QDS1 Motor Soft Starter

User Manual

V2022A-Q

QDS1 Motor Soft Starter

User Manual

15.A

JIAXING DANNAHE ELECTRONIC SCIENCE&TECHNOLOGY CO.,LTD

Contents

1. Foreword

Thank you very much for purchasing our soft starter.

This user's manual provides the users with the instructions on the installation, parameter setting, error diagnosis, routine maintenance and necessary precautions. Please read the manual carefully before the installation of the product in order to ensure that it can be correctly installed and operated.

During this product updating period, some details may be changed without prior notice. If you want to get the latest information, please visit our website.

1.1 Precaution

- Must by professional technicians to install the soft starter.
- The specifications of the motor must match with the soft starter.
- Please be sure to read the operating instructions before installation.
- Prohibit to connect the capacitors in soft starter output terminal (U, V, W).
- The bare terminals must be wrapped by insulating tape after installation.
- No more than 6 loaded starts per hour.
- Input power must be cut off when equipment maintenance.

1.2 Check the delivery

Please check as the following steps after getting and unpacking device:

(1) Check with the machine, the instruction manual, the product certification.

(2) Check that the starter reference printed on the label is the same as that on the delivery note corresponding to the purchase order.

(3) Remove the starter from its packaging and check that it has not been damaged in transit.

Please contact dealers or directly contact with the company if found problem, our professional staff is willing to serve for you.

2. Product description

2.1 Nameplate and Model designation

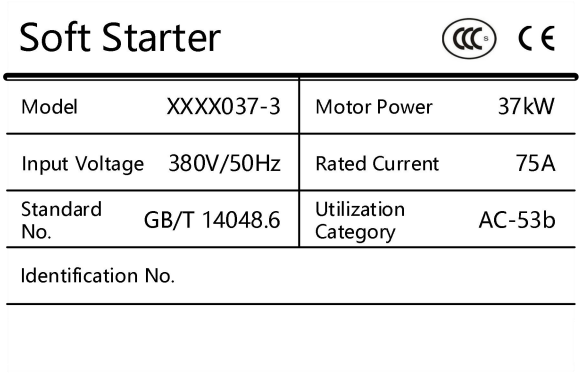


Figure 2.1 Nameplate

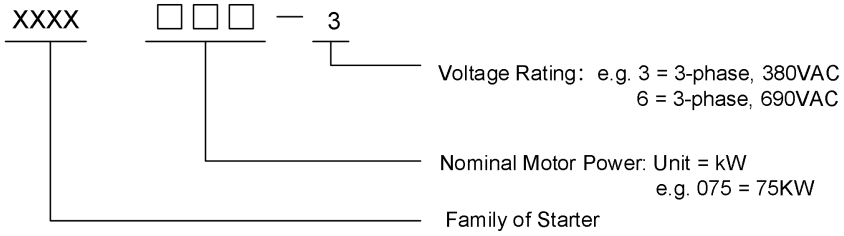


Figure 2.2 Model designation

2.2 model specifications

Table 2.1 QDS1 soft starter list (5.5KW-500KW)

Soft starter model	Rated current (A)	Adaptive motor power (kW)
QDS1-005-3	11	5.5
QDS1-007-3	15	7.5
QDS1-011-3	23	11
QDS1-015-3	30	15
QDS1-018-3	37	18.5
QDS1-022-3	45	22
QDS1-030-3	60	30
QDS1-037-3	75	37
QDS1-045-3	90	45
QDS1-055-3	110	55
QDS1-075-3	150	75
QDS1-090-3	180	90
QDS1-115-3	230	115
QDS1-132-3	264	132
QDS1-160-3	320	160
QDS1-185-3	370	185
QDS1-200-3	400	200
QDS1-250-3	500	250
QDS1-280-3	560	280
QDS1-320-3	640	320
QDS1-400-3	800	400
QDS1-450-3	900	450
QDS1-500-3	1000	500

2.3 The appearance and installation dimension★

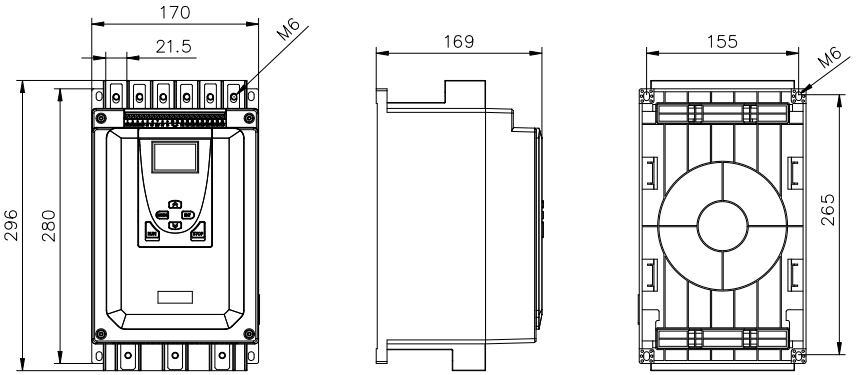


Figure 2.3 5kW~75kW (Units:mm)

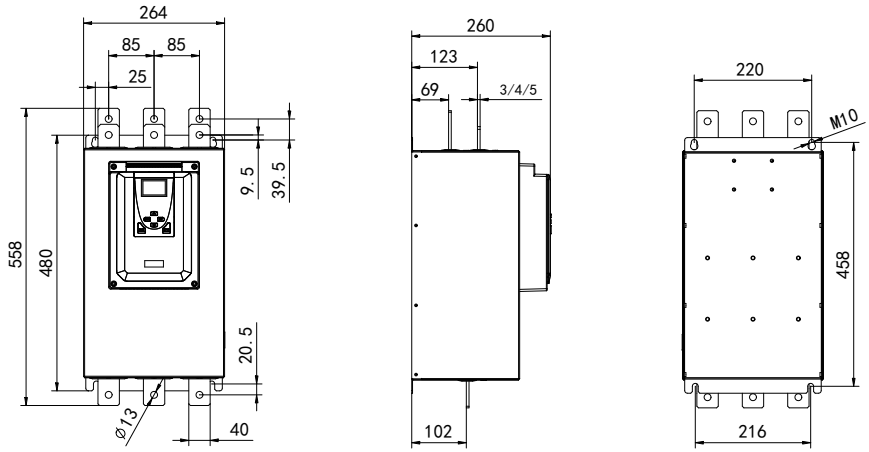


Figure 2.4 90kW~200kW (Units:mm)

