Speed	0.0~6553.5		0.0
P06.04	Customer Defined Value for Max Speed	0.0~6553.5		100.0
P06.05	Keypad Display Option	0~8191		0
P06.31	Local/Remote Mode Selection	0:Remote Mode 1:Local Mode		0
P06.34	Lock Keypad for Parameter Edit	0:Disabled 1:Enabled and Lock		0

Parameter Group 7:Auxiliary and Special Functions				
Parameters	Name	Range	Unit	Default
P07.00	Special Operation Function	0:No Function 9:Reset Parameters to Factory Defaults		0
*P07.10	Min Switch Frequency	2~16:2~16 kHz	kHz	2
*P07.11	Over Modulation Coefficient	90.0~105.5	%	100.0
*P07.12	DC-Link Voltage PWM Compensation Function	0:Compensate Average DC voltage 2:Compensate DC Ripple Voltage		0
P07.13	DC-link Voltage PWM Compensation Disable at VF control	0:Disable 1:Enable		1
P07.14	Dead Time Compensation Adjustment Coefficient	0~200	%	100
P07.17	Max Speed for Dead Time Compensation	20~590	Hz	*
P07.26	Function at Mains Voltage Sag	0:No Function		0
P07.27	Threshold Triggering Mains Voltage Sag Function	100~220/380	V	*
P07.31	Under voltage threshold in ups mode	200~350	V	200
P07.36	Method to Reset Alarm Fault	0:Reset by Command 1~10:Auto Reset for 1~10 Times 11:Auto Reset for Unlimited Times		0
P07.37	Alarm Auto Reset Waiting Time	0~600	s	10
P07.40	Magneton Optimization Factor (PM)	-400~400	%	10
P07.46	Threshold Voltage for OVC Function	Grid Voltage Dependent	V	*
P07.47	OVC Function	0:Disable 1:Enable with Mode 1 2:Enable with Mode 2		*
P07.48	OVC Integral Time	0.01~0.10	s	*
P07.49	OVC Proportional Gain	0~200	%	*
P07.50	Bypass Speed Start 1	0.0~590.0	Hz	0.0
P07.51	Bypass Speed End 1	0.0~590.0	Hz	0.0
P07.52	Bypass Speed Start 2	0.0~590.0	Hz	0.0
P07.53	Bypass Speed End 2	0.0~590.0	Hz	0.0
P07.54	Bypass Speed Start 3	0.0~590.0	Hz	0.0
P07.55	Bypass Speed End 3	0.0~590.0	Hz	0.0

Parameter Group 8:Basic and Running Information				
Parameters	Name	Range	Unit	Default
P08.00	PU SW Version			
P08.01	CU SW Version			
P08.30	Total Days with Power On	0~9999	d	
P08.31	Total Running Hours	0~60000	h	

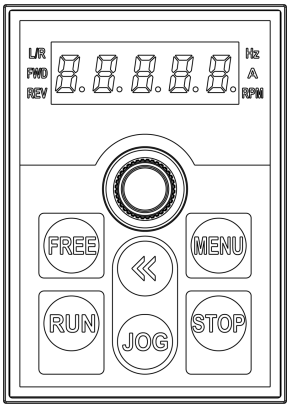
Parameter Group 8:Basic and Running Information				
Parameters	Name	Range	Unit	Default
P08.32	Total Energy Consumed (kWh)	0~65535	kWh	
P08.33	Number of Power Ups	0~65535		
P08.34	Number of Over-Temperatures	0~65535		
P08.35	Number of Over-Voltages	0~65535		
P08.36	Reset Consumed Energy Counter	0:Not Reset 1:Reset		0
P08.37	Reset Running Hours Counter	0:Not Reset 1:Reset		0
P08.40~ P08.49	Alarm Log			
P08.50~ P08.59	Warnings Log			

Parameter Group 9:Real Time Running Status Monitoring				
Parameters	Name	Range	Unit	Default
P09.00	Control Word	0~65535		
P09.01	Status Word	0~65535		
P09.02	Set Value	-4999.0~4999.0		
P09.04	Motor Speed	0~24000	rpm	
P09.05	Output Power	0.000~655.35	kW	
P09.06	Output Voltage	0.0~6553.5	V	
P09.07	Output Frequency	0.0~590.0	Hz	
P09.08	Output Current	0.00~655.35	A	
P09.09	Output Torque	-200.0~200.0	%	
P09.10	Motor Thermal Load Status	0~100	%	
P09.11	DC Link Voltage	0~65535	V	
P09.13	Heatsink or IGBT Temperature	-128~127	℃	
P09.14	Inverter Thermal Load Status	0~255	%	
P09.15	Nominal Inverter Current	0.0~6553.5	A	
P09.16	Max Inverter Current	0.0~6553.5	A	
P09.37	Speed Feedback from Encoder		Rps	
P09.47	Set Value from Bus Communication	-32768~32767		
P09.48	Variable Defined by Customer	0~6553.5		

Note:a. Parameters marked with '*' on the parameter number cannot be changed during motor running. '*' in the Factory default column means the default value vary with the different product types.

Chapter 4 The introduction of Keypad

The keypad built in can be used for parameter set/read, control and monitoring etc. Below shows the appearance of the keypad.



The product has two different running modes:Local Mode and Remote Mode.

Local Mode:The product is controlled by keypad, including start/stop and target frequency set etc.

Remote Mode:The product is controlled by I/O terminals or communication Bus, keypad is only for monitoring and parameter setup.

Description of the lights on keypad

L/R Light:To indicate the mode of the product, Always On --- Remote Mode, Flashing --- Local Mode.

FWD、REV Lights:

FWD	REV	Status
On	Off	Running in Forward Direction
Off	On	Running in Reverse Direction
Off	Off	Stopped

Hz、A Lights:To indicate the physical meaning and units of the data displayed.

Display

Total 5 Digits of LED to show the set value, output frequency and running data, warnings and alarms etc.

4.1 Introduction of the Keys:

Key Name	Function
<<	In home display, Press to switch the physical variables shown; in parameter number selection, Press to switch the digit place of the parameter number to be modified; in parameter value modification, Press to switch the digit place of parameter value to be modified
STOP	Press to control the product stop when product is in Local Mode or reset the fault (if there is alarm)
▲	Press to increase the numerical value of parameter or parameter number
▼	Press to decrease the numerical value of parameter or parameter number
MENU	Press to enter the menu for parameter setup or exit the menu
ENTER	Press to confirm the parameter number selection and enter the parameter value displaying/ modification, or Press to confirm the parameter value and back to the Parameter number selection menu.
RUN	Press to control the product run when product is in Local Mode.

4.2 Setting of the Parameters

Take changing the parameter P01.06 “rated motor current” to 9.6A as an example:

1. From home display, press the “MENU” key to enter the parameter number selection display;

2. Press the “<<” key to select the digit place of parameter number you want to change and turn the potential meter to adjust the parameter number to “P01.06”

3. Press the potential meter to confirm the parameter number selection and enter the parameter value modification display.

4. Press the “<<” key to select the digit place of parameter value you want to change and turn the potential meter to adjust the parameter value to “9.6”

5. Press the potential meter to confirm the parameter value input and back to the parameter number selection display, parameter number “P01.07” will be shown.

6. Repeat the operation steps 2 to 5 if more parameters need to be changed. press the “MENU” key back to the home display

Note:In parameter number selection or parameter value modification, if no operation for certain period, the keypad will jump back to the home display automatically

4.3 Monitor the Product Status

In the default setup, the keypad will only show one of the motor frequencies, set value and motor current in home display (switchable by “<<” key). If more physical variables need to be shown in the home display, you can set the parameter P06.05. You can use the “<<” key to switch and select one of the variables defined in P06.05 and show it in the home display.

