Table-1

Multi-step frequency terminal 4	Multi-step frequency terminal 3	Multi-step frequency terminal 2	Multi-step frequency terminal 1	Set frequency
OFF	OFF	OFF	OFF	Multi-step frequency 0
OFF	OFF	OFF	ON	Multi-step frequency 1
OFF	OFF	ON	OFF	Multi-step frequency 2
OFF	OFF	ON	ON	Multi-step frequency 3
OFF	ON	OFF	OFF	Multi-step frequency 4
OFF	ON	OFF	ON	Multi-step frequency 5
OFF	ON	ON	OFF	Multi-step frequency 6
OFF	ON	ON	ON	Multi-step frequency 7
ON	OFF	OFF	OFF	Multi-step frequency 8
ON	OFF	OFF	ON	Multi-step frequency 9
ON	OFF	ON	OFF	Multi-step frequency 10
ON	OFF	ON	ON	Multi-step frequency 11
ON	ON	OFF	OFF	Multi-step frequency 12
ON	ON	OFF	ON	Multi-step frequency 13
ON	ON	ON	OFF	Multi-step frequency 14
ON	ON	ON	ON	Multi-step frequency 15

Table-2

ACC and DEC time selection 2	ACC and DEC time selection 1	ACC and DEC time selection
OFF	OFF	ACC and DEC time 1
OFF	ON	ACC and DEC time 2
ON	OFF	ACC and DEC time 3
ON	ON	ACC and DEC time 4

Monitoring Parameter Table

Function code	Name	Minimum unit
U0 Group: Basic Monitoring Parameter		
U0-00	Running frequency (Hz)	0.01Hz
U0-01	Setting frequency (Hz)	0.01Hz
U0-02	Bus voltage (V)	0.1V
U0-03	Output voltage (V)	1V
U0-04	Output current (A)	0.01A
U0-05	Output power (kW)	0.1kW
U0-06	Output torque (%)	0.1%
U0-07	DI input status	1
U0-08	DO output status	1
U0-09	AI1 voltage (V)	0.01V
U0-10	AI2 voltage (V)	0.01V
U0-11	AI3 voltage (V)	0.01V
U0-12	Count value	1
U0-13	Length value	1
U0-14	Load speed display	1
U0-15	PID setting	1
U0-16	PID feedback	1
U0-17	PLC stage	1
U0-18	PULSE input pulse frequency (Hz)	0.01kHz
U0-19	Feedback speed (unit : 0.1Hz)	0.1Hz
U0-20	Remaining running time	0.1Min
U0-21	AI1 voltage before calibration	0.001V
U0-22	AI2 voltage before calibration	0.001V
U0-23	AI3 voltage before calibration	0.001V
U0-24	Linear speed	1m/Min
U0-25	Current power-on time	1Min
U0-26	Current running time	0.1Min
U0-27	PULSE input pulse frequency	1Hz
U0-28	Communication setting value	0.01%
U0-29	Encoder feedback speed	0.01Hz

Function code	Name	Minimum unit
U0-30	Main frequency X display	0.01Hz
U0-31	Auxiliary frequency Y display	0.01Hz
U0-32	View any memory address value	1
U0-33	Synchronous machine rotor position	0.1°
U0-34	Motor temperature	1℃
U0-35	Target torque (%)	0.1%
U0-36	Rotational position	1
U0-37	Power factor angle	0.1°
U0-38	ABZ position	1
U0-39	VF separation target voltage	1V
U0-40	VF separation output voltage	1V
U0-41	DI input status visual display	1
U0-42	DO input status visual display	1
U0-43	DI function status display 1 (function 01-function 40)	1
U0-44	DI function status visual display 2 (function 41-function 80)	1
U0-59	Setting frequency (%)	0.01%
U0-60	Running frequency (%)	0.01%
U0-61	Inverter status	1

Chapter 6 EMC (Electromagnetic Compatibility)

6.1 Definition

Electromagnetic compatibility is the ability of the electric equipment to work in the electromagnetic interference environment and implement its function stably without interferences in the electromagnetic environment.

6.2 EMC Standard Description

In accordance with the requirements of the national standard GB/T12668.3, the inverter needs to comply with electromagnetic interference and anti-electromagnetic interference requirements.

Products apply the latest international standard—IEC/EN61800-3: 2004 (Adjustable speed electrical power drive systems part 3: EMC requirements and specific test methods), which is equivalent to the national standard GB/T12668.3.

IEC/EN61800-3 assesses the inverter in terms of electromagnetic interference and anti-electronic interference. Electromagnetic interference mainly tests the radiation interference, conduction interference and harmonics interference on the inverter (required for the inverter for civil use). Anti-electromagnetic interference mainly tests the conduction interference rejection, radiation interference rejection, surge interference rejection, fast and mutable pulse group interference rejection, ESD interference rejection and power low frequency end interference rejection (specific test items including: 1. Interference rejection tests of input voltage sag, interrupt and change; 2. Phase conversion interference rejection test; 3. Harmonic input interference rejection test; 4. Input frequency change test; 5. Input voltage unbalance test; 6. input voltage fluctuation test).

The tests should be conducted strictly in accordance with the above requirements of IEC/ EN61800-3, and the products of our company are installed and used according to Section 6.3 and have good electromagnetic compatibility in general industry environment.

6.3 EMC Guide

6.3.1 Harmonic effect

Higher harmonics of power supply may damage the inverter. Thus, at some places where mains quality is rather poor, it is recommended to install AC input reactor.