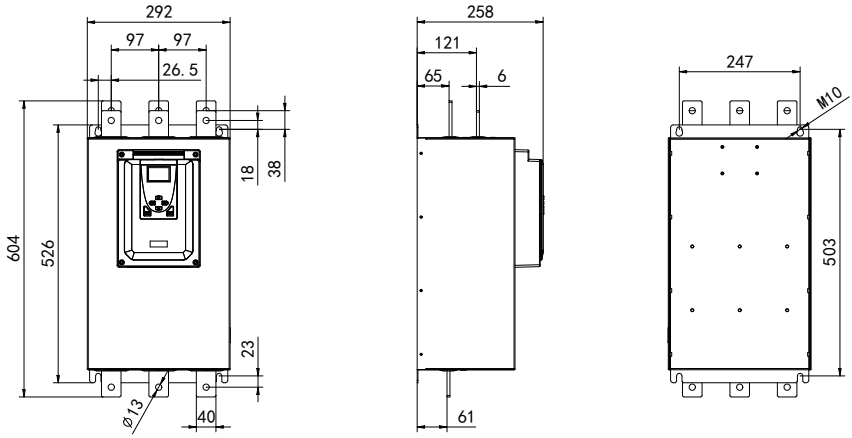


Figure 2.5 250kW~320kW (Units:mm)

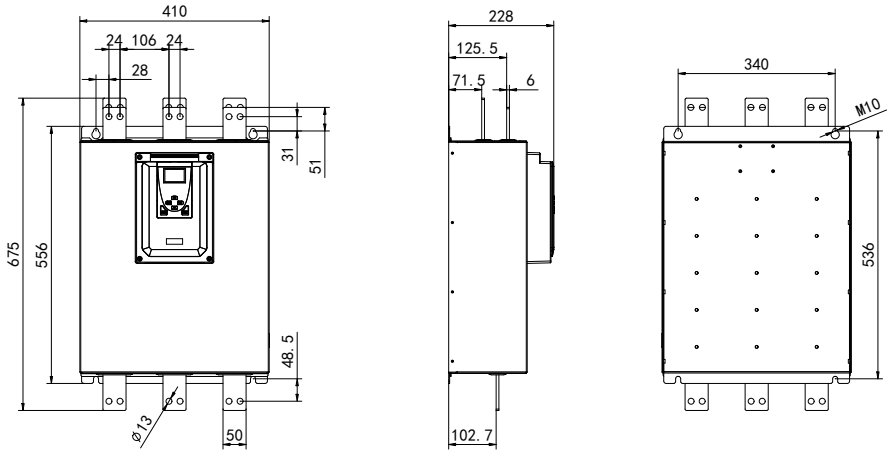
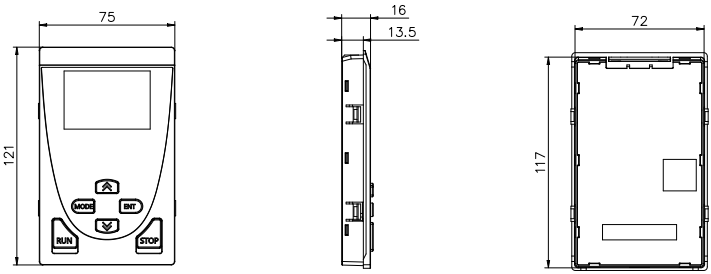
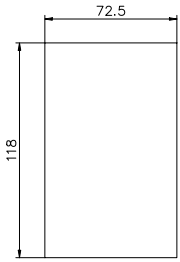


Figure 2.6 400kW~500kW (Units:mm)



(a) Control panel dimensions



(b) Cut-out dimensions

Figure 2.7 Control panel and Cut-out dimensions (Units:mm)

★**Note:** Correct dimensions depend on the actual model. All dimensions are subject to change without prior notice.

3. Installation and Connection

3.1 Installation

3.1.1 Environmental Conditions

Table 3.1 Environmental Specifications

Description	Specification
Power supply	3-phase 380VAC (-10% ~ +15%）, 50Hz
Type of load	3-phase squirrel cage induction motor
Start duty	3 x I_N for 30 sec, 6 starts per hour (Standard Connection)
Temperature	Operating: 0℃ ~ 40℃ Storage: -25℃ ~ 70℃
Humidity	0% to 93% non-condensing
Altitude	1000m (3300ft) without derating
Shock resistance	15g，11ms
Vibration resistance	below 0.5g
Mounting mode	Wall mount
Cooling	Natural convection
Others	Protected from rain, moisture and direct sun. Free from metallic particles, conductive dust, and corrosive gas. Free from Flammable or explosive material.

3.1.2 Mounting

When drilling or punching holes in the enclosure, cover the electrical assembly to prevent metal filings from becoming lodged in areas which can cause clearance reduction or actually short out electronics. After work is complete, thoroughly clean the area and reinspect the unit for foreign material. Make sure there is sufficient clearance all around the unit for cooling, wiring and maintenance purposes. To maximize effective air flow and cooling, the unit must be installed with its heat sink ribs oriented vertically and running parallel to the mounting surface.

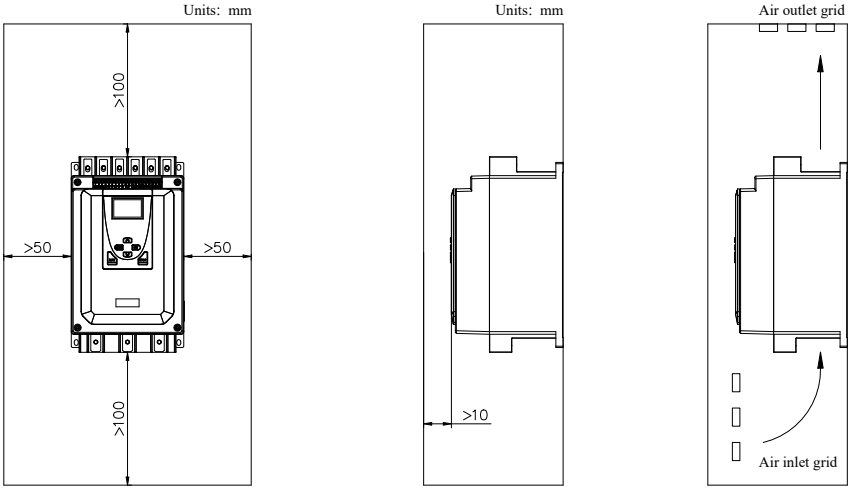


Figure 3.1 Mounting clearances

★**Note:** Do not install the unit close to, especially above, heating elements.

3.2 Wiring

When making power and control connections, the following should be observed:

(1) Check that the motor and supply voltage correspond to the values on the rating plate of the soft starter.

(2) Connect the incoming AC power wires from the power disconnect and/or protection devices to R, S and T terminals, and tighten each terminal. Never connect input AC power to the motor terminals U, V, or W.

