Appendix B
Communication Protocol

NZ8000 series inverter provides RS232 / RS485 communication interface, and support the Modbus communication protocol. Users can be achieved by computing machine or PLC central control, through the communication protocol set frequency converter running commands, modify or read function code parameters, read the inverter working condition and fault information, etc.

1, the agreement content

The serial communication protocol defines the serial communication transmission of information content and format.Including: host polling or wide planting format;Host encoding method, the content includes: the function of the required action code, data transmission and error checking, etc.From the ring of machine should be used is the same structure, content including: action confirmation, return the data and error checking, etc.

If there was an error in receiving information from a machine, or cannot achieve the requirements of the host, it will organize a fault feedback information in response to the host.Application mode converter with RS232 / RS485 bus access to the "from" single main PC/PLC control network.

Bus structure

(1) The interface way RS232 / RS485 interface hardware

(2) Asynchronous serial transmission mode, half-duplex transmission mode.At the same time the host and the only one to send data from the machine and the other can only receive data.

Data in the process of serial asynchronous communication, the form of a message, a frame of a frame to send

(3) Topological structure from single host machine system.From the machine address set in the range of 1 ~ 247, 0 for broadcast communication address.In the network from the machine address must be unique.

Agreement that

NZ8000 series inverter is a kind of asynchronous serial port communication protocol of master-slave Modbus communication protocol, the network has only one equipment (host) to establish agreement (called "query/command").Other equipment (machine) can only by providing data response of the main machine "query/command", or "query/command" according to the host to make the corresponding action.Host in this refers to the personal computer (PC), industrial control equipment or programmable logic controller (PLC), etc., from machine refers to NZ8000 inverter.The host can communicate to a separate from the machine, also can to all under a broadcast information from machine release.For access to the host alone "query/command", from the machine to return to a information (called response), for radio host information, from the machine without feedback response to the host.

Communication data structure NZ8000 series frequency converter of the Modbus protocol communication data format is as follows: using the RTU mode, messages are sent at least begin with 3.5 characters pause time interval.

In network wave rate under varied characters of the time, this is the most easy to implement (below T1, T2, T3, T4).Transmission equipment is the first domain address.

The transmission character of you can use is the hex 0…9, A...F.Continuously detect network bus network facilities, including pause interval of time.When the first domain (domain) to receive, every equipment decoding to determine whether to own.After the

last transmission character, a pause at least 3.5 characters time calibration for the end of the message.A new message can be started after the pause.

The entire message frame must be as a continuous flow of transmission.If the time frame to complete more than 1.5 characters before pause time, receiving equipment will refresh incomplete message and assume that the next byte is a new message the address of the domain.Likewise, if a new message in less than 3.5 characters of time and then a message before, receiving equipment will think it is a continuation of the previous message.This will result in an error, because in the final CRC field value can't be right.

RTU frame format:

The frame header START	3.5 characters
Slave address ADR	Communication address: 1~247
command code CMD	03: Read the machine parameters; 06: write the machine parameters
Date content DATA (N-1)	Information content: Function code parameter address, function code number of parameters, function code parameter values, etc
Data content DATA (N-2)	
……	
Data contentDATA0	
high-order position of CRC CHK	estimated value: CRC value
low-order position of CRC CHK	
END	3.5 characters'time

CMD (Command instruction) and DATA (the description of data word)

command code: 03H, read N word (Word) (Can read the most words of 12) For example,From the machine address of 01 inverter startup F105 continuous read for two consecutive values

The host command information

ADR	01H
CMD	03H

high-order position of the starting address	F1H
low-order position of the starting address	05H
high-order position of register	00H
low-order position of register	02H
low-order position of CRC CHK	Wait to calculate the CRC CHK values
high-order position of CRC CHK	

In response to information from the slave machine

Set PD.05 to 0:

ADR	01H
CMD	03H
high-order position of bytes	00H
low-order position of bytes	04H
Data high-order position of F002H	00H
Data low-order position of F002H	00H
Data high-order position of F003H	00H
Data low-order position of F003H	01H
low-order position of CRC CHK	Wait to calculate the CRC CHK values
high-order position of CRC CHK	

Set PD.05 to 1:

ADR	01H
CMD	03H
The number of bytes	04H
Data high-order position of F002H	00H
Data low-order position of F002H	00H
Data high-order position of F003H	00H

Data low-order position of F003H	01H
low-order position of CRC CHK	Wait to calculate the CRC CHK values
high-order position of CRC CHK	

The command code: 06H write a word (Word) For example,write 000 (BB8H) to slave machine.

Address 05H frequency converter's F00AH address.

