I. Communication setting of the controller:

Parameter	Setting range	Default
1. Communication add	1~247	1
2. Baud rate	2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200	9600
3. Parity check	No parity, odd, even	No parity
4. Communication test	Off, On	Off

※ Communication add setting

Using RS485 communication method, accord with MODBUS RTU protocol, the communication add parameter is 1~247.

※ Baud rate setting

Baud rate: 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200.

※ Parity check setting

Parity check has no parity check, odd check and even check.

※ Communication test setting

Communication test function is to judge whether the communication between the host computer and control board is normal. When this function is on, the control board will check if the host computer has send command every 1 minute, if no commands received it will shut off the output automatically, and indicates "communication error".

II. Communication protocol explanation:

1. The control board is accord with MODBUS RTU protocol, RS485 interface, the communication format is 11 bits:

    1 initial bit

    8 data bit

    1 odd and even parity bit

    1 stop bit when there is odd and even parity, 2 stop bit when there is no odd and even parity. （Ver3.5 Version and upper also support no odd and even parity 1 stop bit）

    Data transmission type: Unsigned int

Initial bit	1	2	3	4	5	6	7	8	Odd and even bit	Stop bit

With odd and even parity check

Initial bit	1	2	3	4	5	6	7	8	Stop bit	Stop bit

Without odd and even parity check

2. Start from the pause interval which is upper than 3.5 character of the message frame, the first transit domain is the controller address, then is the functional code, data address, data, CRC16 parity check, and finish at the last pause interval which is upper than 3.5 character, the frame format is as below:

Initial bit	Controller address	Functional code	Register add high byte	Register add low byte	Data high byte	Data low byte	CRC parity check	Final character
Upper than 3.5 byte	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte	2 byte	Upper than 3.5 byte
	1-247	0X03 0X06	0X10	0X01	0X00	0X01	CRC	

3. The controller running mode information read by Host computer: 0X03 can be read

Host send as below:

1	2	3	4	5	6	7	8
ADR	0X03	Initial register add high byte	Initial register add low byte	Register number high byte	Register number low byte	CRC check low byte	CRC check high byte

The first byte ADR: Slave computer address code (001 ~ 247)

The second byte 03H: The functional code to read register value

The third and fourth byte: The initial register address which is going to be read

The fifth and sixth byte: the register number which 0X0001 is going to read

The seventh and eighth byte: The checksum of CRC16 from byte 1 to 6

1	2	3	4, 5	6, 7	……	N-1, N	N+1	N+2
ADR	0X03	Total byte	Register data 1	Register data 2	……	Register data N	CRC check low byte	CRC check high byte

The first byte ADR: Slave computer address code (001 ~ 247)

The second byte 03H: The returned functional code to read register value

The third byte: The total number of the data byte, a register is 2 byte.

The fourth to N byte: The register data returned by slave.

The N+1 and N+2 byte: The checksum of CRC16 from byte 1 to N.

The return from the slave when there is a data receive error

1	2	3	4	5
ADR	0X83	Error code	CRC check low byte	CRC check high byte

The first byte ADR: Slave computer address code (001 ~ 247)

The second byte 0X83: The returned read error functional code, it is the return result of "80+ functional code"

The third byte: The returned functional code when there is a register value read error.

      0X01 is functional code error, 0X02 is register address error, 0X03 is register number exceeds the range, 0X04 is CRC check code error.

The fourth and fifth byte: The checksum of CRC16 from byte 1 to 3.

4. The controller running data information written by host: 0X06 can be read
Host send:

1	2	3	4	5	6	7	8
ADR	0X06	Register add High byte	Register add Low byte	Register data High byte	Register data Low byte	CRC check Low byte	CRC check High byte

The first byte ADR: Slave computer address code (001 ~ 247)

The second byte 06H: The functional code to write register value

The third and fourth byte: The register add which is going to be written

The fifth and sixth byte: The register data which is going to be written

The seventh and eighth byte: The checksum of CRC16 from byte 1 to 6.

The return from slave when the receive is correct

1	2	3	4	5	6	7	8
ADR	0X06	Register add High byte	Register add Low byte	Register data High byte	Register data Low byte	CRC check Low byte	CRC check High byte

The first byte ADR: Slave computer address code (001 ~ 247)

The second byte 06H: The returned functional code to write register value

The third and fourth byte: The returned register add which is going to be written

The fifth and sixth byte: The returned register data from the slave

The seventh and eighth byte: The checksum of CRC16 from byte 1 to 6

The return from the slave when there is a data receive error

1	2	3	4	5
ADR	0X86	Error code	CRC check low byte	CRC check high byte

The first byte ADR: Slave computer address code (001 ~ 247)

The second byte 0X86: The returned written error functional code, it the return result from "80+ functional code".

The third byte: The returned functional code when there is register value read error

        0X01 is functional code error, 0X02 is register address error, 0X03 is register number exceeds the range, 0X04 is CRC check code error.

The fourth and fifth byte: The checksum of CRC16 from byte 1 to 3.

The controller running data information written by the host: 0X10 （16） multiple parameters is written. There is no data range judge function when write in multiple parameters, the specific functional code and format explanation is omitted here, pls communicate with PLC or Configuration software according to the MODBUS RTU standard protocol.