(3) Capacitors for power factor compensation are not permitted in between the Softstarter and the motor, because this can cause current peaks which can burn the thyristors in the Softstarter.

(4) Do not apply voltage to the control input terminals. These terminals are active 12 V DC inputs and must be controlled with potential-free contacts.

(5) All naked electric terminals must be wrapped with insulating tape.

(6) Wiring need to be fixed firmly, and make sure all wirings are secured.

3.2.1 Basic Connection Diagram

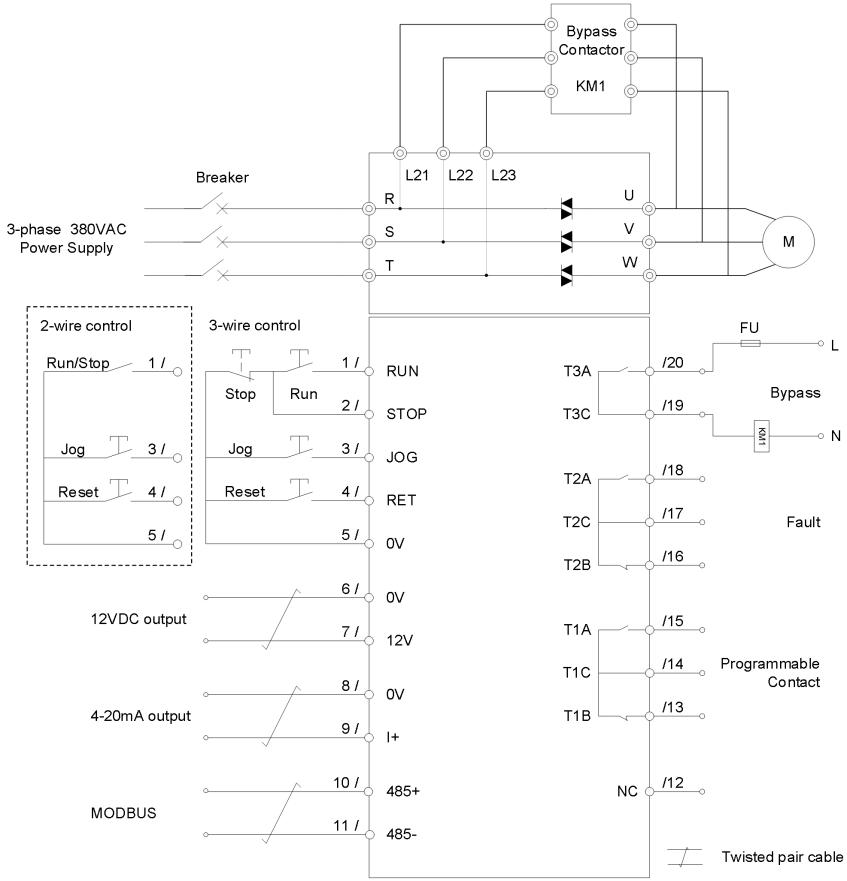


Figure 3.2 Basic Connection Diagram

3.2.2 Power Terminal Block

Table 3.2 Power Terminal Block Description

Terminal Block	Description
R, S, T	Terminals for connection of the power supply (380VAC, 50Hz)
U, V, W	Motor terminals for connection of the induction motor

L21, L22, L23	Bypass terminals for connection of the bypass contactor
★**Note:** If the motor turns in the incorrect direction upon energization, exchange two phases at the motor terminal box or at the output terminals of the soft starter or at the input terminals of the soft starter.	

3.2.3 Control Terminal Block

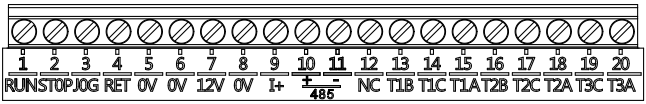


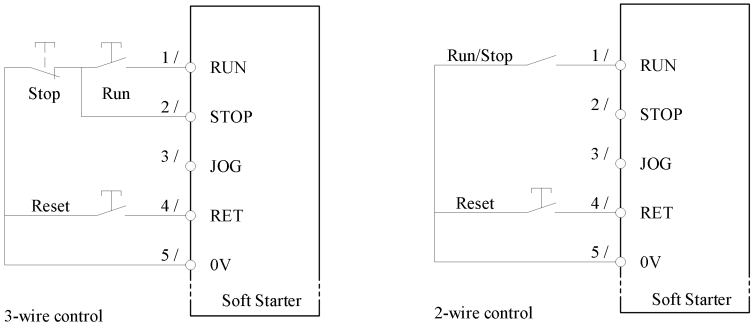
Figure 3.3 Layout of control terminals

Table 3.3 Control Terminal Block Description

Terminal Block	Function	Description
1/ RUN	Run starter	2-wire control: state 1 = run, state 0 = stop 3-wire control: state 1 = run if STOP is at 1
2/ STOP	Stop starter	3-wire control: state 0 = stop
3/ JOG	Jog the motor	A00 = jogging: state 1 = drive the motor with Jog voltage (A06)
4/ RET	Fault Reset	state 1 = reset a trip on the soft starter.
5/ 0V	Logic input Common	-
6/ 0V 7/ 12V	12VDC output	+12V ± 25%, 100 mA
8/ 0V 9/ I+	Analog output	4-20mA, max. load impedance 400Ω 20mA = 2* (Soft starter rated current)
10/ 485+ 11/ 485-	Modbus RTU	RS485+: A RS485-: B
12/ NC	Null	No function definition
13/ T1B 14/ T1C 15/ T1A	Programmable realy	T1A-T1C: Normally open (N/O) contact, 5A@250VAV，5A@30VDC T1B-T1C: Normally closed (N/C) contact, 3A@250VAV，3A@30VDC

Table 3.3 Control Terminal Block Description (continued)

Terminal Block	Function	Description
16/ T2B 17/ T2C 18/ T2A	Fault relay	T2A-T2C: Normally open (N/O) contact, 5A@250VAV，5A@30VDC T2B-T2C: Normally closed (N/C) contact, 3A@250VAV，3A@30VDC
19/ T3C 20/ T3A	Bypass relay	T3A-T3C: Normally open (N/O) contact, 8A@250VAV



(a) 3-Wire Control Connection (b) 2-Wire Control Connection

Figure 3.4 Comparison of 3-wire and 2-wire control

4. Operation

4.1 Human-Machine Interface (HMI)

The Starter utilizes a HMI that allows the user to operate the starter. It includes an easy-to-read display and keypad to scroll through the parameters. The HMI allows the user to control the starter (run, stop, and reset), modify control parameters, enable or disable protections, set system variances, set communication variables, monitor system parameters such as line voltages and currents and access the fault queue.

