사용설명서

Brushless DC Motor Driver

XV series

(통신편)

OTOR

SPG Co., Ltd.
http://www.spg.co.kr

SPG MOTOR의 제품을 구입해 주셔서 감사합니다.
사용전에 반드시 사용설명서를 숙독하여, 제품에 대한 지식 및 안전에 관한 정보 그리고 주의 사항등 모든것에 대해 충분히 숙지한 후 사용해 주십시오.

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1. 안전상의 유의점

이 사용설명서에는, 안전상의 등급을 [경고],[주의]로 구분하고 있습니다.

⚠ [경 고]	• 부적절한 취급으로 인해 위험한 상황이 발생하여, 사망 또는 중상 등을 당할 가능성에 해당될 경우.
⚠ [주 의]	• 부적절한 취급으로 인해 위험한 상황이 발생하여, 경상을 당할 가능성에 해당될 경우.

아울러 [주의]로 기재된 사항에서도 상황에 따라 중대한 결과에 도달할 가능성이 있습니다.
어느쪽이든 중요한 내용을 기재하여 놓은 것이므로 반드시 지켜주시기 바랍니다.

⚠ [경 고]

- 폭발성, 인화성, 부식성, 가연성 물질 및 물이 있는 장소에는 사용하지 마십시오. 화재, 감전, 부상의 원인이 됩니다.
- 젖은 손으로 조작하지 마십시오. 감전의 우려가 있습니다.
- 설치,이동,배선,점검 때에는 반드시 전원을 꺼 주십시오. 감전의 우려가 있습니다.
- 설치,접속,운전,조작,점검의 작업은 적절한 자격을 가진 전문가가 행하여 주십시오. 감전의 원인이 됩니다.
- MOTOR, DRIVER를 장치에 부착한 경우에는 반드시 접지하여 주십시오. 감전의 우려가 있습니다.
- DRIVER의 전원입력 전압은 정격 범위를 반드시 지켜 주십시오.
- 접속종료 후에는 전원 접속단자, 입출력 신호 접속단자의 단자 COVER를 설치하여 주십시오. 화재, 감전의 원인이 됩니다.
- 전원 케이블이나 MOTOR 케이블을 무리하게 구부리거나, 강한 힘으로 잡아 당기지 말아 주십시오. 감전, 화재의 원인이 됩니다.
- 정전이 되었을 때에는 반드시 DRIVER의 전원을 꺼 주십시오. 전원 복귀시에 MOTOR의 돌연 기동에 의한 부상 및 장치 파손의 우려가 있습니다.
- 승강장치에는 사용하지 말아 주십시오. DRIVER의 보호기능이 동작하여 MOTOR가 정지하고 가동부가 낙하하여 부상 및 장치 파손의 원인이 됩니다.
- 통전상태에서 전원을 끊은 후 30초간은 DRIVER의 단자에 접촉하지 말아주십시오. 감전의 우려가 있습니다.
- MOTOR, 감속기, DRIVER를 분해, 개조하지 말아 주십시오. 감전, 부상, 장치 파손의 원인이 됩니다.
- 내부의 점검이나 수리는 가까운 영업대리점 또는 본사로 연락하여 주십시오.

[주 의]

- MOTOR, DRIVER의 사양치를 초과하여 사용하지 말아 주십시오. 감전, 부상,장치파손의 원인이 됩니다.
- MOTOR의 출력축이나 케이블을 잡아 당기지 말아 주십시오. 부상의 원인이 됩니다.
- MOTOR, DRIVER의 주위에는 가연물을 두지 말아 주십시오. 화재, 감전, 장치 파손의 원인이 됩니다.
- MOTOR의 회전부(출력축)에 COVER를 설치하여 주십시오. 부상의 원인이 됩니다.
- DRIVER의 개구부에 이물질을 넣지 말아 주십시오. 화재, 감전, 장치 파손의 원인이 됩니다.
- MOTOR(치절 TYPE SHAFT)와 감속기를 조립할 때에 MOTOR와 감속기 간에 손가락 등이 끼지 않도록 주의하여 주십시오. 부상의 원인이 됩니다.
- MOTOR 또는 감속기 부착 MOTOR를 장치에 설치 할 때에 장치와 MOTOR 또는 감속기 간에 손가락 등이 끼지 않도록 주의하여 주십시오. 부상의 원인이 됩니다.
- MOTOR와 DRIVER는 지정된 조합으로 사용하여 주십시오. 화재, 감전, 장치 파손의 원인이 됩니다.
- 시운전을 시행할 때에는 항상 비상정지 할 수 있도록 준비한 후 시행하여 주십시오. 부상의 원인이 됩니다.
- 이상이 발생할 때에는 즉시 운전을 정지하고 DRIVER의 전원을 꺼 주십시오. 화재, 감전, 부상의 원인이 됩니다.
- 보호기능이 동작한 때에는 전원을 끄고 원인을 제거한 후에 전원을 재 투입하여 주십시오. 원인을 제거하지 않은 MOTOR의 운전을 계속할 경우 MOTOR, DRIVER가 오동작하여 부상 또는 장치 파손의 원인이 됩니다.
- DRIVER의 SLOW RUN/SLOW STOP시간 설정기의 설정은 절연된 정밀 드라이버를 사용하여 주십시오. 감전의 원인이 됩니다.
- 절연저항 측정, 절연내압시험을 행할 경우에는 단자를 절대 만지지 말아 주십시오. 감전의 원인이 됩니다.
- MOTOR, DRIVER를 폐기할 경우에는 산업용 폐기물로 처리하여 주십시오.
- 운전시에는 MOTOR, DRIVER 표면 온도가 70℃를 초과할 수 있으므로 운전 중이거나 정지한 직후에는 MOTOR, DRIVER를 만지지 말아 주십시오. 고온으로 인한 화상의 원인이 됩니다.

[중 요]

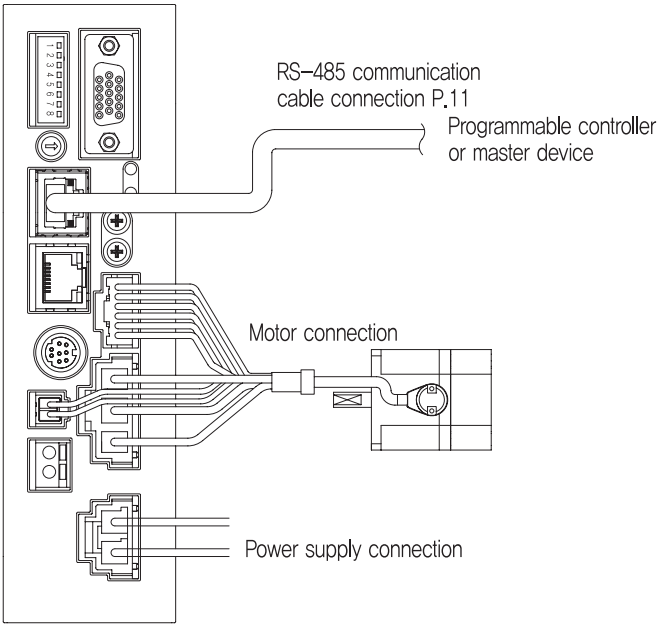
- XVD Series 는 당사 MOTOR의 XVM Series 전용 DRIVER입니다. 그러므로 다른 MOTOR와는 사용할 수 없으며, 반드시 전용 DRIVER와 MOTOR를 사용하여야 합니다.
- 전원을 OFF한 후, 전원 재 투입시에는 5초 이상의 시간이 경과한 후에 재투입하여 주십시오.

2. Modbus Protocol

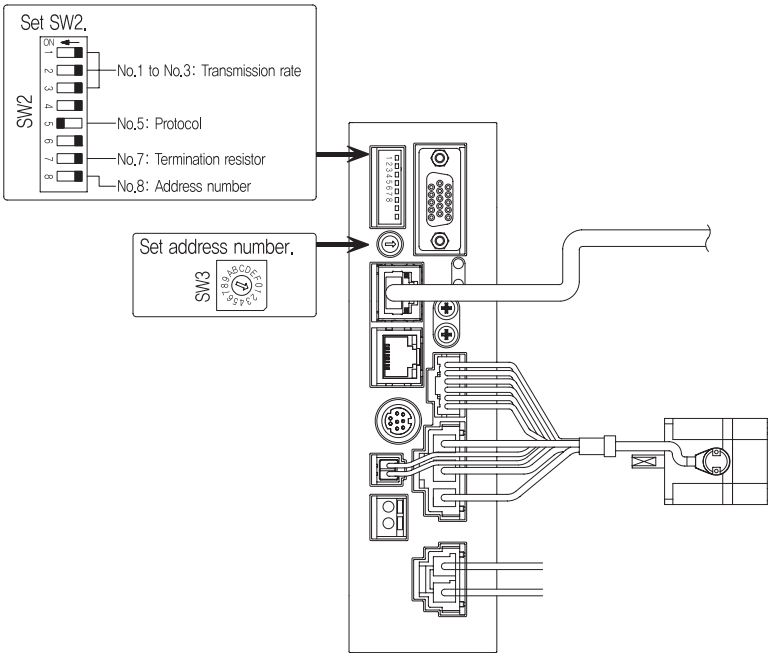
다음은 RS-485 통신 (Modbus Protocol)을 사용하여 Program을 구현하는 방법을 설명합니다.

2.1 Guidance

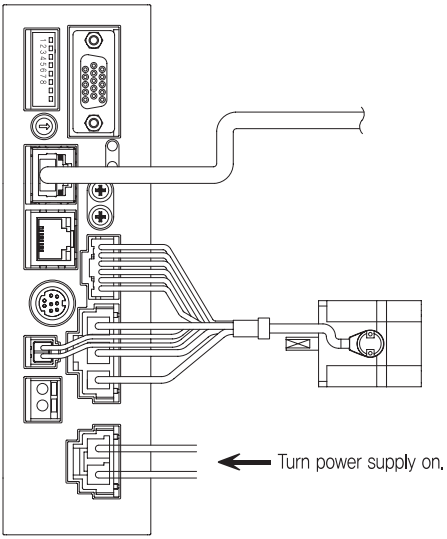
2.1.1 설치 및 접속



2.1.2 스위치 설정



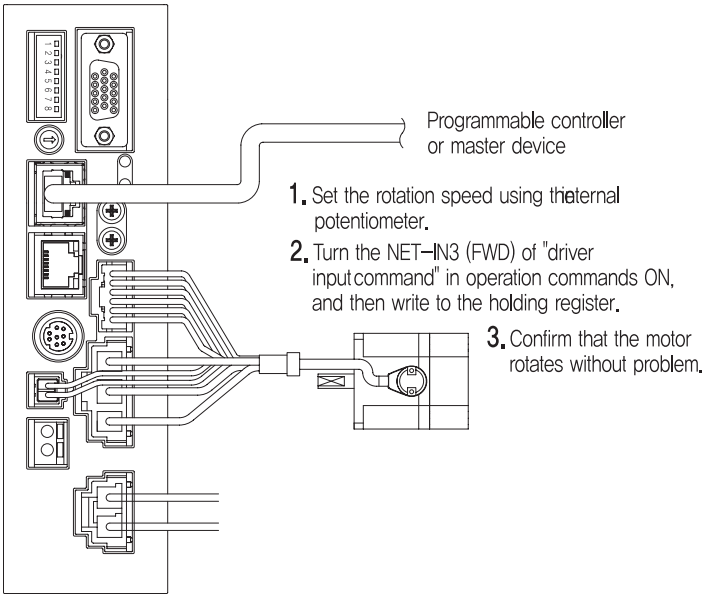
2.1.3 전원 접속 및 Parameter 설정



2.1.4 전원 재 투입

통신 parity, 통신 stop bit, transmission waiting time등의 parameter enable 을 위하여 전원을 재 투입하여 주십시오.

2.1.5 Motor 조작



2.1.6 Motor 조작 시 확인 사항

Motor가 제대로 동작하지 않을 경우, 다음을 확인하여 주십시오.

- Alarm이 발생하고 있는가?
- 전원은 공급되고 있는가?
- Motor 및 RS-485 통신 케이블이 바르게 연결되어 있는가?
- Slave address, 전송속도, 종단저항이 바르게 연결되어 있는가?

