

TECO Frequency Inverter
7300PA MODBUS RTU Slave
Communication Interface

APPLICATION MANUAL

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1. Introduction

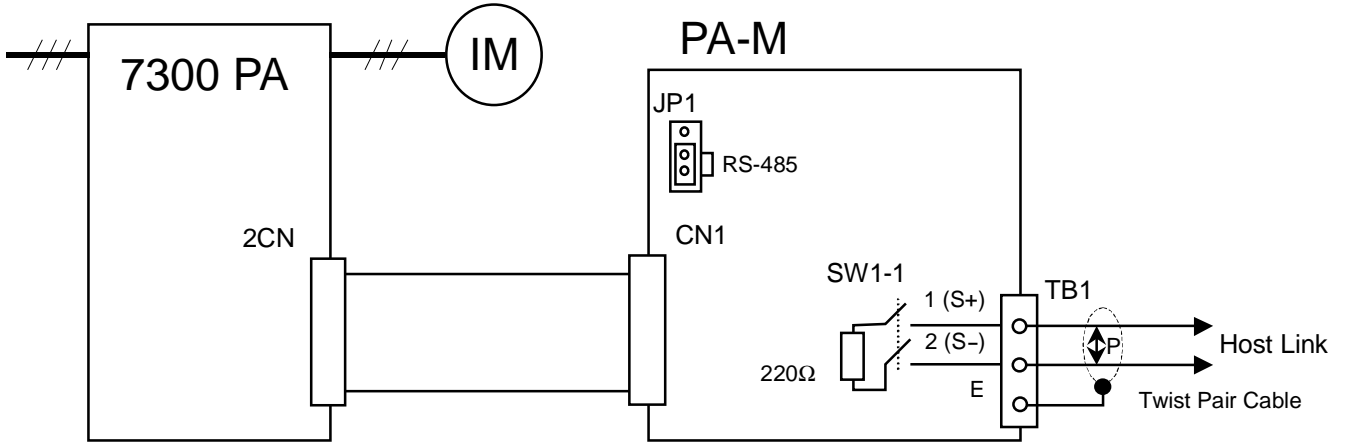
This manual describes feature of PA-M communication card and the communication methods between TECO frequency inverter 7300PA and host controllers (PC, PLC...) using PA-M.

2. Specification

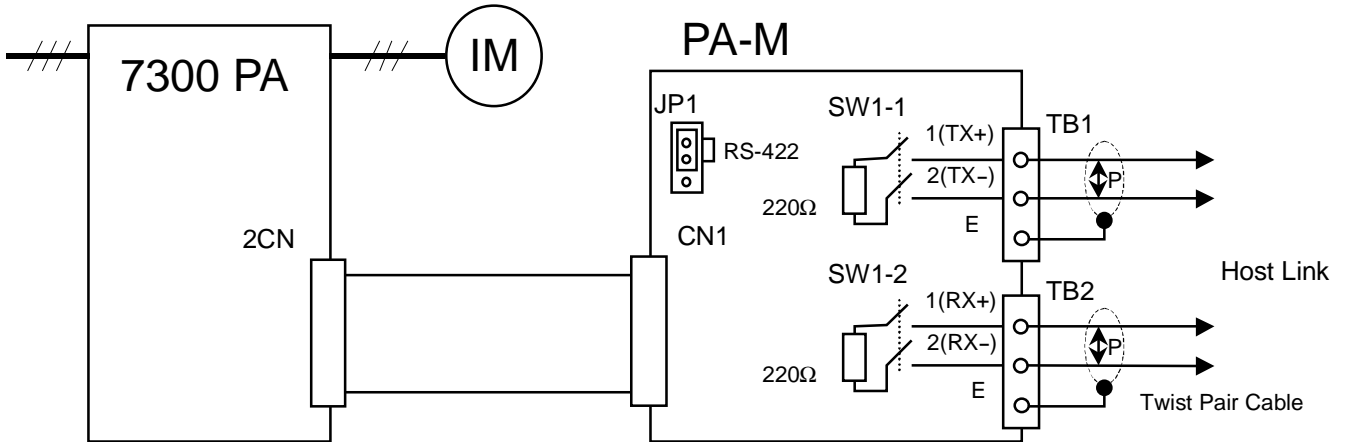
Part No.		4H300D2950006
Transmission	Serial Interface	RS-422/RS-485
	Maximum Connection	32 MODBUS (RTU mode) slave standard
	Baud Rate	2400/4800/9600/19200 (BPS)
	Data Bit	8 Bit
	Parity	No Parity/Odd Parity /Even Parity
	Stop Bit	1 Bit (Odd Parity, Even Parity)/2 Bit (No Parity)
	Distance	(Max.) 100m
	Mode	Half-Duplex
Product Feature	Connection Medium	Shielded Twisted Pair Cable
	RTS Repeater	TTL Level
	Photocoupler Isolation	Common Mode Rejection $V_{CM} = 50V$, $dV/dt = 5000V/\mu\text{sec}$
	Error Check	Cyclic Redundancy Check (CRC)
	Access Data	All Parameters of 7300PA
	Terminal Resistors	Onboard Switch Setting
	Communication Status	2 LED Indication
	Mechanical Size	64mm x 87mm

3. Wiring Diagram

(1) RS-485 interface (Set JP1 to "RS-485")

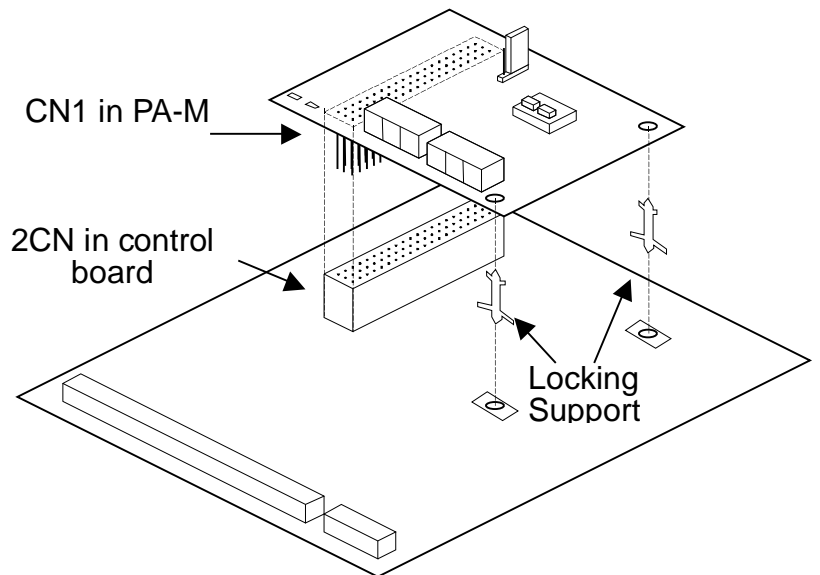


(2) RS-422 interface (Set JP1 to "RS-422")

