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Technical Support Document for Inverter

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N100^{plus} Inverter RS485 Interface Instruction Manual

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1. RS485 Communication function

1.1 Communication function

Communication circuit for RS485 is built in N100 Inverter.

It is possible to control 1~32 Inverters (Slave) from a main control device (Master) by using RS485 serial communication is supported.

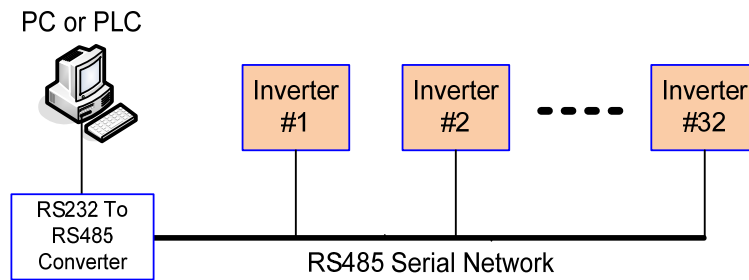


Fig. 1 RS485 Serial network

1.1.1 Interface Cable Pin Arrangement

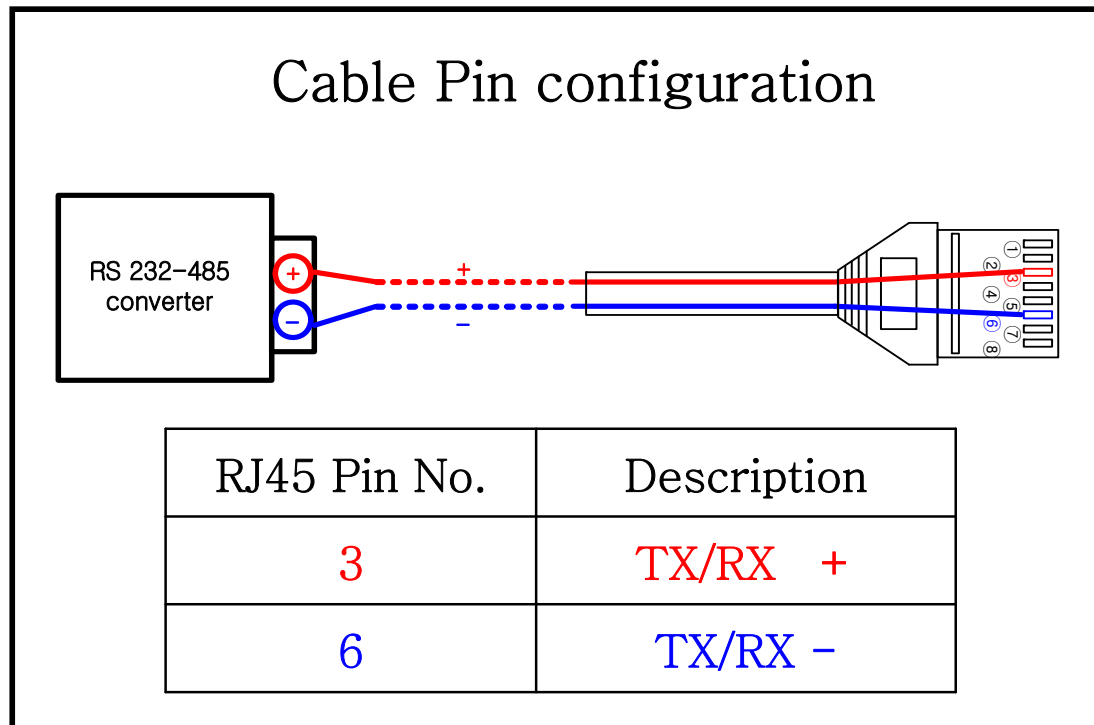


Fig. 2 Cable Pin configuration

1.1.2 Interface Cable Pin Arrangement

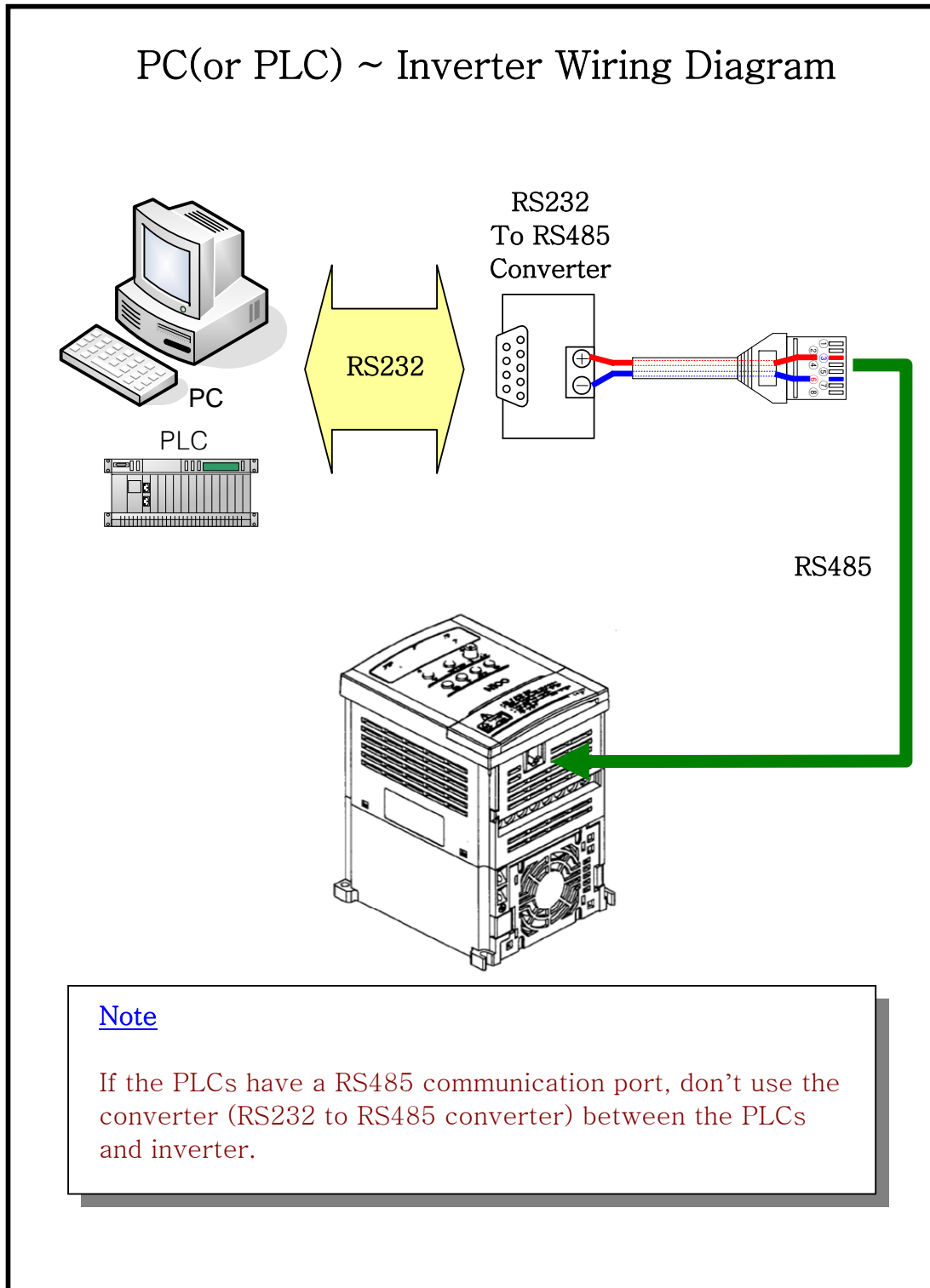


Fig. 3 PC(or PLC) ~ Inverter Wiring Diagram

1.1.3 RS485 Communication specification

Item	Specification	Notes
Communication interface	RS485	
Communication methods	Half duplex communication methods	
Transmission speed (Baud Rate)	9600[BPS]	
Start methods	Response for the external read, write command	The inverter operates only as slave.
Transmission code	Binary code	
Data bit	8[bit]	
Parity	No parity/even/odd	
Stop bit	1[bit]	
Connect form	1:N (N=Maximum 32)	
Main function	Fleming/CRC/CMD/MAXREQ/Parameter	

Table 1 RS485 Communication specification

1.1.4 RS485 Communication setting in Inverter

The following setting are required to operate RS485 communication

Function code	Set item	Initial data	Data	Description
b17	Communication Number	1	1	Inverter Address No. 1 (Address : 1 ~ 32)
A01	Frequency commanding (Multi-speed commanding method)	0	3	0 : Keypad potentiometer 1 : Control terminal input 2 : Standard operator 3 : Remote operator (Communication)
A02	RUN commanding	0	2	0 : Standard operator 1 : Control terminal input 2 : Remote operator (Communication)

Table 2 RS485 Communication setting

1.1.5 Communication order

The flow of the communication protocol between an external control device and an inverter is shown below in the time diagram.