6.3.2 Electromagnetic interference and installation precautions

There are two kinds of electromagnetic interferences, one is interference of electromagnetic noise in the surrounding environment on the inverter, and the other is interference of inverter on the surrounding equipment.

Installation precautions:

1) The earth wires of the Inverter and other electric products should be well grounded;

2) The power input and output power cables of the inverter and weak current signal cables (e.g. control line) should not be arranged in parallel and vertical arrangement is preferable.

3) It is recommended that the output power cables of the inverter employ shield cables or steel pipe shielded cables and that the shielding layer be earthed reliably. The lead cables of the equipment suffering interferences are recommended to employ twisted-pair shielded control cables, and the shielding layer should be earthed reliably.

4) When the length of motor cable is longer than 100 meters, it needs to install output filter or reactor.

6.3.3 Handling method for the interferences of the surrounding equipment on the inverter

The electromagnetic interference on the inverter is generated because plenty of relays, contactors and electromagnetic brakes are installed near the inverter. When the inverter has error action due to the interferences, the following measures can be taken:

1) Install surge suppressor on the devices generating interference;

2) Install filter at the input end of the inverter. Refer to Section 6.3.6 for the specific operations;

3) The lead cables of the control signal cable of the inverter and the detection line employ shielded cable and the shielding layer should be earthed reliably.

6.3.4 Handling method for the interferences of inverter on the surrounding equipment

These interferences include two types: one is radiation interference of the inverter, and the other is conduction interference of the inverter. These two types of interferences cause the surrounding electric equipment to suffer electromagnetic or electrostatic induction. The surrounding equipment hereby produces error action. For different interferences, it can be handled by referring to the following methods:

1) For the measuring meters, receivers and sensors, their signals are generally weak. If they are placed nearby the inverter or together with the inverter in the same control cabinet, they are easy to suffer interference and thus generate error actions. It is recommended to handle with the following methods: Put in places far away from the interference source; do not arrange the signal cables with the power cables in parallel and never bind them together; both the signal cables and power cables employ shielded cables and are well earthed; install ferrite magnetic ring (with suppressing frequency of 30 to 1,000MHz) at the output side of the inverter and wind it 2 to 3 cycles; install EMC output filter in more severe conditions.

2) When the equipment suffering interferences and the inverter use the same power supply, it may cause conduction interference. If the above methods cannot remove the interference, it should install EMC filter between the inverter and the power supply.

3) The surrounding equipment is separately earthed, which can avoid the interference caused by the leakage current of the inverter's earth wire when common earth mode is adopted.

6.3.5 Leakage current and handling

There are two forms of leakage current when using the inverter. One is leakage current to the earth, and the other is leakage current between the cables.

1) Factors influencing the leakage current to the earth and the solutions:

There are distributed capacitance between the lead cables and the earth. The larger the distributed capacit-ance is, the larger the leakage current will be. The distributed capacitance can be reduced by effectively reducing the distance between the inverter and the motor. The higher the carrier frequency is, the larger the leakage current will be. The leakage current can be reduced by reducing the carrier frequency. However, reducing the carrier frequency may result in addition of motor noise. Note that additional installation of reactor is also an effective method to remove the leakage current.

The leakage current may increase following the addition of circuit current. Therefore, when the motor power is high, the corresponding leakage current will be high too.

2) Factors of producing leakage current between the cables and solutions:

There is distributed capacitance between the output cables of the inverter. If the current passing the lines has higher harmonic, it may cause resonance and thus result in leakage current. If thermal relay is used, it may generate error action.

The solution is to reduce the carrier frequency or install output reactor. It is recommended that thermal relay not be installed before the motor when using the inverter, and that electronic over current protection function of the inverter be used instead.

6.3.6 Precautions for Installing EMC input filter at the input end of power supply

1) When using the inverter, please follow its rated values strictly. Since the filter belongs to Classification I electric appliances, the metal enclosure of the filter should be large and the metal ground of the installing cabinet should be well earthed and have good conduction continuity. Otherwise there may be danger of electric shock and the EMC effect may be greatly affected.

2) Through the EMC test, it is found that the filter ground must be connected with the PE end of the inverter at the same public earth. Otherwise the EMC effect may be greatly affected.

3) The filter should be installed at a place close to the input end of the power supply as much as possible.

Chapter 7 Trouble Shooting

7.1 Fault and Trouble Shooting

There are 24 warning messages and protection features on the NG80 inverter. When a fault occurs, the inverter's output is halted and the protection mechanism is activated. When the inverter fault relay makes contact, the inverter display screen shows the fault code. Users can perform a self-inspection using the advice in this area to identify the problem and locate a fix before calling for assistance. Please seek service if it relates to the cause listed in the dotted box. You can get in touch with our business or the person who sold you the inverter.

The hardware overcurrent or overvoltage signal appears as error code 22 in the 21 warning messages. Err22 alarms are often caused by hardware overvoltage failure.

