

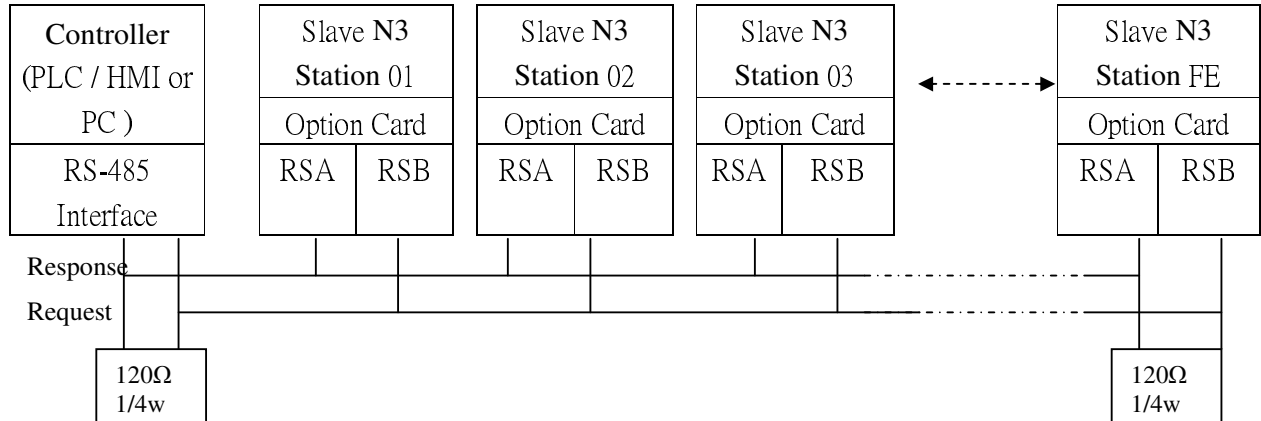
N3 Modbus protocol

1. Communication Data Frame

N3 series inverter can be communication controlled by the PC or other controller with the communication protocol, Modbus ASCII Mode & Mode RTU, RS485 or RS232.

Frame length maximum 80 bytes

1.1 Hardware installation



** The network is terminated at each end with an external terminating resistor (120 ohm, 1/4 watt).

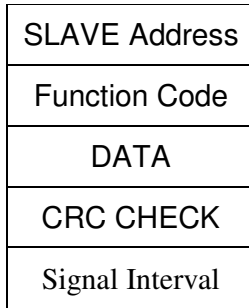
1.2 Data format frame FOR ASCII MODE

STX (3AH)	Start Bit = 3AH
Address Hi	Communication Address(Station):
Address Lo	
Function Hi	Function Code (command):
Function Lo	
Command Start Address	Command Start byte:
Command Start Address	
Command Start Address	
Command Start Address	
Data length	The length of the command:
Data length	
Data length	
Data length	
LRC Check Hi	LRC Check Code:
LRC Check Lo	
END Hi	End Byte : END Hi=CR (0DH) , END Li = LF (0AH)
END Lo	

Data format frame FOR RTU MODE

MASTER (PLC etc.) send request to SLAVE, whereas SLAVE response to MASTER. The signal receiving is illustrated here.

The data length is varied with the command (Function).



** The interval should be maintained at 10ms between command signal and request

1. 3 SLAVE Address

- 00H : Broadcast to all the drivers
- 01H : to the No. 01 Driver
- 0FH : to the No.15 Driver
- 10H : to the No.16 Driver
- and so on...., Max to No. 254(FEH)

1. 4 Function Code

- 03H : Read the register contents
- 06H : Write a WORD to register
- 08H : Loop test
- 10H : Write several data to register (complex number register write)

2.CMS (Checksum and time-out definition)

2.1 LRC

```

ex. ADDRESS      01H
    FUNCTION      03H
    COMMAND       01H
                00H
    DATA LENGTH  0AH
-----
                0FH----- true complement
Checksum =      F1H
CS(H)    =      46H (ASCII)
    
```

CS(L) = 31H (ASCII)

2.2 CRC CHECK :

CRC check code is from Slave Address to end of the data. The calculation method is illustrated as follow:

- (1) Load a 16-bit register with FFFF hex (all's 1). Call this the CRC register.
- (2) Exclusive OR the first 8-bit byte of the message with the low-order byte of the 16-bit CRC register, putting the result in the CRC register.
- (3) Shift the CRC register one bit to the right (toward the LSB), Zero-filling the MSB, Extract and examines the LSB.
- (4) (If the LSB was 0): Repeat Steps (3)(another shift).(If the LSB was 1): Exclusive OR the CRC register with the polynomial value A001 hex (1010 0000 0000 0001).
- (5) Repeat Steps (3) and (4) until 8 shifts been performed. When this is done, a complete 8-bit byte will be processed.
- (6) Repeat Steps (2) through (5) for next 8-bit byte of the message, Continue doing this until all bytes have been processed. The final content of the CRC register is the CRC value. Placing the CRC into the message: When the 16-bit CRC (2 8-bit bytes) is transmitted in the message, the low-order byte will be transmitted first, followed by the high-order byte, For example, if the CRC value is 1241 hex, the CRC-16 Upper put the 41h, the CRC-16 Lower put the 12h

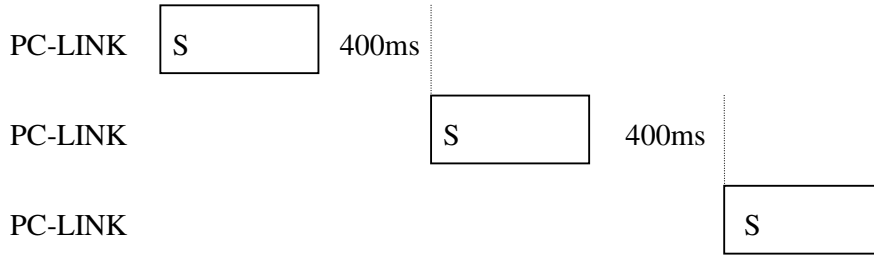
● **CRC calculation application program**

```

UWORD ch_sum ( UBYTE long , UBYTE *rxdbuf ) {
    BYTE i = 0;
    UWORD wkg = 0xFFFF;
    while ( long-- ) {
        wkg ^= rxdbuf++;
        for ( i = 0 ; i < 8; i++ ) {
            if ( wkg & 0x0001 ) {
                wkg = ( wkg >> 1 ) ^ 0xa001;
            }
            else {
                wkg = wkg >> 1;
            }
        }
    }
    return( wkg );
}

```

2.3 TIME-OUT (400ms) & RETRY (max. : 2 times)



(When INV(PLC) time-out or detect checksum error, or INV(PLC) response error code = checksum error, PC-LINK retry maximum two times, and if two times after still error, then display “ERR6”)

3.Error code

ASCII Mode

STX	' : '
Address	' 0 '
	' 1 '
Function	' 8 '
	' 6 '
Exception code	' 5 '
	' 1 '
LRC Check	' 2 '
	' 8 '
END	' CR '
	' LF '

RTU Mode

SLAVE Address	02H	
Function	83H	
Exception code	52H	
CRC-16	High	C0H
	Low	CDH

Under communication linking, the driver responses the Exception Code and send Function Code AND 80H to main system if there is error happened.

Error Code	Description
51	Function Code Error
52	Address Error
53	Data Amount Error
54	Data Over Range
55	Writing Mode Error

4 Inverter Control

4.1 Command Data (Readable and Writable)

Register No.	Content			
101H	Operation Signal			
	Bit	Description	1	0
	0	Operation Command	Run	Stop
	1	Reverse Command	Reverse	Forward
	2	External Fault	Fault (EFO)	
	3	Fault Reset	Reset	
	4	Jog Command	Jog	
	5	Multi-function Command S1	ON	OFF
	6	Multi-function Command S2	ON	OFF
	7	Multi-function Command S3	ON	OFF
	8	Multi-function Command S4	ON	OFF
	9	Multi-function Command S5	ON	OFF
	A	Multi-function Command S6	ON	OFF
	B	Multi-function Command AIN	ON	OFF
	C	Multi-function Command RY1	ON	OFF
	D	Multi-function Command RY2	ON	OFF
	E	(Not used)		
F	(Not used)			
102H	Frequency Command			
103H~11FH	(Reserved)			

Note: Write in zero for Not used BIT, do not write in data for the reserved register.