Blow table shows the meaning and how them will be shown for the main physical variables which can be defined in P06.05.

Physical Variable	Monitoring Parameter	Indication Character	LED lights Status
Output Frequency	P09.07	T	“Hz” Always On
Set Value	P09.02	N/A	“Hz” Always On "A" Always ON
Motor Current	P09.08	A	"A" Always On
Motor Voltage	P09.06	N/A	“Hz” Always On “RPM” Always On
Motor Speed	P09.04	N/A	“RPM” Always On
DC Voltage	P09.11	N/A	"A" Always On “RPM” Always On
Inverter Temperature	P09.13	N/A	“RPM” Flashing
Feedback Value	P09.20	N/A	“Hz” Always On “RPM” Flashing
Analogue Inputs	P09.24 or P09.26	N/A	“Hz” Flashing “RPM” Flashing

4.4 Check the Fault Log (Warning or Alarm Log)

The keypad will show the fault code when any fault is triggered. The product can log 10 latest warnings and 10 latest alarms. You can check the latest warning information via parameters P08.40~P08.49 and alarms via parameters P08.50~P08.59.

4.5 Comparison Table for Character Displaying

0	1	2	3	4	5	6	7	8	9
									
A	B	C	D	E	F	G	H	I	J
									
K	L	M	N	O	P	Q	R	S	T
									
U	V	W	X	Y	Z	-	+	.	=
									
a	b	c	d	e	f	g	h	i	j
									
k	l	m	n	o	p	q	r	s	t
									
u	v	w	x	y	z				
									

Chapter 5 Fault Handling and Maintenance

5.1 Fault Handling

5.1.1 Fault Codes and Handling

SA710L classify the Faults into 3 categories:Warning, Alarm and Error and they can be shown on the keypad with defined codes.

Warning is for faults close to design limit or parameter set limit, but with which the product can continue to work under a designed control or the product can suspend and recover automatically when the anomaly disappears. Customer can monitor the specific warning information via keypad or communication bus. On an LED keypad, the warning will be shown as ‘u.XX’. ‘u’ means warning, ‘XX’ represents the code of the fault.

Alarm is for faults which could damage the product or other equipment in short time so that the product must be disabled from the system immediately. When an alarm is triggered, a ‘reset’ operation must be taken by a command from keypad or from the upper controller before the product can run again. On an LED keypad, the alarm will be shown as ‘A.XX’. ‘A’ means alarm, ‘XX’ represents the code of the fault. To eliminate some of the faults, customers must power down the product and do debug or test on part of the circuits. For this type of faults, SA710L affords lock function and when the fault is triggered it will be locked. The locked fault cannot be reset until a power down-power on cycle is operated and the reason for fault is cleared. This type of faults is called locked-fault. All locked-fault will be treated as ‘alarm’ as well. Customer can disable the lock function for some of the locked-fault by setting P05.30=0. Doing this, the customer must be very careful and be responsible for the safety.

Error is for mis-operation from the customer, e.g. trying to change a parameter value via Keypad which is not allowed to change. An Error will be shown as ‘Er. XX’ on an LED keypad. The product will continue to run and the Error will not be logged.

Below is the list for all the faults:

Warning	Alarm	Error	Fault Name	Reason Description	Suggested Handling
	A.01		Factory Reset	Parameters reset to factory defaults without confirmation	Press "STOP “key to Confirm
	A.02*		Internal Fault		Contact our local support
u.03	A.03*		PU CU communication time out	PU Failed to communicate with CU	1.Power off, then confirm the installation between PU and CU 2.Contact our local support
	A.04*		Power Board 24V Error	Internal Hardware fault	1.Confirm no problem in external load to 24V 2.Contact our local support
	A05*		Gate drive voltage fault	Internal Hardware fault	
u.07	A.07*		Fan Fault	Too much dust on the fan or the fan is aged	Clean or replace the fan
u.08			Fan2 Fault	Too much dust on the fan or the fan is aged	Clean or replace the fan
	A.16*		Short Circuit	Short circuit between phases of motor	Check the motor cable and motor insulation status
u.17	A.17*		Earth fault	Flashover or short circuit between output phases and ground	1.Check cable/motor phase to ground insulation status 2.Replace cable or motor

Warning	Alarm	Error	Fault Name	Reason Description	Suggested Handling
u.19	A.19*		Brake resistor short-circuit	Brake resistor is short circuit (22kW and below)	Check the wire of brake resistor or Replace Brake resistor
u.20	A.20*		Brake transistor short-circuit	Brake transistor is damaged (22kW and below)	Contact our local support to repair
u.21	A.21*		Brake Detect	Brake resistor is not connected or working.	Check the Brake resistor or replace suitable Brake resistor
u.23	A.23		Over Current at low voltage	Over current due to that power supply voltage dips too much	Check the Power supply
u.24	A.24		Under Voltage	Power supply voltage dips too much, or high load to too low power supply voltage	Check the Power supply
u.25	A.25		Overload at low voltage	High load at continuous low power supply voltage	Check the Power supply
u.26	A.26*		Mains Phase Loss	Missing phase on supply side	Check the Power supply
u.27	A.27		KEB fault	KEB function triggered but failed to hold the DC voltage at power supply voltage drop, due to too less inertia or two long time for power supply voltage drop.	1.Check the Power supply 2.Set suitable KEB Threshold voltage
	A.28*		Motor phase U missing	1.motor phase imbalance 2.motor cable loose	Check the motor phase cable and motor.
	A.29*		Motor phase V missing		
	A.30*		Motor phase W missing		
u.36	A.36		Over Voltage	1.The input voltage is too high 2.The motor works in generator mode 3.The deceleration time is too short 4.The braking unit and braking resistor are not installed.	1.Check the power supply 2.Use brake resistor or energy feedback unit to consume or use up the generate energy 3.Adjust relative parameters to avoid the motor working in generator mode
u.37	A.37		IGBT Over Temperature	Too high load or the cooling condition beyond the specification	1.Check the load 2.Check the cooling condition, include to clean the airduct or replace the fan
u.38	A.38		IGBT Temperature Sensor Error U		Contact our local support to repair
u.39	A.39		IGBT Temperature Sensor Error V		
u.40	A.40		IGBT Temperature Sensor Error W		

Warning	Alarm	Error	Fault Name	Reason Description	Suggested Handling
u.41	A.41		Rectifier Temperature High	Too high load or the cooling condition beyond the specification	1.Check the load 2.Check the cooling condition, include to clean the airduct or replace the fan
u.42	A.42		Rectifier Temperature Sensor Error		Contact our local support to repair
u.43	A.43		Power Board Over Temperature	Too high load or too high ambient temperature	1.Check the load 2.Check the cooling condition, include to clean the airduct or replace the fan
u.45	A.45		Over Current	1.Motor parameters and/or motor control parameters are not set appropriately; 2.The power size of inverter is too small comparing to the motor or the load; 3.The power supply voltage is too low; 4.The inverter failed to catch a spinning motor at fly;	1.Adjust relevant parameters 2.Select inverter with higher power rating 3.Check the power supply voltage 4.Contact our local support
u.46	A.46		Drive Overload	1.Too heavy load or too low power supply voltage 2.The power size of inverter is too small comparing to the motor or the load 3.Motor parameters and/or motor control parameters are not set appropriately;	1.Correctly set relevant parameters especially the motor parameters 2.Select inverter with high power rating. 3.Contact the local distributor
u.48	A.48		Motor Over Temperature	1.Too heavy load on the motor 2.Cooling condition for the motor is not good enough 3.Thermistor for motor temperature sensing is not used correctly	1.Check selection/installation of the thermistor for motor temperature sensing 2.Check the cooling conditions for motor 3.Check the load versus rated power of the motor
u.49	A.49		Motor Overload	1.Motor parameters and/or motor control parameters are not set appropriately; 2.Too heavy load on the motor	1.Correctly set relevant parameters especially the motor parameters 2.Check the load versus rated power of the motor
u.50	A.50		Current Limit	Current exceeds the parameter set max. current(P05.07)due to: 1.Too heavy load comparing to the power size of the inverter 2.Too fast ramp with inertia 3.Too low power supply voltage 4.Motor parameters and/or	Adjust P05.07 or try A.45 solution