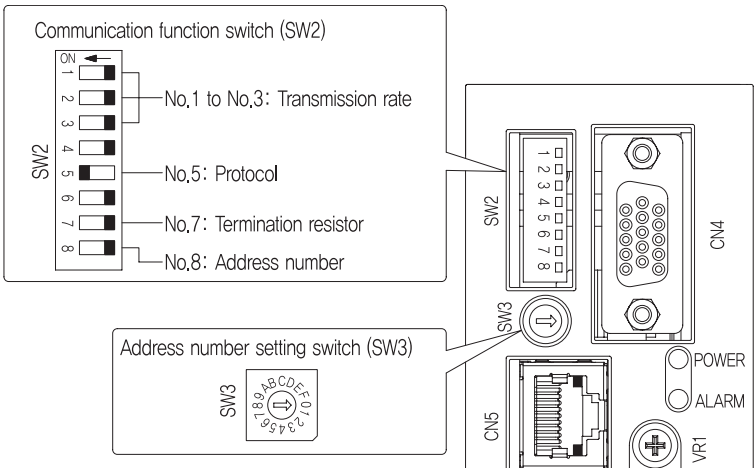
2.2 통신 사양

Electrical characteristics	In conformance with EIA-485 Use a twisted pair cable (TIA/EIA-568B CAT5e or higher is recommended) and keep the total wiring distance including extension to 50 m (164 ft.) or less.
Transmission mode	Half duplex
Transmission rate	Selectable from 9600 bps, 19200 bps, 38400 bps, 57600 bps and 115,200 bps.
Physical layer	Asynchronous mode (Data: 8 bits, stop bit: 1 bit, parity: even number)
Protocol	Modbus RTU mode
Connection pattern	Up to 31 drivers can be connected to one programmable controller (master device).

2.3 스위치 설정

[중 요] • 스위치 설정 전에는 반드시 전원을 꺼 주십시오. 전원을 투입한 상태에서 스위치 설정을 행할 경우, 새로운 스위치 설정이 유효하지 않습니다. 스위치 설정 후 반드시 전원을 재 투입 하여 주십시오.

• SW2의 No.4 와 No.6 은 [ON]으로 설정하지 말아 주십시오.



2.3.1 Protocol 설정

SW2의 No.5를 [ON]으로 하여 주십시오. Modbus protocol이 선택됩니다.
(출하시 : SW2-No.5 [OFF])

2.3.2 Address number (Slave address) 설정

SW2의 No.8과 address 설정 스위치 (SW3)를 사용하여 Address number (slave address)를 설정하여 주십시오.

Address number (slave address) 0 은 Broadcast이므로, 이 address는 설정하지 말아 주십시오.

(출하시 : SW3 [0], SW2-No.8 [OFF])

SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF
0	Broadcast	8	8	0	16	8	24
1	1	9	9	1	17	9	25
2	2	A	10	2	18	A	26
3	3	B	11	3	19	B	27
4	4	C	12	4	20	C	28
5	5	D	13	5	21	D	29
6	6	E	14	6	22	E	30
7	7	F	15	7	23	F	31

2.3.3 전송속도 설정

SW2의 No.1 ~ No.3를 이용하여 전송속도를 설정할 수 있습니다.

전송속도는 반드시 Master device와 동일하게 설정하여 주십시오.

(출하시 : 9600 bps)

SW2-No.3	SW2-No.2	SW2-No.1	Transmission rate (bps)
OFF	OFF	OFF	9,600
OFF	OFF	ON	19,200
OFF	ON	OFF	38,400
OFF	ON	OFF	47,600
ON	OFF	OFF	115,200

[중 요] • 상기 Table외의 SWITCH 설정은 하지 말아 주십시오.

2.3.4 종단 저항

Master device로부터 종단에 설치된 driver는 반드시 종단 저항을 연결하여 주십시오.

SW2의 No.7을 [ON]으로 하면 RS-485 통신을 위한 종단저항(120Ω)이 연결됩니다.

(출하시 : [OFF])

SW2-No.7	SW2-No.2
OFF	Disabled
ON	Enabled

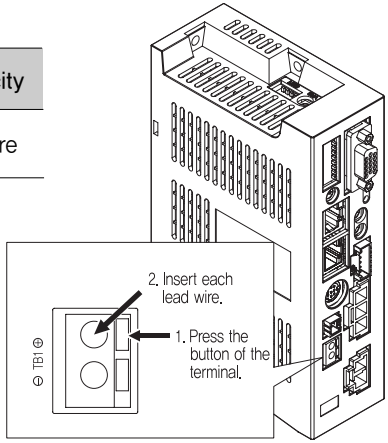
2.4 제어 전원 연결

Driver에 제어 전원을 연결하면, 주 전원을 연결하지 않아도 Master device와 통신을 할 수 있습니다. 통신 기능만을 사용하여, operation data, parameter, alarm 등을 설정 및 확인 할 수 있습니다.

[중 요] • 주 전원이 연결되지 않은 동안 Driver 제어 전원이 연결되었을 때에는 저전압 Alarm이 발생하나, 통신 기능은 정상적으로 동작합니다.

2.4.1 제어 전원 사양

Model	Input power supply voltage	Current capacity
XVD200F	24 VDC±10%	300 mA or more
XVD400R	48 VDC±10%	



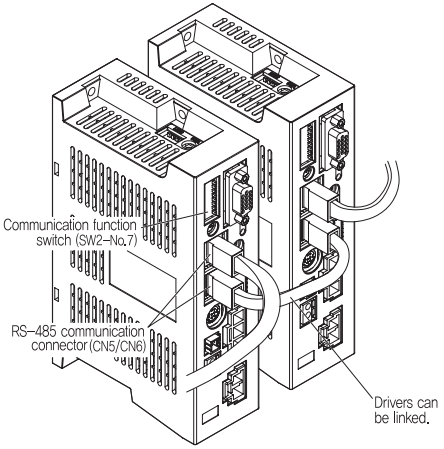
2.4.2 Applicable lead wire

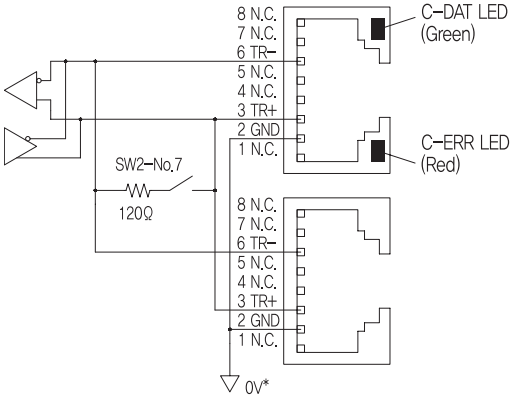
• Lead wire는 AWG24 ~16 (0.2 ~ 1.25 mm2) 을 사용하여 주십시오.

Master device로부터 종단에 설치된 driver는 반드시 종단 저항을 연결하여 주십시오. SW2의 No.7을 [ON]으로 하면 RS-485 통신을 위한 종단저항(120Ω)이 연결됩니다.

2.5 RS-485 통신 Cable의 접속

RS-485 통신 Cable을 Driver의
CN5 또는 CN6에 연결하여 주십시오





※ GND선은 주전원 단자 (CN1)와 제어전원 단자(TB1) 와 공통으로 사용됩니다. (절연되어 있지 않음.)

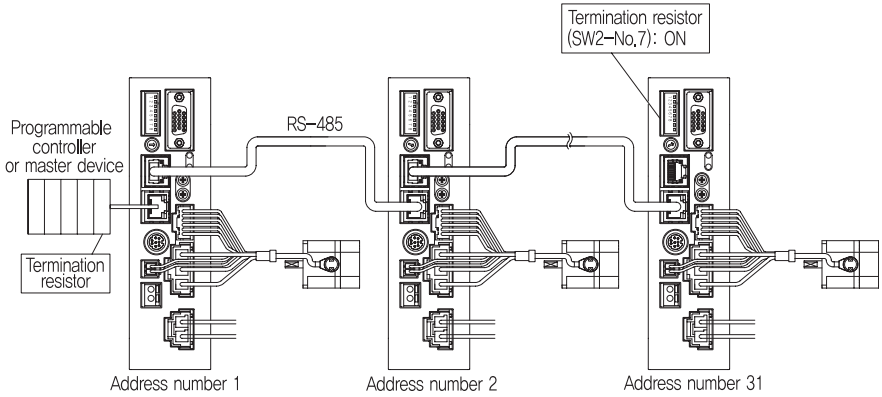
• CN5/CN6 pin assignments

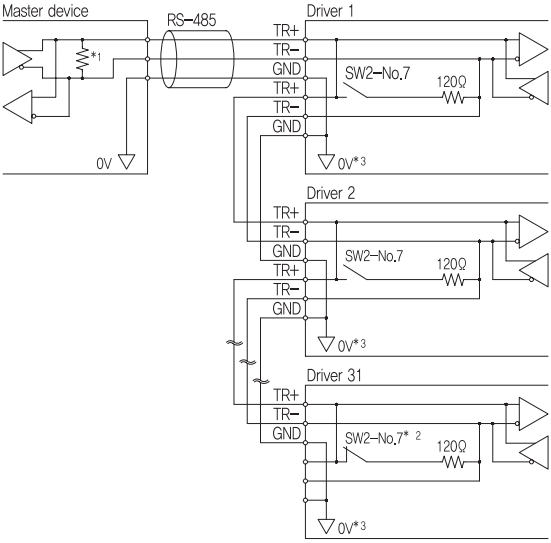
Pin No.	Signal name	Description
1	N.C.	Not used
2	GND	GND
6	TR+	RS-485 communication signal (+)
4	N.C.	Not used
5	N.C.	Not used
6	TR-	RS-485 communication signal (-)
7	N.C.	Not used
8	N.C.	Not used

• LED

Name	Description
C-DAT LED (Green)	master station과 정상 교신중 일 경우 동작합니다.
C-ERR LED (Red)	master station과 교신 error가 발생했을 경우 동작합니다.

2.5.1 접속 예





*1 Termination resistor 120Ω

*2 Turn the termination resistor (SW2-No.7) to ON.

*3 The GND line is used in common with main power supply input terminal (CN1) and control power supply input terminal (TB1) [not insulated].

2.6 RS-485 통신 설정

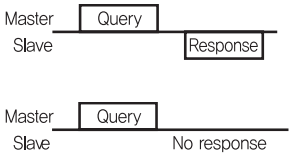
RS-485 통신을 위한 Parameter는 아래와 같습니다.

Parameter name	Value
Parity	even number
Stop bit	1 bit
전송 대기 시간	10 ms

2.7 통신 Mode

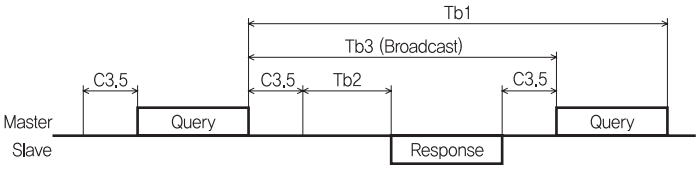
Modbus protocol 통신은 Single-master / multiple-slave 방법을 기본으로 합니다. 아래 protocol을 참조하여, 두 가지 방법 중 하나의 방법으로 message를 전송하여 주십시오.

• Unicast mode
master에서 하나의 slave로 query를 전송합니다.
Slave는 process를 수행하고 응답합니다.



• Broadcast mode
master에서 slave의 address를 0으로 설정할 경우,
master는 모든 slave에 query를 전송할 수 있습니다.
각각의 slave는 process를 수행하나, 응답은 하지 않습니다.

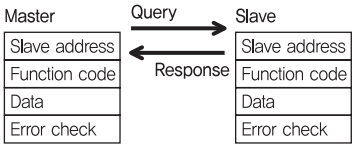
2.8 통신 타이밍



구분	Name	Description
Tb1	통신 timeout	"통신 timeout" parameter의 설정 시간 내에 query가 수신되지 않을 경우 통신 timeout alarm이 발생합니다. * 초기 설정값 : Not monitored
Tb2	전송대기시간	전송 대기시간은 "전송대기시간" parameter에서 설정 가능합니다. 실제 전송대기 시간 = Silent 간격 + 실행시간 + 전송대기 시간 * 초기 설정값 : 10ms
Tb3	Broadcasting 간격	Broadcasting에 다음 query를 보낼 때까지의 시간입니다. Tb3 time는 Silent 간격 + 5ms 보다 더 길수 있습니다.
C3,5	Silent 간격	3,5 character의 대기시간을 제공해야 합니다. 3,5 character이하의 대기 시간일 경우 Driver는 응답하지 않습니다. 전송속도가 19200 bps 이상의 경우는 1.75 ms 이상의 대기 시간을 가져야 합니다.

2.9 Message

message 포맷은 아래와 같습니다.



2.9.1 Query

Query message 구조는 아래와 같습니다.