4.2 Monitor Data (Only for reading)

Register No.	Content																																																																															
120H	<table border="1"> <thead> <tr> <th>Bit</th> <th>Description</th> <th>1</th> <th>0</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Operation state</td> <td>Run</td> <td>Stop</td> </tr> <tr> <td>1</td> <td>Direction state</td> <td>Reverse</td> <td>Forward</td> </tr> <tr> <td>2</td> <td>Inverter operation prepare state</td> <td>ready</td> <td>unready</td> </tr> <tr> <td>3</td> <td>Abnormal</td> <td>Abnormal</td> <td></td> </tr> <tr> <td>4</td> <td>DATA setting error</td> <td>Error</td> <td></td> </tr> <tr> <td>5-F</td> <td>(unused)</td> <td></td> <td></td> </tr> </tbody> </table>				Bit	Description	1	0	0	Operation state	Run	Stop	1	Direction state	Reverse	Forward	2	Inverter operation prepare state	ready	unready	3	Abnormal	Abnormal		4	DATA setting error	Error		5-F	(unused)																																																		
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	42	Parameter setting error (Err2)	43	Modifying the parameter in communication(Err5)
	44	Communication failure (Err6)	45	Parameter setting error (Err7)

Register No.	Content																																																		
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0123H	Frequency command(V1)																																																		
0124H	Output frequency(V2)																																																		
0125H	Output voltage command (1/1V)																																																		
0126H	Output DC voltage command (1/1V)																																																		
0127H	Output current (10/1A)(V6)																																																		
0128H	Reserved																																																		
0129H	Output torque(V7)																																																		
012AH	PID Feedback value (100% / Max output frequency, 10/1%)																																																		
012BH	PID input value (100% / Max output frequency, 10/1% , sign attached)																																																		
012CH	TM2 AIN input value (1024 / 10V) *1(V3)																																																		
012DH	TM2 S6 input value (1024 / 10V) *1(V4)																																																		
012EH	KEYPAD VR input value (1024 / 10V) *1(V5)																																																		

Note: Do not write in data for the reserved register

4.3 Read the data in the holding register [03H]

Master unit reads the contents of the holding registers with the continuous numbers for the specified quantity.

(Example) Read the SLAVE station No: 01, N3 drive's frequency command.

ASCII Mode

Instruction Message		Response Message (Normal)		Response Message (Fault)		
3AH	STX	3AH	STX	3AH	STX	
30H	SLAVE Address	30H	SLAVE Address	30H	SLAVE Address	
31H		31H		32H		
30H	Function Code	30H	Function Code	38H	Function Code	
33H		33H		33H		
30H	Start Address	30H	DATA number	35H	Error Code	
31H		32H		32H		
32H		First holding register	31H	LRC CHECK	0DH	END
33H			37H		0AH	
30H	Quantity	37H	END			
30H		30H				
30H		?				
31H		?				
?	LRC CHECK	0DH				
?		0AH				
0DH	END					
0AH						

RTU Mode

Instruction Message			Response Message (Normal)			Response Message (Fault)		
SLAVE Address	01 H		SLAVE Address	01H		SLAVE Address	02H	
Function Code	03H		Function Code	03H		Function Code	83H	
Start Address	High	01H	DATA number	02H		Error Code	52H	
	Low	23H	First holding register	High	17H	CRC-16	High	C0H
Quantity	High	00H		Low	70H		Low	CDH
	CRC-16	High	74H	CRC-16	High	AFH		
Low		3CH	Low		82H			

4.4 Loop back testing [08H]

The function code is check communication between MASTER and SLAVE, the Instruction message is returned as a response message without being change, Any values can be used for test codes or data

ASCII Mode

Instruction Message		Response Message (Normal)		Response Message (Fault)	
3AH	STX	3AH	STX	3AH	STX
30H	SLAVE Address	30H	SLAVE Address	30H	SLAVE Address
31H		31H		31H	
30H	Function Code	30H	Function Code	38H	Function Code
38H		38H		38H	
30H	Test Codes	30H	Test Codes	32H	Error Code
30H		30H		30H	
30H		30H		?	LRC CHECK
30H		30H		?	
41H	DATA	41H	DATA	0DH	END
35H		35H		0AH	
33H		33H			
37H		37H			
?	LRC CHECK	?	LRC CHECK		
?		?			
0DH	END	0DH	END		
0AH		0AH			

RTU Mode

Instruction Message			Response Message (Normal)			Response Message (Fault)		
SLAVE Address	01 H		SLAVE Address	01H		SLAVE Address	01H	
Function Code	08H		Function Code	08H		Function Code	88H	
Test Codes	High	00H	Test Codes	High	00H	Error Code	20H	
	Low	00H		Low	00H	CRC-16	High	47H
DATA	High	A5H	DATA	High	A5H		Low	D8H
	Low	37H		Low	37H			
CRC-16	High	DAH	CRC-16	High	DAH			
	Low	8DH		Low	8DH			

4.5 Write holding register [06H]

The specified data are written into the specified holding register.