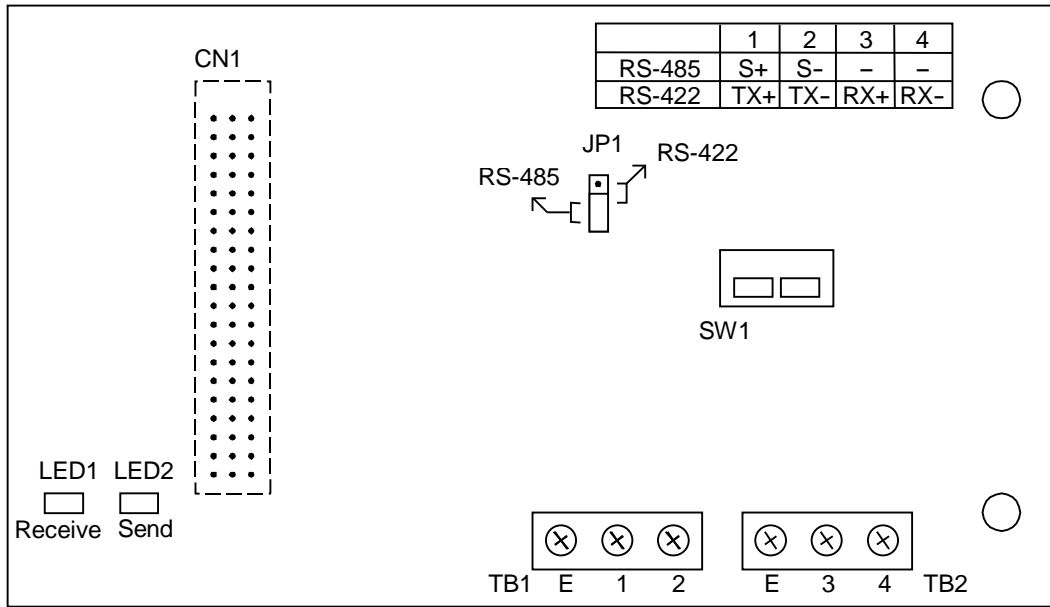


4. Installation

- (1) Turn off the inverter.
- (2) Insert attached 2 locking supports into the 7300PA control board.
- (3) Mount the PA-M communication interface to the control board, with the holes in the right side aligned to the locking supports, and the connector CN1 aligned to 2CN of control board.



5. Description of Terminal, LED, DIP Switch and Jumper



(1) Terminal

Terminal		Function	
		RS-485	RS-422
TB1	1	S+	TX+
	2	S-	TX-
	E	Shield	Shield
TB2	3	—————	RX+
	4	—————	RX-
	E	—————	Shield

(2) LED

LED	Description
Receive	Flash while data are being received from PLC.
Send	Flash while data are being sent from PLC.

(3) DIP Switch (ON : enable terminal resistor, OFF : disable terminal resistor)

DIP Switch	Description	
	RS-485	RS-422
SW1-1	Control terminal resistor between S+ and S-.	Control terminal resistor between TX+ and TX -.
SW1-2	—————	Control terminal resistor between RX+ and RX-.

(4) Jumper

Jumper	Description
RS-422	RS-422 Communication Interface.
RS-485	RS-485 Communication Interface.

6. Related parameters for MODBUS communication

(1) Node address (*1)

Sn-23 = 1~31 Inverter Node Address (Default = 1)

(2) Baud rate (*1)

Sn-24 = 00-- 2400 BPS
 = 01-- 4800 BPS
 = 10-- 9600 BPS
 = 11-- 19200 BPS (Default = 11--)

(3) Parity Check (*1)

Sn-24 = --00 No Parity (Default = --00)
 = --01 Even Parity
 = --10 Odd Parity
 = --11 Reserved

(4) Stopping Method while RS485 Communication Fault/Alarm.

Sn-08 = 00-- Decelerating to stop by Bn-02 (Default = 00--)
 = 01-- Coasting to stop
 = 10-- Decelerating to stop by Bn-04
 = 11-- Continuous operation
 (Can be stopped by STOP Key if Sn-05 = ----0)

(5) Time-out Check

Cn-31 = 00.0 s Don't care
 = 0.1 - 25.5 Checked Error (Default = 01.0 s)

(6) Source of Run/Stop command and Frequency reference

Sn-08 = ---0 Frequency reference is from RS-485.
 = ---1 Frequency reference is from Operator or Terminal.
 = --0- Run/Stop command is from RS-485.
 = --1- Run/Stop command is from Operator or Terminal.
 (Default = --11)

*1 The change will be effective in the next start time after turning off the inverter.

7. Connecting inverter with host controller

(1) Operation procedure

- A. Turn on the inverter, set the related parameters and turn off the inverter.
- B. Turn on the inverter again.
- C. Connect inverter and host controller.
- D. Host controller sends communication message.

(2) Communication status indication of inverter

While Run/Stop command and/or Frequency reference is from RS-485 (Sn-08), and the inverter does not receive any message from host controller after power on 1 seconds, the inverter will display "Call" and flash. This message will disappear while inverter has received messages from host controller.

While Run/Stop command and/or Frequency reference is from RS-485 (Sn-08), the time-out detection is enabled (Cn-31 \neq 0) and the inverter does not receive any message from host controller in time specified by Cn-31, the inverter will display "CPF21".

While Run/Stop command and/or Frequency reference is from RS-485 (Sn-08), the inverter receives any message with incorrect communication format. (Baud rate, parity, data bit and stop bit) the inverter will display "CPF22".

Bit 2, 3 of parameter Sn-08 will decide the display format and operation of "CPF21", "CPF22".

Sn-08 = 00--	Decelerating to stop by Bn-02 (fault "CPF21"/"CPF22" light up)
= 01--	Coasting to stop (fault "CPF21"/"CPF22" light up)
= 10--	Decelerating to stop by Bn-04 (fault "CPF21"/"CPF22" light up)
= 11--	Continuous operation (alarm "CPF21"/"CPF22" flash)

8. Protocol Format

- (1) A message of MODBUS RTU mode contains 4 parts: slave address, function code, data and CRC-16 character. The interval between two messages needs 3.5 characters transferring time.

