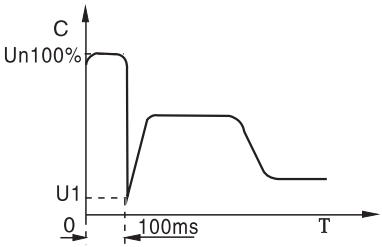
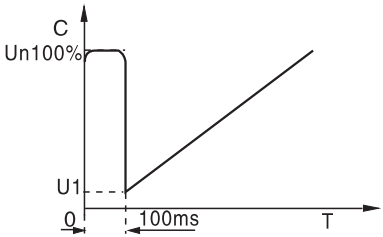
3) Kick Start

① When the code PB is set to "2" (kick + current-limiting) or "3" (kick + voltage), then kick start mode is selected. The figure below is the change waveform of output in kick start mode. This start mode can be selected in case there is a failure start of the motor due to influence of the machine's static friction force on the occasion of heavy loads. While the machine is just started, DO feed a fixed higher voltage to the motor and keep it for a short period of time so as to smooth away static friction force of motor loads and enable the motor rotate, and then select a start mode of current-limiting or voltage ramp.

② Before selecting this mode, it is strongly recommended to start the motor by non-kick starting. Then select this mode ONLY AFTER the motor failed to start. DO keep clear of kick start as possible to reduce unnecessary impulse of strong current.

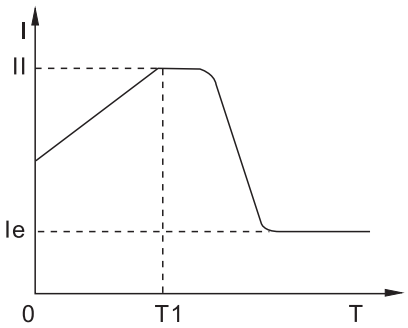




4) Current Ramp Start

① When the code PB is set to "4" (current ramp), then current ramp start mode is selected. The figure below is a waveform of output current in the mode of current ramp start. "I1" in this figure stands for current-limiting value set by the code P3, and T1 stands for time set by the code P1.

② Current ramp start mode is applicable to bipolar motor owing to its strong accelerating capacity. This mode can also shorten the starting period of time within a certain range.



5) Voltage and Current-limiting Double-closed Loop Start

① When the code PB is set to "5" (double closed-loop), then this start mode is selected. Voltage and current-limiting double-closed loop start mode, with adoption of voltage ramp and current-limiting double-closed loop control, is a kind of comprehensive start mode that both steady start and strict current-limiting are required. It uses a pre-reckoning method for estimating the working state of the motor.

② The waveform of output voltage in this mode always fluctuates according to different conditions of the motor and loads.

Functional Code PC Output protective permission Setting Range: 00~04 Factory Default Setting: 02

To adapt to different applications, this motor soft starter provides 5 protection classes, namely, 0: primary class; 1: light load; 2: standard, 3 heavy load; 4: advanced, which are set by the code PC.

Primary protection, disabling the function of external instantaneous terminals and only remaining overheat protection, shortcut protection and input open phase protection while starting, is applied to some emergency occasions, i.e., fire pump etc..

Light load, standard and heavy load protection classes have full protection functions. Their distinguish lies in different time curves of motor's overload heat protection. Refer to the table below and the figure in page 25 to see time parameters for motor heat protection. The protection standard for advanced protection is even stricter. Functional parameters for the rest protection classes are set the same as the standard protection. See the table below for different protection classes and heat protection set by the code PC.

PC Setting	0 (Primary Class)	1 (Light Load)			2 (Standard)			3 (Heavy Load)			4 (Advanced)			Description
Overload Running Protection Classes	/	Class 2			Class 10			Class 20			Class 10			In accordance with IEC60947-4-2 standard.
Overcurrent Starting Protection Time	/	3S			15S			30 S			15S			Based on that the starting current is more than 5 times the set value.
Overload Running Trip Time List	Current Multiple	3	4	5	3	4	5	3	4	5	3	4	5	Numerical values in this table are typical ones.
	Trip Time (S)	4.5	2.3	1.5	23	12	7.5	46	23	15	23	12	7.5	

Functional Code PD Operate Control Modes Setting Range: 00~07 Factory Default Setting: 01

00: operation panel control;
01: operation panel + external control;
02: external control;
03: external control + COM control;
04: operation panel + external + COM control;
05: operation panel + COM control;
06: COM control;
07: start/stop disabled

Functional Code PE Restart permission Setting Range: 0-13 Factory Default Setting: 0