Warning	Alarm	Error	Fault Name	Reason Description	Suggested Handling
				motor control parameters are not set appropriately;	
u.51	A.51		Torque Limit	Torque exceeds the parameter set max. torque(P05.04/P05.05)	Adjust P05.04/P05.05 or try A.45 solution
u.57	A.57		Analogue input terminals Error	1.Wire connection problem 2.The parameters for AI1/AI2 live zero are not correctly set	1.Check the wire connection 2.Adjust the relevant parameter setup
u.61	A.61		Encoder Error	1.Encoder Wire connection problem 2.Encoder rotation direction is reverse 3.Parameter encoder resolution P02.70 is incorrect 4.Motor parameters or speed close loop PID parameters are not set appropriately 5.The value of Parameters P05.20 and P05.21 is too small	1.Check the encoder wire connection 2.Change Parameter P02.71 3.Correctly set P02.70 4.Adjust motor relative parameters or speed close loop PID parameters 5.Increase P05.20 and P05.21 appropriately
u.62	A.62		Communication Timeout	Drive communication timeout (with external controller PC/PLC/HMI etc.) 1.External controller abnormal 2.Communication line connection problem 3.Communication Parameters (P00.8X) incorrect. 4.EMC problem.	1.Check external controller PC, PLC, HMI etc. 2.Check communication line connection 3.Correctly set communication parameters(P00.8X) 4.Wiring the communication cables correctly, including shielding and grounding 5.Contact our local support
u.66	A66		Motor Loss	Motor cable connection or motor problems; Actual motor current do not exceed P05.61	Check motor cable or motor phase Correctly set P05.60~P05.62
	A.69		Mechanic Brake Current Low	Actual motor current cannot exceed release brake current (P01.97~P01.98) within start delay time.	Correctly set mechanical brake parameters(P01.97~P01.98)
u.75			Drive License Timeout	Drive License Timeout function activated	Contact our local support
u.76	A.76		External alarm	DI terminals select external alarm function	Check external alarm source
		Er.90	CU communication Timeout	CU Failed to communicate with PU	1.Power off, then confirm the installation between PU and CU 2.Contact our local support
		Er.93	Parameter change disabled	The parameter cannot be changed when Drive running	Change the parameter after Drive stop

Warning	Alarm	Error	Fault Name	Reason Description	Suggested Handling
		Er.95	Keypad communication Timeout	Keypad failed to communicate with PU or CU	1.Check the connection between Keypad and PU/CU 2.Make sure PU or CU works properly
	A.99		AMA Error	Failed to finish the motor parameter auto tuning	Correctly set motor parameters according to motor nameplate

Note:The Alarms marked with '*' are locked faults.

5.1.2 How to Get the Fault Info

The customer can get the fault information from the keypad display or get the fault information via the RS485

5.2 Maintenance

The parts of product could be impacted by the environment temperature, humidity, vibration, salt mist, dust etc. Proper maintenance of the product during storage and running is important to keep the product from failure and life reduction.

5.2.1 Routine Inspection

Below items should are suggested for routing inspection:

Any abnormal sound from the motor during running?

Any abnormal vibration from the motor during running?

Is there any special change in the installation environment?

Are the cooling fans running, ok?

Check the temperatures inside the product via the parameter group 9

Check the motor voltage, current and frequency

Is there any special dust, e.g. metal dust or corrosive liquid?

5.2.2 Maintenance

According to the application, customer can check the product at a regular interval, e.g. every 3~6 months to clear the hidden problem.

Items for Maintenance	Measures
Control terminals loose?	Fasten the screws with a torque-controlled screw driver if loose
Power terminals loose	Fasten the screws with a torque-controlled screw driver or socket wrench if loose
PE terminals loose?	Fasten the screws with a torque-controlled screw driver or socket wrench if loose
Fixation of the product loose?	Fasten the screws with a torque-controlled screw driver or socket wrench if loose
Control wire or power cable worn?	Replace the wire or cable
Air duct blocked?	Clean the air duct
Fan speed too low or blocked?	Clean or replace the fan

Caution:

Please power off the product and wait for enough time to ensure safety before maintenance.

Avoid dropping any screws, wire lead and other metal materials inside the product, otherwise it could be damaged when power on.

It is forbidden to do any change inside the product.

5.2.3 The Storage and Transportation of Product

The product should be stored inside the package before installation. Below items are demanded for storage:

In a dust free and dry environment.

Storage temperature:-25℃~65℃；

Storage humidity:5%-95% and no condensing.

Storage in environment without corrosive gas or liquid.

Put on shelf away from the ground with package.

Transportation ambient temperature:-25℃~70℃.

Transportation ambient humidity: below 95%

Caution:It’s inadvisable to store the product for longtime due to electrolytic capacitors inside. If you DO need to store the product for long time please follow bellow rules:

Power the product every 6 months for more than 5 hours in a special way.

Power the product before the first time running in a special way.

The special way to power the product means to power the product with a voltage and current controlled supply and increase the voltage slowly, normally with a voltage regulator.