T1 T2 T3 T4	Slave Address	Function Code	Data Character	CRC-16 Character	T1 T2 T3 T4
-------------	---------------	---------------	----------------	------------------	-------------

T1~T4 : 3.5 Characters transferring time at least

- (2) Following is the data bit format for MODBUS RTU mode. (LSB will be sent first)

	LSB								MSB		
	Bit0	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Bit8	Bit9	Bit10
Even/Odd Parity	Start	1	2	3	4	5	6	7	8	Parity	Stop
No Parity	Start	1	2	3	4	5	6	7	8	Stop	Stop

- (3) Slave Address

Parameter Sn-23 can set the node address of each inverter (1~31). Every slave stand can receive the message sent from host controller. Only the corresponding one returns the message to master.

If the slave address of receiving message is 0, all slave stands will execute this command and do not return the message to master. This message can only use for Register 0001H and 0002H.

- (4) Function Code

Code	Function	Note
03H	Read Data of Holding Register	-----
06H	Write Data to Single Register	the Slave Address can be 0
08H	Loop Test	-----
10H	Write Data to Holding Register	the Slave Address can be 0

- (5) Data Characters

Detail descriptions will be discussed in "Message Format" section (p.9-12) because it depends on the function code.

(6) CRC-16 data

CRC-16 Generation Procedure.

A. Load a 16-bit register with FFFFH. Call this the CRC register.

B. Exclusive OR the first 8-bit byte of the message with the low order byte of the 16-bit CRC registers, putting the result in the CRC register.

C. Shift the CRC register one bit to the right (toward the LSB), zero filling the MSB. Extract and examine the LSB.

D. If LSB is 0, repeat procedure C (another shift).

If LSB is 1, Exclusive OR the CRC register with the polynomial value A001H.

E. Repeat procedure C, D until eight shifts has been performed.

While this is done, a complete byte will have been processed.

F. Repeat procedure B-E to the following byte of the message until all bytes of the message is processed.

Now, the value of CRC register is the CRC-16 data.

G. When the CRC is placed into the message, it upper and lower bytes must be swapped.

(7) Inverter return messages

A. Please refer to the "Message Format" in next page about inverter returning messages for more detail descriptions.

B. It needs 15ms to return messages after inverter had received normal message from host controller.

C. In next two cases, inverter does not return any message :

(a) There is any error detected in received data message (parity error, framing error, overrun error or CRC-16 error).

(b) Slave Address character is different to parameter Sn-23 (Inverter Slave No.).

9. Message Format

7300PA supports 4 MODBUS Function codes only.

Table 1 Message Length

Function	Code	Function	Host Query		Inverter Return	
			Byte (Min.)	Byte (Max.)	Byte (Min.)	Byte (Max.)
Data Read	03H	Read Data from Holding Register	8	8	7	37
Data Write	06H	Write Data to Single Holding Register	8	8	8	8
Loop Test	08H	Loop Test	8	8	8	8
Data Write	10H	Write Data to Holding Register	11	41	8	8

(1) Read Command : Read data of Holding Register

Host Query

Slave Address		01H
Function Code		03H
Head Address (*1)	High Byte	00H
	Low Byte	01H
Access Count (*2)	High Byte	00H
	Low Byte	01H
CRC-16	Low Byte	D5H
	High Byte	CAH

Inverter Return (Normal)

Slave Address		01H
Function Code		03H
Data Byte Count		02H
Data Value	High Byte	00H
	Low Byte	00H
CRC-16	Low Byte	B8H
	High Byte	44H

Inverter Return (Error Detected)

Slave Address		01H
80H + Function Code		83H
Error Code (*3)		03H
CRC-16	Low Byte	01H
	High Byte	31H

*1 Refer to p.13-23 to see the holding register tag list.

*2 Host controller can read 16 registers at most in each transferring message.

*3 Refer to p.24 to see the error code.

(2) Write Command : Write Data to Single Holding Register

Host Query

Slave Address (*1)		01H
Function Code		06H
Address (*2)	High Byte	00H
	Low Byte	01H
Data Value	High Byte	00H
	Low Byte	01H
CRC-16	Low Byte	19H
	High Byte	CAH

Inverter Return (Normal)

Slave Address		01H
Function Code		06H
Address	High Byte	00H
	Low Byte	01H
Data Value	High Byte	00H
	Low Byte	01H
CRC-16	Low Byte	19H
	High Byte	CAH

Inverter Return (Error Detected)

Slave Address		01H
80H + Function Code		86H
Error Code (*3)		01H
CRC-16	Low Byte	83H
	High Byte	A0H

- *1 If slave address is 0 (valid for address 0001H and 0002H only), all slave inverters will execute this command but do not return message to master.
- *2 Refer to p.13-23 to see the holding register tag list.
- *3 Refer to p.24 to see the error code.
- Parameters modified will not be saved to EEPROM Automatically. We can save parameters to EEPROM by writing data 0000H to address 0900H while the inverter is not running.

(3) Loop Test Command (test inverter communication status)

Host Query

Slave Address		01H
Function Code		08H
Test Code	High Byte	00H
	Low Byte	00H
Test Data (*1)	High Byte	AAH
	Low Byte	55H
CRC-16	Low Byte	5EH
	High Byte	94H

Inverter Return (Normal)

Slave Address		01H
Function Code		08H
Test Code	High Byte	00H
	Low Byte	00H
Test Data	High Byte	AAH
	Low Byte	55H
CRC-16	Low Byte	5EH
	High Byte	94H

Inverter Return (Error Detected)

Slave Address		01H
80H + Function Code		88H
Error Code (*2)		01H
CRC-16	Low Byte	87H
	High Byte	C0H

*1 The test data is arbitrary.

*2 Refer to p.24 to see the error code.

(4) Write Holding Register Command (*4)

Host Query

Slave Address (*1)		01H
Function Code		10H
Head address (*2)	High Byte	00H
	Low Byte	01H
Access Count (*3)	High Byte	00H
	Low Byte	01H
Data Byte Count (*4)		02H
Data Value	High Byte	00H
	Low Byte	01H
CRC-16	Low Byte	66H
	High Byte	41H

Inverter Return (Normal)

Slave Address		01H
Function Code		10H
Head address	High Byte	00H
	Low Byte	01H
Access Count (*1)	High Byte	00H
	Low Byte	01H
CRC-16	Low Byte	50H
	High Byte	09H

Inverter Return (Error Detected)

Slave Address		01H
80H+Function Code		90H
Error Code (*5)		03H
CRC-16	Low Byte	0CH
	High Byte	01H

- *1 If the slave address of host query message is 0, all slave inverters will execute this command but do not return message to master.
- *2 Refer to p.13-23 to see the holding register tag list.
- *3 Host controller can write 16 registers at most in each transferring message.
- *4 Data Byte Count = 2 * Access Count.
- *5 Refer to p.24 to see the error code.
- Parameters modified will not be saved to EEPROM Automatically. We can save parameters to EEPROM by writing data 0000H to address 0900H while the inverter is not running.