The host command information

ADR	05H
CMD	06H
high-order position of data address	F0H
low-order position of data address	0AH
high-order position of information content	0BH
low-order position of information content	B8H
low-order position of CRC CHK	Wait to calculate the CRC CHK values
high-order position of CRC CHK	

In response to information from the slave machine

ADR	02H
CMD	06H
high-order position of data address	F0H
low-order position of data address	0AH
high-order position of information content	13H
low-order position of information content	88H
low-order position of CRC CHK	Wait to calculate the CRC CHK values
high-order position of CRC CHK	

Check way——CRC Check way: CRC (Cyclical Redundancy Check) use RTU frame format,The message includes error detection field

based on the method of CRC .CRC domain test the whole content of a message. CRC domain is two bytes, contains a 16-bit binary values.it is calculated by the transmission equipment, added to the message.receive messages the device recalculate.And compared with receives the CRC in the domain of value, if the two CRC value is not equal, then there is an error in transmission.

CRC is saved in 0xFFFF,Then call a process to continuous 8-bit bytes of the message and the values in the current register for processing.Only 8 bit data in each character of CRC is effective, Starting bit and stopping bit and parity bits are invalid.

In the process of CRC,Each of the eight characters are separate and dissimilar or register contents (XOR) ,The results move to the least significant bit direction, set the most significant bit to 0. LSB is extracted to test, if set LSB to 1,Register and preset value dissimilarity or alone, if set LSB to 0, is not to.The whole process will repeat 8 times.when the last time (the eighth time) is completed, next 8-bit bytes and separate and register under the current value of the alien or.The values in the final register, Is all bytes in the message is executed after the CRC value.

When CRC added to the messages .The low byte to join first and then high byte.CRC Simple function is as follows:

```
unsigned int crc_cal_value(unsigned char *data_value,unsigned
char data_length)
{
int i;
unsigned int crc_value=0xffff;
 while(data_length--)
{
crc_value^=*data_value++;
 for(i=0;i<8;i++)
 {
lf(crc_value&0x0001)
```

```
crc_value=(crc_value>>1)^0xa001;
  else
crc_value=crc_value>>1;
 }
}
Return(crc_value);
}
```

Address definition of communication parameters

This part is the content of the communication, used to control the operation of the inverter, inverter status and related parameters setting.Read and write functional code parameter (some function code which can not be changed, only for the use of manufacturers or monitoring) : function code parameter address label rules:

By function block number and the label for the parameter address representation rules .High byte: F0~FF (P group) , A0~AF (C group) , 70~7F (D group) low byte: 00~FF

Such as: P3.12, The address is expressed as F30C; attention: PF group: Neither read the parameters, and do not change parameters;Group D group: only can read, do not change the parameters.

When some parameters in converter is in operation, do not change;Some parameters of the frequency converter in any state, cannot be changed;Change function code parameters, but also pay attention to the range of parameters, units, and related instructions.

In addition, because the EEPROM is stored frequently, the service life of the block can reduce the the life of the block EPROM, so some function code under the mode of communication, do not need to be stored, just change the value of RAM.If it is P group of parameters, in order to realize the function, as long as putting this function code address high F into 0 can be achieved.If it is C group of parameters, in order to realize the function, as long as putting the function code the address of high A into 4 can be achieved.

Corresponding function codes are shown as the following address: the high byte: 00 ~ 0F (P group), 40 ~ 4F(group B) low byte: 00 to FF

Such as:

Function code P3.12 is not stored in the EEPROM,The address is expressed as 030C; Function code C0-05 is not stored in the EEPROM,The address is expressed as 4005; The address representation can only do writing RAM, can't do reading action,when reading,it is invalid address. For all the parameters, can also use the command code 7H to implement this function.

Stopping/starting parameters:

Parameter address	Parameter description
1000	Communication Setting value (-10000~10000) (decimal system)
1001	Operating frequency
1002	Bus voltage
1003	output voltage
1004	current output
1005	output power
1006	output torque
1007	running velocity
1008	X Input Flag
1009	YO output Flag
100A	FIV voltage
100B	FIC voltage
100C	reserved
100D	count value input
100E	The length of the input
100F	The load speed
1010	PID setting
1011	PID feedback
1012	PLC steps
1013	PULSE the input pulse frequency,unit 0.01kHz
1014	Feedback speed, unit 0.1Hz
1015	The remaining running time
1016	FIV before correction voltage
1017	FIC before correction voltage

1018	reserved
1019	Linear velocity
101A	the current access to electricity time
101B	the current running time
101C	PULSE input pulse frequency,unit 1Hz
101D	Communication Setting value
101E	The actual speed of feedback
101F	The main frequency X show
1020	Auxiliary frequency Y show

attention:

Communication setting value is relative percentage, 10000 corresponds to 100.00% and - 10000-100.00%.The frequency of dimensional data, the percentage is relative to the percentage of maximum frequency (P012);Counter rotating torque dimensional data, the percentage is P2.10.