Slave address	Function code	Data	Error check
8 bits	8 bits	N×8 bits	16 bits

• **Slave address**

Slave address (unicast mode)를 설정하여 주십시오.
Slave address를 0으로 설정할 경우, master는 모든 slave에 query를 전송할 수 있습니다. (broadcast mode)

• **Function code**

Function code 및 message 길이는 아래와 같습니다.

Function code	Description	Broadcast
03h	Read from a holding register(s).	Impossble
06h	Write to a holding register.	Possible
08h	Perform diagnosis.	Impossible
10h	Write to multiple holding registers.	Possible

• **Data**

Function code를 선택하여 data를 설정하여 주십시오.
Function code에 따라 data의 길이는 달라집니다.

• **Error check**

Modbus RTU mode에서는 error check를 CRC-16 방식을 기본으로 합니다.
Slave는 수신된 message의 CRC-16을 연산하여 message에 포함되어 있는 error check값과 비교합니다. 연산된 CRC-16값이 error check값과 동일하면, slave는 message를 정상 data로 처리합니다.

〈 CRC-16 연산 방법〉

1) Slave address (8 bit)와 default 값 [FFFFh]를 exclusive-OR (XOR) 연산을 합니다.
2) 상기 1항의 결과를 오른쪽으로 1bit를 shift 합니다. Overflow bit가 "1"이 될 때까지 Shift를 반복합니다.
3) Overflow bit가 "1"이 되면, 상기 2항의 결과와 [A001h]를 XOR 연산을 합니다.
4) Shift가 8번 수행될 때 까지 상기 2항, 3항을 반복합니다.
5) 상기 4항의 결과와 function code (8bit)를 XOR 연산을 합니다.

• 모든 byte에 대해서 상기 2항에서 4항까지를 반복합니다.
• 마지막 결과가 CRC-16 연산의 결과 입니다.

2.9.2 Response

Slave는 Normal response, No response, Exception response의 3가지 형태로 응답합니다.
응답 message 구조는 query message 구조와 동일합니다.

Slave address	Function code	Data	Error check
8 bits	8 bits	N×8 bits	16 bits

• 정상 응답

master로부터 query를 수신할 경우, slave는 프로세스를 수행하고 응답합니다.

• 무 응답

Slave는 master에 응답을 하지 않습니다. "무 응답"경우는 아래와 같습니다.

1) 전송 에러

아래의 전송 에러가 감지되면, slave는 query를 폐기하고 master에 응답을 하지 않습니다.

Cause of transmission error	Description
Framing error	Stop bit 0 was detected.
Parity error	A mismatch with the specified parity was detected.
Mismatched CRC	The calculated value of CRC-16 was found not matching the error check value.
Invalid message length	The message length exceeded 256 bytes.

2) 전송 에러 외

다음의 경우, 다른 전송 에러의 감지 없이 응답을 하지 않습니다.

Cause	Description
Broadcast	If the query was broadcast, the slave executes the requested process but does not return a response.
Mismatched slave address	The slave address in the query was found not matching the slave address of the driver.

• 예외 응답

Slaver 가 query에 의해 요청된 프로세스를 수행 할 수 없는 경우에 예외 응답이 반환됩니다. 그리고, 이 예외 응답에는 프로세스가 수행 될 수 없는 이유를 나타내는 예외 code를 포함하고 있습니다. 예외 응답의 message 구조는 아래와 같습니다

Slave address	Function code	Exception code	Error check
8 bits	8 bits	8 bits	16 bits

1) Function code

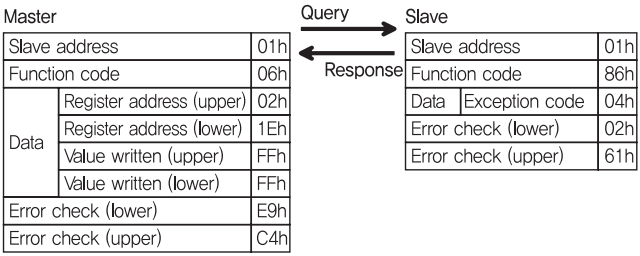
예외 응답의 function code는 query의 function code와 [80h]의 sum입니다.
예) query : [03h] –〉 예외 응답 : [83h]

2) 예외 code

프로세스 수행을 할 수 없는 이유를 나타냅니다.

Exception code	Communication error code	Cause	Description
01h	88h	Invalid function	· 기능 code가 지원되지 않습니다. · 진단 서브 기능 code (08h)가 00h와 다르다
02h		Invalid data address	· 지원하지 않는 address입니다. · register address와 register 수가 2000h 이상이다.
03h	8Ch	Invalid data	· regiater의 수가 0 또는 17 이상이다. · byte의 수가 register 수의 2배와 다르다 · data의 길이가 지정된 범위를 벗어났다.
04h	89h 8Ah 8Ch 8Dh	Slave error	· NV memory가 실행 중이다. · 명령의 disable을 실행중이다. · 기록값이 설정 범위를 벗어났다.

3) 예외 응답의 예



Master		
Slave address		01h
Function code		06h
Data	Register address (upper)	02h
	Register address (lower)	1Eh
	Value written (upper)	FFh
	Value written (lower)	FFh
Error check (lower)		E9h
Error check (upper)		C4h

Query →

← Response

Slave		
Slave address		01h
Function code		86h
Data	Exception code	04h
Error check (lower)		02h
Error check (upper)		61h

2.10 Function code

2.10.1 holding 레지스터 읽기 [03h]

이 Function code [03h]는 레지스터(16bit)를 판독하는데 사용됩니다. 최대 연속 16레지스터(16*16 bit)를 읽을 수 있습니다. 동시에 upper/lower data를 읽습니다. 다수의 holding 레지스터를 읽을 경우 레지스터 address 순서로 읽습니다.

■ Example

Slave address 1의 회전속도 No.0과 1 operation data을 읽습니다.

Description	Register address	Value read	Corresponding decimal
Rotation speed No.0 (upper)	0480h	0000h	100
Rotation speed No.0 (lower)	0481h	0064h	
Rotation speed No.1 (upper)	0482h	0000h	4000
Rotation speed No.1 (lower)	0483h	0FA0h	

1) Query

Field name		Data	Description
Slave address		01h	Slave address 1
Function code		03h	Reading from holding registers
Data	Register address (upper)	04h	Register address to start reading from
	Register address (lower)	80h	
	Number of registers (upper)	00h	Number of registers to be r ead from the starting register address (4 registers=0004h)
	Number of registers (lower)	04h	
Error check (lower)		44h	Calculation result of CRC-16
Error check (upper)		D1h	

2) 응답

Field name		Data	Description
Slave address		01h	Same as query
Function code		03h	Same as query
Data	Number of data bytes	08h	Twice the number of registers in the query
	Value read from register address (upper)	00h	Value read from register address 0480h
	Value read from register address (lower)	00h	
	Value read from register address+1 (upper)	00h	Value read from register address 0481h
	Value read from register address+1 (lower)	64h	
	Value read from register address+2 (upper)	00h	Value read from register address 0482h
	Value read from register address+2 (lower)	00h	
	Value read from register address+3 (upper)	0Fh	Value read from register address 0483h
	Value read from register address+3 (lower)	A0h	
Error check (lower)		E1h	Calculation result of CRC-16
Error check (upper)		97h	

2.10.2 holding 레지스터 쓰기 [06h]

이 Function code [06h]는 지정된 레지스터 주소에 data를 기록하는데 사용됩니다. 그러나 Upper/lower의 결과는 data 범위를 넘을 수 있으므로, "multiple holding 레지스터 [10h]"를 사용하여 동시에 기록하여 주십시오.

■ Example

Slave address 2의 과부하 경고 level(lower) 50[32h]를 기록합니다.

Description	Register address	Written value	Corresponding decimal
Overload warning level (lower)	10ABh	32h	50

1) Query

Field name		Data	Description
Slave address		02h	Slave address 2
Function code		06h	Writing to a holding register
Data	Register address (upper)	10h	Register address to be written
	Register address (lower)	ABh	
	Written value (upper)	00h	Written value for the register address
	Written value (lower)	32h	
Error check (lower)		7Dh	Calculation result of CRC-16
Error check (upper)		0Ch	

2) 응답

Field name		Data	Description
Slave address		02h	Same as query
Function code		06h	Same as query
Data	Register address (upper)	10h	Same as query
	Register address (lower)	ABh	
	Written value (upper)	00h	Same as query
	Written value (lower)	32h	
Error check (lower)		7Dh	Calculation result of CRC-16
Error check (upper)		0Ch	

2.10.3 진단 [08h]

이 Function code [08h]는 master와 slaver 간의 통신을 진단하는 데 사용됩니다. 임의의 data를 전송 및 반환하여 통신이 정상인지를 확인합니다.
[00h] (query 응답)는 function code에서 지원하는 sub-function 입니다.

■ Example

Slave address 3에 임의의 data [1234h]를 전송합니다.

1) Query

Field name		Data	Description
Slave address		03h	Slave address 3
Function code		08h	Diagnosis
Data	Sub-functioncode (upper)	00h	Return the query data
	Sub-functioncode (lower)	00h	
	Data value (upper)	12h	Arbitrary data (1234h)
	Data value (lower)	34h	
Error check (lower)		ECh	Calculation result of CRC-16
Error check (upper)		9Eh	

2) 응답

Field name		Data	Description
Slave address		03h	Same as query
Function code		08h	Same as query
Data	Sub-functioncode (upper)	00h	Same as query
	Sub-functioncode (lower)	00h	
	Data value (upper)	12h	Same as query
	Data value (lower)	34h	
Error check (lower)		ECh	Same as query
Error check (upper)		9Eh	

2.10.4 Multiple holding 레지스터 쓰기 [10h]

이 Function code [10h]는 여러 연속적인 레지스터에 data를 기록하는데 사용됩니다.

■ Example

Slave address 4의 가속시간 No.0~2 operation data를 설정합니다.

Description	Register address	Written value	Corresponding decimal
Acceleration time No.0 (upper)	0600h	0000h	2
Acceleration time No.0 (lower)	0601h	0002h	
Acceleration time No.1 (upper)	0602h	0000h	50
Acceleration time No.1 (lower)	0603h	0032h	
Acceleration time No.2 (upper)	0604h	0000h	150
Acceleration time No.2 (lower)	0605h	0096h	

1) Query

Field name		Data	Description
Slave address		04h	Slave address 4
Function code		10h	Writing to multiple holding registers
Data	Register address (upper)	06h	Register address to start writing from
	Register address (lower)	00h	
	Number of registers (upper)	00h	Number of registers to be written from the starting register address (6 registers=0006h)
	Number of registers (lower)	06h	
	Number of data bytes	0Ch	Twice the number of registers in the query (6 registers × 2 = 12 registers: 0Ch)
	Written value for register address (upper)	00h	Written value for register address 0600h
	Written value for register address (lower)	00h	
	Written value for register address+1 (upper)	00h	Written value for register address 0601h
	Written value for register address+1 (lower)	02h	
	Written value for register address+2 (upper)	00h	Written value for register address 0602h
	Written value for register address+2 (lower)	00h	
	Written value for register address+3 (upper)	00h	Written value for register address 0603h
	Written value for register address+3 (lower)	32h	
	Written value for register address+4 (upper)	00h	Written value for register address 0604h
	Written value for register address+4 (lower)	00h	
	Written value for register address+5 (upper)	00h	Written value for register address 0605h
	Written value for register address+5 (lower)	96h	
Error check (lower)		85h	Calculation result of CRC-16
Error check (upper)		70h	

2) 응답

Field name		Data	Description
Slave address		04h	Same as query
Function code		10h	Same as query
Data	Register address (upper)	06h	Same as query
	Register address (lower)	00h	
	Number of registers (upper)	00h	Same as query
	Number of registers (lower)	06h	
Error check (lower)		40h	Calculation result of CRC-16
Error check (upper)		D6h	

2.11 레지스터 address list

Driver에서 사용되는 모든 data는 32bit 입니다. Modbus protocol 레지스터는 16bit 이기 때문에, 하나의 data는 2개의 레지스터로 구성됩니다. 짝수 address는 upper이고, 홀수 address는 lower가 됩니다.

2.11.1 운전 명령

Motor 운전과 관련된 명령입니다. 운전 명령은 NV memory에 저장되지 않습니다.