10. Holding Register Tag List

(1) Control Data Register (Read / Write)

Address		Function Description			Ref. Page
HEX	DEC				
0001H	1	Operation Signals	0	RUN Command	p.14
			1	REV Command	
			2	External Fault	
			3	Fault Reset	
			4	Multifunction Ref 1	
			5	Multifunction Ref 2	
			6	Multifunction Ref 3	
			7	Multifunction Ref 4	
		8-15	Reserved		
0002H	2	Frequency Reference (100/1Hz)			p.15
0003H	3	Reserved			
0004H	4	Reserved			
0005H	5	Reserved			
0006H	6	Reserved			
0007H	7	Reserved			
0008H	8	Reserved			
0009H	9	Multifunction Output Command	0	Relay Output (R2A-R2C) Output	p.15
			1	Digital Output (DO1) Output	
			2	Relay Output (R1A-R1C) Output	
			3-15	Reserved	
000AH	10	Analog Output 1 Command (255/10V)			p.15
000BH	11	Analog Output 2 Command (255/10V)			p.15
000CH	12	Reserved			
000DH	13	Reserved			
000EH	14	Reserved			
000FH	15	Reserved			

*1 Control Data Register can be used for Salve Address '0' write-in message.

Address		Function Description
HEX	DEC	
0001H	1	Operation Signals

BIT	Function Description
2 (*1)	1 : Run (RUN), 0 : Stop (STOP)
2 (*1)	1 : Reverse Run (REV), 0 : Forward Run (FWD)
2 (*2)	External Fault (EB) : Invert output OFF, Fault Output ON
3	Fault Reset (RESET)
4 (*3)	Multifunction Ref. 1 (By Sn-15 setting, Initial setting : multi-step speed ref. 1)
5 (*3)	Multifunction Ref. 2 (By Sn-16 setting, Initial setting : multi-step speed ref. 2)
6 (*3)	Multifunction Ref. 3 (By Sn-17 setting, Initial setting : jogging ref.)
7 (*3)	Multifunction Ref. 4 (By Sn-18 setting, Initial setting : external baseblock)
8-15	Reserved

- *1 This register becomes effective by setting Sn-08 (run mode selection 5) to --0-.
- *2 External baseblock function is OR operation of command from bit 2 (EB) and command by inverter external terminal ③. "Emergency stop" is possible by external terminal ③ even while inverter is running by MODBUS.
- *3 Multifunction Ref. 1-4 are OR operation of command from bit 4-7 and command by inverter external terminals ⑤-⑧.

Address		Function Description
HEX	DEC	
0001H	1	Frequency Reference (100/1Hz)

- This register becomes effective by setting Sn-08 (run mode selection 5) to ---0.

Address		Function Description
HEX	DEC	
0009H	9	Multifunction Output Command

BIT	Function Description
0	1 : R2A-R2C ON, 0 : R2A-R2C OFF
1	1 : DO1 ON, 0 : DO1 OFF
2	1 : R1A-R1C ON, 0 : R1A-R1C OFF
4-15	Reserved

- These bits become effective by setting Sn-20-22 (Sn-20 for bit 0, Sn-21 for bit 1 and Sn-22 for bit 2) to 0F.

Address		Function Description
HEX	DEC	
000AH	10	Analog Output 1 Command (255/10V)
000BH	11	Analog Output 2 Command (255/10V)

- These registers become effective by setting Sn-26-27 (Sn-26 for register 000A, Sn-27 for register 000B) to 10.

(2) Monitor Data Register (Read Only)

Address		Function Description		Ref. Page	
HEX	DEC				
0020H	32	Status Signals	0	Running	p.18
			1	Reverse Running	
			2	Inverter Ready	
			3	Major Fault	
			4	Reserved	
			5	Relay Output (R2A-R2C) Output	
			6	Digital Output (DO1) Output	
			7	Relay Output (R1A-R1C) Output	
		8-15	Reserved		
0021H	33	Fault Contents	0	Overcurrent or Ground Fault (OC, GF)	p.18
			1	Overvoltage (OV)	
			2	Inverter Overload (OL1, OL2)	
			3	Inverter Overheat (OH)	
			4	Reserved	
			5	Reserved	
			6	Reserved	
			7	External Fault (EFxx)	
			8	Control Circuit Fault (CPFxx)	
			9	Motor Overload (OL3)	
			10	Reserved	
			11	Reserved	
			12	Power Loss or MC defective (UVx)	
		13-15	Reserved		
0022H	34	Reserved			
0023H	35	Frequency Reference (100/1Hz)			
0024H	36	Output Frequency (100/1Hz)			
0025H	37	Reserved			
0026H	38	Reserved			
0027H	39	Output Current (10/1A)			
0028H	40	Output Voltage (1/1V)			
0029H	41	Main Speed (VIN+AIN) A/D Converted Value (1023/10V)			
002AH	42	AUX. Speed A/D Converted Value (1023/10V)			
002BH	43	Digital Input Terminal Value	0	1 : Terminal ① is close	
			1	1 : Terminal ② is close	
			2	1 : Terminal ③ is close	
			3	1 : Terminal ④ is close	
			4	1 : Terminal ⑤ is close	
			5	1 : Terminal ⑥ is close	
			6	1 : Terminal ⑦ is close	
			7	1 : Terminal ⑧ is close	

Address		Function Description		Ref. Page	
HEX	DEC				
002CH	44	Inverter Status	0	Running	p.19
			1	During Zero Speed	
			2	During Frequency Coincidence	
			3	Arbitrary Frequency Coincidence	
			4	Frequency Detection 1	
			5	Frequency Detection 2	
			6	Inverter Ready	
			7	Undervoltage Detecting	
			8	Output Baseblock	
			9	Frequency Reference Mode	
			10	Run Command Mode	
			11	Overtorque Detection	
			12	Frequency Reference Missing	
			13	Reserved	
			14	Major Fault	
15	Reserved				
002DH	45	Digital Output Terminal Value	0	1 : R2A-R2C ON	
			1	1 : DO1-DCOM ON	
			2	1 : R1A-R1C ON	
			3-15	Reserved	
002EH	46	Reserved			
002FH	47	Reserved			
0030H	48	Reserved			
0031H	49	Main Circuit DC Voltage (1/1V)			
0032H	50	Reserved			
0033H	51	Reserved			
0034H	52	Reserved			
0035H	53	Reserved			
0036H	54	Reserved			
0037H	55	Reserved			
0038H	56	Reserved			
0039H	57	Reserved			
003AH	58	Reserved			
003BH	59	Reserved			
003CH	60	Reserved			
003DH	61	Reserved			