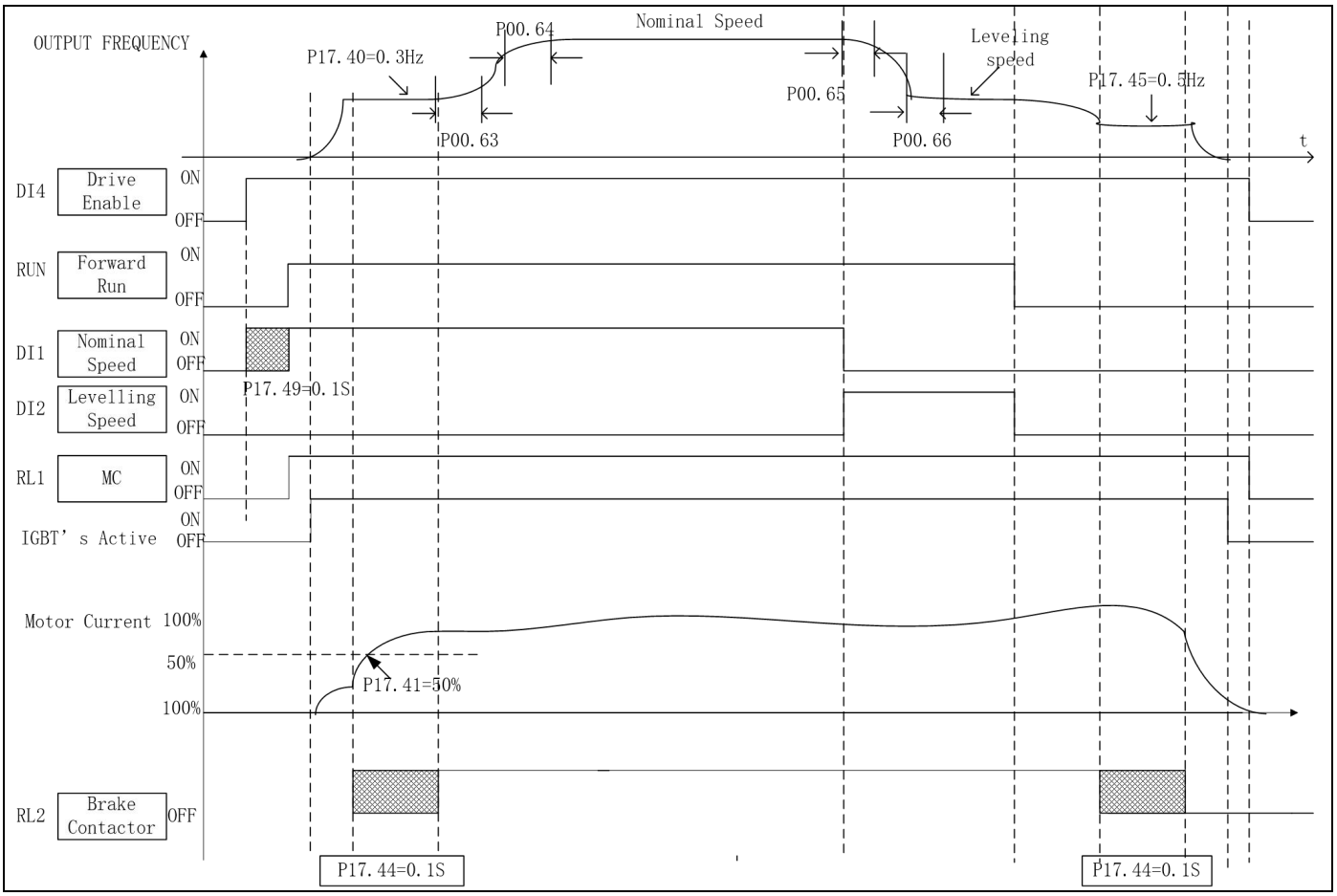
Power the product directly to high voltage after long time storage could explode the electrolytic capacitors.

5.2.4 Scrapping of the Product

Materials used in the product are recyclable to save resource and protect the environment. For example, the package material is biodegradable and recyclable. All the metal parts can be recycled as well as the plastic and rubber. Scrapping the Printed Circuit Board and electrolytic capacitor should follow standards IEC62635. All the handling for scrapping of the product should follow the local regulations.

Chapter 6 SA710L Application Guideline

6.1 Setup Steps



STEP 1	For IM motor: Set the Motor Control to Principle (Set P00.02=1), control Mode (P00.01) and Motor parameters (P01.03~P01.07), P01.91=1 (open the resistor brake function). Motor parameters(P01.03~P01.07) according to motor nameplate. For Gearless motor (PM motor): Set P01.02=3(select motor type as PM motor), then set the motor parameters:P01.06, P01.07, P01.08, P01.24,P01.25 according to the motor nameplate. Note: For P01.08, if the motor nameplate indicates that the motor has no rated torque, you could please use below formula:Tn=9550*P (motor rated power, Unit:KW)/motor rated speed (Unit:rpm); For P01.24, if the motor nameplate doesn't have motor poles, please use below formula:120*motor rated frequency (Unit:Hz)/motor rated speed (Unit:rpm); For P01.25, if the motor nameplate indicates that the motor has no rated back EMF, please don't change this parameter, and use the inverter default value.
STEP 2	For Motor Auto tuning. You could please refer to the chapter 6.2.
STEP 3	For IM motor: If it works in speed open loop, skip to step 4. If it works in speed close loop, set the Encoder relative parameters, and check the encoder input. Set the Encoder Resolution (P02.70) according to the Encoder nameplate, then check the encoder is ok or not (refer to chapter 8). Then adjust Speed PID parameters P04.30(P), P04.31(I) as your requests, set P04.32=0.

	For Gearless motor (PM motor): Work in speed close loop, set the Encoder relative parameters and check encoder input. Set the Encoder Resolution (P02.70) according to the Encoder nameplate, then check the encoder situation (refer to chapter 8). Adjust P04.31(Integral Time) as your requests. If we increase P04.31, the speed control loop response time be longer.
STEP 4	Set Ramp up/down time and S-curve time (P00.50~P00.52, P00.63~P00.66), multi-frequency values (P17.61~P17.68, refer to chapter 10) and other relative parameters in Group 17 (brake and magnetic contactor control sequence, DI/DO/RL functions). SA710L provides two groups of braking control logic parameters for different operation directions. If running forward, the brake control logic parameters are P17.40 / P17.41 / P17.45, In running reserve, the braking control logic parameters are P17.42 / P17.43 / P17.46. For lift applications, customers can set these two sets of parameters to the same value. The details of braking logic are shown below (for example:Forward Running):if the output current ≥ P17.41 and output frequency >= P17.40, after waiting for a period of time, the brakes will release (defined by P17.44); If the output frequency drops to P17.45, the brake will close after waiting for a period of time (defined by P17.47), After the brake is closed, the inverter will maintain the IGBT output for a period of time (defined by P17.48), then the MC relay will be disabled and the IGBT will be disabled. For Gearless motor (PM motor): Please use the stop function (P01.86 / P01.87) when starting and the DC injection function (P01.83 / P01.84 / P01.85) when stopping. We recommend setting P01.87 = 0.5 seconds, P01.83 = 0.5 seconds, P01.84 = 0.1 Hz, P01.85 = 0 (must be set to 0). We suggest setting braking logic parameters:P17.40 = P17.42 = 0.0h, P17.41 = P17.43 = 50% motor rated current, P17.45 = P17.46 = 0.0hz, P17.47 = 0.3s (< P01.83)
STEP 5	Motor running direction inspection. Please ensure that the inverter is in remote mode (P06.31 = 0), otherwise the lifting application will be disabled. Then connect the di wire and try to run. If the inverter cannot operate, please read P17.92 and P17.93 and check the di / do / RL status. Then check whether the motor running direction is correct. If not, change the motor phase UVW sequence.
STEP 6	Motor control performance inspection. For speed open-loop, first check the startup performance during no-load up and down operation. When starting, if the motor shaft rolls back after the brake is released, increase the slip compensation P01.37. Otherwise, if the inverter reports an overcurrent warning / alarm, reduce the slip compensation P01.37. Then check the stop performance during no-load up and down operation. Please adjust the DC injection parameters (see Chapter 9). For speed closed loop, first ensure that P04.32 = 0 (speed PID differential time), and then if the motor control performance is not good enough, adjust the speed PI P04.30 (P) and P04.31 (I). For gearless motors (PM motors): Please adjust P04.31 (integration time) to improve motor control performance. If we add P04.31, the response time of the speed control loop will be longer and longer.
STEP7	For Leveling adjust, please refer to chapter 6.7.
STEP8	Parameters setting. For detailed logic, refer to Chapter 13 (UPS functions) Note:if we need to reset all parameters to factory default values. Please set parameter P07.00 = 9; Then completely power off the product and power on again, and the keyboard will display a.01; Then press the "stop" key to clear a.01 and reset the parameters.