Register address		READ/WRITE	Name	Description
Dec	Hex			
48	0030h	R/W	Group (upper)	Sets the address number for the group send.
49	0031h		Group (lower)	
124	007Ch	R/W	Driver input command (upper)	Sets the input command to the driver.
125	007Dh		Driver input command (lower)	
126	007Eh	R	Driver output command (upper)	Sets the output status of the driver.
127	007Fh		Driver output command (lower)	

• **그룹 (0030h, 0031h)**
다중 slave는 그룹으로 만들어지며, query는 한번에 그룹의 모든 slave에 전송됩니다.

• **Driver 입력 명령 (007Ch, 007Dh)**
RS-485 통신을 접속할 수 있는 driver 입력 신호입니다.
다음과 같이 remote I/O (NET-IN0~15)가 할당됩니다.

Address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
007Ch	Upper	–	–	–	–	–	–	–	–
	Lower	–	–	–	–	–	–	–	–
007Dh	Upper	NET-IN15 (Not used)	NET-IN14 (Not used)	NET-IN13 (Not used)	NET-IN12 (Not used)	NET-IN11 (Not used)	NET-IN10 (Not used)	NET-IN9 (Not used)	NET-IN8 (Not used)
	Lower	NET-IN7 (MB-FREE)	NET-IN6 (Not used)	NET-IN5 (STOP-MODE)*	NET-IN4 (REV)*	NET-IN3 (FWD)*	NET-IN2 (M2)	NET-IN1 (M1)	NET-IN0 (M0)

※ "3-wire 입력 mode" 는 "운전 입력 mode 선택" 의 parameter에 의해 설정되고,
다음과 같이 신호가 인가됩니다.
FWD ➡ START/STOP, REV ➡ RUN/BRAKE, STOP MODE ➡ FWD/REV

Parameter 설정에 의한 remote I/O 출력 단자 NET-IN 0 – 15의 할당된 입력신호입니다.

신호명	기능	설정범위
Not used	입력 단자가 사용되지 않을 경우 set	–
FWD	**[2-wire 입력 mode]** FWD 입력이 "1"일 경우, FWD 방향으로 MOTOR가 회전합니다. FWD 입력이 "0"이면 정지합니다. REV 입력이 "1"일 경우, REV 방향으로 MOTOR가 회전합니다. REV 입력이 "0" 이면 정지합니다. Motor의 정지 방법에 따라 STOP MODE 입력을 선택하여 주십시오	0: Stop 1: Rotate to FWD direction
REV		0: Stop 1: Rotate to REV direction
STOP MODE		0: Instantaneous stop 1: Decelerationstop
START / STOP	**[3-wire 입력 mode]** START/STOP 입력과 RUN/BRAKE 입력이 모두 "1"일 경우, Motor가 회전합니다. START/STOP 입력이 "0"이면 Motor는 감속 정지합니다. RUN/BRAKE 입력이 "0" 이면 Motor는 순시 정지합니다. Motor의 회전 방향은 FWD/REV 입력 단자로 선택하여 주십시오	0: Decelerationstop 1: Operation
RUN / BRAKE		0: Instantaneous stop 1: Operation
FWD / REV		0: FWD direction 1: REV direction
FREE	Motor 정지시 전자 brake의 동작 여부에 따라 선택하여 주십시오	0: Lock when it stops 1: Release when it stops
M0~M2	M0~M2의 3비트를 사용하여 동작 DATA를 선택하여 주십시오	0 to 7: Operation data No.

[중 요]
• 여러 입력 단자에 동일한 입력 신호를 할당하지 마십시오. 동일한 입력 신호가 여러 입력 단자에 할당되면, 단자 중 하나가 활성화 될 때 기능이 실행됩니다.
• 동일한 입력 신호가 remote I/O 및 direct I/O (X0~X5)에 모두 할당되면, 단자 중 하나가 활성화 될 때 기능이 실행 됩니다.
• HMI 입력이 입력 단자에 할당되지 않은 경우, HMI 입력은 항상 [1]이 됩니다. (기능 제한).
HMI 입력이 remote I/O 및 direct I/O (X0~X5)에 모두 할당 될 경우, 모든 단자가 [1]이 되면 기능이 제한 됩니다.

• **Driver 출력 명령 (007Eh, 007Fh)**

RS-485 통신을 접속할 수 있는 driver 출력 신호입니다.
다음과 같이 remote I/O (NET-OUT0~15)가 할당됩니다.

Address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
007Eh	Upper	–	–	–	–	–	–	–	–
	Lower	–	–	–	–	–	–	–	–
007Fh	Upper	NET-OUT15 (TLC)	NET-OUT14 (VA)	NET-OUT13 (MOVE)	NET-OUT12 (ALARM-OUT2)	NET-OUT11 (Not used)	NET-OUT10 (Not used)	NET-OUT9 (Not used)	NET-OUT8 (S-BSY)
	Lower	NET-OUT7 (ALARM-OUT1)	NET-OUT6 (WNG)	NET-OUT5 (STOP-MODE_R)*	NET-OUT4 (REV_R)*	NET-OUT3 (FWD_R)*	NET-OUT2 (M2_R)	NET-OUT1 (M1_R)	NET-OUT0 (M0_R)

※ "3-wire 입력 mode" 는 "운전 입력 mode 선택" 의 parameter에 의해 설정되고,
다음과 같이 신호가 인가됩니다.
FWD ➡ START/STOP, REV ➡ RUN/BRAKE, STOP MODE ➡ FWD/REV

Parameter 설정에 의한 remote I/O 출력 단자 NET-IN 0 – 15의 할당된 입력신호입니다.

신호명	기능		설정범위
Not used	입력 단자가 사용되지 않을 경우 set		–
FWD_R	2-wire 입력 mode	FWD 응답 출력	0: FWD=OFF 1: FWD=ON
REV_R		REV 응답 출력	0: REV=OFF 1: REV=ON
STOP-MODE_R		STOP MODE 응답 출력	0: STOP-MODE=OFF 1: STOP-MODE=ON
START/STOP_R	3-wire 입력 mode	START/STOP 응답 출력	0: START/STOP=OFF 1: START/STOP=ON
RUN/BRAKE_R		RUN/BRAKE 응답 출력	0: RUN/BRAKE=OFF 1: RUN/BRAKE=ON
FWD/REV_R		FWD/REV 응답 출력	0: FWD/REV=OFF 1: FWD/REV=ON
MB-FREE_R	FREE 응답출력		0: MB-FREE=OFF 1: MB-FREE=ON
M0_R	M0 응답 출력		0: M0=OFF 1: M0=ON
M1_R	M1 응답 출력		0: M1=OFF 1: M1=ON
M2_R	M2 응답 출력		0: M2=OFF 1: M2=ON
ALARM-OUT1	Alarm 출력 1		0: Normal operation 1: Alarm present
WNG	Warning 출력		0: Normal operation 1: Warning present
MOVE	Motor 회전 중 출력		0: Motor standstill 1: Motor in operation
TLC	Torque 도달 출력		0: Within the torque limiting value 1: Outside the torque limiting value
VA	속도 도달 출력		0: Within the speed attainment band 1: Outside the speed attainment band
S-BSY	내부 처리중		0: Internal processing not in progress 1: Internal processing in progress
ALARM-OUT2	Alarm 출력 2		0: Normal operation 1: In overload operation
MPS	주 전원 상태 출력		0: Main power-OFF 1: Main power-ON

2.11.2 유지 보수 명령

유지보수 명령은 alarm 및 warning을 재설정하는데 사용됩니다. 또한, NV memory를 일괄 처리도 가능합니다. 모든 명령은 읽고 쓸 수 있습니다. [0]에서 [1]로 설정 시 실행 됩니다.

Register address		Name	Description	설정범위
Dec	Hex			
384	0180h	Reset alarm (upper)	Alarm을 reset 합니다. (일부 alarm은 reset할 수 없습니다.)	0, 1
385	0181h	Reset alarm (lower)		
388	0184h	Clear alarm records (upper)	Alarm 기록을 지웁니다.	
389	0185h	Clear alarm records (lower)		
390	0186h	Clear warning records (upper)	Warning 기록을 지웁니다.	
391	0187h	Clear warning records (lower)		
392	0188h	Clear commun ication error records (upper)	통신 error 기록을 지웁니다.	
393	0189h	Clear commun ication error records (lower)		
396	018Ch	Configuration (upper)	parameter를 재 설정 하고 실행합니다.	
397	018Dh	Configuration (lower)		
398	018Eh	All data initialization (upper)*	NV memory에 저장되어 있는 동작 data 와 parameter를 초기치로 reset 합니다.	
399	018Fh	All data initialization (lower)*		
400	0190h	Batch NV memory read (upper)	NV memory에 저장되어 있는 동작 data 와 parameter를 읽어 RAM에 덮어 씁니다.	
401	0191h	Batch NV memory read (lower)		
402	0192h	Batch NV memory write (upper)	RAM의 parameter를 NV memory에 write합니다. NV momory는 약 100,000번 write가 가능합니다.	
403	0193h	Batch NV memory write (lower)		

[중 요] • 모든 data 초기화를 실행하기 전에, direct I/O의 X0/X1 단자와 remote I/O의 NET-IN3/NET-IN4 단자 신호를 [OFF]로 하여 주십시오. 초기화 후에 Motor가 갑자기 회전할 수 있습니다.

• **Configuration (018Ch)**

다음의 모든 조건이 만족 될 때 Configuration이 실행 됩니다.

- Alarm 이 발생하지 않을 때
- Motor가 동작하지 않을 때

Configuration의 실행 전후의 Driver 상태를 표시합니다.

Item	Configuration is ready to execute	Configuration is executing	Configuration is completed
POWER LED	Lit	Lit	Based on the driver condition.
ALARM LED	OFF	OFF	
Electromagnetic brake	Hold/Release	Hold/Release	
Output signals	Allowed	Indeterminable	Allowed
Input signals	Allowed	Not allowed	Allowed

[중 요] • Configuration이 실행 되는 동안에는 RS-485 통신 모니터 값이 제대로 반환되지 않을 수 있습니다.

2.11.3 모니터 명령

속도, alarm, 경고 기록 등 모든 명령을 읽을 수 있습니다.

Register address		Name	Description	설정범위
Dec	Hex			
128	0080h	Present alarm (upper)	현재의 alarm code를 Monitor합니다.	00h to FFh
129	0081h	Present alarm (lower)		
130	0082h	Alarm record 1 (upper)	1~10까지의 alarm기록을 Monitor합니다.	
131	0083h	Alarm record 1 (lower)		
132	0084h	Alarm record 2 (upper)		
133	0085h	Alarm record 2 (lower)		
134	0086h	Alarm record 3 (upper)		
135	0087h	Alarm record 3 (lower)		
136	0088h	Alarm record 4 (upper)		
137	0089h	Alarm record 4 (lower)		
138	008Ah	Alarm record 5 (upper)		
139	008Bh	Alarm record 5 (lower)		
140	008Ch	Alarm record 6 (upper)		
141	008Dh	Alarm record 6 (lower)		
142	008Eh	Alarm record 7 (upper)		
143	008Fh	Alarm record 7 (lower)		
144	0090h	Alarm record 8 (upper)		
145	0091h	Alarm record 8 (lower)		
146	0092h	Alarm record 9 (upper)		
147	0093h	Alarm record 9 (lower)		
148	0094h	Alarm record 10 (upper)		
149	0095h	Alarm record 10 (lower)		
150	0096h	Present warning (upper)	현재의 warning code를 Monitor합니다.	00h to FFh
151	0097h	Present warning (lower)		
152	0098h	Warning record 1 (upper)	1~10까지의 warning기록을 Monitor합니다.	
153	0099h	Warning record 1 (lower)		
154	009Ah	Warning record 2 (upper)		
155	009Bh	Warning record 2 (lower)		
156	009Ch	Warning record 3 (upper)		
157	009Dh	Warning record 3 (lower)		
158	009Eh	Warning record 4 (upper)		
159	009Fh	Warning record 4 (lower)		
160	00A0h	Warning record 5 (upper)		
161	00A1h	Warning record 5 (lower)		
162	00A2h	Warning record 6 (upper)		
163	00A3h	Warning record 6 (lower)		
164	00A4h	Warning record 7 (upper)		
165	00A5h	Warning record 7 (lower)		
166	00A6h	Warning record 8 (upper)		
167	00A7h	Warning record 8 (lower)		
168	00A8h	Warning record 9 (upper)		
169	00A9h	Warning record 9 (lower)		
170	00AAh	Warning record 10 (upper)		
171	00ABh	Warning record 10 (lower)		
172	00ACh	Communication error code (upper)	마지막으로 수신한 통신 error code Monitor입니다.	
173	00ADh	Communication error code (lower)		