Address		Function Description
HEX	DEC	
0020H	32	Status Signals

BIT	Function Description
0	1 : Running, 0 : Stop
1	1 : Reverse Run, 0 : Forward Run
2	1 : Inverter Operation Ready (*1)
3	1 : Major Fault (Except CPF00, CPF01)
4	Reserved
5	Multifunction Output 1 (R2A-R2C) (By Sn-20 setting. Default setting : during running)
6	Multifunction Output 2 (DO1-DCOM) (By Sn-21 setting, Default setting : zero speed)
7	Multifunction Output 3 (R1A-R1C) (By Sn-22 setting, Default setting : agreed frequency)
8-15	Reserved

- *1 This bit will be set to 1 when the inverter is in the DRIVE mode and there is no alarm, fault or baseblock.

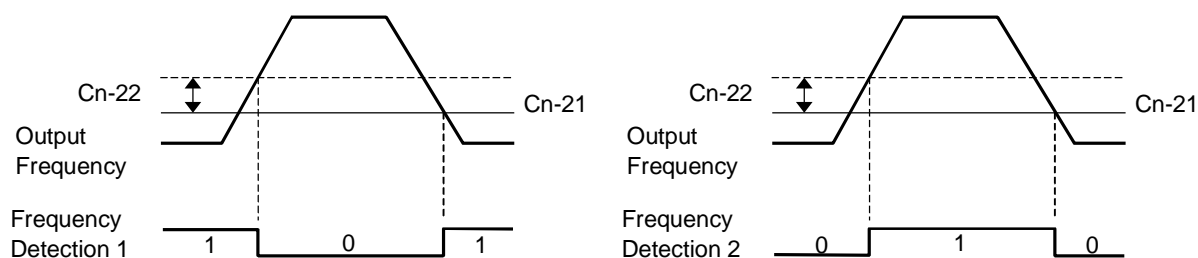
Address		Function Description
HEX	DEC	
0021H	33	Fault Contents

BIT	Function Description
0	Overcurrent (OC) or Ground Fault (GF)
1	Overvoltage (OV)
2	Inverter Overload (OL1, OL2)
3	Inverter Overheat (OH)
4-6	Reserved
7	External Fault (EF3, EF5, EF6, EF7, EF8)
8	Control Circuit Fault (CPF02) EEPROM fault (CPF03) EEPROM BCC CODE Error (CPF04) CPU ADC Fault (CPF05)
9	Motor Overload (OL3)
10-11	Reserved
12	Main circuit low voltage or momentary power loss protection (UV1) Control circuit low voltage (UV2) Main circuit soft charge contactor defective (UV3)
13-15	Reserved

Address		Function Description
HEX	DEC	
002CH	44	Inverter Status

BIT	Function Description
0	1 : Running
1	1 : During Zero Speed
2	1 : During Frequency Coincidence $\left(\text{Freq. Ref} - \frac{\text{Cn-22}}{\text{Cn-22}} \right) \leq \text{Output Freq.} \leq \left(\text{Freq. Ref} + \frac{\text{Cn-22}}{\text{Cn-22}} \right)$
3	1 : Arbitrary Frequency Coincidence Frequency Coincidence and $(\text{Cn-21} - \text{Cn-22}) \leq \text{Output Freq.} \leq (\text{Cn-21} + \text{Cn-22})$
4	1 : Frequency Detection 1 Output Freq. \geq Cn-21 (*1)
5	1 : Frequency Detection 2 Output Freq. \leq Cn-21 (*1)
6	1 : Inverter Operation Ready (*2)
7	1 : Undervoltage Detecting
8	1 : Output Baseblock
9	0 : Frequency Reference is from RS-485. 1 : Frequency Reference is from Operator or terminal.
10	0 : RUN/STOP Command is from RS-485. 1 : RUN/STOP Command is from Operator or terminal.
11	1 : Overtorque Detection (Detection Level : Cn-26, Detection Time : Cn-27)
12	1 : Frequency Reference is Missing
13	Reserved
14	1 : Major Fault (Except CPF00, CPF01)
15	Reserved

*1



*2 This bit will be set to 1 when the inverter is in the DRIVE mode and there is no alarm, fault or baseblock.

(3) Inverter Parameter Register

(An, Bn : Read/Write, Others : Read Only in DRIVE Mode, Read/Write in PRGM Mode)

Address		Parameter			Notes
HEX	DEC	No.	Description	Unit	
System Parameters Sn					
0101H	257	Sn-01	Inverter Capacity Selection	-	
0102H	258	Sn-02	V/f Curve Selection	-	
0103H	259	Sn-03	Operation Status	-	
0104H	260	Sn-04	Operation Mode Select 1	-	
0105H	261	Sn-05	Operation Mode Selection 2	-	
0106H	262	Sn-06	Operation Mode Selection 3	-	
0107H	263	Sn-07	Operation Mode Selection 4	-	
0108H	264	Sn-08	Operation Mode Selection 5	-	
0109H	265	Sn-09	Operation Mode Selection 6	-	
010AH	266	Sn-10	Protective Characteristic Selection 1	-	
010BH	267	Sn-11	Protective Characteristic Selection 2	-	
010CH	268	Sn-12	Protective Characteristic Selection 3	-	
010DH	269	Sn-13	Protective Characteristic Selection 4	-	
010EH	270	Sn-14	Protective Characteristic Selection 5	-	
010FH	271	Sn-15	Terminal ⑤ Function	-	
0110H	272	Sn-16	Terminal ⑥ Function	-	
0111H	273	Sn-17	Terminal ⑦ Function	-	
0112H	274	Sn-18	Terminal ⑧ Function	-	
0113H	275	Sn-19	Terminal AUX Function	-	
0114H	276	Sn-20	Terminal R2A-R2C Function	-	
0115H	277	Sn-21	Terminal D01 Function	-	
0116H	278	Sn-22	Terminal R1A Function	-	
0117H	279	Sn-23	Inverter station address	-	
0118H	280	Sn-24	RS-485 communication protocol setting	-	
0119H	281	Sn-25	LCD Language displayed selection	-	
011AH	282	Sn-26	Multi-Function Analog Output A01 Function Selection	-	
011BH	283	Sn-27	Multi-Function Analog Output A02 Function Selection	-	
011CH	284	-	Reserved	-	
011DH	285	-	Reserved	-	
011EH	286	Sn-30	Pump Operation Mode Selection	-	
011FH	287	Sn-31	PA-PID Card Relay 2 Control	-	
0120H	288	Sn-32	PA-PID Card Relay 3 Control	-	
0121H	289	Sn-33	PA-PID Card Relay 4 Control	-	
0122H	290	Sn-34	PA-PID Card Relay 5 Control	-	
0123H	291	Sn-35	PA-PID Card Relay 6 Control	-	
0124H	292	Sn-36	PA-PID Card Relay 7 Control	-	
0125H	293	Sn-37	PA-PID Card Relay 8 Control	-	
0126H	294	Sn-38	Parameter copy	-	