- Automatic restart function is permitted when PE is 1-9. This function is valid when the external control with two wires. Didn't affect controlled by the extrocontrol setting PD . Please connect with two wires when switched on and start status .
- Time delay for 60 S to automatic start after power is on.
- Time delay for 60 S to automatic restart after the machine stop with fault . But the setting time of P5 is more than 60S. Please refer to P5 to set time delay. The indicator flash on time delay period status .
- Can automatic start for n times , includes start when power on and restart after failure. n times can be PE setting value .
- Automatic restart mode have to be power on and save again.
- Forbid protection function when PE is 10 . Can be start automatically if the external start terminals switched on when the power is on . That is to say .Starting the motor when power on is permission .
- Restart after failure when PE is 11. Can start the motor again . No need to reset in the following situation . When the instantaneous stop terminal don't forbid .(PC>0), Or return to normal after stopping immediately ,overheat , over voltage ,under voltage and other fault .
- When PE is 12,Power failure protection is forbidden and restart after failure.
- Move Status memory recovery when PE is 13.When the Power is off and then power is on under the bypass running status. The soft start will recover automatically to the bypass running status .
- Warnings: The soft starter have voltage loss protection . It will not start automatically and Avoid caused by damage accident when the external terminal stay any position after power is offer and then power on . But when the Automatic restart function permit forbidding power failure permit running status memory recovery function . Power failure function will be failure.

Functional Code PF Parameter modification permission Setting Range: 00~02 Factory Default Setting: 01

Functional Description: This function is used to set the internal parameter of the soft starter can be modified or not .
00 Do not allow modify the parameter,. Except PF.
01: Allow modify the parameter, Except P4,P7,P8,PE,PH,PP,Po,Pr
02 Allow modify the parameter

PH Communication address Setting Range： 00-63 Factory setting： 01

When the communication address is set to 0, it is the broadcast address. All the slaves on the MODBUS bus will accept the frame, but the slave will not reply.
Note that the slave address can not be set to 0.
The soft starter communication address is unique in the communication network, which is the basis for the point-to-point communication between the host and the soft starter .

PJ Baud rate Setting Range： 0-5 Factory Setting： 3

This parameter defines the baud rate when serial communication, the protocol

used in the data format, only the same format can be normal communication.
0: 1200bps 1: 2400bps 2: 4800 bps
3: 9600bps 4: 19200bps 5: 38400bps

PL Data Verification Setting Range: 0-5 Factory Setting: 1

This parameter defines the data format when serial communication, the protocol used in the data format, only the same format can be normal communication.
0:No Parity check (N, 8, 1)for RTU 3:No parity check(N, 8, 2)for RTU
1:Even parity check(E, 8, 1)for RTU 4:Even parity check(E, 8, 2)for RTU
2:Odd parity check(O, 8, 1)for RTU 5:Odd parity check(O, 8, 2)for RTU
The data format set by the host and soft starter must be the same, otherwise, the communication can not be performed.

Functional Code PP Programmable Output Setting Range: 00~19 Factory Default Setting: 07

Code PP is used to set the action time for operation output relay.

- The output function of programmable relay provides 2 working modes: programmable sequential output and programmable status output.
- When PP is set to 0~4 (10~14), programmable output works in the mode of time output. The set starting moment of this output is seen in the table as follow:

Values set by PP	0(10)	1(11)	2(12)	3(13)	4(14)
Moment of Programmable Output	When ordering the command of start	When being started	When bypass runs	When ordering the command of stop	When shutdown is completed

- This working mode is used in an immediate state and the relay acts at the moment when the state set by PP just begins. The reset moment of this output will be completed 1 second's later after this state ends up. Eg.: The factory default setting value of PP is 7, which means the soft starter is in a "hold" mode when energized and the relay attracts at the same time. If the soft starter receives start command at this moment, then the relay will be disconnected.
- Programmable sequential output mode takes the whole process of a start as its control cycle. If the motor is restarted, the previous programming output will automatically be interrupted and this procedure shall be preceded again.
- If PP is set to 5~9(15~19), the programmable output working and state output mode, and the set working state output will be shown in the table below:

Values set by PP	5(15)	6(16)	7(17)	8(18)	9(19)
Moment of Programmable Output	Fault State	Operation State	Ready State	Starting State	Bypass State

- Programmable state output is used to indicate the working state of soft starter. The factory default setting value of PP is 7, which indicates hold mode of softer starter. In this state, the motor can be started. When programmable output is in fault state, it indicates motor failure (Err05, Err06, Err07, Err08 , Err12), which is different from the function of failure output terminals. Operation state refers to non-hold or non-fault state, including such three procedures as start, bypass and soft stop.
- If PP>9, the reset state of programmable output (③ ④ external terminals) changes from open to close, that is, reversed phase output. Flexible use of programmable relay output functions can simplify external control logic circuit.

Functional Code PU Soft stop limiting current Setting Range: 20~100% Factory Default Setting: 80%

Function Description: To make the motor balance and stable stop when the soft start stop .

Functional Code Po Motor Rated Current Setting Range: 11~1200
Factory Default Setting: Set according to the specifications

Function Description: This parameter should be set in conformity with rated current value displayed on specifications label of the motor. Otherwise, it may cau se big deviation betwe en starting current and protective current. The motor rated current set by Po should not be 20% lower than the nominal current of soft starter. The flexibility tolerance of protective trip action will increase if there is less motor rated current set by Po .