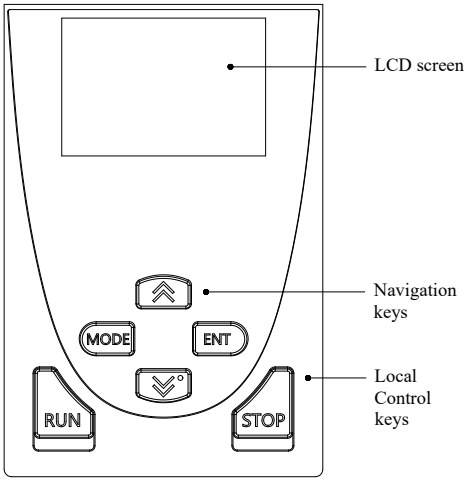


Figure 4.1 Human-Machine Interface (HMI) Front View

Table 4.1 Basic Functions of the LCD screen and Keys

Unit	Description
LCD screen	4-line display for status and programming details.
MODE	Selects the display between monitoring, setting and fault history. Exits the menu or parameter, or cancels a parameter change.
⩓	Scroll to the next or previous menu or parameter. Change the setting of the current parameter.
⩔	

ENT	Enters a menu or parameter, or saves a parameter change.
RUN	Starts the motor.
STOP	Stops the motor, and resets a trip.

4.2 Operation

4.2.1 Display modes

There are three display modes: the monitoring mode, the programming mode, and the fault history mode. Press the [MODE] key to switch between the display modes.
On power up, the monitoring mode is shown by default.

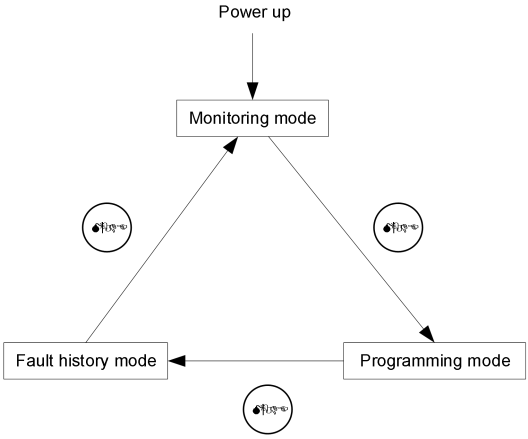
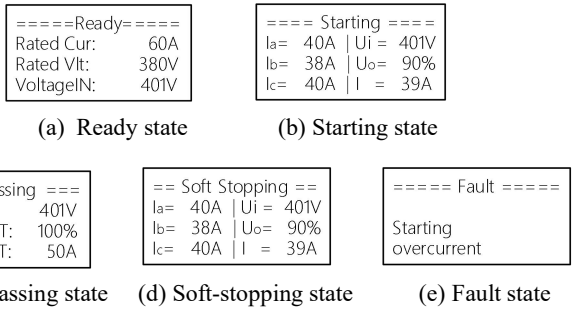


Figure 4.2 Display modes

4.2.2 Monitoring mode

The soft start operation can be divided into 5 states: Ready, Start, Bypass, Soft Stop and Fault. In monitoring mode, the screens show the status and operating information in each state (See figure 4.3).
On power up, the Ready screen (Figure 4.3(a)) is shown by default.



(a) Ready state (b) Starting state

(c) Bypassing state (d) Soft-stopping state (e) Fault state

Figure 4.3 Monitoring mode screens

Note: The fault screen automatically appears when a fault condition is detected.

4.2.3 Programming mode

To open the Programming Menu, press the [MODE] key while viewing the monitoring screens. The programming mode allow viewing and changing all programmable parameters that control how the soft starter operates. See figure 4.4.

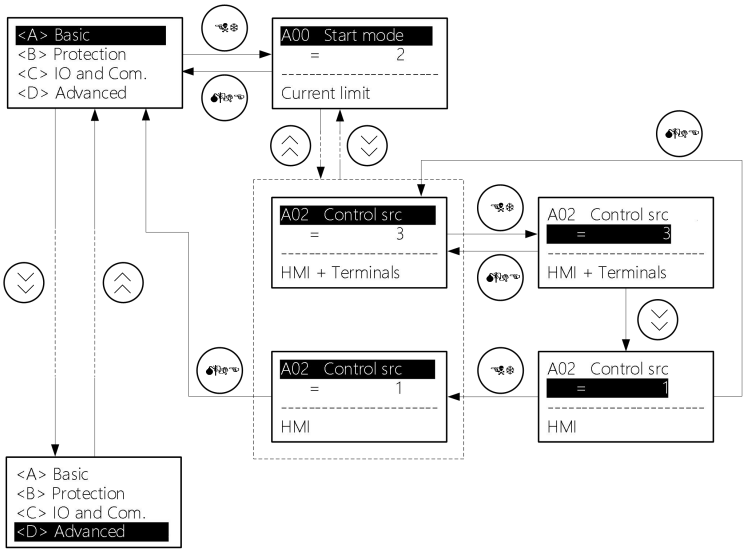


Figure 4.4 Menu Navigation

4.2.4 Fault history mode

The starter stores information on the 5 latest faults. Three of the latest faults are displayed in the fault history, See Figure 4.5.

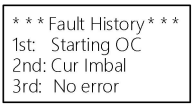


Figure 4.5 Fault history screen

In the figure above:

1st -- The most recent fault stored in the fault history.

2nd -- Second most recent fault.

3rd -- Third most recent fault.

5. Parameter listing and descriptions

5.1 Parameter List

Basic menu				
Code	Name	Range	Default	User
A00★1	Start mode	1：Voltage ramp 2：Current limit 3：Jogging 4：Current ramp 5：Voltage ramp with current limit 6：Voltage kick start	1	
A01★1	Stop mode	1：Freewheel stop (Coast) 2：Voltage ramp	1	
A02★2	Control src/ Control source	1：HMI 2：Terminals 3：HMI + Terminals 4：Network 5：HMI + Network 6：Terminals + Network 7：HMI + Terminals + Network	7	
A03	Init voltage/ Initial voltage	0-80%	30%	
A04	VltRampTime/ Voltage ramp time	1-120 s	30 s	
A05	Cur limit Lv/ Current limit level	50-500%	320%	
A06	Jog voltage	0-80%	30%	
A07	Cur Ramp Lvl/ Current ramp level	10-400%	300%	

Code	Name	Range	Default	User
A08	CurRampTime/ Current ramp time	0-120 s	20 s	
A09	Kick level/ Kick start level	0-80%	0%	
A10	Kick time/ Kick start time	0-2000 ms	0 ms	
A11	Start delay	0-999 s	0 s	
A12	StopRampTime/ Stop ramp time	0-60 s	0 s	
A99	Param Reset/ Reset to defaults	0：None 1：Reset to defaults 2：Reserved	0	
★**Note:** Additional details on the start/stop mode can be found in section 5.2 ★**Note:** The RUN command can't be initiated through a network command, or the RUN key on the HMI when parameter A02 is set to 3/6/7, and terminal 2 (STOP) is open.				