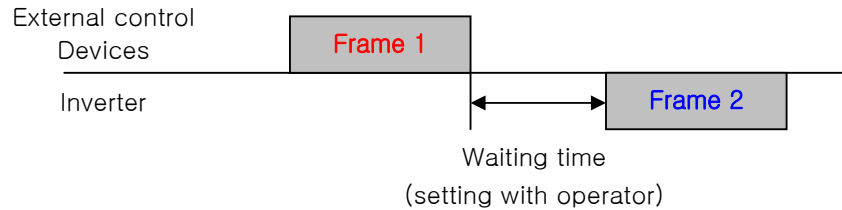


Fig. 4 Communication order

Frame start : Frame start is recognized by signal line data transmitted.

Frame completion: Frame completion is recognized by no data during correspond 4, 5-character time.

Frame 1: Transmit from external controller to inverter.

Frame 2: Indication reflects from inverter to external controller.

Frame 2 in inverter displays as the signal that inverter receiving Frame 1 and recognizes a suitable frame and responds, and don't output actively.

1.2 Communication protocol

ModBus protocol that applies Query-Response Cycle method is used in the communication.

The communication network is controlled by the master equipment, and it is operated by the method that the slave equipment reply from the transmission request of the master equipment. ModBUS communication frame type and form is as follows.

1.2.1 Inverter read frame

It requires 1~8 parameters of Inverter.

(1) External controller transmit frame

Communication number	Command	parameter	Parameter count	CRC Hi	CRC Lo
----------------------	---------	-----------	-----------------	--------	--------

Clause	Description	Data size	Specifications
Communication number	Inverter communication number	1 byte	1~32
Command	Frame type	1 byte	0x03
Parameter	Parameter	2 byte	1st byte : Group 2nd byte : index (Note1)
Parameter number	Request parameter Number	2 byte	1st byte : 0x00 2nd byte : N(0x01~0x08)
CRC Hi	-	1 byte	Higher 8bit of 16 bit CRC
CRC Lo	-	1 byte	Lower 8bit of 16 bit CRC

Table 3 External controller transmit frame

(2) Inverter response frame

Communication number	Order	Byte number	Data1	Data N	CRC Hi	CRC Lo
----------------------	-------	-------------	-------	-------	--------	--------	--------

Clause	Description	Data size	Specifications
Communication number	Inverter communication number	1 byte	1~32
Command	Frame type	1 byte	0x03
Request Byte	Data byte number	1 byte	Request parameter number x 2
Data 1	Parameter 1	2 byte	Parameter value
Data N	Parameter N	2 byte	Nth parameter value
CRC Hi	-	1 byte	Higher 8bit of 16bit CRC
CRC Lo	-	1 byte	Lower 8bit of 16bit CRC

Table 4 Inverter response frame

※ Frame size = 5byte (Communication number + Command + Request Byte + CRC H + CRC L) + Request parameter number x 2byte (Data1 + Data2 + + Data N)

1.2.2 Request frame for setting parameter

Setting 1 parameter and command (note3) of Inverter

(1) External transmit frame

Communication number	Order	Parameter	Data	CRC Hi	CRC Lo
----------------------	-------	-----------	------	--------	--------

Clause	Description	Data size	Specifications
Communication number	Inverter communication number	1 byte	1~32
Order	Frame type	1 byte	0x06
Parameter	Parameter	2 byte	1st byte : Group 2nd byte : index (Note1)
Data	Data	2 byte	Setting value (Note2)
CRC Hi	-	1 byte	Higher 8bit of 16bit CRC
CRC Lo	-	1 byte	Lower 8bit of 16bit CRC

Table 5 External transmit frame

(2) Inverter response frame

Communication number	Order	Parameter	Data	CRC Hi	CRC Lo
----------------------	-------	-----------	------	--------	--------

Clause	Description	Data size	Specifications
Communication number	Inverter communication number	1 byte	1~32
Order	Frame type	1 byte	0x06
Parameter	Parameter	2 byte	1st byte : Group 2nd byte : index (Note1)
Data	Data	2 byte	Setting value is response (note 4)
CRC Hi	-	1 byte	Higher 8bit of 16bit CRC
CRC Lo	-	1 byte	Lower 8bit of 16bit CRC

Table 6 Inverter response frame

(3) Parameter setting [Note 1]

① Basic parameter

1st byte : Each group is setting.