Register address		Name	Description	설정범위
Dec	Hex			
174	00AEh	Communication error code record 1 (upper)	1~10까지의 통신 error 기록을 Monitor합니다.	00h to FFh
175	00AFh	Communication error code record 1 (lower)		
176	00B0h	Communication error code record 2 (upper)		
177	00B1h	Communication error code record 2 (lower)		
178	00B2h	Communication error code record 3 (upper)		
179	00B3h	Communication error code record 3 (lower)		
180	00B4h	Communication error code record 4 (upper)		
181	00B5h	Communication error code record 4 (lower)		
182	00B6h	Communication error code record 5 (upper)		
183	00B7h	Communication error code record 5 (lower)		
184	00B8h	Communication error code record 6 (upper)		
185	00B9h	Communication error code record 6 (lower)		
186	00BAh	Communication error code record 7 (upper)		
187	00BBh	Communication error code record 7 (lower)		
188	00BCh	Communication error code record 8 (upper)		
189	00BDh	Communication error code record 8 (lower)		
190	00BEh	Communication error code record 9 (upper)		
191	00BFh	Communication error code record 9 (lower)		
192	00C0h	Communication error code record 10 (upper)		
193	00C1h	Communication error code record 10 (lower)		
196	00C4h	Present selected data No. (upper)	현재 선택한 운전 Data No.를 Monitor합니다.	0 to 7
197	00C5h	Present selected data No. (lower)		
200	00C8h	Command speed (upper)	현재의 명력속도를 Monitor합니다.	−4010 to +4010 r/min +: Forward −: Reverse 0: Stop
201	00C9h	Command speed (lower)		
206	00CEh	Feedback speed (upper)	Feedback 속도를 Monitor합니다.	−5200 to +5200 r/min
207	00CFh	Feedback speed (lower)		
212	00D4h	Direct I/O and electromagnetic brake status (upper)	각각의 I/O신호와 전자 Brake의 상태를 Monitor합니다.	See next table.
213	00D5h	Direct I/O and electromagnetic brake status (lower)		

I/O 및 전자 Brake 상태 (00D4h)

Register address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
00D4h	Upper	−	−	−	−	−	−	−	MB
	Lower	−	−	−	−	−	−	Y1	Y0
00D5h	Upper	−	−	−	−	−	−	−	−
	Lower	−	−	X5	X4	X3	X2	X1	X0

2.11.4 Parameter R/W 명령 [Operation data]

모든 명령을 읽기 또는 쓰기를 할 수 있습니다.

Register address		Name	설정범위	설정단위	초기치	실행
Dec	Hex					
1152	0480h	회전속도 No.0 (upper)	0 r/min, and 80 to 4000 r/min	1	0	즉시실행
1153	0481h	회전속도 No.0 (lower)				
1154	0482h	회전속도 No.1 (upper)				
1155	0483h	회전속도 No.1 (lower)				
1156	0484h	회전속도 No.2 (upper)				
1157	0485h	회전속도 No.2 (lower)				
1158	0486h	회전속도 No.3 (upper)				
1159	0487h	회전속도 No.3 (lower)				
1160	0488h	회전속도 No.4 (upper)				
1161	0489h	회전속도 No.4 (lower)				
1162	048Ah	회전속도 No.5 (upper)				
1163	048Bh	회전속도 No.5 (lower)				
1164	048Ch	회전속도 No.6 (upper)				
1165	048Dh	회전속도 No.6 (lower)				
1166	048Eh	회전속도 No.7 (upper)				
1167	048Fh	회전속도 No.7 (lower)				
1536	0600h	가속시간 No.0 (upper)	2 to 150 (1=0.1 s)	0.1	5	
1537	0601h	가속시간 No.0 (lower)				
1538	0602h	가속시간 No.1 (upper)				
1539	0603h	가속시간 No.1 (lower)				
1540	0604h	가속시간 No.2 (upper)				
1541	0605h	가속시간 No.2 (lower)				
1542	0606h	가속시간 No.3 (upper)				
1543	0607h	가속시간 No.3 (lower)				
1544	0608h	가속시간 No.4 (upper)				
1545	0609h	가속시간 No.4 (lower)				
1546	060Ah	가속시간 No.5 (upper)				
1547	060Bh	가속시간 No.5 (lower)				
1548	060Ch	가속시간 No.6 (upper)				
1549	060Dh	가속시간 No.6 (lower)				
1550	060Eh	가속시간 No.7 (upper)				
1551	060Fh	가속시간 No.7 (lower)				
1664	0680h	감속시간 No.0 (upper)	2 to 150 (1=0.1 s)	0.1	5	
1665	0681h	감속시간 No.0 (lower)				
1666	0682h	감속시간 No.1 (upper)				
1667	0683h	감속시간 No.1 (lower)				
1668	0684h	감속시간 No.2 (upper)				
1669	0685h	감속시간 No.2 (lower)				
1670	0686h	감속시간 No.3 (upper)				
1671	0687h	감속시간 No.3 (lower)				
1672	0688h	감속시간 No.4 (upper)				
1673	0689h	감속시간 No.4 (lower)				
1674	068Ah	감속시간 No.5 (upper)				
1675	068Bh	감속시간 No.5 (lower)				
1676	068Ch	감속시간 No.6 (upper)				
1677	068Dh	감속시간 No.6 (lower)				
1678	068Eh	감속시간 No.7 (upper)				
1679	068Fh	감속시간 No.7 (lower)				

Register address		Name	설정범위	설정 단위	초기치	실행
Dec	Hex					
1792	0700h	Torque 제한 No.0 (upper)	0 to 200%	1	200	즉시실행
1793	0701h	Torque 제한 No.0 (lower)				
1794	0702h	Torque 제한 No.1 (upper)				
1795	0703h	Torque 제한 No.1 (lower)				
1796	0704h	Torque 제한 No.2 (upper)				
1797	0705h	Torque 제한 No.2 (lower)				
1798	0706h	Torque 제한 No.3 (upper)				
1799	0707h	Torque 제한 No.3 (lower)				
1800	0708h	Torque 제한 No.4 (upper)				
1801	0709h	Torque 제한 No.4 (lower)				
1802	070Ah	Torque 제한 No.5 (upper)				
1803	070Bh	Torque 제한 No.5 (lower)				
1804	070Ch	Torque 제한 No.6 (upper)				
1805	070Dh	Torque 제한 No.6 (lower)				
1806	070Eh	Torque 제한 No.7 (upper)				
1807	070Fh	Torque 제한 No.7 (lower)				

2.11.5 Parameter R/W 명령 [User parameters]

Register address		Name	Description	설정범위	설정 단위	초기치	실행
Dec	Hex						
646	0286h	JOG operation speed (upper)	JOG 운전의 회전 속도를 설정합니다.	0 r/min, and 80 to 1000 r/min	1	300	즉시 실행
647	0287h	JOG operation speed (lower)					
900	0384h	Motor direction seledion (upper)	FWD 입력이 ON 일 경우 MOTOR의 회전 방향을 설정합니다.	0: + side=CCW 1: + side=CW	–	1	config.후 실행
901	0385h	Motor direction seledion (lower)					
4160	1040h	Operation input mode selection (upper)	외부 입력 mode를 설정합니다.	0: 2-wire input mode 1: 3-wire input mode	–	0	
4161	1041h	Operation input mode selection (lower)					
4162	1042h	JOG operation torque (upper)	JOG 운전의 Torque 제한 값을 설정합니다.	0 to 200%	1	200	즉시 실행
4163	1043h	JOG operation torque (lower)					
4170	104Ah	Speed reduction ratio (upper)	감속비를 설정하여 감속기 출력 shaft의 회전 속도를 표시합니다. 소수점의 위치를 설정함으로써 다양한 감속비를 설정할 수 있습니다.	100 to 9999	1	100	
4171	104Bh	Speed reduction ratio (lower)					
4172	104Ch	Speed reduction ratio decimal digit setting (upper)		0: 1 digit 1: 2 digit 2: 3 digit	–	2	
4173	104Dh	Speed reduction ratio decimal digit setting (lower)					

Register address		Name	Description	설정범위	설정 단위	초기치	실행
Dec	Hex						
4174	104Eh	Speed increasing ratio (upper)	가속비를 설정하여 Motor shaft의 출력 회전 속도를 표시합니다. 가속비가 1일 경우에는 감속비가 적용됩니다. 가속비가 1이 아닐 경우에는 가속비가 적용됩니다.	1 to 5	–	1	즉시 실행
4175	104Fh	Speed increasing ratio (lower)					
4176	1050h	Conveyor speed reduction ratio (upper)	conveyor의 반송속도의 감속 비율을 표시할 수 있습니다.	100 to 9999	1	100	
4177	1051h	Conveyor speed reduction ratio (lower)					
4178	1052h	Conveyor speed reduction ratio decimal digit setting (upper)		0: 1 digit 1: 2 digit 2: 3 digit	–	2	
4179	1053h	Conveyor speed reduction ratio decimal digit setting (lower)					
4180	1054h	Conveyor speed increasing ratio (upper)	conveyor의 반송속도의 가속 비율을 표시할 수 있습니다.	1 to 5	–	1	
4181	1055h	Conveyor speed increasing ratio (lower)					
4322	10E2h	Analog input signal selection (upper)	운전 data의 설정 방법을 선택할 수 있습니다.	0: Mode 0 1: Mode 1 2: Mode 2 3: Mode 3 4: Mode 4 5: Mode 5	–	0	config.후 실행
4323	10E3h	Analog input signal selection (lower)					
4430	114Eh	Rotation speed attainment band (upper)	속도 도달 범위를 설정 할 수 있습니다.	0 to 400 r/min	1	200	즉시 실행
4431	114Fh	Rotation speed attainment band (lower)					

• **아날로그 입력 신호를 선택하여 운전 data 설정**

운전 data의 설정 방법은 아날로그 입력 신호 선택 parameter를 사용하여 변경할 수 있습니다. 아래와 같이 mode 번호 및 아날로그 설정 / 디지털 설정의 조합을 참조하십시오. 다음과 같은 조합을 제외한 기타 설정은 사용할 수 없습니다

Mode	Operation data No.	VR1	VR2	VR3	외부VR	Digital 설정
Mode 0 (Initial setting)	0	Rotation speed	Acceleration/ Deceleration time	Torque limiting value	–	–
	1	–	Acceleration/ Deceleration time	Torque limiting value	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 1	0 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 2	0 to 7	–	–	–	Torque limiting value	Rotation speed Acceleration time Deceleration time
Mode 3	0	Acceleration time	Deceleration time	Rotation speed	–	Torque limiting value
	1	Acceleration time	Deceleration time	–	Rotation speed	Torque limiting value
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 4	0	Rotation speed	Torque limiting value	Acceleration/ Deceleration time	–	–
	1	–	Torque limiting value	Acceleration/ Deceleration time	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 5	0	Torque limiting value	Acceleration/ Deceleration time	Rotation speed	–	–
	1	Torque limiting value	Acceleration/ Deceleration time	–	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value

[중 요] • Torque 제한 가변 저항 (VR3)의 공장 출하시 설정은 최대 값으로 설정됩니다. Mode No.3, No.4 또는 No.5를 선택할 경우, 모터를 작동하기 전에 설정 값을 확인 하여 주십시오. 회전 속도, 감속/가속 값은 최대 값으로 설정되어 있습니다.