Protection menu				
Code	Name	Range	Default	User
B00★1	Motor FLA/ Motor rated current	(50%~100%) *I_N	I_N	
B01	OC Lvl (S)/ Starting overcurrent level	400-600%	450%	
B02	OC Lvl (R)/ Running overcurrent level	20-400%	200%	
B03	OL Class (S) Starting overload class	1-6	5	
B04	OL Class (R) Running overload class	1-6	2	
B05	Cur Imbal Lvl/ Current imbalance level	5-150%	40%	

Code	Name	Range	Default	User
B06	Over Vlt Lvl/ Overvoltage level	380-1500 V	450 V	
B07	Undr Vlt Lvl Undervoltage level	100-380 V	300 V	
B08	MaxStartTime/ Excessive starting time	5-200 s	70 s	
★**Note:** I_N is a shorthand notation for soft starter rated current.				

I/O and Communication menu				
Code	Name	Range	Default	User
C01★1	T1 Config/ T1 configuration (T1A-T1B-T1C)	1：Ready 2：Fault 3：Reserved 4：Starting 5：Bypassing 6：Soft stopping 7：Running (motor powered) 8：Power-on	7	
C03★2	Modbus Addr. / Modbus address	1-63	1	
C04★2	Mdbus BdRate/ Modbus baud rate	1：1200 2：2400 3：4800 4：9600 5：19200	4	
★**Note:** Additional details on the T1 configuration can be found in section 5.4. ★**Note:** The starter provides only a Modbus RTU to support remote communication. The data format si 8-N-1 (8 Data bits, No Parity, 1 Stop bit), Modbus address and baud rate are set individually in parameters C03 and C04.				

Advanced menu				
Code	Name	Range	Default	User
D01	Starter FLA/ Soft starter rated current	Immutable/Only Read	Model dependant	
D02	Current CAL. / Current calibration	5-500% (Only Read)		
D03	Voltage CAL. / Voltage calibration	5-500% (Only Read)		
D04	Reserved	-	-	
D05	Reserved	-	-	
D06	Reserved	-	-	
D99	Version	-	-	

5.2 Start/Stop Options

5.2.1 Voltage ramp

The voltage ramp provides soft starting of a motor by increasing the voltage applied to motor from the Initial Voltage setting (A03) to full (100%) line voltage. When the Starter receives a start signal, it quickly increases the voltage to the Initial Voltage setting (A03). The Starter then controls the output voltage in a start ramp. The voltage ramp time (A04) sets the speed at which the voltage is increased. When the ramp reaches full line voltage, the starter quickly completes the voltage ramp and closes the bypass contactor(s), see Figure 5.1.

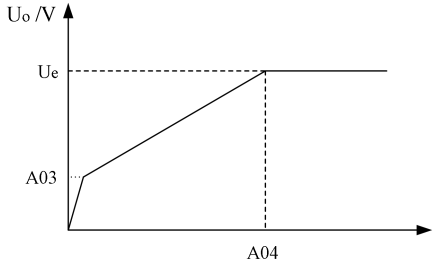


Figure 5.1 Voltage ramp

It should be noted that a lightly loaded motor takes less torque, and thus lower voltage and time, to accelerate to full speed. For this case the starter will go into bypass before the ramp reaches full voltage. In other words, the starter may go into bypass before the Soft Start Time has elapsed.

5.2.2 Current limit

This mode is typically used when it is necessary to limit the maximum current during start-up due to line power limitations or other considerations. During a Current Limit Start the starter applies a constant current to the motor. The level of current is set by the Current limit level parameter (A05). See below.

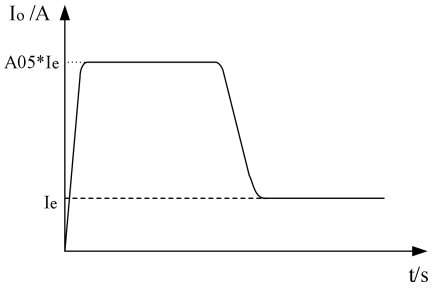


Figure 5.2 Current limit

★**Note:** Current Limit Starts are not recommended on variable torque load applications like fans and pumps.

★**Note:** Attempting starts with the Current Limit set to a value of 200% Rated Current (Ie) or lower are not recommended as the motor may not develope adequate torque to accelerate properly.

5.2.3 Jogging

In the Jogging Profile, starter quickly increases the voltage to the set Jog voltage value (A06) when the JOG terminal is closed. After opening, the JOG input executes the deceleration via ramp, as long as this function is enabled in A01.

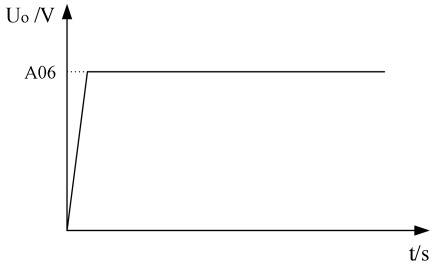


Figure 5.3 Jogging

The JOG function allows the motor to spin with a reduced torque, while someone/something (an operator, a PLC, etc) sends a digital signal to the Soft-Starter. It is used to allow alignment of the load or to assist servicing.

5.2.4 Current ramp

With current ramp starting, output voltage varies to provide a linear increase in current up to the Current ramp level (A07), and Current ramp time (A08) sets the speed of this linear current increase. The following figure shows the relationships of these different ramp settings.

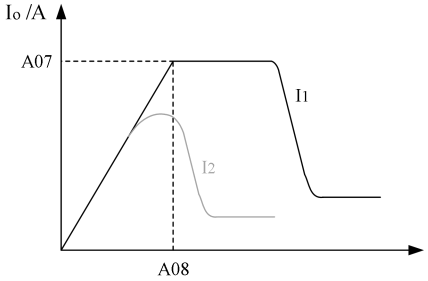


Figure 5.4 Current ramp

★**Note:** The motor may achieve full speed at any time during the current ramp. This means that the maximum current setting may not be reached. Therefore, the maximum current setting is the most current that could ever reach the motor, and not necessarily the maximum current that reaches the motor.

Current ramp starting can be useful for applications where:

- The load breaks away easily, but starting time must be extended (for example a centrifugal pump where pipeline pressure must build up slowly).
- The electricity supply is limited (for example a generator set), and a slower increase of load allows more time for the supply to respond.