(Example) Set SLAVE station No: 01, N3 drive's frequency command is 60.0Hz.

ASCII Mode

Instruction Message		Response Message (Normal)		Response Message (Fault)	
3AH	STX	3AH	STX	3AH	STX
30H	SLAVE	30H	SLAVE	30H	SLAVE
31H	Address	31H	Address	31H	Address
30H	Function	30H	Function	38H	Function
36H	Code	36H	Code	36H	Code
30H	Start Address	30H	Start Address	35H	Error Code
31H					
30H					
32H					
31H	DATA	31H	DATA	0DH	END
37H					
37H					
30H					
?	LRC CHECK	?	LRC CHECK	?	LRC CHECK
?					
0DH	END	0DH	END	0AH	END
0AH					

RTU Mode

Instruction Message			Response Message (Normal)			Response Message (Fault)		
SLAVE Address	01 H		SLAVE Address	01H		SLAVE Address	01H	
Function Code	06H		Function Code	06H		Function Code	86H	
Start Address	High	01H	Start Address	High	01H	Error Code	52H	
	Low	02H		Low	02H	CRC-16	High	C3H
DATA	High	17H	DATA	High	17H		Low	9DH
	Low	70H		Low	70H			
CRC-16	High	27H	CRC-16	High	27H			
	Low	E2H		Low	E2H			

4.6 Write in several holding registers [10H]

Specified data are written into the several specified holding registers from the specified number, respectively.

(Example) Set SLAVE station No: 01, N3 drive as forward run at frequency reference 60.0Hz

ASCII Mode

Instruction Message		Response Message (Normal)		Response Message (Fault)	
3AH	STX	3AH	STX	3AH	STX
30H	SLAVE Address	30H	SLAVE Address	30H	SLAVE Address
31H		31H		31H	
31H	Function Code	31H	Function Code	39H	Function Code
30H		30H		30H	
30H	Start Address	30H	Start Address	35H	Error Code
31H		31H		32H	
30H		30H		?	LRC CHECK
31H		31H		?	
30H	Quantity	30H	Quantity	0DH	END
30H		30H		0AH	
30H		30H			
32H		32H			
30H	DATA Number*	?	LRC CHECK		
34H		?			
30H	First DATA	0DH	END		
30H		0AH			
30H					
31H					
31H	Next DATA				
37H					
37H					
30H					
?	LRC CHECK				
?					
0DH	END				
0AH					

* Data numbers are the actual number times 2

RTU Mode

Instruction Message

SLAVE Address	01 H	
Function Code	10H	
Start Address	High	01H
	Low	01H
Quantity	High	00H
	Low	02H
DATA Number *	04H	
First DATA	High	00H
	Low	01H
Next DATA	High	17H
	Low	70H
CRC-16	High	60H
	Low	27H

Response Message (Normal)

SLAVE Address	01H	
Function Code	10H	
Start Address	High	01H
	Low	01H
Quantity	High	00H
	Low	02H
CRC-16 Low	High	11H
	Low	F4H

Response Message (Fault)