Address		Parameter			Notes
HEX	DEC	No.	Description	Unit	
Control Parameters Cn					
0200H	512	Cn-01	Input Voltage	0.1V	
0201H	513	Cn-02	Max. Output Frequency	0.1Hz	
0202H	514	Cn-03	Max. Output Voltage	0.1V	
0203H	515	Cn-04	Max. Voltage Frequency	0.1Hz	
0204H	516	Cn-05	Middle Output Frequency	0.1Hz	
0205H	517	Cn-06	Voltage At Middle Output Frequency	0.1V	
0206H	518	Cn-07	Min Output Frequency	0.1Hz	
0207H	519	Cn-08	Voltage At Min. Output Frequency	0.1V	
0208H	520	Cn-09	Motor Rated Current	0.1A	
0209H	521	Cn-10	DC Injection Braking Starting Frequency	0.1Hz	
020AH	522	Cn-11	DC Braking Current	1%	
020BH	523	Cn-12	DC Injection Braking Time At Stop	0.1s	
020CH	524	Cn-13	DC Injection Braking Time At Start	0.1s	
020DH	525	Cn-14	Frequency Command Upper Bound	1%	
020EH	526	Cn-15	Frequency Command Lower Bound	1%	
020FH	527	Cn-16	Frequency Jump Point 1	0.1Hz	
0210H	528	Cn-17	Frequency Jump Point 2	0.1Hz	
0211H	529	Cn-18	Frequency Jump Point 3	0.1Hz	
0212H	530	Cn-19	Jump Frequency Width	0.1Hz	
0213H	531	Cn-20	Digital Operator Display Unit	1	
0214H	532	Cn-21	Frequency Agree Detection Level	0.1Hz	
0215H	533	Cn-22	Frequency Agree Detection Width	0.1Hz	
0216H	534	Cn-23	Carrier Frequency Upper Limit	0.1KHz	
0217H	535	Cn-24	Carrier Frequency Lower Limit	0.1KHz	
0218H	536	Cn-25	Carrier Frequency proportion Gain	1	
0219H	537	Cn-26	Overtorque Detection Level	1%	
021AH	538	Cn-27	Overtorque Detection Time	0.1s	
021BH	539	Cn-28	Stall Prevention Level During Acceleration	1%	
021CH	540	-	Reserved	-	
021DH	541	Cn-30	Stall Prevention Level During Running	1%	
021EH	542	Cn-31	Communication Fault Detection Time	0.1s	
021FH	543	Cn-32	Frequency Detection 1 Level	0.1Hz	
0220H	544	Cn-32	Frequency Detection 2 Level	0.1Hz	
0221H	545	-	Reserved	-	
0222H	546	-	Reserved	-	
0223H	547	Cn-36	Number of Auto Restart Attempt	1	
0224H	548	Cn-37	Power Loss Ride-through Time	0.1s	
0225H	549	Cn-38	Speed Search Detection Level	1%	
0226H	550	Cn-39	Speed Search Time	0.1s	
0227H	551	Cn-40	Min. Baseblock Time	0.1s	
0228H	552	Cn-41	V/F Curve in Speed Search	1%	
0229H	553	Cn-42	Voltage Recovery Time	0.1s	
022AH	554	Cn-43	PID Integral Upper Bound	1%	

Address		Parameter			Notes
HEX	DEC	No.	Description	Unit	
022BH	555	Cn-44	PID Primary Delay Time Constant	0.1s	
022CH	556	Cn-45	Energy-Saving Volt. Upper Limit (60Hz)	1%	
022DH	557	Cn-46	Energy-Saving Volt. Upper Limit (6Hz)	1%	
022EH	558	Cn-47	Energy-Saving Volt. Lower Limit (60Hz)	1%	
022FH	559	Cn-48	Energy-Saving Volt. Lower Limit (6Hz)	1%	
0230H	560	Cn-49	Tuning Operation Voltage Limit	1%	
0231H	561	Cn-50	Tuning Operation Control Cycle	0.1s	
0232H	562	Cn-51	Tuning Operation Volt. Step (100% output Volt)	0.10%	
0233H	563	Cn-52	Tuning Operation Volt. Step (5% output Volt)	0.10%	
0234H	564	-	Reserved	-	
0235H	565	-	Reserved	-	
0236H	566	-	Reserved	-	
0237H	567	-	Reserved	-	
0238H	568	-	Reserved	-	
0239H	569	Cn-58	Energy-Saving Coefficient K2 (60Hz)	0.01	
023AH	570	Cn-59	Energy-Saving Coefficient Reduction ratio (6Hz)	1%	
023BH	571	Cn-60	Motor Code	-	
023CH	572	-	Reserved	-	
023DH	573	Cn-62	Auto Restart Time Interval	1s	
023EH	574	Cn-63	Motor Overheat protection time	1s	
Order Parameters On					
0300H	768	On-01	Control Status 1	-	
0301H	769	On-02	Control Status 2	-	
0302H	770	On-03	Control Status 3	-	
0303H	771	-	Reserved	-	
0304H	772	-	Reserved	-	
0305H	773	-	Reserved	-	
0306H	774	On-07	Hunting Prevention gain	0.01	
0307H	775	On-08	Hunting Prevention limit	1%	
0308H	776	On-09	Effective current detection filter time constant	1(3.5ms)	
0309H	777	-	Reserved	-	
030AH	778	On-11	ON-DELAY TIME	1(0.25 μ s)	
030BH	779	On-12	ON-DELAY Compensated value	1(0.25 μ s)	
030CH	780	-	Reserved	-	
030DH	781	-	Reserved	-	
030EH	782	On-15	Power detection filter changing width	1%	
030FH	783	On-16	Power detection filter time constant	1(7ms)	
0310H	784	On-17	Motor phase to phase resistance	0.001 Ω	
0311H	785	On-18	Torque Compensation of care loss	1W	
0312H	786	On-19	Torque Compensation limit	1V	
0313H	787	On-20	Motor Constant R1	0.001 Ω	*1
0314H	788	On-21	Motor Constant R2	0.001 Ω	*1
0315H	789	On-22	Motor Constant L	0.001mH	*1
0316H	790	On-23	Motor Constant Rm	0.001m Ω / ω	*1
0317H	791	On-24	Motor Constant Lm	0.01mH	*1