5.2.5 Voltage ramp with current limit

Voltage Ramp with Current Limit works similarly to the Voltage ramp, except adds an adjustable maximum current output. Voltage is increased gradually until the Current limit level (A05) is reached, then held at this voltage level; When the motor current drops below the limit level the output voltage is automatically increased; This is repeated until the motor voltage reaches the full line voltage.

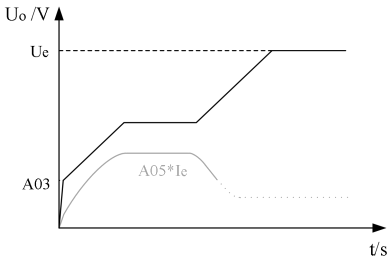


Figure 5.5 Voltage ramp with current limit

Voltage Ramp with Current Limit may be necessary in applications where the electrical power is limited.

Examples would be:

- portable or emergency generator supplies
- utility power near the end of a transmission line
- utility starting power demand restrictions.

Using Current Limit will override the Ramp Time setting if necessary, so use this feature when acceleration time is not critical.

5.2.6 Voltage kick start

Voltage kick start applies a pulse of voltage to the motor before the ramp begins. The voltage pulse provides an initial boost in torque to overcome the static friction or high inertial loads common in some applications. The level of voltage boost is set by the Kick start level parameter (A09) and the duration of the “kick” is set by the Kick start time (A10).

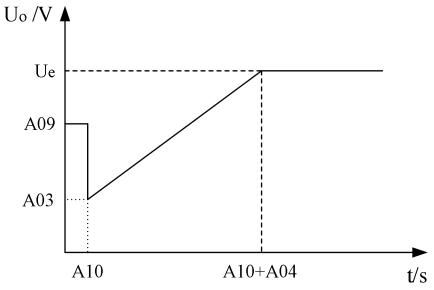


Figure 5.6 Voltage kick start

Voltage kick start is only useful on motor loads that are hard to get rotating but then are much easier to move once they are rotating. An example of a load that is hard to get rotating is a ball mill. The ball mill requires a high torque to get it to rotate the first quarter turn (90°). Once the ball mill is past 90° of rotation, the material inside begins tumbling and it is easier to turn.

5.2.7 Soft stop (Voltage ramp)

The Soft stop is used for applications that require a controlled (ramp) extended stop. It is designed for high frictional loads that tend to stop suddenly when voltage to the motor is removed. During Soft Stop the voltage is ramped to zero in the time set by the Stop ramp time parameter (A12).

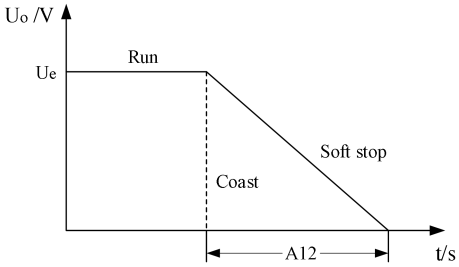


Figure 5.7 Soft stop

Freewheel stop (Coast): When the STOP command is initiated, the bypass contactor is opened, and no voltage is applied to the motor by the starter.

5.3 Motor overload protection

The starter contains an advanced I^2t electronic motor overload (OL) protection function. It is designed to protect the motor and power wiring against overheating caused by operating at excessive current levels for extended periods of time. Separate overload classes can be programmed for acceleration and for normal running operation. These classes are easily configured through parameters Starting overload class (B03) and Running overload class (B04).

The available overload classes are based on the trip time when operating at 600% of rated motor current. For example, a Class 2 overload trips in 3 seconds when the motor

is operating at 600% rated current; a Class 5 overload trips in 15 seconds when the motor is operating at 600% rated current. For details, see Table 5.1 and Figure 5.8.

Table 5.1 Overload protection classes (The recovery time is 180s)

Current / Class	6Ie	5Ie	4Ie	3Ie	2Ie	1.5Ie	1.2Ie	1.05Ie
1	1s	3s	6s	8s	10s	15s	150s	3600s
2	3s	8s	12s	16s	20s	30s	300s	3600s
3	6s	15s	22s	30s	40s	60s	350s	3600s
4	10s	22s	35s	48s	60s	90s	400s	3600s
5	15s	35s	55s	75s	90s	120s	450s	3600s
6	20s	45s	70s	95s	120s	150s	500s	3600s

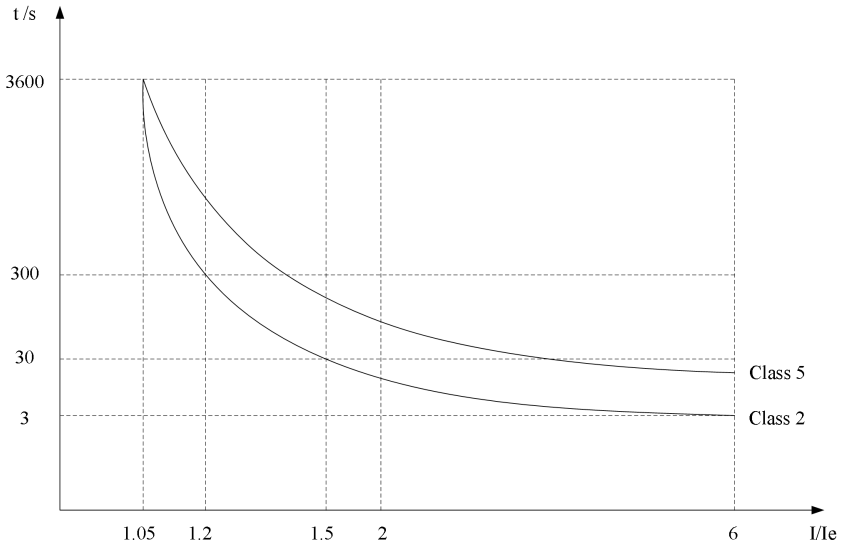
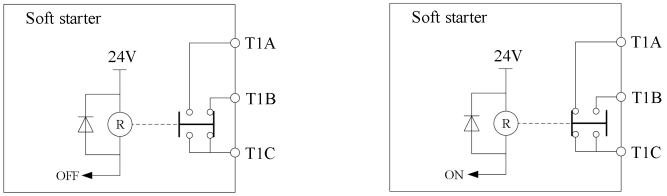