Group	1 st byte	Group	1 st byte
d	0x01	C	0x05
F	0x02	S	0x06
A	0x03	H	0x07
b	0x04	-	-

Table 7 Basic parameters (1st byte)

2nd byte : Parameter number setting

Ex) The case of A60 parameter reading or writing

1st byte : 0x03

2nd byte : 0x3C

② Trip information

Trip information is 4 parameters. (output frequency, output current, DC link voltage at trip occurs)

	Trip information	Previous first trip	Previous second trip	Previous third trip	Trip count
1st byte	0x01	0x01	0x01	0x01	0x01
2nd byte	0x0D	0x11	0x15	0x19	0x1D

Table 8 Trip information List (1st byte, 2nd byte)

③ Trip information items

Trip data	Trip contents	Trip data	Trip contents
1	Over current trip	7	Electric thermal trip
2	Over voltage trip	8	Outside trip
3	Under voltage trip	9	EEROM trouble
4	Arm short trip	10	Communication trouble
5	Reserved	11	USP trip
6	Inverter over heat trip	12	GF trip

Table 9 Trip information items

(4) Data value setting [Note 2]

Data value is transmitted except decimal point.

Ex1) Output frequency

Parameter value	Communication data	Converted hexadecimal value
60.00Hz	6000	1st byte : 0x17 2nd byte : 0x70

Ex 2) acceleration/deceleration time

Parameter value	Communication data	Converted hexadecimal value
10.0sec	100	1st byte : 0x00 2nd byte : 0x64

(5) Special parameter [Note 3]

A special parameter is used to operating and commanding a frequency value for the basic parameter.

① Run command Parameter

1st byte : 0x00

2nd byte : 0x02

Setting data

1st byte

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved							

2nd byte

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Reserved					RST	REV	FWD

Data value on RUN command

Byte & Bit Command	1 st Byte								2 nd Byte							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Forward RUN (0x01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Reverse RUN (0x02)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
STOP (0x00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

② Frequency command Parameter

1st byte : 0x00

2nd byte : 0x04

Setting data

Output frequency × 100

Ex) The case of output frequency command is 60 Hz

Data 6000 transmit

1st byte : 0x17

2nd byte : 0x70

(6) Response data in Parameter setting

Note) Response frame when you send a command for setting a parameter

When the data cannot be stored due to the attempt to store data while the unit is running, the setting data will not be stored and the original data will be responded.

(7) 16bit CRC generation

The step of CRC-16 generation is as follows:

- All of 16-bit register is 1. 0xffff
- The exclusive OR of 16-bit register and 8-bit register.
- Shift right side 1bit a 16-bit register
- If the result of step 3 is 1, exclusive OR 16-bit register and 0xa001.
- Execute 8 times step 3 and step 4.
- Execute step 2~6 until data completion
- Exchange the step 6 result of higher 8bit and lower 8bit.

Ex) The case of d001 output frequency reading.

Byte1	Byte2	Byte3	Byte4	Byte5	Byte6
Communication number	Command	Parameter		Parameter number	
0x01	0x03	0x01	0x01	0x00	0x01

The sequence of addition Byte(0x01)

<u>16Bit Register</u>		<u>MSB</u>			<u>Flag</u>
(Exclusive OR)	1111	1111	1111	1111	
01	0000	0001			
	1111	1111	1111	1110	
Shift1	0111	1111	1111	1111	
Shift2	0011	1111	1111	1111	1
Polynomial	1010	0000	0000	0001	
	1001	1111	1111	1110	
Shift3	0100	1111	1111	1111	
Shift4	0010	0111	1111	1111	1
Polynomial	1010	0000	0000	0001	
	1000	0111	1111	1110	
Shift5	0100	0011	1111	1111	
Shift6	0010	0001	1111	1111	1
Polynomial	1010	0000	0000	0001	
	1000	0001	1111	1110	
Shift7	0100	0000	1111	1111	
Shift8	0010	0000	0111	1111	1
Polynomial	1010	0000	0000	0001	
	1000	0000	0111	1110	

Byte1~6	CRC of operation results
0x01	0x807e
0x03	0x2140
0x01	0x30e1
0x01	0x8831
0x00	0xd449
0x01	0x36d4