III. Register definition form:

1. The host query or modify the setting parameters of the slave: 0X03 can be read, 0X06 can be wirtten

Controller add	Functional code	Register add	Data	CRC Check	Parameter description
1 byte	1 byte	2 byte	2 byte	2 byte	
ADR	0X03 0X06	0X1001	0 is constant voltage, 1 is constant current, 2 is open loop		Running mode
		0X1002	10~6000		Voltage range
		0X1003	10~6000		Current range
		0X1004	10~6000		Transformer ratio
		0X1005	10~6000 The setting value is Off when it is bigger than the voltage		Voltage limit

		Register add	Value/Range	Parameter description
			range	
		0X1006	10~6000 The setting value is Off when it is bigger than the current range	Current limit
		0X1007	1~200	Soft start time
		0X1008	0~200	Soft stop time
		0X1009	0~180	Phase limit
		0X100A	40~160 Shift angle is 0 when it is 100. Shift angle is -60 when it is 40 Shift angle is 60 when it is 160	Host/Slave shift
		0X100B	0 is communication, 1 is local	Control method
		0X100C	0 is jog, 1 is self-lock	Start method
		0X100D	0~6000, 0 is off	Over voltage protection range
		0X100E	0~200	Over voltage protection time
		0X100F	0~6000, 0 is off	Under voltage protection range
		0X1010	0~200	Under voltage protection time
		0X1011	0~6000, 0 is off	IF Over load protection selection
		0X1012	0~200	IF Over load protection time
		0X1013	0~6000, 0 is off	CT Transformer over load protection
		0X1014	0~200	CT transformer over load time
		0X1015	0 is off, 1 is on	Phase loss protection selection
		0X1016	0~60, under 10 is off	Three phase unbalance protection
		0X1017	1 is fast, 2 is medium speed, 3 is slow speed, 4 is self-define	PID parameter
		0X1018	1~128	P parameter（only write PID=4）
		0X1019	1~128	I parameter（only write PID=4）
		0X101A	1~199 It is related to 0 when is 100. It is related to -99 when is 1 It is related to 99 when is 199	Current balance parameter（For TC690C only）
		0X101B	3500~4500	Initial parameter function reserved
		0X101C	3500~4500	Initial parameter function reserved
		0X101D	3500~4500	Initial parameter function reserved
		0X101E		Function reserved
		0X101F		Function reserved
		0X1020		Function reserved

2. Query or modify the control information (can be read or written): 0X03 can be read, 0X06 can be written

Controller add	Functional code	Register add	Data	CRC check	Parameter description
1 byte	1 byte	2 byte	2 byte	2 byte	

ADR	0X03 0X06	0X1021	0		Reset or query the present running time (minute).
		0X1022	0		Reset or query the present running time (hour).
		0X1023	0		Reset or query the accumulating running time (minute).
		0X1024	0		Reset or query the accumulating running time (hour).
		0X1025	0		Rend the reset action (write only)
		0X1026	0		Send the restore factory value command (write only)
		0X1027	0 is stop, 1 is run		Send the start and stop command
		0X1028	0~1000		Given signal, i.e. adjust the input (percentage)

3. Query the running mode information (read only): 0X03

Controller add	Functional code	Register add	Data	CRC check	Parameter description
1 byte	1 byte	2 byte	2 byte	2 byte	
ADR	0X03	0X1029	Transformer current value		U phase current
		0X102A	Transformer current value		V phase current
		0X102B	Transformer current value		W phase current
		0X102C	DC current value		IF current feedback value
		0X102D	DC voltage value		VF voltage feedback value
		0X102E	0 is no fault 1 is phase loss protection 2 is IF over load protection 3 is IF over current protection 4 is CT over load protection 5 is CT over current protection 6 is over voltage protection 7 is under voltage protection 8 is three phase current unbalance 9 is phase sequence error 10 is over heat protection 11 is communication error 12 is feedback fault 13 is frequency error		The return of Fault mode

4. Query or modify special control information (can be read and written): 0X03 can be read, 0X06 can be written （**They are unopened parameters inside the system, please modify circumspectly**）

Controller add	Functional code	Register add	Data	CRC check	Parameter description
1 byte	1 byte	2 byte	2 byte	2 byte	
ADR	0X03 0X06	0X102F	1~247 (Default: 1)		Communication address
		0X1030	0（2400）,1（4800）,2（9600）, 3（14400）, 4（19200）, 5（38400）, 6（57600）, 7（115200） （Default: 2）		Baud rate
		0X1031	0 is no check（2 stop byte）, 1 is odd check, 2 is even check, 3 is no check (1 stop byte)		Parity check

			(Default: 0)		
		0X1032	0 is off, 1 is on （Default: 0）		Communication test
		0X1033	（Default: 4095）		Function reserved
		0X1034	（Default:4095）		Function reserved
		0X1035	（Default: 4095）		Function reserved
		0X1036	（Default: 4095）		Function reserved
		0X1037	（Default: 4095）		Function reserved
		0X1038	（Default: 0）		Function reserved
		0X1039	（Default: 0）		Function reserved
		0X103A	（Default: 0）		Function reserved
		0X103B	（Default: 0）		Function reserved
		0X103C	（Default: 0）		Function reserved
		0X103D	（Default: 0）		Function reserved
		0X103E	（Default: 180）		Function reserved
		0X103F	（Read only）		Output angle