Fault Name	Inverter unit protection
Fault Code	ERR01
Reason	1. Short-circuit at inverter output side 2. The cable connecting the motor with the inverter is too long 3. The module is over-heat 4. The cable connections inside the inverter are loosen 5. The main board is abnormal 6. The driver board is abnormal 7. The IGBT module is abnormal
Solution	1. Inspect whether motor damaged, insulation worn or cable damaged 2. Install a reactor or output filter 3. Check if the air duct is blocked and if the fan is in normal status, and resolve the existing problems 4. Make sure the cables are connected well 5. Seeking technical support 6. Seeking technical support 7. Seeking technical support

Fault Name	Over current when acceleration
Fault Code	ERR02
Reason	1. Short-circuit or ground fault occurred at inverter output side 2. Control mode is vector control & motor parameters are not identified 3. The acceleration time is too short 4. The manual torque boost or V/F curve is not proper 5. The voltage is too low 6. Start the running motor 7. Load is added suddenly during the acceleration 8. Capacity of inverter is too small
Solution	1. Inspect whether motor damaged, insulation worn or cable damaged 2. Identify the motor parameters 3. Increase the acceleration time 4. Adjust the manual torque boost or V/F curve 5. Make the voltage in the normal range 6. Select speed tracking start or start the motor till it stops 7. Cancel the sudden added load 8. Select bigger capacity inverter

Fault Name	Over-current when deceleration
Fault Code	ERR03
Reason	1. Short-circuit or ground fault occurred at inverter output side 2. Control mode is vector control & motor parameters are not identified 3. The deceleration time is too short 4. The voltage is too low 5. Load is added suddenly during the deceleration 6. Have not installed braking unit and braking resistor
Solution	1. Inspect whether motor damaged, insulation worn or cable damaged 2. Identify the motor parameters 3. Increase the deceleration time 4. Make the voltage in the normal range 5. Cancel the sudden added load 6. Install braking unit and braking resistor

Fault Name	Over-current when constant speed running
Fault Code	ERR04
Reason	1. Short-circuit or ground fault occurred at inverter output 2. Control mode is vector control & motor parameters are not identified 3. The voltage is too low 4. Load is added suddenly during running 5. Capacity of inverter is too small
Solution	1. Inspect whether motor damaged, insulation worn or cable damaged 2. Identify the motor parameters 3. Make the voltage in the normal range 4. Cancel the sudden added load 5. Select bigger capacity inverter

Fault Name	Over-voltage when acceleration
Fault Code	ERR05
Reason	1. The input voltage is too high 2. There is external force driving the motor to run during acceleration 3. The acceleration time is too short 4. Have not installed braking unit and braking resistor
Solution	1. Make the voltage in the normal range 2. Cancel the external force 3. Increase the acceleration time 4. Install braking unit and braking resistor

Fault Name	Over-voltage when deceleration
Fault Code	ERR06
Reason	1. The input voltage is too high 2. There is external force driving the motor to run during deceleration 3. The deceleration time is too short 4. Have not installed braking unit and braking resistor
Solution	1. Make the voltage in the normal range 2. Cancel the external force 3. Increase the deceleration time 4. Install braking unit and braking resistor

Fault Name	Over-voltage when constant speed running
Fault Code	ERR07
Reason	1. The input voltage is too high 2. There is external force driving the motor to run during the inverter running
Solution	1. Make the voltage in the normal range 2. Cancel the external force or install braking resistor

Fault Name	Power-supply fault
Fault Code	ERR08
Reason	1. The input voltage is out of range
Solution	1. Make the voltage in the normal range

Fault Name	Under-voltage fault
Fault Code	ERR09
Reason	1. Instantaneous power-off 2. The input voltage is out of range 3. Bus voltage is abnormal 4. The rectifier bridge and buffer resistor are abnormal 5. The driver board is abnormal 6. The control board is abnormal
Solution	1. Fault reset 2. Make the voltage in the normal range 3. Seeking technical support 4. Seeking technical support 5. Seeking technical support 6. Seeking technical support

Fault Name	Inverter over load
Fault Code	ERR10
Reason	1. The load is too heavy or motor blockage occurs 2. Capacity of inverter is too small
Solution	1. Reduce the load, check the status of motor & machinery 2. Select bigger capacity inverter

Fault Name	Motor over load
Fault Code	ERR11
Reason	1. P9-01 is set improperly 2. The load is too heavy or motor blockage occurs 3. Capacity of inverter is too small
Solution	1. Set P9-01 properly 2. Reduce the load, check the status of motor & machinery 3. Select bigger capacity inverter

Fault Name	Output phase failure
Fault Code	ERR12
Reason	1. Three-phase input power supply is abnormal 2. The driver board is abnormal 3. The lightning protection board is abnormal 4. The main board is abnormal
Solution	1. Inspect whether motor damaged, insulation worn or cable damaged 2. Seeking technical support 3. Seeking technical support 4. Seeking technical support

Fault Name	Output phase failure
Fault Code	ERR13
Reason	1. The connection between inverter and motor is abnormal 2. Three-phase output unbalance of inverter during the motor running 3. The driver board is abnormal 4. The IGBT module is abnormal
Solution	1. Inspect whether motor damaged, insulation worn or cable damaged 2. Make sure the motor three phase winding is normal 3. Seeking technical support 4. Seeking technical support

Fault Name	Module over-heat
Fault Code	ERR14
Reason	1. Ambient temperature is too high 2. Air duct is blocked 3. Cooling fans are broken 4. Thermal resistor(temperature sensor) of the module is broken 5. IGBT module is broken
Solution	1. Reduce the ambient temperature 2. Clear the air duct 3. Replace cooling fans 4. Replace the thermal resistor 5. Replace IGBT module

Fault Name	Peripheral device fault
Fault Code	ERR15
Reason	1. Input external fault signal through multifunctional terminal DI 2. Input external fault signals through virtual IO function
Solution	1. Reset running 2. Reset running

Fault Name	Communication fault
Fault Code	ERR16
Reason	1. Master computer works abnormal 2. Communication cable is abnormal 3. The communication expansion card P0-28 setting is incorrect 4. The communication parameter PD group setting is incorrect
Solution	1. Check the connection of master computer 2. Check the communication connection 3. Correct setting of communication expansion card type 4. Set communication parameters correctly