SLAVE Address	01H	
Function Code	90H	
Error Code	52H	
CRC-16	High	CDH
	Low	FDH

* Data numbers are the actual number times 2

Comparison list between parameter and register

Register No.	Function	Register No.	Function
0000H	A000	0023H	A030
0001H	A001	0024H	A031
0002H	A002	0025H	A032
0003H	A003	0026H	A033
0004H	A004	0027H	A034
0005H	A005	0028H	A035
0006H	A006	0029H	A039
0007H	A007	002AH	A040
0008H	B012	002BH	A041
0009H	B000	002CH	A042
000AH	B001	002DH	A043
000BH	B002	002EH	A044
000CH	A010	002FH	B013
000DH	A012	0030H	B014
000EH	B003	0031H	B015
000FH	B004	0032H	~
0010H	A011	0033H	A046
0011H	A013	0034H	A045
0012H	A014	0035H	A050
0013H	A019	0036H	A051
0014H	A018	0037H	A052
0015H	A015	0038H	A053
0016H	A016	0039H	A054
0017H	A020	003AH	A055
0018H	B005	003BH	A056
0019H	B006	003CH	A058
001AH	B007	003DH	A057
001BH	B008	003EH	A061
001CH	A023	003FH	A059
001DH	A024	0040H	A062
001EH	A025	0041H	A063
001FH	A026	0042H	A064
0020H	A027	0043H	A065
0021H	A028	0044H	A066
0022H	A029	0045H	A067

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Register No.	Function	Register No.	Function
0046H	A068	0069H	A134
0047H	A092	006AH	A135
0048H	A093	006BH	A136
0049H	A094	006CH	A137
004AH	A095	006DH	A140
004BH	A096	006EH	A141
004CH	A097	006FH	A142
004DH	A103	0070H	A143
004EH	A104	0071H	A144
004FH	A105	0072H	A145
0050H	A106	0073H	A146
0051H	A107	0074H	A147
0052H	A108	0075H	A148
0053H	A111	0076H	A149
0054H	A112	0077H	A150
0055H	A113	0078H	A151
0056H	A114	0079H	A152
0057H	A115	007AH	A153
0058H	A116	007BH	A154
0059H	A117	007CH	A163
005AH	A118	007DH	A164
005BH	A119	007EH	A165
005CH	A120	007FH	A166
005DH	A121	0080H	A167
005EH	A122	0081H	A168
005FH	A123	0082H	A169
0060H	A124	0083H	A170
0061H	A125	0084H	A171
0062H	A126	0085H	A172
0063H	B009	0086H	A175
0064H	A129	0087H	A176
0065H	A130	0088H	A177(1)
0066H	A131	0089H	A177(2)
0067H	A132	008AH	A177(3)
0068H	A133	008BH	A178

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Register No.	Function	Register No.	Function
008CH	A179	00AFH	A086
008DH	A180	00B0H	A087
008EH	A181	00B1H	A088
008FH	~	00B2H	B010
0090H	A158	00B3H	A157
0091H	A159	00B4H	~
0092H	A160	00B5H	~
0093H	~	00B6H	~
0094H	~	00B7H	~
0095H	~	00B8H	~
0096H	~	00B9H	B011
0097H	A060	00BAH	~
0098H	~	00BBH	~
0099H	A017	00BCH	~
009AH	~	00BDH	~
009BH	A155	00BEH	~
009CH	A156	00BFH	~
009DH	B016	00C0H	~
009EH	A098	00C1H	~
009FH	A099	00C2H	~
00A0H	A071	00C3H	~
00A1H	A072	00C4H	~
00A2H	A073	00C5H	A127
00A3H	A074	00C6H	A128
00A4H	A075	00C7H	~
00A5H	A076	00C8H	~
00A6H	A077	00C9H	~
00A7H	A078	00CAH	~
00A8H	A091	00CBH	~
00A9H	~	00CCH	~
00AAH	A081	00CDH	~
00ABH	A082	00CEH	~
00ACH	A083	00CFH	~
00ADH	A084	00D0H	~
00AEH	A085	00D1H	~

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Register No.	Function	Register No.	Function
00D2H	~	00F7H	~
00D3H	~	00F8H	~
00D4H	~	00F9H	~
00D5H	~	00FAH	~
00D6H	~	00FBH	~
00D7H	~	00FCH	~
00D8H	~	00FDH	~
00D9H	~	00FEH	~
00DAH	~	00FFH	~
00DBH	~	~	~
00DCH	~		
00DDH	~		
00DEH	~		
00DFH	~		
00E0H	~		
00E1H	~		
00E2H	~		
00E3H	~		
00E4H	~		
00E5H	~		
00E6H	~		
00E7H	~		
00E8H	~		
00E9H	~		
00EAH	~		
00EBH	~		
00ECH	~		
00EDH	~		
00EEH	~		
00EFH	~		
00F0H	~		
00F1H	~		
00F2H	~		
00F3H	~		
00F4H	~		
00F5H	~		
00F6H	~		