Address		Parameter			Notes	
HEX	DEC	No.	Description	Unit		
Frequency Command An						
0400H	1024	An-01	Frequency Command 1	0.01Hz	*2	
0401H	1025	An-02	Frequency Command 2	0.01Hz	*2	
0402H	1026	An-03	Frequency Command 3	0.01Hz	*2	
0403H	1027	An-04	Frequency Command 4	0.01Hz	*2	
0404H	1028	An-05	Frequency Command 5	0.01Hz	*2	
0405H	1029	An-06	Frequency Command 6	0.01Hz	*2	
0406H	1030	An-07	Frequency Command 7	0.01Hz	*2	
0407H	1031	An-08	Frequency Command 8	0.01Hz	*2	
0408H	1032	An-09	Jog Frequency Command	0.01Hz	*2	
Parameters Groups Can Be Changed during Running Bn						
0500H	1280	Bn-01	Acceleration Time 1	0.1s	*2	
0501H	1281	Bn-02	Deceleration Time 1	0.1s	*2	
0502H	1282	Bn-03	Acceleration Time 2	0.1s	*2	
0503H	1283	Bn-04	Deceleration Time 2	0.1s	*2	
0504H	1284	Bn-05	Analog Frequency Cmd. Gain	0.10%	*2	
0505H	1285	Bn-06	Analog Frequency Cmd. Bias	0.10%	*2	
0506H	1286	Bn-07	Auto torque Boost Gain	0.1	*2	
0507H	1287	Bn-08	Multi-Function Analog Output A01 Bias	0%	*2	
0508H	1288	Bn-09	Multi-Function Analog Output A02 Bias	0.10%	*2	
0509H	1289	Bn-10	Monitor No. After power ON	-	*2	
050AH	1290	Bn-11	Multi-Function Analog Output A01 Gain	1%	*2	
050BH	1291	Bn-12	Multi-Function Analog Output A02 Gain	0.01	*2	
050CH	1292	Bn-13	PID Detection Gain	0.01	*2	
050DH	1293	Bn-14	PID Proportional Gain	10%	*2	
050EH	1294	Bn-15	PID Integral Gain	0.1s	*2	
050FH	1295	Bn-16	PID Differential Time	0.01s	*2	
0510H	1296	Bn-17	PID Bias	1%	*2	
0511H	1297	Bn-18	PID sleep Frequency	0.01Hz	*2	
0512H	1298	Bn-19	PID sleep/Wake-up Delay Time	0.1s	*2	
0513H	1299	Bn-20	PID Wake Up Frequency	0.01Hz	*2	
0514H	1300	Bn-21	PID Detected Value Display Bias	0.001	*2	
0515H	1301	Bn-22	PID Detected Value Display Gain	0.001	*2	
0516H	1302	Bn-23	Freq. Command Upper-Bound Delay Time	1s	*2	
0517H	1303	Bn-24	Freq. Command Lower-Bound Delay Time	1s	*2	
0518H	1304	Bn-25	MC ON/OFF Delay Time	0.01s	*2	
0519H	1305	Bn-26	Pump ON/OFF Detection Level	0.1%	*2	
Enter Command						
0900H	2304	Save An, Bn, Sn and Cn to EEPROM.			-	*2 *3

*1 These parameters can not be saved to EEPROM.

*2 These parameters can be written in DRV mode or PRG mode.

*3 Writing data 0000H to this address while the inverter is not running can save parameter (except On-20 - 24) to EEPROM.

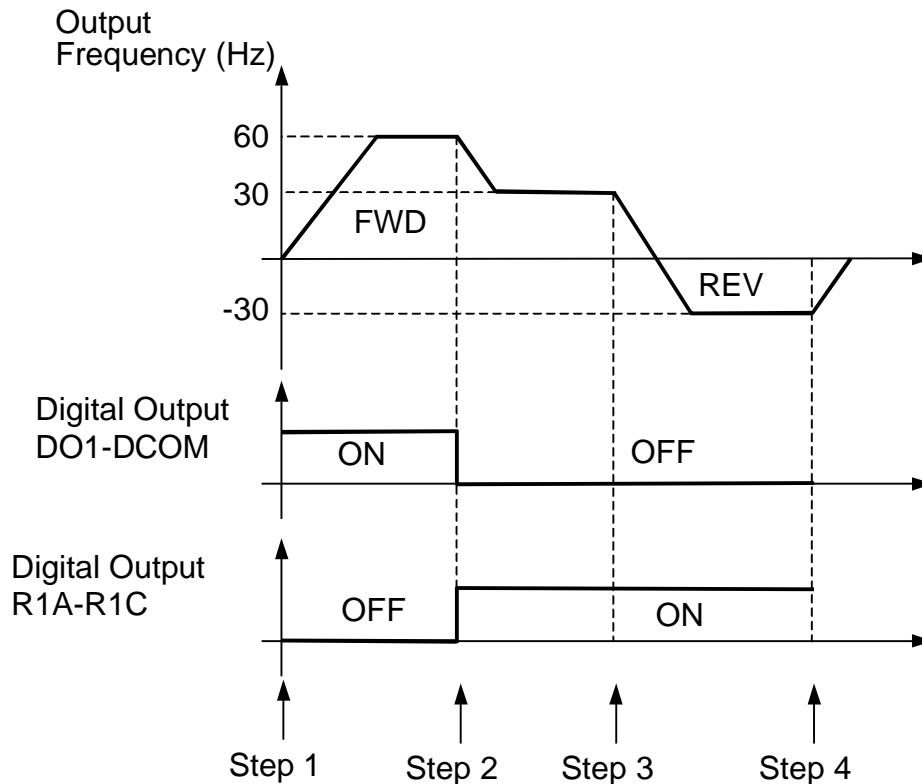
- All parameters can be read in PRG mode or DRV mode, and parameters without note *1 can be written in PRG mode only.