Fault Name	Contactor fault
Fault Code	ERR17
Reason	1. The driver board and power supply are abnormal 2. The contactor is abnormal
Solution	1. Replace the driver board or power board 2. Replace the contactor

Fault Name	Current detection fault
Fault Code	ERR18
Reason	1. Hall device is abnormal 2. The driver board is abnormal
Solution	1. Replace the Hall device 2. Replace the driver board

Fault Name	Motor tuning fault
Fault Code	ERR19
Reason	1. Motor parameters are set improperly 2. Parameter identification process is delayed
Solution	1. Set parameters according to the motor nameplate 2. Check the cables connecting inverter with motor

Fault Name	Encoding disk fault
Fault Code	ERR20
Reason	1. Encoder model mismatch 2. Encoder wiring error 3. Encoder damaged 4. PG card abnormality
Solution	1. Set the encoder type correctly according to the actual situation 2. Eliminate circuit faults 3. Replace encoder 4. Replace PG card

Fault Name	EEPROM read/write fault
Fault Code	ERR21
Reason	1. EEPROM chip is broken
Solution	1. Replace the main board

Fault Name	Inverter hardware fault
Fault Code	ERR22
Reason	1. Over voltage 2. Over current
Solution	1. Handle as over voltage fault 2. Handle as over current fault

Fault Name	Short-circuit to ground fault
Fault Code	ERR23
Reason	1. The motor is short-circuit to ground
Solution	1. Replace cables or motor

Fault Name	Accumulated running time arrival fault
Fault Code	ERR26
Reason	1. The accumulated running time reaches the setting value
Solution	1. Clear the record information via parameter initialization function

Fault Name	Customized fault 1
Fault Code	ERR27
Reason	1. Input user-defined fault 1 signal through multifunctional terminal DI 2. Input user-defined fault 1 signal through virtual IO function
Solution	1. Reset running 2. Reset running

Fault Name	Customized fault 2
Fault Code	ERR28
Reason	1. Input user-defined fault 2 signal through multifunctional terminal DI 2. Input user-defined fault 2 signal through virtual IO function
Solution	1. Reset running 2. Reset running

Fault Name	Accumulated power-on time arrival fault
Fault Code	ERR29
Reason	1. The accumulated power-on time reaches the setting value
Solution	1. Clear the record information via parameter initialization function

Fault Name	Off-load fault
Fault Code	ERR30
Reason	1. The inverter running current is smaller than P9-64
Solution	1. Confirm if the load breaks away and P9-64 & P9-65 are set properly

Fault Name	PID feedback lost fault when running
Fault Code	ERR31
Reason	1. PID feedback is smaller than PA-26
Solution	1. Check PID feedback signal or set PA-26 properly

Fault Name	Current-limiting fault
Fault Code	ERR40
Reason	1. Whether the load is heavy or the motor is blocked 2. Capacity of inverter is too small.
Solution	1. Reduce the load and detect the motor & machinery condition 2. Select bigger capacity inverter

Fault Name	Switching motor fault when running
Fault Code	ERR41
Reason	1. Change the current motor selection through terminals during the operation of the inverter
Solution	1. Perform motor switching operation after the inverter is shut down

Fault Name	Excessive speed deviation fault
Fault Code	ERR42
Reason	1. The encoder parameter setting is incorrect 2. No parameter identification conducted 3. The detection parameters P9-69 and P9-60 for excessive speed deviation are not set properly
Solution	1. Set encoder parameters correctly 2. Perform motor parameter identification 3. Reasonably set detection parameters based on actual situations

Fault Name	Motor over speed fault
Fault Code	ERR43
Reason	1. The encoder parameter setting is incorrect 2. No parameter identification conducted 3. Improper setting of motor over speed detection parameters P9-69 and P9-60
Solution	1. Set encoder parameters correctly 2. Perform motor parameter identification 3. Reasonably set detection parameters based on actual situations

Fault Name	Motor over temperature fault
Fault Code	ERR45
Reason	1. The temperature sensor wiring is loose 2. Motor temperature too high
Solution	1. Detect temperature sensor wiring and troubleshoot 2. Reduce the carrier frequency or take other heat dissipation measures to heat the motor

Fault Name	Initial position error
Fault Code	ERR51
Reason	1. The deviation between the motor parameters and the actual value is too large
Solution	1. Reconfirm whether the motor parameters are correct, focusing on whether the rated current is set too low

7.2 Common Faults and Solutions

No.	Fault	Reason	Solution
1	No display when power-on	The input voltage is 0 or too low. The switching power supply on the driver board is broken. Rectifier bridge is broken. Buffer resistors are broken. The control board or keypad is broken. The connection between the control board, driver board, and keyboard is broken.	Check the input power-supply. Check the bus voltage. Reseat the 8-core and 28-core ribbon cables. Seeking manufacturer service.
2	HC is displayed when power-on	The connection of the cables of the driver board and control board are not good. The relevant components on the control board are damaged. There is a short circuit to ground in the motor or motor wire. Hall fault. The grid voltage is too low.	Reseat the 8-core and 28-core ribbon cables. Seeking manufacturer service.
3	Power on display “ERR23” alarm	The motor or the output line is short circuited to the ground. The inverter is damaged.	Measure the insulation of the motor and output line with magneto -ohmmeter. Seeking manufacturer service.