It exchanges higher 8bit of the final result 0x36d4. → 0xd436

Byte7 : CRC higher 8Bit = 0xd4

Byte8 : CRC lower 8Bit = 0x36

2. Example of Transmit/Receive Data frame

2.1 Read Request & Response Data

2.1.1 A prior condition

- (1) Communication number : 1 (Inverter address 1)
- (2) Command : 03 (Read request)
- (3) Parameter count : 1 (Parameter Q'ty)

2.1.2 Example 1 – Output frequency Monitoring (Function code : D01)

(1) Transmit Data

Transmit (8Byte)	Com. Num.	Com-mand	Parameter		Parameter Count		CRC 16	
							Hi	Lo
010301010001D436	01	03	01	01	00	01	D4	36

(2) Response Data (In case of D01 = 0.00Hz)

Response (7Byte)	Com. Num.	Com-mand	Byte Q'ty	Data		CRC 16	
						Hi	Lo
0103020000B844	01	03	02	00	00	B8	44
Data Description	$0 \times 16^3 + 0 \times 16^2 + 0 \times 16^1 + 0 \times 16^0 = 0$ (Communication Data) → divide by 100 → 0.00Hz (Parameter value)						

(3) Response Data (In case of D01 = 60.00Hz)

Response (7Byte)	Com. Num.	Com-mand	Byte Q'ty	Data		CRC 16	
						Hi	Lo
0103021770B650	01	03	02	17	70	B6	50
Data Description	$1 \times 16^3 + 7 \times 16^2 + 7 \times 16^1 + 0 \times 16^0 = 6000$ (Communication Data) → divide by 100 → 60.00Hz (Parameter value)						

2.1.3 Example 2 – Output frequency (Function code : F01)

(1) Transmit Data

Transmit (8Byte)	Com. Num.	Com-mand	Parameter		Parameter Count		CRC 16	
							Hi	Lo
010302010001D472	01	03	02	01	00	01	D4	72

(2) Response Data (In case of F01 = 60.0Hz)

Response (7Byte)	Com. Num.	Com-mand	Byte Q'ty	Data		CRC 16	
						Hi	Lo
0103021770B650	01	03	02	17	70	B6	50
Data Description	$1 \times 16^3 + 7 \times 16^2 + 7 \times 16^1 + 0 \times 16^0 = 6000$ (Communication Data) → divide by 100 → 60.00Hz (Parameter value)						

(3) Response Data (In case of F01 = 50.00Hz)

Response (7Byte)	Com. Num.	Com-mand	Byte Q'ty	Data		CRC 16	
						Hi	Lo
0103021388B512	01	03	02	13	88	B5	12
Data Description	$1 \times 16^3 + 3 \times 16^2 + 8 \times 16^1 + 8 \times 16^0 = 5000$ (Communication Data) → divide by 100 → 50.00Hz (Parameter value)						

2.1.4 Example 3 – Acceleration time (Function code : F02)

(1) Transmit Data

Transmit (8Byte)	Com. Num.	Com-mand	Parameter		Parameter Count		CRC 16	
							Hi	Lo
010302010001D472	01	03	02	02	00	01	24	72

(2) Response Data (In case of F02 = 10.0sec)

Response (7Byte)	Com. Num.	Com-mand	Byte Q'ty	Data		CRC 16	
						Hi	Lo
0103020064B9AF	01	03	02	00	64	B9	AF
Data Description	$0 \times 16^3 + 0 \times 16^2 + 6 \times 16^1 + 4 \times 16^0 = 100$ (Communication Data) → divide by 10 → 10.0sec (Parameter value)						

2.2 Setting Request & Response Data

2.2.1 A prior condition

- (1) Communication number : 01 (Inverter address 1)
- (2) Command : 06 (Setting request)

2.2.2 Output frequency setting (Function code : F01)

Please refer to [Clause 2.3 Frequency command on page 13](#).