11. Error Code

Code	Description	Possible Cause
00H	CRC Code Error	CRC Word (High or Low Byte) Error
01H	Function Code Error	Function code is not 03H, 06H, 08H or 10H.
02H	Register Address Error	Register address is not in the range that can be accessed.
03H	Access Count Error	The Access Count is more than 16. "Access Count" in writing command (10H) does not match the amount of actual data.
21H	Data Value Error	Data value is out of range in writing message. Write parameters which not be written through Modbus command.
22H	Register Write Error	Write Cn ,Sn or On parameters during DRIVE mode
Not Response	UART Error	Parity, Overrun, Frame error.
Not Response	Data Format Error	Data string is not correct. (Incomplete Message, "Data Byte Count" in writing command (10H) does not match the amount of actual data.)
Not Response	CRC Error	The CRC of data string is not correct.

12. Example of RS-485 Communication Application

Host Controller can control the inverter 7300PA via RS-485 serial communication and let the inverter operating as following



- (1) Run 7300PA forward with 60Hz. Set DO1-DCOM.
- (2) Run 7300PA forward with 30Hz. Clear DO1-DCOM. Set R1A-R1C.
- (3) Run 7300PA reverse with 30Hz. Set R1A-R1C.
- (4) Stop 7300PA. Set R1A-R1C.

(1) Set inverter parameters

Sn-23 = 1 (Inverter Slave Address), Sn-24

Cn-31 = 0.0s (Disable time-out check)

Sn-08 = 1100

(11-- : Continue Running while RS-485 communication fault occurs)

(--00 : Run/Stop and frequency reference from RS-485)

Sn-21 = 0F (DO1-DCOM Output Reserved), Sn-22 = 0F (R1A-R1C Output Reserved)

- (2) Turn off the inverter and turn it on again (For Sn-23 and Sn-24 are modified). And program host controller to operate in step 1-4 and desired operation can be done by inverter.

Step 1 : Run 7300PA forward with 60Hz. Set DO1-DCOM.

Host Query

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	09H
Data Byte Count		12H
Data Value 1	High Byte	00H
	Low Byte	01H
Data Value 2	High Byte	17H
	Low Byte	70H
Data Value 3	High Byte	00H
	Low Byte	00H
Data Value 4	High Byte	00H
	Low Byte	00H
Data Value 5	High Byte	00H
	Low Byte	00H
Data Value 6	High Byte	00H
	Low Byte	00H
Data Value 7	High Byte	00H
	Low Byte	00H
Data Value 8	High Byte	00H
	Low Byte	00H
Data Value 9	High Byte	00H
	Low Byte	02H
CRC-16	Low Byte	B1H
	High Byte	2BH

Inverter Return

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	09H
CRC-16	Low Byte	51H
	High Byte	CFH

Data Value 1 of Address 0001H = 0001H : Run 7300PA Forward.

Data Value 2 of Address 0002H = 1770H : Speed Reference 60.00Hz.

Data Value 9 of Address 0009H = 0002H : Set DO1-DCOM.

- When Inverter received this message, it will start, accelerate to 60Hz in forward direction and set digital output terminal DO1-DCOM.

Step 2 : Run 7300PA forward with 50% Speed. Clear DO1-DCOM. Set RA-RB-RC.

Host Query

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	09H
Data Byte Count		12H
Data Value 1	High Byte	00H
	Low Byte	01H
Data Value 2	High Byte	0BH
	Low Byte	B8H
Data Value 3	High Byte	00H
	Low Byte	00H
Data Value 4	High Byte	00H
	Low Byte	00H
Data Value 5	High Byte	00H
	Low Byte	00H
Data Value 6	High Byte	00H
	Low Byte	00H
Data Value 7	High Byte	00H
	Low Byte	00H
Data Value 8	High Byte	00H
	Low Byte	00H
Data Value 9	High Byte	00H
	Low Byte	04H
CRC-16	Low Byte	F1H
	High Byte	B6H

Inverter Return

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	09H
CRC-16	Low Byte	51H
	High Byte	CFH

Data Value 1 of Address 0001H = 0001H : Run 7300PA Forward.

Data Value 2 of Address 0002H = 0BB8H : Speed Reference 30.00Hz.

Data Value 9 of Address 0009H = 0004H : Set R1A-R1C. Clear DO1-DCOM.

- When Inverter received this message, it will decelerate to 30.00Hz in forward direction, clear the digital output terminal DO1-DCOM and set the digital output R1A-R1C.

Step 3 : Run 7300PA reverse with 50% Speed. Set RA-RB-RC.

Host Query

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	09H
Data Byte Count		12H
Data Value 1	High Byte	00H
	Low Byte	03H
Data Value 2	High Byte	0BH
	Low Byte	B8H
Data Value 3	High Byte	00H
	Low Byte	00H
Data Value 4	High Byte	00H
	Low Byte	00H
Data Value 5	High Byte	00H
	Low Byte	00H
Data Value 6	High Byte	00H
	Low Byte	00H
Data Value 7	High Byte	00H
	Low Byte	00H
Data Value 8	High Byte	00H
	Low Byte	00H
Data Value 9	High Byte	00H
	Low Byte	04H
CRC-16	Low Byte	50H
	High Byte	D6H

Inverter Return

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	09H
CRC-16	Low Byte	51H
	High Byte	CFH

Data Value 1 of Address 0001 = 0003H : Run 7300PA Reverse.

Data Value 2 of Address 0002 = 0BB8H : Speed Reference 30.00Hz

Data Value 9 of Address 0009 = 0004H : Set R1A-R1C.

- When Inverter received this message, it will run at 30.00 Hz in reverse direction, clear the digital output terminal DO1-DCOM and set the digital output R1A-R1C.

Step 4 : Stop 7300PA. Set R1A-R1C.

Host Query

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	01H
Data Byte Count		02H
Data Value 1	High Byte	00H
	Low Byte	00H
CRC-16	Low Byte	A7H
	High Byte	81H

Inverter Return

Slave Address		01H
Function Code		10H
Head Address	High Byte	00H
	Low Byte	01H
Access Count	High Byte	00H
	Low Byte	01H
CRC-16	Low Byte	50H
	High Byte	09H

Data Value1 of Address 0000H = 0000H : Stop 7300PA.

- When inverter received this message, it will stop and decelerate to zero speed, digital output terminal DO1-DCOM and R1A-R1C do not change their status.