No.	Fault	Reason	Solution
4	The power on inverter displays normally, and after running, it displays "HC" and immediately shuts down	Fan damaged or blocked. There is a short circuit in the wiring of the peripheral control terminal.	Replace the fan. Eliminate external short circuit faults
5	Frequent reporting of "ERR14" (module over -heating) fault	Carrier frequency is too high. Fans are broken or air duct is broken. The inverter inside components are broken (such as thermistor).	Reduce the carrier frequency (P0-15). Replace fans, clear the air duct. Seeking manufacturer service.
6	Motor does not run after the inverter runs	Motor and motor cables are abnormal. The inverter parameters are set improperly (motor parameter). The connection of the cables of the driver board and control board are not good. The driver board is broken.	Make sure the connection of the inverter and motor is very well. Replace the motor or clear the mechanical failure. Check & reset the motor parameters.
7	DI terminal is invalid	The parameter is set improperly. The external signal is wrong. The jumper between OP and +24V is loose. The control board is broken.	Check & reset P4 group parameters. Reconnect the external signal cable. Reconnect the jumper between OP and +24V. Seeking manufacturer service.
8	When the closed -loop vector control, the motor speed cannot be increased	Encoder is fault. Encoder is wired incorrectly or has poor contact. PG card is fault. Driver board is fault.	Replace the encoding disk and reconfirm the wiring. Replace the PG card. Seeking manufacturer service.
9	Over voltage and over current fault are displayed frequently	Motor parameters are set improperly. The ACC/DEC time is improper. The load fluctuates.	Reset motor parameters or perform auto tuning. Set proper ACC/DEC time. Seeking manufacturer service.
10	ERR17 is displayed when power-on or running	The soft-start contactor is not closed	Check if the contactor cables are loosened. Check if the contactor is broken. Check if the contactor 24V power supply is broken. Seeking manufacturer service.
11	Power on display 88888	The relative components of the control board are broken.	Replace the control board.

Chapter 8 MODBUS Communication Protocol

NG80 series inverter provides RS232/RS485 communication interface, and adopts MODBUS communication protocol. User can realize centralized monitoring through PC/PLC, host computer, and also can set inverter's operating commands, modify or read function parameters, read operating status and fault information, etc.

8.1 About Protocol

This serial communication protocol defines the transmission information and use format in the series communication. It includes the formats of master-polling, broadcast and slave response frame, and master coding method with the content including slave address (or broadcast address), command, transmiting data and error checking. The response of slave adopts the same structure, including action confirmation, returning the data and error checking etc. If slave takes place the error while it is receiving the information or cannot finish the action demanded by master, it will send one fault signal to master as a response.

8.2 Application Method

The inverter could be connected into a "Single-master Multi-slave" PC/PLC control network with RS232/RS485 bus.

8.3 Bus Structure

(1) Interface mode: RS232/RS485

(2) Transmission mode

There provide asynchronous series and half-duplex transmission mode. At the same time, just one can send the data and the other only receives the data between master and slave. In the series asynchronous communication, the data is sent out frame by frame in the form of message.

(3) Topological structure

In Single-master Multi-slave system, the setup range of slave address is 1 to 247. 0 refers to broadcast communication address. The address of slave must be exclusive in the network. That is basic condition of MODBUS communication.

8.4 Protocol Description

NG80 series inverter communication protocol is a kind of asynchronous serial master-slave communication protocol. In the network, only one equipment (master) can build a protocol (Named as "Inquiry/Command"). Other equipments (slave) response "Inquiry/Command" of master only by providing the data, or doing the action according to the master's "Inquiry/Command". Here, master is personnel computer, Industrial control equipments or programmable logical controller, and the slave is inverter or other communication equipments with the same communication protocol. Master not only can visit some slave separately for communication, but also sends the broadcast information to all the slaves. For the single "Inquiry/Command" of master, all of slaves will return a signal that is a response; for the broadcast information provided by master, slave needs not feedback a response to master.

8.5 Communication Data Structure

MODBUS protocol communication data format of NG80 series inverter is shown as following:

In RTU mode, the Modbus minimum idle time between frames should be no less than 3.5 bytes. The checksum adopts CRC-16 method. All data except checksum itself sent will be counted into the calculation. Please refer to section: CRC Check for more information. Note that at least 3.5 bytes of Modbus idle time should be kept and the start and end idle time need not be summed up to it.

The entire message frame must be transmitted as a continuous data stream. If a idle time is more than 1.5 bytes before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message. Similarly, if a new message begins earlier than 3.5 bytes interval following a previous message, the receiving device will consider it as a continuation

of the previous message. Because of the frame's confusion, at last the CRC value is incorrect and communication fault will occur.

RTU frame format:

START	Transmission time of 3.5 bytes
Slave Address	Communication addr. : 1 to 247
Command Code	03H: Read slave parameters 06H: Write slave parameters
DATA (N-1)	Data: Function code parameter address, the number of function code parameter, function code parameter, etc.
DATA (N-2)	
……	
DATA0	
CRC CHK High byte	Detection value: CRC value
CRC CHK Low byte	
END	Transmission time of 3.5 bytes

8.6 Command Code and Communication Data Description

8.6.1 Command code: 03H, reads N words. (There are 12 characters can be read at the most.)

For example: The inverter start address F002 of the slave 01 continuously reads two consecutive values.