2.11.6 Parameter R/W 명령 [Alarm, 경고]

Register address		Name	Description	설정범위	설정 단위	초기치	실행
Dec	Hex						
840	0348h	Undervoltage warning level (upper)	주 전원의 부족 전압 warning 레벨을 설정합니다.	0 to 480 (=0.1 V)	0.1	24 VDC type: 216 48 VDC type: 432	즉시 실행
841	0349h	Undervoltage warning level (lower)					
4224	1080h	Electromagnetic brake action at alarm (upper)	Alarm이 발생했을 때, 전자 brake의 실제 동작 시간을 설정합니다.	0: Lock after coasting to a stop 1: Lock immediately	–	1	config,후 실행
4225	1081h	Electromagnetic brake action at alarm (lower)					
4226	1082h	Operation error during initialization alarm function (upper)	초기화 alarm 동안 운전 error의 enable/disable를 설정합니다.	0: Disable 1: Enable	–	0	
4227	1083h	Operation error during initialization alarm function (lower)					
4228	1084h	Undervoltage alarm latch (upper)	부족 전압 alarm이 해제 되었을 때, Motor의 운전 상태를 설정합니다.	0: Disable 1: Enable	–	0	
4229	1085h	Undervoltage alarm latch (lower)					
4258	10A2h	Overload warning function (upper)	과부하 warning 기능의 enable/disable를 설정합니다.	0: Disable 1: Enable	–	1	즉시 실행
4259	10A3h	Overload warning function (lower)					
4264	10A8h	Undervoltage warning function (upper)	부족 전압 warning 기능의 enable/disable를 설정합니다.	0: Disable 1: Enable	–	1	
4265	10A9h	Undervoltage warning function (lower)					
4266	10AAh	Overload warning level (upper)	부하 Torque의 warning 레벨을 설정합니다.	50 to 100% 1 100	–	100	
4267	10ABh	Overload warning level (lower)					
4608	1200h	Communication timeout (upper)	통신 timeout 조건을 설정합니다.	0: Not monitored 0 to 10000 ms	–	0	
4609	1201h	Communication timeout (lower)					
4610	1202h	Communication error alarm (upper)	통신 error alarm 발생 조건을 설정합니다.	1 to 10 times	–	3	
46 11	1203h	Communication error alarm (lower)					

2.11.7 Parameter R/W 명령 [Data setter]

Register address		Name	Description	설정범위	초기치	실행
Dec	Hex					
960	03C0h	Data setter speed display (upper)	Sets the display method of operation speed in the monitor mode. If "0" is set, "–" will be displayed when rotating in REV input direction.	0: Signed 1: Absolute value	0	즉시실행
961	03C1h	Data setter speed display (lower)				
4320	10E0h	Data setter initial display (upper)	Select the initial screen when the driver power is turned on.	0: Operation speed 1: Conveyor transfer speed 2: Load factor 3: Operation data number 4: Top screen of monitor mode	0	전원 재투입후 실행
4321	10E1h	Data setter initial display (lower)				

2.11.8 Parameter R/W 명령 [I/O 기능(직접 I/O)]

Register address		Name	설정범위	초기치	실행
Dec	Hex				
4352	1100h	X0 입력기능선택 (upper)	0: Not used 1: FWD (START/STOP)*1 2: REV (RUN/BRAKE) *1 19: STOP–MODE (FWD/REV)*1 20: MB–FREE 21: EXT–ERROR 24: ALARM–RESET 27: HMI 48: M0 49: M1 50: M2	1	정지후 실행
4353	1101h	X0 입력기능선택 (lower)		2	
4354	1102h	X1 입력기능선택 (upper)		19	
4355	1103h	X1 입력기능선택 (lower)		48	
4356	1104h	X2 입력기능선택 (upper)		24	
4357	1105h	X2 입력기능선택 (lower)		20	
4358	1106h	X3 입력기능선택 (upper)			
4359	1107h	X3 입력기능선택 (lower)			
4360	1108h	X4 입력기능선택 (upper)			
4361	1109h	X4 입력기능선택 (lower)			
4362	110Ah	X5 입력기능선택 (upper)			
4363	110Bh	X5 입력기능선택 (lower)			
4416	1140h	Y0 출력기능선택 (upper)	0: Not used 65: ALARM–OUT1 66: WNG 68: MOVE 71: TLC 77: VA 81: ALARM–OUT2	65	즉시실행
4417	1141h	Y0 출력기능선택 (lower)			
4418	1142h	Y1 출력기능선택 (upper)		66	
4419	1143h	Y1 출력기능선택 (lower)			

*1 ( )는 "운전 입력 mede 선택" Parameter의 "3-wire 입력 mode"가 설정될 때 적용 됩니다.

2.11.9 Parameter R/W 명령 [I/O 기능(원격 I/O)]

Register address		Name	설정범위	초기치	실행
Dec	Hex				
4448	1160h	NET-IN0 입력기능선택(upper)	0: Not used 1: FWD (START/STOP) *1 2: REV (RUN/BRAKE) *1 19: STOP-MODE (FWD/REV) *1 20: MB-FREE 27: HMI 48: M0 49: M1 50: M2	48	config.후 실행
4449	1161h	NET-IN0 입력기능선택(lower)			
4450	1162h	NET-IN1 입력기능선택(upper)		49	
4451	1163h	NET-IN1 입력기능선택(lower)			
4452	1164h	NET-IN2 입력기능선택(upper)		50	
4453	1165h	NET-IN2 입력기능선택(lower)			
4454	1166h	NET-IN3 입력기능선택(upper)		1	
4455	1167h	NET-IN3 입력기능선택(lower)			
4456	1168h	NET-IN4 입력기능선택(upper)		2	
4457	1169h	NET-IN4 입력기능선택(lower)			
4458	116Ah	NET-IN5 입력기능선택(upper)		19	
4459	116Bh	NET-IN5 입력기능선택(lower)			
4460	116Ch	NET-IN6 입력기능선택(upper)		0	
4461	116Dh	NET-IN6 입력기능선택(lower)			
4462	116Eh	NET-IN7 입력기능선택(upper)		20	
4463	116Fh	NET-IN7 입력기능선택(lower)			
4464	1170h	NET-IN8 입력기능선택(upper)		0	
4465	1171h	NET-IN8 입력기능선택(lower)			
4466	1172h	NET-IN9 입력기능선택(upper)		0	
4467	1173h	NET-IN9 입력기능선택(lower)			
4468	1174h	NET-IN10 입력기능선택(upper)		0	
4469	1175h	NET-IN10 입력기능선택(lower)			
4470	1176h	NET-IN11 입력기능선택(upper)		0	
4471	1177h	NET-IN11 입력기능선택(lower)			
4472	1178h	NET-IN12 입력기능선택(upper)		0	
4473	1179h	NET-IN12 입력기능선택(lower)			
4474	117Ah	NET-IN13 입력기능선택(upper)		0	
4475	117Bh	NET-IN13 입력기능선택(lower)			
4476	117Ch	NET-IN14 입력기능선택(upper)		0	
4477	117Dh	NET-IN14 입력기능선택(lower)			
4478	117Eh	NET-IN15 입력기능선택(upper)		0	
4479	117Fh	NET-IN15 입력기능선택(lower)			

*1( )는 "운전 입력 mede 선택" Parameter의 "3-wire 입력 mode"가 설정될 때 적용 됩니다.

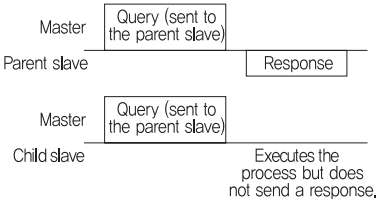
Register address		Name	설정범위	초기치	실행
Dec	Hex				
4480	1180h	NET-OUT0 출력기능선택(upper)	0: Not used 1: FWD_R (START/STOP_R) *1 2: REV_R (RUN/BRAKE_R) *1 19: STOP-MODE_R (FWD/REV_R) *1 20: MB-FREE_R 27: HMI_R 48: M0_R 49: M1_R 50: M2_R 65: ALARM-OUT1 66: WNG 68: MOVE 71: TLC 77: VA 80: S-BSY 81: ALARM-OUT2 82: MPS	48	config.후 실행
4481	1181h	NET-OUT0 출력기능선택(lower)			
4482	1182h	NET-OUT1 출력기능선택(upper)		49	
4483	1183h	NET-OUT1 출력기능선택(lower)			
4484	1184h	NET-OUT2 출력기능선택(upper)		50	
4485	1185h	NET-OUT2 출력기능선택(lower)			
4486	1186h	NET-OUT3 출력기능선택(upper)		1	
4487	1187h	NET-OUT3 출력기능선택(lower)			
4488	1188h	NET-OUT4 출력기능선택(upper)		2	
4489	1189h	NET-OUT4 출력기능선택(lower)			
4490	118Ah	NET-OUT5 출력기능선택(upper)		19	
4491	118Bh	NET-OUT5 출력기능선택(lower)			
4492	118Ch	NET-OUT6 출력기능선택(upper)		66	
4493	118Dh	NET-OUT6 출력기능선택(lower)			
4494	118Eh	NET-OUT7 출력기능선택(upper)		65	
4495	118Fh	NET-OUT7 출력기능선택(lower)			
4496	1190h	NET-OUT8 출력기능선택(upper)		80	
4497	1191h	NET-OUT8 출력기능선택(lower)			
4498	1192h	NET-OUT9 출력기능선택(upper)		0	
4499	1193h	NET-OUT9 출력기능선택(lower)			
4500	1194h	NET-OUT10 출력기능선택(upper)		0	
4501	1195h	NET-OUT10 출력기능선택(lower)			
4502	1196h	NET-OUT11 출력기능선택(upper)		0	
4503	1197h	NET-OUT11 출력기능선택(lower)			
4504	1198h	NET-OUT12 출력기능선택(upper)		81	
4505	1199h	NET-OUT12 출력기능선택(lower)			
4506	119Ah	NET-OUT13 출력기능선택(upper)		68	
4507	119Bh	NET-OUT13 출력기능선택(lower)			
4508	119Ch	NET-OUT14 출력기능선택(upper)		77	
4509	119Dh	NET-OUT14 출력기능선택(lower)			
4510	119Eh	NET-OUT15 출력기능선택(upper)		71	
4511	119Fh	NET-OUT15 출력기능선택(lower)			

*1 ( )는 "운전 입력 mede 선택" Parameter의 "3-wire 입력 mode"가 설정될 때 적용 됩니다.

2.12 그룹 전송

다중 Slave는 그룹으로 만들어지며 Query는 한번에 그룹의 모든 slaved에 전송됩니다.

- 그룹 구성
  그룹은 하나의 parent slave와 child slave로 구성되어 있으며, parent slave만 응답합니다.
- 그룹 주소
  그룹 전송을 수행하기 위해 그룹에 포함되어 있는 child slave에 그룹 주소를 설정하여 주십시오.

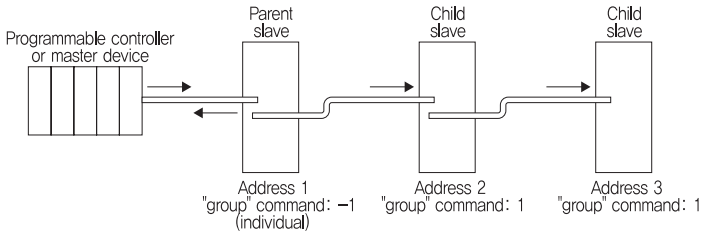


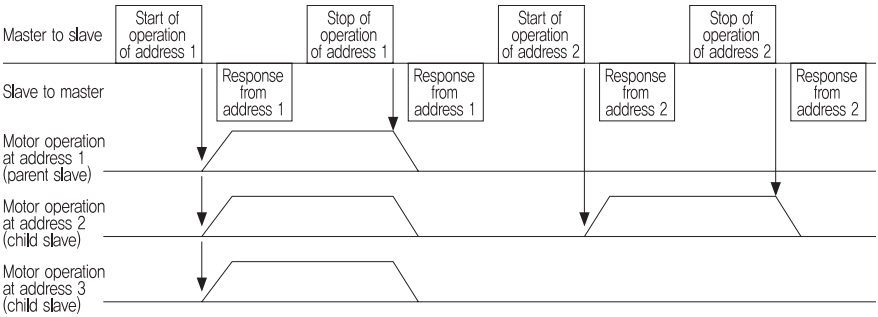
- Parent slave
  그룹 전송을 위해 parent slave에 특별한 설정을 할 필요는 없습니다.
  그룹 주소 query가 master로부터 parent slave로 전송되면, parent slave는 프로세스를 수행하고 응답합니다.
- Child slave
  각각의 child slave에 그룹 주소를 설정하기 위해 “group” 명령을 사용하여 주십시오.
  Unicast mode에서 그룹을 변경하여 주십시오.

Address	설정범위	초기치
0030h	−1: No group specification (Group send is not performed) 1 to 31: Sets a group address.	−1

[중 요] • 그룹설정은 [배치 NV 메모리 쓰기]가 실행 되더라도 NV 메모리에 저장되지 않기 때문에 전원을 재 투입 할 경우 그룹설정은 해제됩니다. 전원을 켤 때마다 그룹설정을 재설정하여 주십시오.

Function code	기능
10h	Writing to multiple holding registers





2.13 통신 오류 검출

이 기능은 RS-485 통신을 하는 동안 발생할 수 있는 오류를 검출합니다.

2.13.1 통신 오류

통신 오류 기록은 RAM에 저장됩니다. [communication error record] 명령을 사용하여 통신 오류를 확인 할 수 있습니다.

[중 요] • Driver의 전원을 차단하여 통신 오류 기록을 지울 수도 있습니다.