Figure 5.8 Overload Curves

5.4 Relay T1 configuration

Code	Name	Range	Default
C01	T1 configuration/T1A-T1B-T1C	0~8	7



（a）Relay OFF state　　（b）Relay ON state

Figure 5.8 Relay states

Table 5.2 T1 configuration options

C01 setting	Relay action	Soft starter states
1：Ready	OFF	Starting, Bypassing, Soft stopping, Fault
	ON	Ready/Standby
2：Fault	OFF	No Fault
	ON	Fault
3：Reserved	OFF	-
	ON	-
4：Starting	OFF	Ready, Bypassing, Soft stopping, Fault
	ON	Starting
5：Bypassing	OFF	Ready, Starting, Soft stopping, Fault
	ON	Bypassing
6：Soft stopping	OFF	Ready, Starting, Bypassing, Fault
	ON	Soft stopping
7：Running (Motor powered)	OFF	Ready, Fault
	ON	Starting, Bypassing, Soft stopping
8：Power-on	OFF	Power-off
	ON	Power-on (including Fault)

6. Start-up and Maintenance

6.1 Power-up

Caution:

- Only qualified personnel familiar with this equipment are to perform work described in this set of instructions.
- Perform such work only after reading and understanding all of the instructions contained in this bulletin.
- Ensure that the installation complies with the appropriate local regulations.
- Turn off all power before working on or inside equipment.
- Before performing visual inspections, tests, or maintenance on the equipment, disconnect all sources of electric power.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices.
- Replace all devices, doors, and covers before turning on power to this equipment.
- Leakage current may occur from the SCRs when a 3-phase mains supply is connected. Full voltage can be detected if no motor is connected.

Failure to follow these instructions will result in death or serious injury.

Before applying power to the soft start, perform the following checks on the equipment:

(1) Supply voltage matches the rated supply voltage of the unit.

(2) The starter iutput terminals R, S, and T are connected to the incoming AC power wires from the power disconnect and/or protection devices.

(3) Horsepower and current ratings of the motor and starter have the same rating or the starter has a higher rating.

(4) Motor leads are connected to the starter output terminals U, V, and W.

(5) The bypass contactor terminals are connected as shown in figure 3.2 in section3.2.1.

(6) Appropriate control connections have been made.

(7) The motor area and equipment area clear of personnel and parts before start-up.

After the Soft-Starter has been prepared it can now be powered-up.

6.2 Start-up

Caution:

- Turn off all power before working on or inside equipment.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices.
- Replace all devices, doors, and covers before turning on power to this equipment.
- No more than 6 loaded starts per hour.

Failure to follow these instructions will result in death or serious injury.

After all power and control connections have been made and you have read and understood the different operating modes and protection features of the soft starter, perform the starting procedure for your application.

(1) set the Operation and Protection parameters for your application. In many cases, only the Motor rated current parameter (B00) requires adjustment to the proper value, and all other parameters may be used with the default values for the initial Start.

(2) Apply the start command to the starter.

(3) The motor should just begin to rotate when start command is applied and reach Ramp End in a minimum starting time. The control is properly set if the motor starts smoothly when power is applied and comes to speed as quickly as possible.

(4) If the direction of rotation of the motor is not correct, switch OFF the Soft-Starter and change two output cables of the Soft-Starter.

(5) If the motor decelerates or stops during the acceleration period, press the stop button immediately and open the isolation means (disconnector).

(6) If the unit does not follow this operational sequence, refer to Section 7 “Troubleshooting”.

6.3 Maintenance

Caution:

- Disconnect always the supply voltage before attempting to service any electric component of the Soft-Starter.

Even after switching OFF the Soft-Starter, during a certain time high voltages may be present. Thus wait 3 minutes to allow a complete discharge of the power capacitors.

Always connect the equipment frame to the grounding (P.E) at the suitable point.

- The electronic boards are fitted with components sensitive to electrostatic discharges.

Never touch the components or connectors directly. If this is necessary, touch before on the metallic frame or use a suitable grounding bracelet.

- Never apply a high voltage test on the Soft-Starter.

If the motor needs to be meggered, remove the motor leads from the starter before conducting the test. Failure to comply may damage the SCRs and WILL damage the control board, which WILL NOT be replaced under warranty.

Maintenance performed on a regular basis will help ensure that the starter continues to operate reliably and safely. The frequency of maintenance depends upon the type of maintenance and the installation site's environment.

During Commissioning:

- Torque all power connections during commissioning. This includes factory wired equipment.
- Check all of the control wiring in the package for loose connections.

One month after the starter has been put in operation:

- Re-torque all power connections. This includes factory wired equipment.

After the first month of operation:

- Re-torque all power connections every year.
- Clean any accumulated dust from the starter using a clean source of compressed air.
- Clean or replace any air vent filters on the starter every three months.

NOTE: If mechanical vibrations are present at the installation site, inspect the electrical connections more frequently.

7. Troubleshooting

This guide is intended to provide the information necessary to successfully troubleshoot issues that may occur during the operation, See Table 7.1.

Table 7.1 Fault indication

Fault Diaplay	Possible Causes	Solution
Line Loss/ Line Loss on power-up★1	• High impedance line connection • Missing supply phase • Incoming 3-phase voltage instability	• Check for line and load loose connections • Check for open line (for example, blown fuse) • Verify power quality
Phase Loss		
Starting OC/ Starting Overcurrent	• Starting parameters are not matched to the application • Insufficient power capacity	• Adjust the starting parameters, for example: A03, A04, A05. • Increase the power capacity
Running OC/ Running Overcurrent	• Instantaneous Overload	• Lighten the load on the motor • Adjust the overload class
Starting OL/ Starting Overload	• Motor overloaded • Overload parameters are not matched to the application • Current sampling fault	• Lighten the load on the motor • Adjust the overload class • Check the motor current and monitoring value
Running OL/ Running Overload		
Cur Imbal/ Current Imbalance	• Incoming voltage imbalance • Loss of load side power wiring • Motor failure • Failed power or control module	• Check power system • Check all load side power connections and motor windings • Check power or control module
SCR Overheat	• Controller ventilation blocked • Controller duty cycle exceeded • Ambient temperature limit exceeded • Failed thermistor	• Check for proper controller ventilation • Check application-appropriate duty cycle • Provide external cooling

Fault Diaplay	Possible Causes	Solution
StartTimeout/ Excess Start Time	• Starting parameters are not matched to the application • Motor overloaded • Insufficient power capacity	• Adjust the starting parameters, for example: A03, A04, A05. • Lighten the load on the motor • Increase the power capacity
★**Note:** To clear the fault, repower the drive and activate a reset.		

APPENDIX A：Modbus services

The starter provides only a Modbus RTU to support remote communication. The data format is 8-N-1 (8 Data bits, No Parity, 1 Stop bit), Modbus address and baud rate are set individually in parameters C03, C04.