Master command information

Address	01H
Command Code	03H
Start Address High byte	F0H
Start Address Low byte	02H
Register Number High byte	00H
Register Number Low byte	02H
CRC CHK Low byte	CRC CHK value to be calculated
CRC CHK High byte	

Slave response information

When PD-05 is set to 0

Address	01H
Command Code	03H
Byte Number High byte	00H
Byte Number Low byte	04H
Data F002H High byte	00H
Data F002H Low byte	00H
Data F003H High byte	00H
Data F003H Low byte	01H
CRC CHK Low byte	CRC CHK value to be calculated
CRC CHK High byte	

When PD-05 is set to 1

Address	01H
Command Code	03H
Byte Number	04H
Data F002H High byte	00H
Data F002H Low byte	00H
Data F003H High byte	00H
Data F003H Low byte	01H
CRC CHK Low byte	CRC CHK value to be calculated
CRC CHK High byte	

8.6.2 Command code: 06H, write a word

For example: Write 5000(1388H) into address F00AH, slave address 02H.

Master command information

Address	02H
Command Code	06H
Data Address High byte	F0H
Data Address Low byte	0AH
Data Content High byte	13H
Data Content Low byte	88H
CRC CHK Low byte	CRC CHK value to be calculated
CRC CHK High byte	

Slave responding information

Address	02H
Command Code	06H
Data Address High byte	F0H
Data Address Low byte	0AH
Data Content High byte	13H
Data Content Low byte	88H
CRC CHK Low byte	CRC CHK value to be calculated
CRC CHK High byte	

8.6.3 CRC checking

In RTU mode, messages include an error-checking field that is based on a CRC method. The CRC field checks the contents of the entire message. The CRC field is two bytes, containing a 16-bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message. The receiving device recalculates a CRC during receipt of the message, and compares the calculated value to the actual value received in the CRC field. If the two values are not equal, an error results.

The CRC is started by 0xFFFF. Then a process begins of applying successive eight-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC.

During generation of the CRC, each eight-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next eight-bit byte is exclusive ORed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value.

When the CRC is appended to the message, the low byte is appended first, followed by the high byte. The following are C language source code for CRC-16.

```
unsigned int crc_chk_value（unsigned char *data_value,unsigned char length）{
                unsigned int crc_value=0xFFFF;
                int i;
                while（length--）                {
                        crc_value^=*data_value++;
                        for（i=0;i<8;i++）                        {
                                if（crc_value&0x0001）
        {
                                        crc_value=（crc_value>>1）
^0xa001;
                                }
                                else
                                {
                                        crc_value=crc_value>>1;
                                }
                        }
                }
                return（crc_value）;
}
```

8.6.4 Address definition of communication parameter

Here is about address definition of communication parameter. It's used to control the inverter operation, status and related parameter setting.

Reading and writing function code parameters (some function codes cannot be changed and are only for use by manufacturers or monitoring)

(1) The mark rules of function code parameters address:

The group number and mark of function code is the parameter address for indicating the rules.

High byte: P0 ~ PF (P Group), A0 ~ AF (A Group), 70 ~ 7F (U Group) Low byte: 00 ~ FF

For example: P3-12, the address is represented as P30C.

Note:

1. PF Group: Either the parameter cannot be read, nor be changed.
2. U Group: Only for reading parameter, cannot be changed parameters.
3. Some parameters cannot be changed during operation; some parameters regardless of what kind of status the inverter in, the parameters cannot be changed. Change the function code parameters, pay attention to the scope of the parameters, units, and relative instructions.

Besides, due to EEPROM be frequently stored, it will reduce the lifetime of EEPROM. So in the communication mode, some function code needn't be stored, only change the RAM value.

If it is a P-group parameter, to achieve this function, simply change the high bit F of the function code address to 0. If it is a group A parameter, to achieve this function, simply change the high bit A of the function code address to 4.

Corresponding function code addresses are indicated below:

High byte: 00 ~ 0F (P Group), 40 ~ 4F (A Group) Low Byte: 00-FF

For example:

Function code P3-12 is not stored in EEPROM, and the address is represented as 030C

Function code A0-05 is not stored in EEPROM, and the address is represented as 4005

These addresses can only act writing RAM, it cannot act reading. When act reading, it is invalid address. For all parameters, the command code 07H can also be used to achieve this function.

(2) Stop/start parameter address

Parameter Address	Parameter Description
1000	Setting frequency (-10000 to 10000) (Decimal)
1001	Running frequency
1002	Bus voltage
1003	Output voltage
1004	Output current
1005	Output power
1006	Output torque
1007	Running speed
1008	DI input status
1009	DO output status
100A	AI1 voltage
100B	AI2 voltage
100C	AI3 voltage
100D	Counting value input
100E	Length value input
100F	Load speed

Parameter Address	Parameter Description
1010	PID setting
1011	PID feedback
1012	PLC stage
1013	PULSE input pulse frequency, unit is 0.01kHz
1014	Feedback speed, unit is 0.1Hz
1015	Remain running time
1016	AI1 voltage before calibration
1017	AI2 voltage before calibration
1018	AI3 voltage before calibration
1019	Linear speed
101A	Current power on time
101B	Current running time
101C	PULSE input pulse frequency, unit is 1Hz
101D	Communication setting value
101E	Actual feedback speed
101F	Main frequency X display
1020	Auxiliary frequency Y display

Note:

Frequency setting value is the percentage of relative value, and 10,000 corresponds to 100.00%, -10000 corresponds to -100.00%.

To the data of frequency, the percentage is the percentage of relative maximum frequency (P0-10).

To the data of torque, the percentage is P2-10, A2-48, A3-48, A4-48 (torque upper limit numerical setting, corresponding to the first, second, third, and fourth motors respectively).