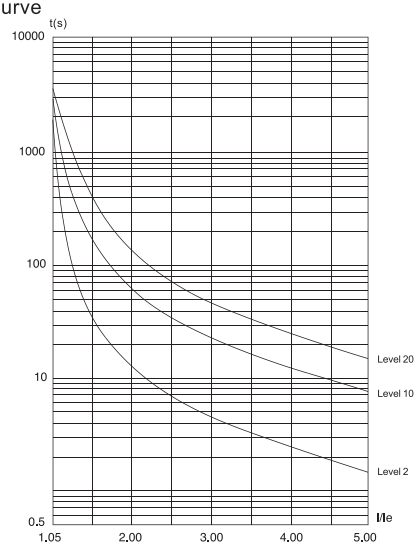
Functional Code Pr Motor Protection Setting Range: 00~99 Factory Default Setting: 00

Function description: Pr<10, motor under load protection function is invalid, The ten digit of the Pr is under load current range, relative to the motor rated current of 10-90%
The unit digit of Pr is under load protection delay range 5-90s, the unit digit is 0. the delay time is 5s and the other numbers are multiplied by 10 to determine.
E.g Pr=53, it means that the under load current is 50% and the protection delay time is 30s.
1) Descriptions of Protective Functions
This motor soft starter has perfect protective fun ctions to guarante e safety while using soft starter and motor. While in use, DO set proper protection classes and protection parameters according to different circumstances.

- Soft Starter Overheat Protection: Overheat protection enabled when temperature rises to 90±5℃ and disabled when temperature falls to 60℃ (lowest).
- Input open phase protection lag time: <3S
- Output open phase protection lag time: <3S
- Three-phase Unbalance Protection Time: <3S. Based on the rule that all phases of current deviation is larger than 50±10%, when load current is 30% lower than the nominal rated value of softer starter, the decision datum deviation will be enhanced.

- Overcurrent Starting Protection Time: This refers to the protection time that is successively 5 times longer than the maximum working current set by the code P4. See protection Time Table in Page 20.
- Overload Running Protection Time: This refers to the inverse time thermal relief protection based on the maximum working current set by the code P4. See the curve of trip protection time in the figure on page 24.
- Power Supply Undervoltage Protection Lag Time: When power supply voltage is 40% lower than limit value, the protection time will be less than 0.5 second; when the power supply voltage is lower than the set value, the protection time will be less than 3 seconds.
- Power Supply Overvoltage Protection Lag Time: When power supply voltage is 130% higher than limit value, the protection time will be less than 0.5 second; when the power supply voltage is higher than the set value, the protection time will be less than 3 seconds.
- Load Shortcut Protection Retarding Time: 0.1 second. If the current is 10 times or more as nominal rated current of the soft starter, than a fuse or shortcut device shall be used.
- The above time parameters are set for the period from valid signals are detected to trip protection command is given. They are for reference only.
- If protective functions of this soft starter do not comply with users' needs, then special protective devices shall be used to insure safety.

2) Protective Trip Curve



5.2 Help Information Indicate

Display	Description
AC:XXX	3 stand for digital Voltmeter, to monitor and measure three phase AC voltage.
022-3	Indicate the soft start is 22KW-380/50HZ.
H1:E05	Indicate the latest fault data Err05.
H2:E01	Indicate the ever fault date Err01.
H3:E06	Indicate the ever fault date Err06.
...	...
...	...
H9:E00	Indicate no fault
UEr3.0	The soft ware of the production is Ver3.0.
LXXXX	The total number of successful start times
RUNXX	The time (Seconds) for the last starting

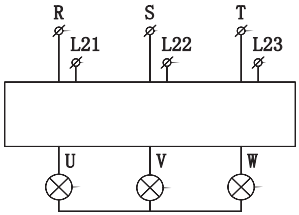
Note: H1-H9 save the latest ninth of fault data by recursion.

○ Please press confirm to enter the help screen when non-soft start and soft stop status and before entering the setting status . Then press increase ;Decrease to choose the helpful information .

○ Press confirm or stop to exit the help status.

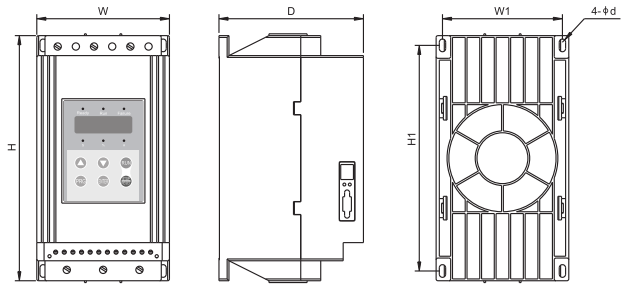
5.3 Factory adjustment project for the complete set factory

The complete factory install the machine or trial test for end users. There have not the matching motor to start for rest . We can use three pieces 100W or 200W bulbs to connect to star type . Can replace of motor as for start test (Can also use small motor for trial test). The soft starter couldn't detect and show output open phase fault because the output current of the main circuit is too small , and the soft start couldn't trial run . The solution is the output protection permission PC change to 0 (without permission) . NO show the open phase fault . The three bulb will get brighter when running . And then bypass bulbs will get bright completely .