A1 Modbus-RTU Frame

The Modbus RTU frame contains no message header byte, nor end of message bytes. It is defined as follows:

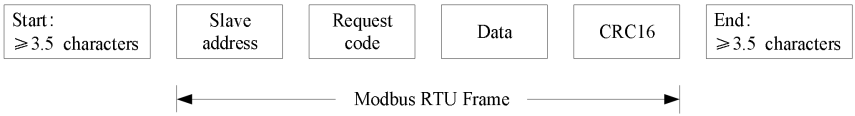


Figure A.1 Modbus RTU Frame

The data is transmitted in binary code.

CRC16: cyclic redundancy check parameter.

The end of the frame is detected on a silence greater than or equal to 3.5 characters.

Table A.1 Modbus RTU Frame

No.	Name	Description
1	Slave address	• The Modbus address can be configured from 1 to 63. • Address 0 coded in a request sent by the master is reserved for broadcasting. The starter drives take account of the request, but do not respond to it.
2	Request code	• The starter supports the following Modbus functions. (1) 03H: Read N output words. (2) 10H: Write N output words.
3	Data	• The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. • If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code.

4	CRC16	• The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error results.

A2 Modbus functions available

Note: Hi = high order byte, Lo = low order byte.

A2.1 Read N output words: Function 0x03

1．Request

Slave address	Function code	No. of first word		Number of words		CRC16	
1 byte	1 byte	2 bytes		2 bytes		2 bytes	
		Hi	Lo	Hi	Lo	Lo	Hi
	03H			N			

2．Response

Slave address	Function code	Number of bytes read	word value					CRC16	
1 byte	1 byte	1 byte	2*N bytes					2 bytes	
			1st		⋯	Last		Lo	Hi
	03H	2*N	Hi	Lo	⋯	Hi	Lo		

3．Error response

Slave address	Function code	Exception code	CRC16	
1 byte	1 byte	1 byte	2 bytes	
			Lo	Hi
	83H			

4．Example：Use function 3 to read soft-starter status

Request: 01 03 10 2A 00 01 A1 02

Response: 01 03 02 00 01 79 84 (status = soft starting)

Error response: 01 83 02 C0 F1 （if No. of first word =0x002A in request frame）

A2.2 Write N output words: Function 0x10

1．Request

Slave add.	Func-tion code	No. of first word		Number of words		Num-ber of bytes	1st word		…	Last word		CRC16	
1 byte	1 byte	2 bytes		2 bytes		1 byte	2 bytes		…	2 bytes		2 bytes	
		Hi	Lo	Hi	Lo		Hi	Lo	…	Hi	Lo	Lo	Hi
	10H								…				

2．Response

Slave address	Function code	No. of first word		Number of words		CRC16	
1 byte	1 byte	2 bytes		2 bytes		2 bytes	
		Hi	Lo	Hi	Lo	Lo	Hi
	10H						

3．Error response

Slave address	Function code	Exception code	CRC16	
1 byte	1 byte	1 byte	2 bytes	
			Lo	Hi
	90H			

4．Example: Write value 0x0040 to word 0x1028 on slave 1

Request: 01 10 10 28 00 01 02 00 40 B0 49 (initiate the run command)

Response: 01 10 10 28 00 01 85 01

Error response: 01 90 02 CD C1 (if No. of first word =0x0028 in request frame)

A2.3 Parameter list

Comm. No.	Name	Range	Units	Access
0x1000	Control source	1：HMI 2：Terminals 3：HMI + Terminals 4：Network 5：HMI + Network 6：Terminals + Network 7：HMI + Terminals + Network		R/W
0x1001	Start mode	1：Voltage ramp 2：Current limit 3：Jogging 4：Current ramp 5：Voltage ramp with current limit 6：Voltage kick start		R/W
0x1002	Stop mode	1：Freewheel stop (Coast) 2：Voltage ramp		R/W
0x1003	Soft starter rated current	Immutable/Only Read	A	R
0x1004	Motor rated current	(50~100%) *(starter rated current)	A	R/W
0x1005	Current limit level	50-500	%	R/W
0x1006	Initial voltage	0-80	%	R/W
0x1007	Voltage ramp time	1-120	s	R/W
0x1008	Jog voltage	0-80	%	R/W

Comm. No.	Function	Range	Units	Access
0x1009	Kick start level	0-80	%	R/W
0x100A	Kick start time	0-2000	ms	R/W
0x100B	Current ramp level	10-400	%	R/W
0x100C	Current ramp time	0-120	s	R/W
0x100D	Stop ramp time	0-60	s	R/W
0x100E	Reserved	-	-	R
0x100F	Current regulation rate	5-500	%	R
0x1010	Voltage regulation rate	5-500	%	R
0x1011	Starting overcurrent level	400-600	%	R/W
0x1012	Running overcurrent level	20-400	%	R/W
0x1013	Starting overload class	1-6	级	R/W
0x1014	Running overload class	1-6	级	R/W
0x1015	Current imbalance level	5-150	%	R/W
0x1016	Reserved	-	-	-
0x1017	Overvoltage level	380-1500	V	R/W
0x1018	Undervoltage level	100-380	V	R/W
0x1019	T1 configuration /T1A-T1B-T1C	1：Ready 2：Fault 3：Reserved 4：Starting 5：Bypassing 6：Soft stopping 7：Running (motor powered) 8：Power-on		R/W
0x101A	Start delay	0-999 s	s	R/W
0x101B	Modbus address	1-63		R/W
0x101C	Modbus baud rate	1：1200 2：2400 3：4800 4：9600 5：19200		R/W

Comm. No.	Function	Range	Units	Access
0x1028	Control word	Bit0-bit4: Reserved Bit5: Fault reset Bit6: Run Bit7: Stop Bit8-bit15: Reserved Note: 1 = Active, 0 = Inactive		W
0x102A	Status word	0: Ready 1: Starting 2: Bypassing 3: Soft stopping 4: Reserved 5: Fault		R
0x102B	Average line current		A	R
0x102C	Line current in phase A		A	R
0x102D	Line current in phase B		A	R
0x102E	Line current in phase C		A	R
0x102F	Line voltage		V	R
0x1034	The most recent fault	0: No Fault 1: Line loss on power-up 2: Phase Loss 3: Starting Overcurrent 4: Running Overcurrent 5: Starting Overload 6: Running Overload 7: Current Imbalance 8: SCR Overheat 9: Overvoltage 10: Undervoltage 11-13: Reserved 14: SCR breakdown 15: Internal fault Note: Please ignore the high byte when reading fault records.		R
0x1035	Second most recent fault			R
0x1036	Third most recent faul			R
0x1037	Fourth most recent fault			R
0x1038	Fifth most recent fault			R

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