(3) Control command input to inverter (write only)

Command Word Address	Command Function
2000	0001：Forward running
	0002：Reverse running
	0003：Forward jog
	0004：Reverse jog
	0005：Freely stop
	0006：Deceleration to stop
	0007：Fault reset

(4) Read inverter status: (read only)

Status Word Address	Status Word Function
3000	0001：Forward running
	0002：Reverse running
	0003：Stop

(5) Parameters locking password check: (If the return is 8888H, it means the password check passes.)

Password Address	Content of Input password
1F00	*****

(6) Digital output terminal control: (write only)

Command Address	Command Content
2001	BIT0: DO1 output control BIT1: DO2 output control BIT2: RELAY1 output control BIT3: RELAY2 output control BIT4: FMR output control BIT5: VDO1 BIT6: VDO2 BIT7: VDO3 BIT8: VDO4 BIT9: VDO5

(7) Analog output AO1 control: (write only)

Command Address	Command Content
2002	0 ~ 7FFF refers to 0% ~ 100%

(8) Analog output AO2 control: (write only)

Command Address	Command Content
2003	0 ~ 7FFF refers to 0% ~ 100%

(9) Pulse output control: (write only)

Command Address	Command Content
2004	0 ~ 7FFF refers to 0% ~ 100%

(10) Inverter fault code description:

Inverter Fault Address	Inverter Fault Information
8000	0000：No fault 0001：Reserved 0002：Over current in ACC process 0003：Over current in DEC process 0004：Over current in constant speed 0005：Over voltage in ACC process 0006：Over voltage in DEC process 0007：Over voltage in constant speed 0008：Buffer resistor overload fault 0009：Under voltage fault 000A：Inverter overload 000B：Motor overload 000C：Input phase failure 000D：Output phase failure 000E：Module overheat 000F：External fault 0010：Communication fault 0011：Contactor fault 0012：Current detection fault 0013：Motor autotuning fault 0014：Encoder/PG card fault 0015：Parameter R/W fault 0016：Inverter hardware fault 0017：Motor short circuit to ground fault 0018：Reserved 0019：Reserved 001A：Running time arrival 001B：Customized fault 1 001C：Customized fault 2 001D：Power on time arrival 001E：Off load 001F：PID feedback lost when running 0028：Fast current limiting over time fault 0029：Switching motor fault when running 002A：Speed deviation oversize 002B：Motor over speed 002D：Motor overtemperature 005A：Encoder line number setting error 005B：Encoder not connected 005C：Initial position error 005E：Speed feedback error

8.6.5 Description data of communication fault information (fault code)

Communication Fault Address	Fault function description
8001	0000：No fault 0001：Password error 0002：Command error 0003：CRC check error 0004：Invalid address 0005：Invalid parameter 0006：Parameter changing invalid 0007：System locked 0008：EEPROM operating

8.7 PD Group Communication Parameter Description

PD-00	Baud Rate	Factory Setting	5005
	Setting range	Units place: MODBUS 0: 300BPS 1: 600BPS 2: 1200BPS 3: 2400BPS 4: 4800BPS 5: 9600BPS 6: 19200BPS 7: 38400BPS 8: 57600BPS 9: 115200BPS Tens place: Profibus-DP 0: 115200BPS 1: 208300BPS 2: 256000BPS 3: 512000BPS Hundreds place: Reserved Thousands place: CANlink baud rate 0: 20 1: 50 2: 100 3: 125 4: 250 5: 500 6: 1M	

This parameter is used to set the data transmission rate between host computer and the inverter. Please note that baud rate of the host computer and inverter must be the same. Otherwise, the communication is impossible. The bigger baud rate is, the faster communication is.

PD-01	Data Format	Factory Setting	0
	Setting range	0: No parity check, data format (8-N-2) 1: Even parity check, data format (8-E-1) 2: Odd parity check, data format (8-O-1) 3: parity check, data format (8-N-1)	

The setting data format of host computer and inverter must be the same; otherwise, the communication is impossible.

PD-02	Local Address	Factory Setting	1
	Setting range	1~247, 0 is broadcast address	

When the local address is set to be 0, that is broadcast address, it can realize the broadcast function of host computer.
Local address must be unique (except broadcast address). This is the base of point-to-point communication between host computer and inverter.

PD-03	Response Delay	Factory Setting	2ms
	Setting range	0~20ms	

Response delay: It refers to the interval time from the inverter finishes receiving data to sending data to the host computer. If the response delay is less than system processing time, then the response delay is based on the system processing time. If the response delay is more than system processing time, after the system processing the data, it should be delayed to wait until the response delay time arrives, then sending data to host computer.

PD-04	Communication Timeout	Factory Setting	0.0s
	Setting range	0.0s (invalid) 0.1~60.0s	

When the function code set to be 0.0 s, the communication timeout parameter is invalid.
When the function code set to be valid value, if the interval time between the communication and the next communication is beyond the communication timeout, the system will report communication failure error (Err16). At normal circumstances, it is set to be invalid. If in the continuous communication system, set the parameter, you can monitor the communication status.

PD-05	Communication Protocol selection	Factory Setting	31
	Setting range	Units place: MODBUS 0: Non-standard MODBUS protocol 1: Standard MODBUS protocol Tens place: Profibus-DP 0: PPO1 format 1: PPO2 format 2: PPO3 format 3: PPO5 format	

PD-05=1: Select standard MODBUS protocol
PD-05=0: When reading the command, the slave return is one byte than the standard MODBUS protocol's, for details refer to communications Data Structure of this protocol.