Control command input to the converter: (write-only)

The command word address	Command function
2000	0001: Running forward
	0002: Reverse running
	0003: normal inching turning
	0004: Reversal point move
	0005: Free downtime
	0006: Slowing down
	0007: Failure reset

Read the inverter state: (read-only)

Status word address	Status word function
3000	0001: Running forward
	0002: Reverse running
	0003: closing down

Parameters lock password check: (if return for 8888H,it indicates that the password check through)

Password address	The content of the input password
1F00	*****

Command address	Command content

2001	BIT0: (reserve) BIT1: (reserve) BIT2: RA-RB-RC output control BIT3: YA-YB-YC output control BIT4: YO-R output control

Analog output FO1 control: (write-only)

Command address	Command content
2002	0~7FFF represent 0%~100%

Analog output FO2 control: (write-only)

Command address	Command content
2003	0~7FFFrepresent 0%~100%

PULSE (PULSE) output control: (write -only)

Command address	Command content
2004	0~7FFFrepresent 0%~100%

Frequency converter fault description:

Frequency converter fault address	Frequency converter fault information
8000	0000: failure-free 0001: Inverter unitprotection 0002: Accelerate over current 0003: Slow down over current 0004: Constant speed over current 0005: Accelerate over the voltage 0006: Slow down over voltage 0007: Constant speed over voltage 0008: Buffer resistance overload fault 0009: Under-voltage fault 000A: The inverter overload 000B: Motor overload 000C: The input phase 000D: The output phase 000E: Module is overheating 000F: External fault 0010: Abnormal communication 0011: Abnormal contactor 0012: Current detection fault 0013: Motor tuning fault 0014: Encoder/PG card failure 0015: Abnormal parameters, reading and writing 0016: Inverter hardware failure 0017: Motor for short circuit fault 0018: reserved 0019: reserved 001A: Running time reached 001B: reserved 001C: reserved 001D: Accumulative power-on time reached

8000	001E: Load becoming 0 001F: PID feedback lost during running 0028: With-wave current limit fault 0029: Motor switchover fault during running 002A: Too large speed deviation 002B: Motor over-speed 002D: reserved 005A: Encoder line number setting error 005B: Don't connect the encoder 005C: Initial position fault 005E: Speed feedback error

Communication failures address	Fault feature description
8001	0000: failure-free 0001: Password mistake 0002: The command code error 0003: CRC Checking error 0004: Invalid address 0005: Invalid parameter 0006: correcting parameter is invalid 0007: System is locked 0008: Block is EEPROM operation

PD group Communication parameters show

PD.00	Baud rate	The factory value	0005
	setting range	units' digit:MODUBS Baud rate 0: 300BPS 1: 600BPS 2: 1200BPS 3: 2400BPS 4: 4800BPS 5: 9600BPS 6: 19200BPS 7: 38400BPS 8: 57600BPS 9: 115200BPS	

This parameter is used to set data transfer rate between the PC and inverter.Notice that setting the baud rate of upper machine and converter must agree, otherwise, the communication can't carry on.The faster the baud rate, the greater the communication.

PD.01	The data format	The factory value	3
	setting range	0: No check: The data format<8,N,2> 1: even-parity: The data format<8,E,1> 2: odd parity check: The data format<8,O,1> 3: No check: The data format<8-N-1>	

PC and data format set by the frequency converter must agree, otherwise, the communication can't carry on.

PD.02	The machine address	The factory value	1
	setting range	1~247, 0 is the broadcast address	

When the machine address set to 0, namely for the broadcast address, realize PC broadcasting functions.

The machine address has uniqueness (except the broadcast address), which is to achieve the basis of upper machine and inverter peer-to-peer communications.

PD.03	Response latency	The factory value	2ms
	setting range	0~20ms	

Response latency: refers to the frequency converter data to accept the end up to a upper machine to send data in the middle of the interval of time.If the response time delay is less than the system processing time, the response time delay will be subject to system processing time, processing time, such as response time delay is longer than system after processing the data, the system will delay waiting, until the response delay time to up to a upper machine to send data.

PD.04	Communication timeout	The factory value	0
	setting range	0.0 s (invalid) 0.1~60.0s	

When the function code is set to 0.0 s, communication timeout parameter is invalid.

When the function code set to valid values, if a communication and the interval time of the next communication beyond the communication timeout, system will be submitted to the communication failure error (E16).Usually, it is set into is invalid.If, in the continuous communication system parameter set the time, you can monitor the communication status.

PD.05	Communication protocol selection	The factory value	1
	setting range	0: Non standard Modbus protocol 1: The standard Modbus protocol	

PD.05=1: choose the standard Modbus protocol

PD.05=0: when reading command ,Returns number of bytes from the machine is a byte more than the standard Modbus protocol, detailed in this agreement 5 Communication data structures.

PD.06	Read the current resolution	The factory value	1
	setting range	0: 0.01A 1: 0.1A	

Used to determine the communication while reading the output current, current value of the output units.