Chapter 6 Structure and Sizes

6.1 Outline Sizes & Install Sizes

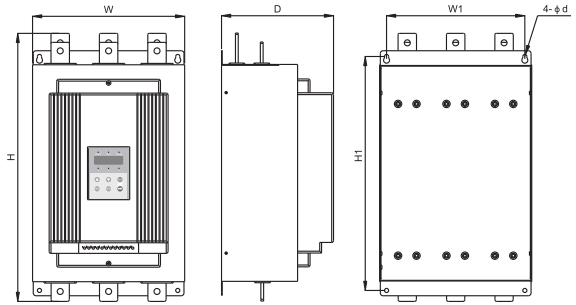


Model	Rated Power (KW)	Rated Current (A)	Outline Size			Install Size			Net Weight (KG)
			H1	W1	D	H2	W2	d	
ZJR2-3055/4055	5.5	11	270	145	159	245	130	7	3.5
ZJR2-3075/4075	7.5	15	270	145	159	245	130	7	3.5
ZJR2-3110/4110	11	23	270	145	159	245	130	7	3.5
ZJR2-3150/4150	15	30	270	145	159	245	130	7	3.5
ZJR2-3185/4185	18.5	37	270	145	159	245	130	7	3.5
ZJR2-3220/4220	22	43	270	145	159	245	130	7	3.5
ZJR2-3300/4300	30	60	270	145	159	245	130	7	3.5
ZJR2-3370/4370	37	75	270	145	159	245	130	7	3.5
ZJR2-3450/4450	45	90	270	145	159	245	130	7	3.5
ZJR2-3550/4550	55	110	270	145	159	245	130	7	3.5

NOTE:

The rated power and rated current in the table above are the maximum values of a soft starter. Generally, rated current matching the motor that has same power should not excess the rated current values listed in this table.

If outline sizes differ from the values above, please refer to actual sizes.



Model	Rated Power (KW)	Rated Current (A)	Outline Size			Install Size			Net Weight (KG)
			H1	W1	D	H2	W2	d	
ZJR2-3750/4750	75	150	530	260	202	380	235	10	25
ZJR2-3900/4900	90	180	530	260	202	380	235	10	25
ZJR2-31150/41150	115	230	530	260	202	380	235	10	25
ZJR2-31320/41320	132	264	530	260	202	380	235	10	25
ZJR2-31600/41600	160	320	530	260	202	380	235	10	25
ZJR2-31850/41850	185	370	530	260	202	380	235	10	25
ZJR2-32000/42000	200	400	530	260	202	380	235	10	25
ZJR2-32500/42500	250	500	560	290	245	460	260	10	35
ZJR2-32800/42800	280	560	560	290	245	460	260	10	35
ZJR2-33200/43200	320	640	560	290	245	460	260	10	35
ZJR2-34000/44000	400	800	600	330	245	500	300	10	40
ZJR2-34500/44500	450	900	600	330	245	500	300	10	40
ZJR2-35000/45000	500	1000	760	406	260	540	370	10	45
ZJR2-36000/46000	600	1200	760	406	260	540	370	10	45

NOTE:

The rated power and rated current in the table above are the maximum values of a soft starter. Generally, rated current matching the motor that has same power should not excess the rated current values listed in this table.

If outline sizes differ from the values above, please refer to actual sizes.

Appendix Ⅰ (A)

The soft start (7.5KW~55KW) Selection List of Peripheral Appliances are as follows:

Model	Rated Power (KW)	Rated Current (A)	Breaker Specification (A)	Bypass contactor Specification(A)	Cable Size (mm^2)
ZJR2-3055/4055	5.5	11	16	16	$4mm^2$
ZJR2-3075/4075	7.5	15	20	16	$4mm^2$
ZJR2-3110/4110	11	23	32	25	$6mm^2$
ZJR2-3150/4150	15	30	40	40	$10mm^2$
ZJR2-3185/4185	18.5	37	50	40	$10mm^2$
ZJR2-3220/4220	22	43	63	40	$16mm^2$
ZJR2-3300/4300	30	60	80	63	$25mm^2$
ZJR2-3370/4370	37	75	100	100	$35mm^2$
ZJR2-3450/4450	45	90	125	100	$35mm^2$
ZJR2-3550/4550	55	110	160	160	$35mm^2$

Appendix Ⅰ (B)

The soft start (75KW~500KW) Selection List of Peripheral Appliances are as follows:

Model	Rated Power (KW)	Rated Current (A)	Breaker Specification	Bypass contactor Specification(A)	Cable Size (mm^2)
ZJR2-3750/4750	75	150	180	160	30X3mm^2
ZJR2-3900/4900	90	180	225	250	30X3mm^2
ZJR2-31150/41150	115	230	315	250	30X3mm^2
ZJR2-31320/41320	132	264	315	400	30X4mm^2
ZJR2-31600/41600	160	320	350	400	30X4mm^2
ZJR2-31850/41850	185	370	400	400	30X4mm^2
ZJR2-32000/42000	200	400	400	400	50x5mm^2
ZJR2-32500/42500	250	500	630	630	50x5mm^2
ZJR2-32800/42800	280	560	630	630	50x5mm^2
ZJR2-33200/43200	320	640	630	630	50X5mm^2
ZJR2-34000/44000	400	800	1000	1000	60X6mm^2
ZJR2-34500/44500	450	900	1000	1000	60X6mm^2
ZJR2-35000/45000	500	1000	1250	1000	80x6mm^2
ZJR2-36000/46000	600	1200	1600	1600	80x6mm^2

Note: The rated power and rated current indicate the maximum rated value of the soft start .

The matching specification of breakers and bypass contactors should match with the motor.

Appendix Ⅱ (A)

The solutions of fault code are in the following sheet.

Panel Display	Warnings	Actions & Treatment
-Err00	Fault cleared!	Faults such as undervoltage, overvoltage, overcurrent, instantaneous terminal open etc. have been eliminated. Everything turns to normal and now the LED "ready" lights up, indicating the motor can be started after reset.
-Err01	External instantaneous terminals open	Check the short circuit connection between terminal ⑦ and COM terminal ⑩, or check break contacts of other protective devices.
-Err02	Soft starter overheat	Check if starting is too frequently operated or the power of power doesn't match with the soft starter.
-Err03	Starting time too long(more than 60S)	Check if starting parameters are improperly set; the load is too heavy or the power capacity is not enough .
-Err04	Input open phase	Check if there is something wrong with input and main circuit . the bypass contactor is blocked on the closed position, the SCR is open loop.
-Err05	Output open phase	Check if connecting wires of output loop and the motor is firm, the bypass contactor is chucked on the closed position, the SCR is shortcut and the ground wire (G) is properly connected.
-Err06	Three phases unbalanced	Check if there is anomaly of input three-phase power supply or the load motor.
-Err07	Starting over current	Check if the load is too heavy or the power of motor doesn't match with the soft starter.
-Err08	Operation overload protection	Check if there is any too heavy load or improper parameter set by the code P7 and Po.
-Err09	Power voltage is too low	Check if there is error input power voltage or improper parameter set by the code P9.
-Err10	Power voltage is too high	Check if there is error input power voltage or improper parameter set by the code PA.

Panel Display	Warnings	Actions & Treatment
-Err11	Parameter setting error	Modify settings or press to restore to the default settings of soft starter when it is energized.
-Err12	Load shortcut	Check the load or the motor; check if the SCR is shortcut or over load.
-Err13	Auto restart wiring error	Check the external control start and stop terminals if they are in two-wire control mode.
-Err14	External control stop terminal wiring error	When external control mode is enabled, external control stop terminals will open, which lead to failure start of the motor.
-Err15	Motor under load	Check the main shaft of the motor and overload fault .

Note:

1) Some faults are correlative, i.e., if there is a report of Err02 (soft starter overheat), this may be concerned with starting overcurrent or load shortcut. Therefore, full considerations should be taken to have an exact judge on faults during troubleshooting.
2) When the soft starter starts the motor, the operation LED in the middle of the panel lights up, which indicates the machine is in the state of bypass operation. If bypass contactor fails to pickup at this time, which results in stop of the motor, check if there is any error or bad contact of the bypass contactor and relevant connecting wires.

Appendix Ⅱ (B)

Function Code	Function Name	Setting Range	Default Value	Instruction
P0	Inception Voltage	30-70%	30%	Voltage ramp mode is valid The current mode initial voltage is 40%.
P1	The soft start time	2-60S	16S	The limit current mode is invalid .
P2	The Soft Stop time	0-60S	0S	Set 0 to free stop . Please set the value =0 while two-wire control mode
P3	Start time delay	0-999S	0S	Time dalay by countdown . When the value is 0 , No time delay , Start immediately.
P4	Programmable delay	0-999S	0S	Is used in programmable relay output
P5	Interval time delay	0-999S	0S	Time delay will be also on over heat relieve , The state indicator will flash at the time delay .
P6	The start current limiting	50-500%	400%	The current limiting mode is valid. The maximum of voltage ramp mode current limiting is 400%.
P7	The maximum working current	50-200%	100%	The input mode of the parameter P6 , P7 are determined by P8.
P8	The input display method	0-3	1	For more details ,Please see Page 20.
P9	Under voltage protection	40-90%	80%	Protection will be action when lower than the setting value.
PA	Overvoltage Protection	100-140%	120%	Protection will be action when higher than the setting value.
PB	Starting Modes	0-5	1	0: current limiting; 1: voltage ramp; 2: kick + current-limiting; 3: kick + voltage ramp; 4: current ramp; 5: voltage and current-limiting double closed loop