PD-06	Communication Read Current Resolution	Factory Setting	0
	Setting range	0：0.01A 1：0.1A	

It is used to confirm the output current unit when communication reads output current.

Appendix: Quick Guide to Frequency Converter Applications

1	External start stop settings	P0-02=1 Terminal wiring：DI1 + COM
2	Speed regulation setting of external potentiometer	P0-03=2 Terminal wiring：+10V, AI1, GND, (P0-03=4 panel potentiometer)
3	Upper limit frequency setting	P0-10 and P0-12 Hz are consistent and increased
4	Terminal forward and reverse control	P0-02=1 P4-01=02 COM+DI1: Foreward COM+DI2: Reverse
5	Restore factory setting	PP-01=001
6	Carrier frequency	P0-15
7	Three wire mode 1	P0-02=1, P4-00=01, P4-01=02, P4-02=03, P4-11=2 Terminal wiring：COM+DI1: Foreward COM+DI2: Reverse COM+DI3: Stop
8	Braking resistor wiring	Braking resistor connected to P+ and PB Brake unit connected to P+and P-
9	Switching between current signal and voltage signal dialing	AI1 dial code: 2+3 is the voltage signal, 1+2 is the current signal AI2 dial code: 2+3 is the voltage signal, 1+2 is the current signal AO1 dial code: 2+3 is the voltage signal, 1+2 is the current signal JP1 dial code: 2+3 for 485 communication on the matching resistor does not access 1+2 for the resistor matching on 485 communication to be connected
10	Two way relay settings	TA1-TC1, fault signaling：P5-02=02 TA2-TC2, running signaling：P5-03=01
11	ACC and DEC time setting	Acceleration time P0-17 Deceleration time P0-18
12	Free shutdown setting	P6-10=1
13	Inverter G/P setting	P0-00=2 (P-type machine)
14	Multi segment speed setting	P0-03=6 Set terminal multi speed function for P4 Set the corresponding frequency size for PC
15	PID simple control settings	P0-03=8 PA-01=50%
16	Terminal UP controls frequency rise and fall	P0-03=1 P4-01=6 P4-02=7 DI1+COM: Frequency plus DI3+COM: Frequency reduction
17	Panel forward and reverse settings	P7-01=2 ″REV" for forward and reverse rotation switching button
18	Running display parameters P7-03	0001 Running frequency 4001 Running frequency Load speed 0002 Setting frequency 4002 Setting frequency Load speed 0008 Output voltage 4010 Load speed Output current 4000 Load speed 0011 Running frequency Output current 0010 Output current 401F Running frequency Setting frequency Bus voltage Output voltage Output current Load speed Note: Running display load speed: P7-03=4000, P7-06=motor speed+500 Note: P7-03 is adjusted to 40IF above all parameters can be displayed

19	Permanent magnet self-learning	Permanent magnet synchronous motor self-learning: P0-02=0 Panel launch P0-01=0 Vector control method P0-10=0 According to the motor nameplate (motor rated frequency) P0-12=0 According to the motor nameplate (motor rated frequency) P1-00=2 Permanent magnet synchronous motor P1-01 According to the motor nameplate (motor rated power) P1-02 According to the motor nameplate (motor rated voltage) P1-03 According to the motor nameplate (motor rated current) P1-04 According to the motor nameplate (motor rated frequency) P1-05 According to the motor nameplate (motor rated speed) P1-37=12 (Permanent magnet synchronous complete coordination) When P1-37=12 is input, press "ENTER" to confirm, the indicator "ALM" will start flashing and the panel will pop up the English letter "FUNE". Then press "RUN" to run (the start mode must be panel start "RUN" to be effective), and the inverter starts to learn itself. Self-learning time is about 30 seconds.
20	Multi segment speed priority	P0-03=6, PC-51=3 The default is panel potentiometer speed control, potentiometer for multi-speed 0-segment.
21	Current overrun relay output	P5-02=36, P8-36=Set output ÷ Motor rated current (P1-03)
22	Switching between analog quantities of 0-20mA and 4-20mA	Input analog quantity A11: P4-13=02-00 Input analog quantity A12: P4-18=02-00 Input analog quantity A01: P5-10=020.0

Warranty Agreement

1. Warranty scope refers to the inverter body.

2. The inverter has a twelve-month factory warranty (twelve months for items sent internationally). If a breakdown or damage happens during the warranty term and it happens during regular usage, the company will repair it for free.

3. If any of the following failure occurrences take place while the device is still under warranty, the warranty will not apply, and a specified maintenance cost will be assessed:
   a) Failure caused by not strictly in accordance with the "User's Manual" or beyond the standard specification requirements for use.
   b) Damage caused by falling or brutal handling after purchase.
   c) Aging or failure of the device caused by use in an environment that does not meet the requirements of this instruction manual.
   d) Failure caused by self-repair or modification without permission.
   e) Failure caused by improper storage.
   f) Failure caused by using the inverter for other than normal functions.
   g) Failure caused by fire, salt corrosion, gas corrosion, earthquake, storm, flood, lightning, voltage abnormality and metal dust pollution or other natural disasters or causes associated with disasters.
   h) Unauthorized tearing of product identification (such as nameplate, etc.).

4. The service charge is determined using the actual cost. The other contract will take precedence if there is one.

5. Please save this card and provide it to the maintenance unit while the warranty is in effect as the warranty for this product is based on the warranty card and the purchase invoice.

6. You can get in touch with the agent or our company directly if you have any queries.

After the warranty expires, the company will provide lifelong maintenance services at a cost.