6.2 Motor Auto Tuning Guide

STEP 1	Ensure that the UVW connection between the inverter and the motor is not cut off by the output contactor; If it is cut off, handle it manually with the output contactor
STEP 2	Set P06.31=1, switch to Local mode.
STEP 3	Set parameter P01.13 = 2 (automatic tuning of static motor is completed), and the keyboard will display "push operation"
STEP 4	Press the "run" key and wait for the auto tuning to complete
STEP 5	If auto tuning is finished(Keypad will display “PUSH ENT”),then press “ENTER”.
STEP 6	Set P06.31=0, switch to Remote mode (If in Local mode, lift application will be invalid).

6.3 Guide of Checking Rncoder

STEP 1	Set P00.01=0 (speed open loop)
STEP 2	Make the inverter forward run to 10Hz (ensure the motor is really running), read parameter P09.37(Encoder feedback value= rotor frequency = stator frequency/motor pole-pairs) to check the encoder direction and resolution is ok or not.
STEP 3	For example, if the motor has 4 poles (2 pole-pairs) and the output frequency is 10Hz, then P09.37 will equal to 5.0(10/2=5.0) theoretically. Usually, the range of error within +/-5%. If the error in the range, please jump to step5, else jump to setp4.
STEP 4	If P09.37 is negative value, please change P02.71(0 to 1 or 1 to 0). If the error out of the range, please first check the Encoder Resolution (P02.70) is right or not, then check the encoder wires connect to PG Card is right or not. If there is no problem, the PG card or encoder may be damaged. Then repeat step 2 / 3.
STEP 5	Set P00.01=1(Speed close loop)

6.4 How to Set DC-Injection When Inverter Stops

STEP 1	Set P01.83 (DC injection time, must be greater than P17.47 + P17.48), P01.84 (DC injection cut in speed, must be greater than P17.45 / P17.46) and P01.85 = 0 (must be 0, otherwise the inverter will stop output before DC injection is activated).
STEP 2	Then adjust the P01.82 (DC injection current) and increase the P01.82 if the motor shaft rolls back when it stops.

6.5 How to Set DC -Injection When Start (IM motor)

STEP 1	Set P01.71=1 (DC Hold) and P01.70>=0.1S
STEP 2	Then adjust P01.72(DC Hold current) and P01.70(DC hold time, must above 0S,else DC hold function will be disabled) what you want.

6.6 Multi-Speed Function

The multi-speed table as below:

DI1	DI2	DI3	Object speed be selected
17-72=3 multi-speed bit0	17-73=4 multi-speed bit1	17-74=5 multi-speed bit2	
0	0	0	Speed0 (P17.61)
1	0	0	Speed1 (P17.62)
0	1	0	Speed2 (P17.63)
1	1	0	Speed3 (P17.64)
0	0	1	Speed4 (P17.65)
1	0	1	Speed5 (P17.66)
0	1	1	Speed6 (P17.67)
1	1	1	Speed7 (P17.68)

By default, the object speed source is defined by multi-speed. It also can be defined by AI1 or AI2 (according to set P17.55=1 or 2) . If P17.55=0 (multi-speed is enabled), AI1 and AI2 will be configured as DI terminal. And If P17.55=1 or 2, AI1 and AI2 will be configured as analog terminals. For analog input, please refer to Chapter 14.

If the object speed is 0HZ, the drive will ramp down and then stop. So if the selected multi-speed(or analog input speed is 0 when P17.55=1 or 2) is 0HZ, the drive will can not start up even if the direction terminal (Example :FOR, Forward Run) is active.

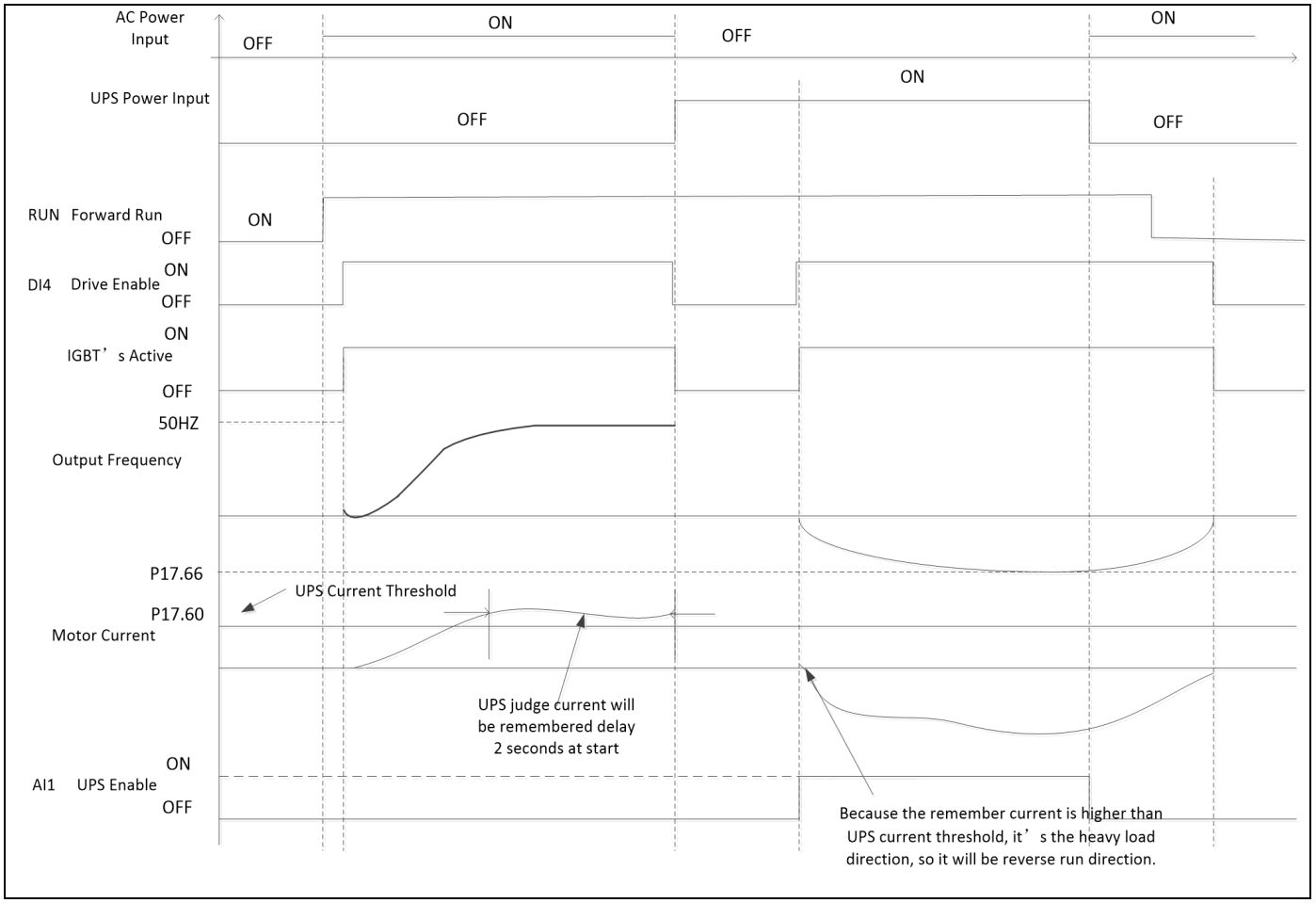
If the customer wants to set a multi-speed selection terminal (Example :DI3 multi-speed bit2) as the highest priority, the customer can set speed4=speed5=speed6=speed7.