Function Code	Function Name	Setting Range	Default Value	Instruction
PC	The output protection permission	0-4	2	0: primary; 1: light load; 2: standard; 3: heavy load; 4: advanced
PD	The operation control mode	0-7	1	Forbid starting or stop operation when the value is 7
PE	Restart Permission	0-13	0	See Page 24 for more details
PF	Parameter modification permission	0-2	1	See Page 24 for more details
PH	The communication address	0-63	1	Use multiple soft starters
PJ	Baud rate	0-5	3	See Appendix
PL	Verification settings	0-5	1	See Appendix
PP	Programmable Output	0-19	7	See Page for 25 for more details
PU	The soft stop current limiting	20-100%	80%	See Page for 26 for more details
Po	Motor Rated Current	11-1200	Rated Value	Current Value for input motor
Pr	Motor under load protection	0-99	0	See Page 26 for more details.

Note:

1) The Maximum of working current of Item P7 is calculated the maximum sustainable running current according to the load of the motor based on Po setting . If the value exceed the P7 , The inverse time limit heat protection will be action .
2) Idle keys for over 2 minutes, the machine will exit from the setting state automatically.
3) Do not set parameters during soft start or soft stop. Can be set them in other states.
4) Press (ENTER) Key to start the machine when the power is on , The setting parameter (Except PP) can be return to factory default.

Appendix III

1）Varieties of Application Load

This soft start can meet the requirements of most heavy loads. The table below is for reference only.

Varieties of Application Loads	Start Ramp Time (S)	Stop Ramp Time (S)	Inception Voltage (%)	Voltage Start (Maximum Current-limiting Value)	Current-limiting Start
Centrifugal Pump	16	20	40	4	2.5
Ball Grinder	20	6	60	4	3.5
Fan	26	4	30	4	3.5
Piston Type Compressor	16	4	40	4	3
Light Load Motor	16	2	30	4	3
Elevating Mechanism	6	10	60	4	3.5
Mixer	16	2	50	4	3
Crusher	16	10	50	4	3.5
Screw Compressor	16	2	40	4	3
Spiral Conveyor	20	10	40	4	2
Leather Belt Conveyer	20	10	40	4	2.5
Heat Pump	16	20	40	4	3

2) RS485 Communication

This soft starter can be connected to PC, PLC or other hosts through a built-in RS485 standard port to perform serial communication (COM). The host can give a command to start or stop the soft starter, monitor the operation state of the soft starter and modify its functional parameters. For details of this communication, please refer to RS485 Operating Manual. By using RS485 COM of the soft starter, remote operation can be realized via a computer such as input of run command, management on operation state, and one-step writing of functional codes for multiple soft starters to realize simplified operation while inputting functional codes.

Main Functions of RS485 COM:

① Inputting start or stop command;

② Monitoring operation status;

③ Real-time tracing (i.e., table display of running information);

④ Once-step reading and writing of functional codes, and saving to the file;

A separate agreement shall be signed between the two parties of us for communication software.

Appendix Ⅳ RS485 Communication Protocol

ZJR2 Series soft starter use popular MODBUS communication protocol .Before using RS485 communication protocol .You must set the soft starter's address ,communication baud rate、data format by manual . and these parameters couldn't be modified when during communication.

PH Communication address	Setting Range： 00-63	Factory setting： 01

When the communication address is set to 0, it is the broadcast address. All the slaves on the MODBUS bus will accept the frame, but the slave will not reply. Note that the slave address can not be set to 0.

The soft starter communication address is unique in the communication network, which is the basis for the point-to-point communication between the host and the soft starter .

PJ Baud rate	Setting Range： 0-5	Factory Setting： 3

This parameter defines the baud rate when serial communication, the protocol used in the data format, only the same format can be normal communication.

0：1200bps 1：2400bps 2：4800 bps

3：9600bps 4：19200bps 5：38400bps

PL Data Verification	Setting Range：0-5	Factory Setting：1

This parameter defines the data format when serial communication, the protocol used in the data format, only the same format can be normal communication.

0:No Parity check (N，8，1)for RTU 3:No parity check(N，8，2)for RTU

1:Even parity check(E，8，1)for RTU 4:Even parity check(E，8，2)for RTU

2:Odd parity check(O，8，1)for RTU 5:Odd parity check(O，8，2)for RTU

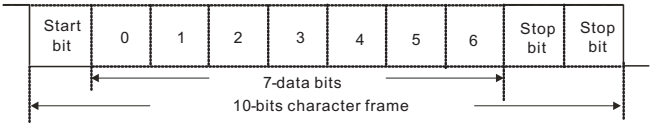
The data format set by the host and soft starter must be the same, otherwise, the communication can not be performed.

MODBUS communication use RTU code.MODBUS communication protocol use RTU encode format, each Byte data is composed of two 4-bit hexadecimal characters, for example: 0x1F RTU representation of the way '1FH'.