Type of communication error	Error code	원인
RS-485 communication error	84h	A transmission error was detected. See "No response" on p.14.
Command not yet defined	88h	An exception response (exception code 01h, 02h) was detected. See p.15.
User I/F communication in progress	89h	An exception response (exception code 04h) was detected. See p.15.
NV memory processing in progress	8Ah	
Outside setting range	8Ch	An exception response (exception code 03h, 04h) was detected. See p.15.
Command execute disable	8Dh	An exception response (exception code 04h) was detected. See p.15.

2.13.2 Alarm 및 경고

Alarm이 발생하면 ALARM OUT 출력이 [OFF]되고 Motor는 정지합니다. 동시에 alarm LED가 점멸합니다.
경고가 발생하면 WNG 출력이 [ON] 되지만, Motor는 계속 동작합니다. 경고의 원인을 제거하면, WNG 출력은 자동으로 [OFF] 됩니다.

[중 요] • Driver의 전원을 차단하여 경고 기록을 지울 수도 있습니다.

• **통신 스위치 설정 오류**

통신 기능 스위치(SW2)의 No.4를 [ON]으로 설정할 경우, 전송속도 설정 스위치 오류가 발생합니다.

• **RS-485 통신 오류 [84h]**

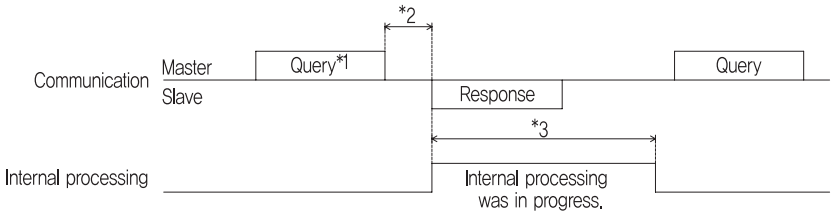
구분	Description
Warning	통신 error(84h)가 검출될 경우 warning이 발생됩니다. 정상 수신시 자동 해제 됩니다.
Alarm	"통신 error alarm" parameter에서 설정한 횟수 이상 error가 검출될 경우 Alarm이 발생됩니다.

• **RS-485 통신 타임아웃 [85h]**

[communication timeout]에 설정된 시간 동안 통신이 두절될 경우 타임아웃 alarm이 발생합니다.

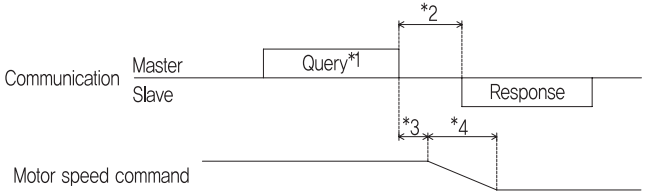
2.14 Timing charts

2.14.1 통신 start



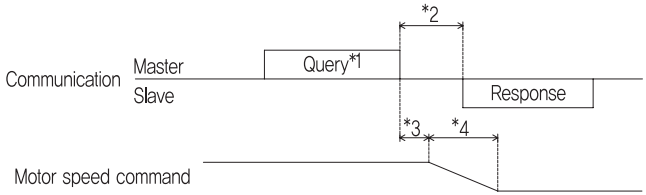
* Tb2 (전송 대기 시간) + C3.5 (간격) + 명령 처리 시간

2.14.2 통신 start



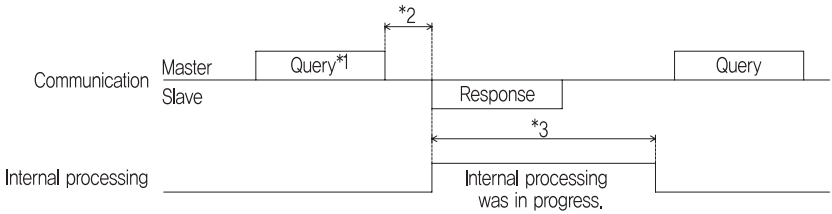
*1 [START] query를 포함하는 메시지입니다.
*2 Tb2 (전송 대기 시간) + C3.5 (간격) + 명령 처리 시간
*3 C3.5 (간격) + 4 ms 이하

2.14.3 STOP, 속도 가변



*1 [STOP], [속도가변] query를 포함하는 메시지입니다.
*2 Tb2 (전송 대기 시간) + C3.5 (간격) + 명령 처리 시간
*3 C3.5 (간격) + 명령 처리 시간
*4 설정 시간은 Driver 입력 명령 또는 Parameter 설정에 따라 변합니다.

2.14.4 Configuration



*1 [Configuration] query를 포함하는 메시지입니다.
*2 Tb2 (전송 대기 시간) + C3.5 (간격) + 명령 처리 시간
*3 C3.5 (간격) + 1초 이하

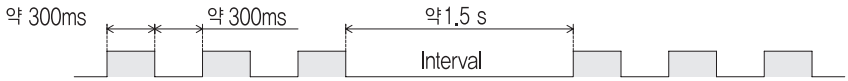
3. Alarm, 경고, 통신오류

과열, 접속불량, 오작동 시 Driver를 보호하기 위해 Alarm이 발생합니다.

3.1 Alarm

Alarm이 발생하면 ALARM OUT 출력이 [OFF]되고 Motor는 정지합니다. 동시에 alarm LED는 점멸합니다. Alarm의 원인은 alarm LED의 점멸 횟수로써 확인 할 수 있습니다.

EX) 센서 오류 alarm (점멸회수 : 3회)



3.1.1 Alarm 목록

Alarm code	Alarm LED 점멸횟수	Alarm type	원인	조치	A/CLR input
30h	2	과부하	Motor에 정격을 초과하는 부하가 약 5초이상 지속되었을 경우	* 부하를 줄여 주십시오 * 가감속 시간을 설정하여 주십시오	가능
28h	3	sensor error	Motor 케이블의 단선 또는 connector의접속 불량으로 인한 motor 피드백 신호에 이상이 발생한 경우	Motor와 Driver간의 배선을 확인하여 주십시오	
42h		초기 sensor error	초기 전원 투입시 Motor 케이블의 단선또는 connector의 접속 불량으로 인한motor 피드백 신호에 이상이 발생한 경우		
22h	4	과전압	Driver에 인가되는 전압이 사양보다 높은경우	입력 전압을 확인 하여 주십시오	
25h	5	부족전압	Driver에 인가되는 전압이 사양보다 낮은경우	입력 전압을 확인 하여 주십시오	
31h	6	과속도	Motor의 속도가 4800 r/min을 초과하는이상 속도 현상이 발생할 경우	* 부하를 줄여 주십시오 * 가감속 시간을 설정하여 주십시오	

Alarm code	Alarm LED 점멸횟수	Alarm type	원인	조치	A/CLR input
20h	7	과전류	지락 전류등으로 과전류가 흐른다.	배선을 재 확인 및 전원을 재투입하여 주십시오.	불가능
6Eh	10	외부 정지*1	EXT input이 OFF 되어 있다.	EXT input을 확인 하여 주십시오	가능
46h	11	초기 동작 error*2	FWD 또는 REV input이 ON 되어 있는 상태에서 전원을 투입하였다	전원을 투입하기 전, FWD 또는 REV input을OFF로 하여 주십시오	
81h	12	Network bus error	Host network bus가 OFF 되어 있다.	배선을 확인 하여 주십시오	
83h		통신 스위치 설정 error	통신 기능 스위치 (SW2-No.4)가 ON되어있다.	통신 기능 스위치 (SW2-No.4)를 확인 하여 주십시오.	불가능
84h		통신 error	"통신 error alarm" parameter가 set 되어있다.	배선 및 통신 설정을 확인 하여 주십시오	가능
85h		통신 timeout	"통신 timeout" parameter가 set되어 있다.	배선 및 통신 설정을 확인 하여 주십시오	
8Eh		Network converter error	Network converter alarm이 발생되었다	Network converter의 alarm code를 확인하여 주십시오.	
2Dh	14	주회로 출력 error*3	Motor와 연결이 되어 있지 않다.	Motor와 Driver간의 배선을 인하여 주십시오	

*1 [EXT ERROR]가 X0-X5에 할당되면 발생합니다.
*2 [Initial operation error]가 활성화 되면 발생합니다.
*3 Torque 제한 값이 200% 미만으로 설정되어 있는 경우, alarm이 발생하지 않습니다.

3.1.2 Alarm reset

Alarm을 reset 할 경우에는 먼저 입력 신호를 [OFF]하여 안전 한지 확인 후, alarm의 원인을 제거하고 아래의 방법 중 하나를 선택하여 주십시오.

- A/CLR 입력을 [ON] 후 [OFF]로 하여 주십시오,
- RS-485 통신을 이용하여 alarm을 reset 하여 주십시오.
- 전원을 [OFF] 후 [ON] 하여 주십시오.

[중 요]
- Alarm 종류에 따라 A/CLR 또는 RS-485 통신으로 alarm reset이 되지 않을 수 있습니다. Alarm 목록을 확인하여 주십시오. alarm을 reset 하려면, 전원을 [OFF] 후 [ON] 하여 주십시오.
- RS-485 통신을 이용하여 alarm을 reset할 경우, 조작 입력 신호가 [ON]으로 되어 있으면 Motor가 갑자기 회전하여 부상의 우려가 있습니다. 반드시 reset 전에 입력 신호를 [OFF]로 하여 주십시오.

3.1.3 Alarm 기록

Alarm 기록은 최대 10 까지 NV 메모리에 저장됩니다.
Alarm 기록을 읽거나 지울 때는 아래 방법 중 하나를 선택하여 주십시오.

- RS-485 통신을 통해 모니터 명령으로 alarm 기록의 확인이 가능합니다.
- 유지보수 명령을 사용하여 Alarm 기록을 삭제할 수 있습니다.

3.2 경고

경고가 발생하면 WNG 출력이 [ON] 되지만, Motor는 계속 동작합니다. 경고의 원인을 제거하면, WNG 출력은 자동으로 [OFF] 됩니다.

3.2.1 경고 목록

Code	Warning type	원인	조치
25h	부족전압	입력전압이 정격 전압보다 약 10% 이상 낮은 경우	입력전압 및 배선을 확인하여 주십시오
30h	과부화	부하 Torque가 과부하 경고 레벨 이상일 경우	부하를 줄여 주십시오 가감속시간을 설정하여 주십시오
84h	통신error	통신 error가 검출된 경우	통신 설정 및 배선을 확인하여 주십시오

3.2.2 경고 기록

경고 기록은 최대 10 까지 NV 메모리에 저장됩니다.
경고 기록을 읽거나 지울 때는 아래 방법 중 하나를 선택하여 주십시오.

- RS-485 통신을 통해 모니터 명령으로 경고 기록의 확인이 가능합니다.
- 유지보수 명령을 사용하여 경고 기록을 삭제할 수 있습니다.

[중 요] • Driver의 전원을 차단하여 경고 기록을 지울 수도 있습니다.

3.3 통신 오류

통신 오류는 최대 10 까지 NV 메모리에 저장됩니다.
RS-485 통신을 이용하여 확인 할 수 있습니다.

3.3.1 통신 오류 목록

Code	Communication error type	원인	조치
84h	통신 error	아래의 error가 검출된 경우 · Framing error · BCC error	통신설정 및 배선을 확인하여 주십시오.
88h	명령 미설정	정의되지 않은 명령은 실행할 수 없습니다.	명령을 설정하여 주십시오.
8Ah	NV memory 실행	NV memory가 실행중인 동안에는 명령을 실행할 수 없습니다.	내부 실행이 완료될때 까지 기달려 주십시오.
8Ch	Outside setting range	master로 부터의 설정Data는 설정 범위를 벗어나 실행할 수 없습니다.	설정 Data를 확인하여 주십시오.
8Dh	명령 실행 불가	명령을 실행할 수 없을때 재시도 합니다.	Status를 확인하여 주십시오.

3.3.2 통신 오류 기록

통신 오류는 최대 10 까지 NV 메모리에 저장됩니다.
RAM에 저장된 통신 오류 기록을 읽거나 다음중 하나를 수행핼 때 삭제 할 수 있습니다.

- RS-485 통신을 통해 모니터 명령으로 통신 오류 기록의 확인이 가능합니다.
- 유지보수 명령을 사용하여 통신 오류 기록을 삭제할 수 있습니다.

[중 요] • Driver의 전원을 차단하여 통신 오류 기록을 지울 수도 있습니다.

21C, for world geared motor!

USER MANUAL

SPG Co., Ltd.

※For further development of the product, specification and design can be changed without notice. For other information, please contact costumer service depot of the head office or sales department.