6.7 Leveling Adjustment

STEP 1	Please ensure the lift have leveling speed run period when stopping every time (from normal speed ramp down to leveling speed and keep the leveling speed at least 3 seconds, and then the lift reaches the leveling position) for UP and Down direction run check. Sometimes, if the normal speed is too high or the ramp down time is too longer, the lift will reach leveling position before the lift speed ramp down to leveling speed, we call this status as non-leveling speed run period. If lift does not have leveling speed run period, please first decrease the ramp down time P00.52, generally, we do not recommend setting P00.52 to less than 1 second, if P00.52 is short enough but the leveling speed run period is also less than 3 seconds(or also do not have leveling speed run period), then please decrease normal speed(for example, from 50Hz to 45Hz) until the leveling speed run period exceeds 3 seconds.
STEP 2	Ensure P17.51/P17.52/P17.53/P17.54 are 0(no time delay and compensation), then check the leveling deviation in UP direction without load and Down direction with full load. We need to adjust S-Ramp down time(P00.65/P00.66) and leveling speed to ensure the stop position is lower than object position at least 1cm in UP direction without load and higher than object position at least 1cm in Down direction with full load (This means the lift stop too early, need run more distance to reach the object position, then we can add time delay in step3). If the stop position do not reach these condition, it means the lift run stop too late, then we need decrease P00.65 and P00.66, usually we do not suggest set P00.65/P00.66 lower than 1 second, if P00.65/P00.66 are short enough but the stop position also do not reach these condition, then we can decrease leveling speed(example, from 5Hz to 4.5Hz) until stop position reach these condition. Then record the UP direction deviation (Pu, must be lower than object position at least 1cm) and Down direction deviation (Pd, must be higher

	than object position at least 1cm).
STEP 3	Calculate UP and Down direction stop delay time (P17.51 and P17.52) by deviation recorded in step2, we can use below formula to calculate: Tu=Pu*FN/(FL*VN); Td=Pd*FN/(FL*VN); Tu:UP direction time delay, Unit:S; Td:Down direction time delay, Unit:S; Pu:UP direction deviation recorded in step2, Unit:cm; Pd:Down direction deviation recorded in step2, Unit:cm; FN:Normal run frequency, Unit:Hz; FL:Leveling run frequency, Unit:Hz; VN:Lift normal speed when run normal frequency, Unit:cm/s
STEP 4	Set P17.51=Tu and P17.52=Td, and then check the stop deviation of no-load UP and full-load Down, usually the deviation of the two directions is close to 0cm, if not, please adjust P17.51/P17.52 slightly until the deviation almost reaches 0cm (For example, if the stop position in the UP direction without load is 0.2cm higher than the object position, then we need to reduce P17.51, if the stop position in the downward direction with full load is 0.2cm higher than the object position, then we need to increase P17.52).
STEP 5	Based on step4, then we can check with full load UP and no-load Down stop deviation, then adjust P17.53 and P17.54. The compensation adjust principle is :The compensation adjustment principle is:For the UP direction, if the full load UP stop position is lower than the object position, increase the compensation, otherwise reduce the compensation. For the Down direction, if the no-load Down stop position is higher than the object position, you need to increase the compensation, otherwise you need to reduce the compensation. Example:(For the UP direction, if the full load UP stop position is 3cm lower than the object position, then we can increase P17.53 from 0% to 200%. Then we check the stop position again, if the full load UP stop position is 1cm higher than the object position , Indicating that P17.53 is too large, you can reduce P17.53 from 200% to 150%, otherwise the full load UP stop position is still 1cm below the object position, indicating that P17.53 is too small, we can change P17.53 from 200% increased to 300%. For the downward direction, if the no-load downward stop position is 2cm lower than the object position, then we can reduce P17.54 from 0% to -150%. Then we check the stop position again, if the no-load descent stop position is 1cm higher than the object position, it means that P17.53 is too small, we can increase P17.53 from -150% to -100%, otherwise, if there is no load, the stop position It is still 1.2cm below the object position, which means that P17.53 is too large, and we can reduce P17.53 from -150% to -200%.)

6.8 The UPS Function

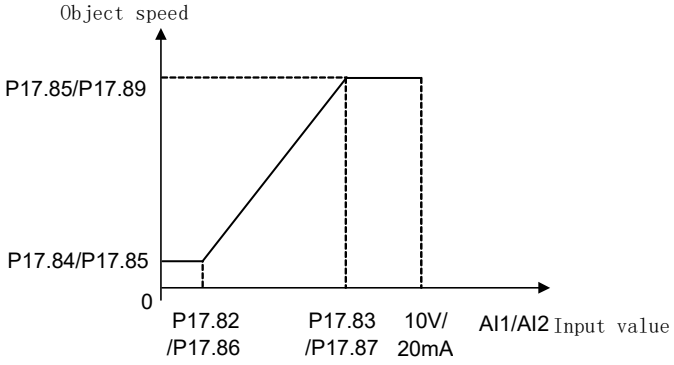


When the UPS function is valid (AI1 terminal:UPS enable, if P17.55=1 or 2, please select DI1, DI2 or DI3 as the UPS enable input), all speed reference sources (set by P17.55) will be Disable, the object speed is forced by P17.69, the undervoltage threshold in UPS mode can be changed by P07.31 (usually it is recommended to set P07.31=200V), the ramp up/down time is defined by P00.54/P00.55 (usually It is recommended to set P00.54/P00.55=20.00 seconds). And please set P05.34=1 (must be set to 1).

The UPS direction check current threshold (P17.60) is defined by the no-load UP and Down currents of the cabin. First, we need to run the elevator when the cabin is empty, and then record the upward current (If) and downward current (Ir) when the elevator speed reaches the normal speed. Then we can calculate P17.60 by the formula:P17.60=(If+Ir)/2. Also please remember that before we do this, we must ensure that the elevator can operate normally.

If we set P17.60=0, then the UPS direction check function will be disabled, and the run direction in UPS mode will be defined by controller.

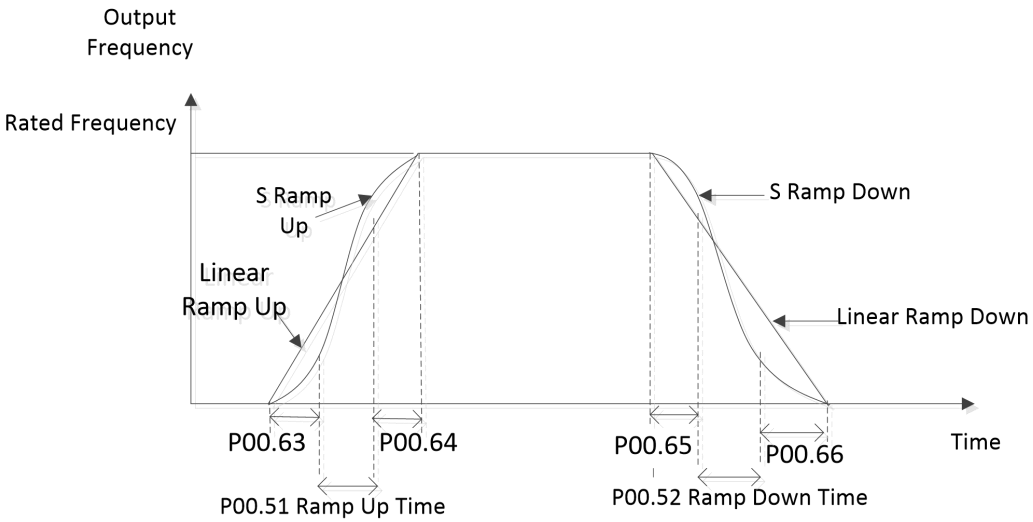
6.9 Speed Source from Analog Input



When P17.55=1,speed reference defined by AI1 input. When P17.55=2,speed reference defined by AI2 input. when P17.55≠0, AI1/AI2 terminal can be configured as voltage input type(the range is 0.000~10.000V) or current input type(the range is 0.000~20.000MA)by P17.56. AI1 input type is set by P17.56 bit0, AI2 input type is set by P17.56 bit1. By default, P17.56=0 (bit0=0, bit1=0, indicating that AI1 and AI2 are voltage input types). If the customer sets P17.56=3 (bit0=1, bit1=1), AI1 and AI2 will be configured as the current input type.