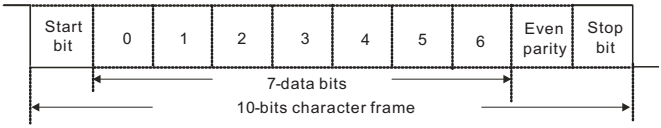
Character structure

10-bit character frame (for 7-bit characters):

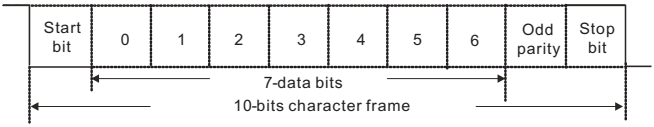
（7，N，2）



（7，E，1）

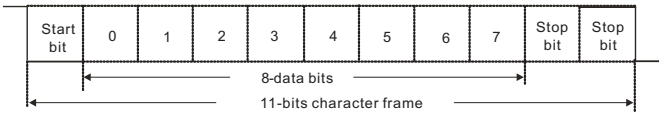


（7，O，1）

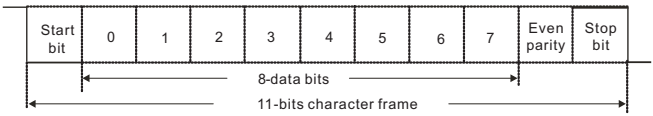


11-bit character frame (for 8-bit characters):

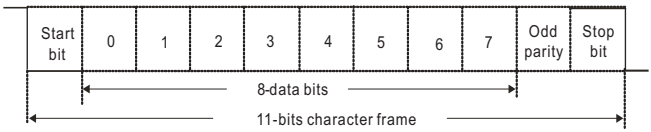
（8，N，2）



（8，E，1）



（8，O，1）



Communication Data Structures

Communication Data Frame :

RTU Mode：

START	More than 10ms at resting time or 3.5 bytes transmission time
ADR	Communication address: 8-bit address
CMD	Command code: 8-bit command
DATA (n-1)	Data content： N×8-bit Data, n<=32
…….	
DATA 0	
CRC CHK Low	CRC check sum： The 16-bit checksum consists of two 8-bit characters
CRC CHK High	
END	More than 10ms at resting time or 3.5 bytes transmission time

ADR（Communication address）
Legal communication addresses are in the range of 1 to 63. An address equals to 0 , means a broadcast to all soft starter in the network. In this case, the soft starter will not reply to the master device.
For example, communication to the soft starter with address 16 decimal:
RTU mode: (ADR)=10H

Function Code and Data Characters
03: Read out the contents of the soft starter from register
06: Write a WORD to soft starter register
08: loop detection
10: Write multiple WORD to soft starter registers
For example, reading continuous 2 words from starting address 0005H of the soft starter with address 01H.

RTU mode:

Command message:

Address	01H
Function	03H
Starting address	00H
	05H
Number of data (count by word)	00H
	02H
CRC CHK Low	D4H
CRC CHK High	0AH

Response message:

Address	01H
Function	03H
Number of data (count by byte)	04H
Content of data address 0005H	00H
	00H
Content of data address 0006H	10H
	24H
CRC CHK Low	F7H
CRC CHK High	E8H

Command code: 06H, write a word to the soft starter register.
For example, write 200(00C8H) to address 0007H of the soft starter with address 01H.

RTU mode:

Command Message

Address	01H
Function	06H
Data address	00H
	07H
Data content	00H
	C8H
CRC CHK Low	39H
CRC CHK High	9DH

Response message

Address	01H
Function	06H
Data address	00H
	07H
Data content	00H
	C8H
CRC CHK Low	39H
CRC CHK High	9DH

Command code: 08H, communication loop circuit detection
It's used to test the communication between the master (usually PC or PLC) and soft starter is normal or not . The soft starter will send the received data to the master.

RTU mode:

Command Message:

Address	01H
Function	08H
Data addres	00H
	00H
Data content	17H
	70H
CRC CHK Low	EEH
CRC CHK High	1FH

Response Message:

Address	01H
Function	08H
Data addres	00H
	00H
Data content	17H
	70H
CRC CHK Low	EEH
CRC CHK High	1FH

Command code: 10H,
For example: Write multiple words to the soft starter register.
write 500(01F4H)、200(00C8H) to the address 0006H and 0007H of the soft starter with address 01H.