2.2.3 Example 4 – Acceleration time 1 setting (F02)

- (1) Transmit Data (In case of 10sec)

Transmit (8Byte)	Com. Num.	Com- mand	Parameter		Data		CRC 16	
							Hi	Lo
0106020200642859	01	06	02	02	00	64	28	59
Data Description	$0 \times 16^3 + 0 \times 16^2 + 6 \times 16^1 + 4 \times 16^0 = 100$ (Communication Data) → divide by 10 → 10.0sec (Parameter value)							

- (2) Response Data

Response (8Byte)	Com. Num.	Com- mand	Parameter		Data		CRC 16	
							Hi	Lo
0106020200642859	01	06	02	02	00	64	28	59

2.2.4 Example 5 – Deceleration time 1 setting (F03)

- (1) Transmit Data (In case of 30sec)

Transmit (8Byte)	Com. Num.	Com- mand	Parameter		Data		CRC 16	
							Hi	Lo
01060203012C783F	01	06	02	03	01	2C	78	3F
Data Description	$0 \times 16^3 + 1 \times 16^2 + 2 \times 16^1 + 12 \times 16^0 = 300$ (Communication Data) → divide by 10 → 30.0sec (Parameter value)							

- (2) Response Data

Response (8Byte)	Com. Num.	Com- mand	Parameter		Data		CRC 16	
							Hi	Lo
01060203012C783F	01	06	02	03	01	2C	78	3F

2.3 Frequency Command

2.3.1 A prior condition

- (1) Communication number : 01 (Inverter address 1)
- (2) Command : 06 (Setting request)
- (3) Parameter : 0004

2.3.2 Example 6 – Frequency Command (In case of 60Hz)

- (1) Transmit Data (In case of 60.00Hz)

Transmit (8Byte)	Com. Num.	Com- mand	Parameter		Data		CRC 16	
							Hi	Lo
010600041770C61F	01	06	00	04	17	70	C6	1F
Data Description	$1 \times 16^3 + 7 \times 16^2 + 7 \times 16^1 + 0 \times 16^0 = 6000$ (Communication Data) → divide by 100 → 60.00Hz (Parameter value)							

- (2) Response Data

Response (8Byte)	Com. Num.	Com- mand	Parameter		Data		CRC 16	
							Hi	Lo
010600041770C61F	01	06	00	04	17	70	C6	1F

2.3.3 Example 7 – Frequency Command (In case of 50Hz)

- (1) Transmit Data (In case of 50.00Hz)

Transmit (8Byte)	Com. Num.	Com- mand	Parameter		Data		CRC 16	
							Hi	Lo
010600041388C55D	01	06	00	04	13	88	C5	5D
Data Description	$1 \times 16^3 + 3 \times 16^2 + 8 \times 16^1 + 8 \times 16^0 = 5000$ (Communication Data) → divide by 100 → 50.00Hz (Parameter value)							

- (2) Response Data

Response (8Byte)	Com. Num.	Com- mand	Parameter		Data		CRC 16	
							Hi	Lo
010600041388C55D	01	06	00	04	13	88	C5	5D

2.4 RUN command parameter

2.4.1 A prior condition

- (1) Communication number : 1 (Inverter address 1)
- (2) Command : 06 (Setting request)
- (3) Parameter : 0002

2.4.2 Example 8 – FWD(Forward) RUN Command

(1) Transmit Data

Transmit (8Byte)	Com. Num.	Com-mand	Parameter		Data		CRC 16	
							Hi	Lo
010600020001E9CA	01	06	00	02	00	01	E9	CA
Data Description	0001 : FWD, 0002 : REV, 0000 : STOP							

(2) Response Data

Response (7Byte)	Com. Num.	Com-mand	Parameter		Data		CRC 16	
							Hi	Lo
010600020001E9CA	01	06	00	02	00	01	E9	CA

2.4.3 Example 9 – REV(Reverse) RUN Command

(1) Transmit Data

Transmit (8Byte)	Com. Num.	Com-mand	Parameter		Data		CRC 16	
							Hi	Lo
010600020002A9CB	01	06	00	02	00	02	A9	CB
Data Description	0001 : FWD, 0002 : REV, 0000 : STOP							

(2) Response Data

Response (7Byte)	Com. Num.	Com-mand	Parameter		Data		CRC 16	
							Hi	Lo
010600020002A9CB	01	06	00	02	00	02	A9	CB

2.4.4 Example 10 – STOP Command

(1) Transmit Data

Transmit (8Byte)	Com. Num.	Com-mand	Parameter		Data		CRC 16	
							Hi	Lo
010600020000280A	01	06	00	02	00	00	28	0A
Data Description	0001 : FWD, 0002 : REV, 0000 : STOP							

(2) Response Data

Response (7Byte)	Com. Num.	Com-mand	Parameter		Data		CRC 16	
							Hi	Lo
010600020000280A	01	06	00	02	00	00	28	0A