The above figure describes the curve:the input value of AI1/AI2 terminal corresponds to the speed of the object.

6.10 S-Ramp Function



Chapter 7 Basic Application Guide

This chapter describes the basic operations through the keyboard or control terminal. The operation through the communication bus is similar to sending control commands to the SA710L and / or setting the parameters of the SA710L (see Appendix).

7.1 Keypad Control

1. Make sure the product works in local mode (L / R light flashes), or set P06.31 = 1 to switch to local mode.
2. Adjust the set frequency by turning the potentiometer.
3. Press the "run" key to start the motor and adjust the motor speed by turning the potentiometer.
4. Press the "stop" key to stop the motor.

Note:in local mode, the product only receives commands from the keyboard. Usually, local mode is used for system debugging.

7.2 Terminals Control

1. Ensure that the product operates in remote mode (L / R light is always on). Otherwise, switch the product to remote mode by setting P06.31 = 0. The product is in remote mode by default.
2. Control in default parameter setting:by default, di terminal named "FWD" is set as start / stop function (P02.05 = 10), di terminal named "Rev" is set as reverse operation function (P02.06 = 12), main setpoint source is set as Ai1 terminal (P00.11 = 1), and Ai1 terminal is set as analog voltage input (P03.00 = 0). In the default parameter setting, you can start the motor forward by enabling the signal to terminal "FWD" (short circuit the "FWD" terminal to "GND") and stop the motor by disconnecting terminal "FWD" from terminal "GND". You can start the motor in reverse by connecting terminal "Rev" to "GND" and stop the motor by disconnecting terminal "Rev" from terminal "GND". You can change the motor speed by adjusting the voltage on terminal Ai1.
3. Preset multi-level value control:according to the default parameter setting, you need to change the main setting value source to the preset multi-level value (P00.11 = 11), keep the functions of terminal "di1" ～ "di3" as the default value (P02.07 ~ P02.10 = 22 ~ 24), and set the preset value in parameters P00.30 ~ P00.37 to your desired speed. Then, you can change the motor speed to the preset value by changing the logical state of terminals "di1" ~ "di3".

7.3 Reset the Parameters to Factory Defaults

1. Set parameter P07.00 = 9;
2. Completely turn off the power of the product, then turn on the power again, and the keyboard displays a.01
3. Press the "stop" key to clear a.01, and then reset the parameters to the factory default values, except for parameter groups 8 and 9.

7.4 Reset Faults (Alarms)

For non-locked faults, press “STOP” key to reset the fault.

For locked faults:

If parameter P05.30 = 0, press “STOP” to reset the fault;

If parameter P05.30 =1, you need to power down and power on first, then press “STOP” key to reset the fault.

You can also set a DI terminal function to reset fault (set one of the parameters from P02.05 to P02.09 equals 1), and use DI signal to reset the fault.

Appendix A. Modbus Communication Guidance

The SA710L drive provide RS485 communication interface. It adopts international standard Modbus communication protocol to perform master-slave communication. The user can realize centralized control through PC/PLC to adapt specific application requirements.

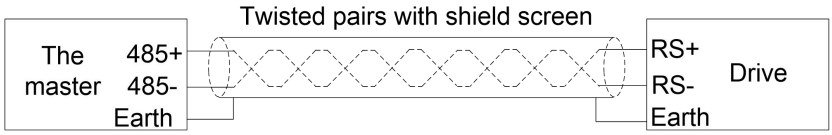
1. Application Mode

1.1 Interface Mode

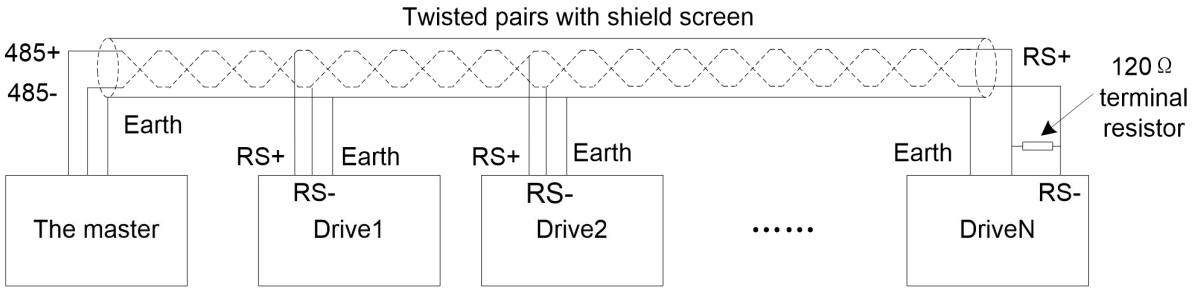
The communication interface is RS485. RS485 works on semi duplex and its data signal applies differential transmission which is called balance transmission too.

1.2 Networking Mode

The drive has two networking modes:single master/multiple slaves networking and single master/single slave networking.



Single master/single slave networking diagram



Single master/multiple slaves networking diagram

Specification:

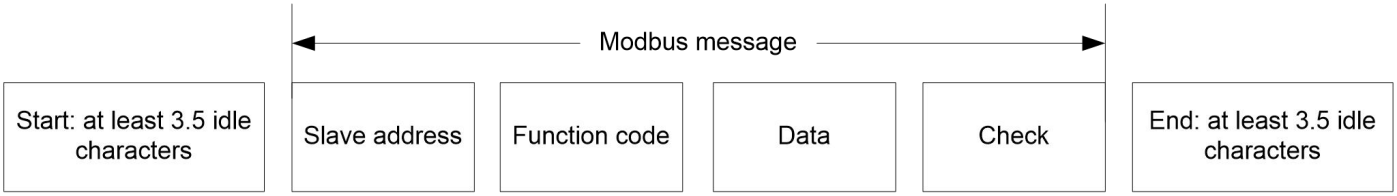
1. No matter which mode, the drive is used as a slave in communication. When master sends commands using broadcast address, the slave does not respond;

2. It is recommended to use shield cables in multiple connection. The basic parameter of the devices, such as baud rate and digital check bit in RS485 should be the same as slave device's and there should be no repeated addresses in slave devices.

2. Protocol Format

Modbus protocol only support RTU mode.

RTU data frame format is shown as the figure below:



Specification:

Start	At least 3.5 idle characters
Slave address	Address:0-127(0 is broadcast address)
Function code	Modbus function code

Start	At least 3.5 idle characters
Data (N-1)	2 * N data
Data (N-2)	
…	
Data 0	
CRC CHK high-8-bit	CRC check
CRC CHK low-8-bit	
End	at least 3.5 idle characters

3. Function Code

Function code supported by SA710L drive Modbus protocol are as shown in the table below:

Function code	Description	Meaning
0x03	Read Holding Registers	Read drive functional parameters and running status parameters
0x06	Preset Single Register	Over-write individual drive functional parameters
0x10	Preset Multiple Regs	Over-write multiple Registers

4. Register Address Definition

All the following register addresses are started from 0.