RTU mode:

Command Message:

Address	01H
Function	10H
Data address	00H
	06H
Number of data (count by word)	00H
	02H
Number of data (count by byte)	04H
The first data content	01H
	F4H
The second data content	00H
	C8H
CRC CHK Low	32H
CRC CHK High	1DH

Response Mode:

Address	01H
Function	10H
Starting data address	00H
	06H
Number of data (count by word)	00H
	02H
CRC CHK Low	A1H
CRC CHK High	C9H

CHK(check sum：)
RTU Mode：
RTU mode
CRC (Cyclical Redundancy Check) is calculated by the following steps:
Step 1: Load a 16-bit register (called CRC register) with FFFFH.
Step 2: The first byte of the command message and 16-bit CRC make low byte XOR arithmetic .
Step 3: Shift the CRC register one bit to the right with MSB zero filling. Extract and examine the LSB.
Step 4: If the LSB of CRC register is 0, repeat step 3, else XOR or the CRC register with the polynomial value A001H.
Step 5: Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed.
Step 6: Repeat steps 2 to 5 for the next 8-bit byte of the command message. Continue doing this until all bytes have been processed. The final contents of the CRC register is the CRC value. When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped. i.e. the lower order byte will be transmitted first.
The following is an example of CRC generation using C language. The function takes two arguments:
Unsigned char* data ←a pointer to the message
Unsigned char length ←the quantity of bytes in the message.
This function returns an unsigned int CRC value.

```
unsigned int crc_chk(unsigned char* data, unsigned char length)
{
int j;
unsigned int reg_crc=0xFFFF;
while(length--)
{
reg_crc ^= *data++;
for(j=0;j<8;j++)
{
if(reg_crc & 0x01)   /* LSB(b0)=1 */
{
reg_crc=(reg_crc>>1) ^ 0xA001;
}
else
{
reg_crc=reg_crc >>1;
}
}
}
return reg_crc;
}
```

The definition of the communication data address

The communication data address is used to control the operation of the soft starter, get the state information and the rated function parameter setting.

The serial number of the function code is corresponding to the register address, but it should convert to hexadecimal number (except group parameters, as they are hexadecimal number), For example , P05 hexadecimal number express the function address is 0005H.

In addition, the EEPROM are frequently stored , will reduce the life of the EEPROM , For the users , No need to store for some function code in the mode of communication. Only change the value of RAM to meet the requirements.

To realize this function, you only need to turn the top digit of the function code address from 0 to 1.For example . the function code P07 only modify the RAM value instead of storing it in the EEPROM.

Function code P07 is not stored in the EEPROM, only modify the value of RAM, the address can be set to 8007H; the address can only be used as an in-chip RAM. which can not do the read function . It's will be invalid address if read.

The definition of the communication parameter address

Parameter Description	Address	Function Description		W/R Feature
Control command	1000H	0001H	Running	W/R
		0002H	Stop	
		0003H	Fault Set	
Monitor State	1001H	0000H	Ready	R
		0001H	Fault	
		0002H	By pass	
		0003H	Soft Starting	
		0004H	Soft Stop	

Parameter Description	Address	Function Description	W/R Feature
Soft starter Monitor State	3000H	Read the voltage value	R
	3001H	Read the current value	R

Parameter Description	Address	Function Description	W/R Feature
Soft starter fault address	5000H	Appendix II (A)	R
Communication fault address	5001H	Table 3-2	R

Additional response to error communication:

When the soft starter are communication connection. The soft starter will response to the error code if the error caused, and the maximum unit (bit 7) of the command code set to 1 (Function code and 80H) and answer to the Master. The master will know there will be error.

Data and fault type in 5000H

Table 3-2

Communication fault address	5001H	00H	NO Fault
		01H	Command code error
		02H	Illegal address
		03H	Illegal data
		04H ～ 05H	Reserved
		06H	Soft starter is busy
		07H ～ 09H	Reserved
		10H	Password Error
		11H	Check error
		12H	Invalid modified parameters
		13H	System locked
		14H	The number of data is illegal

Quality Warranty

The warranty of the soft starter are as follows:

1) Warranty Period Under Normal Conditions

① We provide guarantees for repair, replacement and return of the purchase in 1 month from the date of use.

② We provide guarantees for repair and replacement in 3 months from the date of use.

③ We provide guarantee for repair in 12 months from the date of use or 18 months from the date of ex-factory.

2) The purchaser enjoys life-long paid service whenever and wherever he uses a motor soft starter made in our company.

3) Service in the following cases, even within the warranty period, shall be charged to the purchaser:

① Problems caused by mal-operation in violation of this manual, or caused by unauthorized repair or renovation.

② Problems caused by improper use of soft starter that is off standard and requirement;

③ Malfunction or damage caused by improper transit or storage after purchase;

④ Induced failure or aging of the device due to poor ambient;

⑤ Malfunction or damage caused by fire, flood, thunder, earthquake, abnormal voltage or other natural disasters;

⑥ Unidentifiable nameplate, mark and ORD number due to intentional spoilage;

⑦ Delayed or unsatisfied payment in violation of purchase appointment;

⑧ Fail to give an objective description on the use of installation, wiring, operation, maintenance or else;

4) Defective products should be sent to us for repair, replacement and return, which can be proceeded only after verifying the burden of liability.

5) In case there is any quality problem or accident, we merely promise to bear the above-mentioned responsibilities. If a user needs more guarantees for liabilities, please assure on the insurance company voluntarily.