4.1 The Rules of Register Address of the Parameter Number

The parameters can be mapping to register address. The rules of register address of the parameter number are shown below:

Register address = PNU – 1

For example:The register address of P00.30 is 30 - 1 = 29 (0x001D)

The register address of P09.11 is 911 - 1 = 910(0x038E)

Attention:Parameters Group 8 and 9 are Read-only.

The Drive don’t support write or read multiple parameters at a time.

4.2 Other Register Addresses Specification

In addition to parameter is mapped to Modbus registers, there are some additional registers within the drive which can be used to control the drive, monitor the drive's status. These registers can support write or read maximum 10 registers at a time.

Register address	Specification	R/W
9999*	Control command	W
10000*	Frequency command	W
10099*	State	R
10100*	Warning/Alarm code	R
10101	Output frequency (0~Fmax, unit:0.1Hz)	R
10102	Output current (unit:0.01A)	R
10103	Output voltage (unit:1V)	R
10104	Output power (unit:0.01kW)	R
10105	Motor speed (unit:1rpm)	R

Register address	Specification	R/W
10106	DC bus voltage (unit:1V)	R
10107	Reference	R
10108	Process PID Feedback	R

* Reg. 9999 specification

Bit	Specification
Bit 7~0(run/stop control etc.)	0x00:No function 0x01:Run forward 0x02:Reverse 0x03:Jog 0x04:Jog reverse 0x05:Stop 0x06:Coast 0x07:Reset
Bit 11~8(Preset value select)	0000B:P00.30(Preset Value 0) 0001B:P00.31(Preset Value1) … 1111B:P00.45(Preset Value 15)
Bit 13~12(Ramp time select)	00B:Ramp 1 01B:Ramp 2 10B:Ramp 3 11B:Ramp 4
Bit 14	Reserved
Bit 15	1B:Enable Bit8~13 function; 0B:Disable Bit8~13 function

* Reg. 10000 specification

When using communication to control the drive, you can set the frequency directly by writing register 10000 . The register value is in the range of 0.00 ~ P05.08, unit 0.01Hz.

* Reg. 10099 specification

Bit	Specification
Bit 0	0B:None; 1B:Warning
Bit 1	0B:None; 1B:Alarm
Bit 3~2	00B:Stop 01B:Run forward 10B:Reverse 11B:Reserved
Bit 7~4	Reserved
Bit 11~8	0000B:Using Preset Value 0 0001B:Using Preset Value 1 … 1111B:Using Preset Value 15
Bit 15~12	Reserved

* Reg. 10100specification

Register 10100 is used to read the drive warning/alarm code. For example:When the drive occurs A.48 alarm, the value of register 10100 is 48. When the drive occurs u.24 warning, the value of register 10100 is 24.

5. Communication Ratio Values

The Communication data is expressed by hexadecimal in actual application and there is no radix point in hexadecimal. For example, if you want to set P05.08 = 61.5, 61.5 can be magnified by 10 times into 615. So hex 0x0267 (615) can be used to express 61.5.

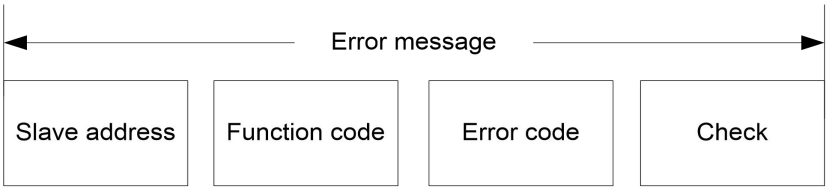
A non-integer can be timed by a multiple to get an integer and the integer can be called communication ratio values.

The communication ratio values are referred to the radix point of the setting range of default value in the functional parameter list. If there are radix point n, then the communication ratio value m is 10^n.

6. Error Message

There may be errors in the communication process, for example, some parameters are read-only, but the PC/PLC sends a written directive, the drive will return an error message.

Error message data frame format is shown as the figure below:



Error message function code = requirements function code + 0x80

Error code	Specification
0x01	Function code error, the drive does not support this kind of function code.
0x02	The register address is invalid.
0x03	The value exceeds the upper limit of the parameter
0x04	Operation error.

7. Examples

7.1 Read Holding Registers (0x03)

7.1.1 Read motor speed

Read parameter P09.04(Reg 903) to get the Motor speed.

Transmit:01 03 03 87 00 01 34 67 (Hexadecimal)

Receive: 01 03 02 05 DC BA 8D (Hexadecimal)

Transmit data specification:

Field	Description
01	Address
03	Function
03 87	Register address:903(0x0387)
00 01	The number of read registers is 1

Receive data specification:

Field	Description
01	Address
03	Function
02	The byte number of received data
05 DC	0x05DC converts to decimal number is 1500. So, the value of P09.04 is 1500RPM

7.1.2 Read Drive Status, Warning/Alarm Code and Output Frequency

Read multiple Registers 10099、10100、10101 to get all information.

Transmit:01 03 27 73 00 03 FE A4 (Hexadecimal)

Receive: 01 03 06 00 04 00 00 01 F4 D0 A2 (Hexadecimal)

Transmit data specification:

Field	Description
01	Address
03	Function
2773	Register address:10099(0x2773)
00 03	The number of read registers is 3
FE A4	CRC check

Receive data specification:

Field	Description
01	Address
03	Function
06	The byte number of received data
00 04 00 00 01 F4	The value of Reg. 10099 is 0x0004. Note: Bit 0 is 0B, that is No warning; Bit 1 is 0B, that is No Alarm; Bit 3~2 is 01B, that is Run forward; Bit 11~8 is 0000B, that is Using Preset Value 0; The value of Reg. 10100 is 0x0000(0). The drive doesn't have warning/ alarm, so it is 0. The value of Reg. 10101 is 0x01F4(500). So, the drive output frequency is 500/10=50.0Hz.

7.2 Write Single Register (0x06)

Set motor rated speed to 1430RPM.

Write P01.07(Reg 106) =1430.

Transmit:01 06 00 6A 05 96 2A E8 (Hexadecimal)

Receive: 01 06 00 6A 05 96 2A E8 (Hexadecimal)

Transmit data specification:

Field	Description
01	Address
06	Function

Field	Description
00 6A	Register address of P01.07 is :107-1= 106(0x006A)
05 96	The value wants to set to P01.07 is 0x0596(1430)

Receive data specification:

Field	Description
01	Address
06	Function
00 6A	Register address of P01.07 is :107-1= 106(0x006A)
05 96	The value of P01.07 is 0x0596(1430)

7.3 Write Multiple Registers (0x10)

Start the drive and set Drive output frequency.

Write register 9999 to control the drive running and write register 10000 to set the drive output frequency.

Transmit:01 10 27 0F 00 02 04 00 01 09 C4 5A 1D (Hexadecimal)

Receive: 01 10 27 0F 00 02 7B 7F (Hexadecimal)

Transmit data specification:

Field	Description
01	Address
10	Function
27 0F	Register address:9999(0x270F)
00 02	The number of write registers is 2
04	The byte number of write data is 4
00 01 09 C4	Reg. 9999= 0x0001 Note: Bit 7~0 is 0x01, that is Run forward; Bit 11~8 is 0000B, that is Using Preset Value 0; Bit 13~12 is 00B, that is Using ramp 1; Bit 15 is 0B, that is Disable bit 13~8; Reg. 10000= 0x09C4(2500, So the Reference frequency is 2500 / 100 = 25.00Hz)

Receive data specification:

Field	Description
01	Address
10	Function
27 0F	Register address:9999(0x270F)
00 02	The number of write registers is 2
01	Address

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