■ **Head office**

Incheon City, Namdong-Gu, Go-Jan dong, 628-11, 67 B/L 12LOT
Tel : 0082-32-820-8200 Fax : 0082-32-812-6218

USER MANUAL

Brushless DC Motor Driver

XV series

(Communication section)

OTOR

SPG Co., Ltd.
http://www.spg.co.kr

Thank you for purchasing SPG Motor. Please make sure to read user manual carefully and then learn knowledge, safety information and cautions and other related information for the product before you use it.

Tables of content

1. Safety cautions ---------- P3
2. Check lists for product arrival ---------- P5
3. Coding system ---------- P5
4. Installation ---------- P6
5. Names and functions for each part ---------- P12
6. Connection ---------- P13
7. Operation ---------- P22
8. Inspection ---------- P30
9. Troubleshooting ---------- P31

1. Safety cautions

This manual identifies safety classes as [Warning] [Cautions]

⚠ [Warning]	• Indicates a potentially hazardous situations, which, if not avoided, could result in personal injuries, death or serious personal injuries
⚠ [Caution]	• Indicates a potentially hazardous situations, which, if not avoided, may result in personal injuries, death or property damages

In addition, articles belonging to [Cautions] may cause critical accidents depending on situations. Whatever the notes in warning or cautions indicate, make sure to keep up with them.

⚠ **[Warning]**

- Do not use this product under explosive, flammable, or corrosive environment and where water splashes or near combustibles. Otherwise it may cause fire, electrical shock or injuries.
- Do not operate machine by wed hands. Otherwise it may cause electric shocks
- Always turn the power of before installing the machine and connect it. Failure to do so may result in electric shock.
- Make sure that only qualified personnel should perform the tasks of installing, wiring, operating, handling and inspecting the product. Failure to do so may result in electric shocks.
- Ground installed motor and driver properly to prevent the risks of electric shock
- Make sure to keep driver's input-power voltage within specification
- After the completion of connection, please install power terminal connected to input and output signals of the connection terminal to terminal cover. Otherwise it may cause fire or electric shock.
- Do not forcibly bend, pull or stress the unnecessary force to the lead wires or the power cables. Doing so may result in fire and electric shock.
- Turn off the driver in the event of power failure. Otherwise it may cause injuries or damages when power is back on
- Please do not use it in lifting devices. The driver's protection function will be activated, which in turn motor stops and then moving parts will also stop. This may cause injuries and damages on equipment.
- Do not touch the driver within 30 seconds after power is turned off. Otherwise remaining voltage may cause electric shock.
- Do not disassemble nor modify the motor, decelerator and driver. This may cause electric shock or injuries
- For more information in connection with technical inspection and repair, contact the nearest SPG sales office or authorized distributors.

[Caution]

- Do not exceed motor and driver's specification to be used. Otherwise it may cause electric shock, injuries or damages on equipment
- Do not pull or hold the output shaft of the motor. This may cause injuries
- Do not place combustibles around the motor and driver. Doing so may result in fire, electric shock and equipment damages.
- Do not touch rotating output shaft of motor and make sure to enclose the top securely. Otherwise it may cause electric shock or bodily injuries.
- Keep your location free of inflammable materials to prevent fire or burn
- Do not put foreign objects into the shaft of the driver. It may cause fire, electric shock and damages on equipment.
- Do not let fingers to be caught between the equipment and motor or when installing motor or motor with gearhead on equipment
- Make sure to use motor and driver with a designated combination. Otherwise it may cause fire, electric shock or equipment damages.
- When a test working is carried out, make sure to be prepared for an emergency stop to start. It may cause injuries.
- Turn off the power immediately if any irregularity or abnormality is found. Otherwise it may cause fire, electric shock or injuries.
- When protection function is activated, turn off the power again after removing the causes of the details. If you continue to operate motor without removing causes of malfunctioning in connection with motor and driver, it may cause injuries or equipment damages.
- Make sure to use insulated precision screw driver for driver's slow run / slow stop time setting device for setting. Otherwise it may cause an electric shock.
- When insulation resistance, dielectric strength test is performed, make sure not to touch terminals. Otherwise it may cause electric shock.
- When you dispose motor and driver, make sure to treat them as industrial wastes.
- The motor's surface temperature may exceed 70 °C during operation. Do not touch the motor and driver during operation. Otherwise it may cause bodily injuries.

[Note]

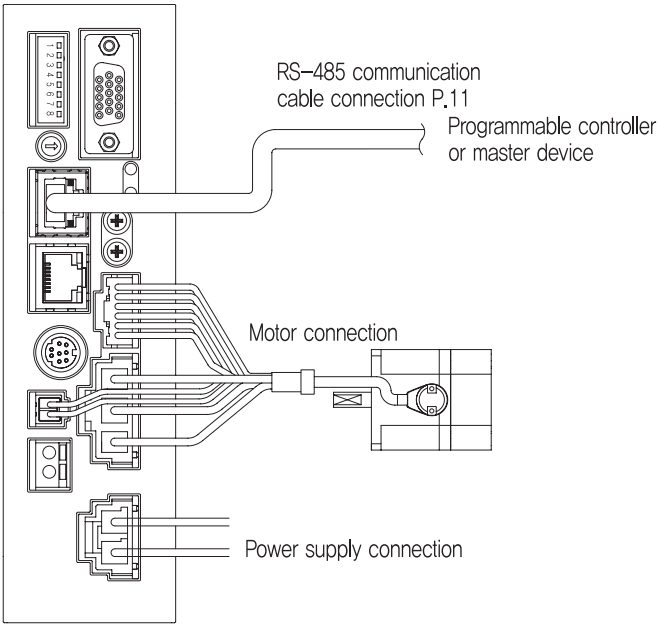
- XVD series are exclusively used for motor's XVM Series from SPG Motor. Therefore, they can't be used with other motors. Make sure to use dedicated driver and motor.
- When power is imposed again after it is turned off, make sure to wait for more than 5 seconds.

2. Modbus Protocol

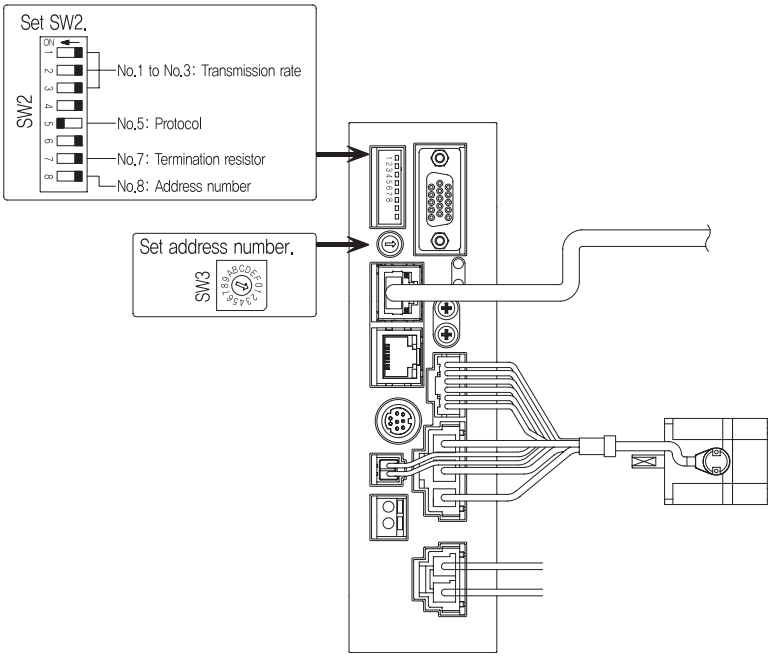
Following indicates how to implement program using RS-485 communication (Modbus protocol)

2.1 Guidance

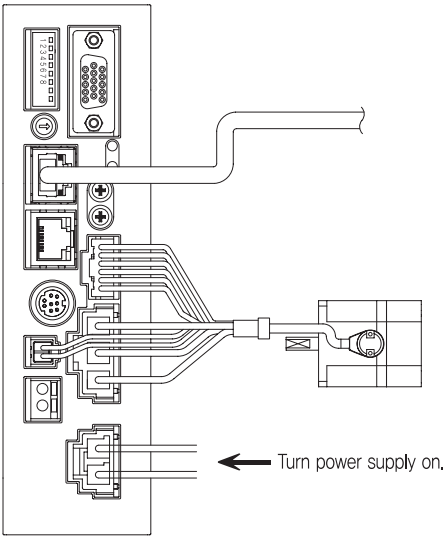
2.1.1 Installation and connection



2.1.2 Setting switches



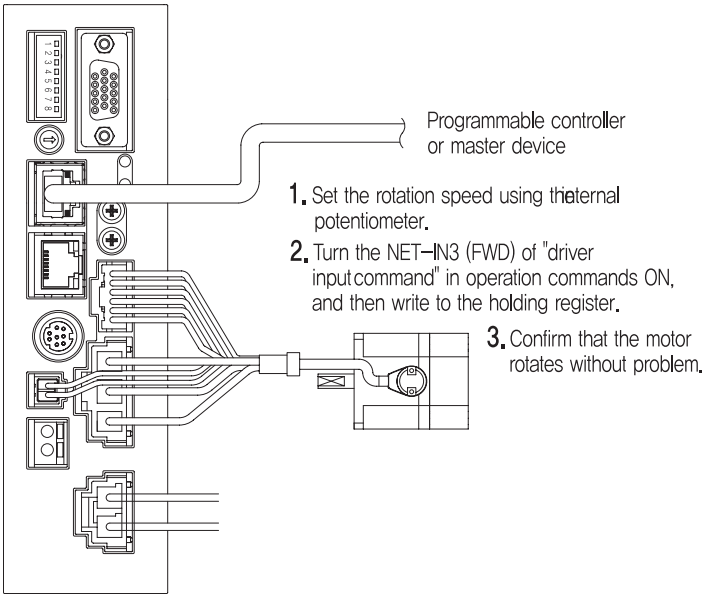
2.1.3 Power connection and setting parameters



2.1.4 Power-up again

Power up again to enable parameters such as communication parity, stop bit and transmission waiting time

2.1.5 Operating motor



2.1.6 Checklists for motor operation

If motor doesn't work properly, make sure to check following articles

- Is alarm is generated?
- Is power supplied?
- Is motor and RS-485 communication cable connected correctly?
- Is slave address, transmission speed and terminating resistance connected correctly?

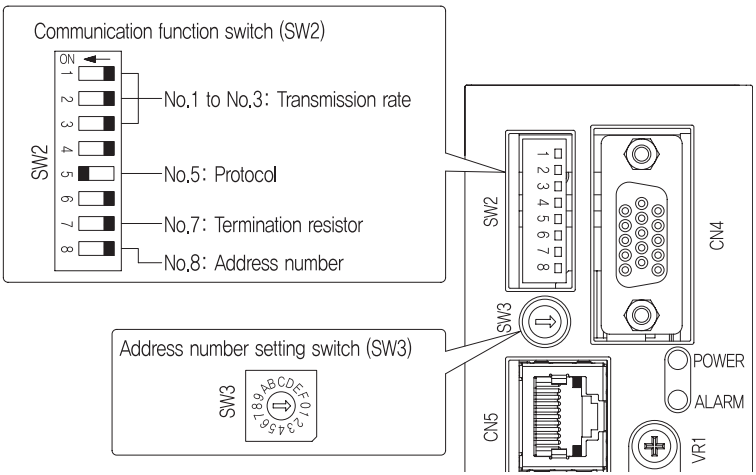
2.2 Communication specification

Electrical characteristics	In conformance with EIA-485 Use a twisted pair cable (TIA/EIA-568B CAT5e or higher is recommended) and keep the total wiring distance including extension to 50 m (164 ft.) or less.
Transmission mode	Half duplex
Transmission rate	Selectable from 9600 bps, 19200 bps, 38400 bps, 57600 bps and 115,200 bps.
Physical layer	Asynchronous mode (Data: 8 bits, stop bit: 1 bit, parity: even number)
Protocol	Modbus RTU mode
Connection pattern	Up to 31 drivers can be connected to one programmable controller (master device).

2.3 Setting switch

[Importance]

- Make sure to turn off power before you set switches. If a switch is set during power supply, new switch setting becomes unavailable . Make sure to power up again after switch is set.
- Do not set On No.4 and No.6 in SW2



2.3.1 Setting protocol

Make sure to set No.5 at SW2 to [On] and then Modbus protocol is selected (For delivery: SW2-No.5 [OFF])

2.3.2 Setting address number (slave address)

Set address number (slave address) using No.8 in SW2 and SW3 (address setting switch) Do not set address for address number 0 (slave number) since it is broadcast) (For delivery: SW3 [0], SW2-No.8 [Off])

SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF
0	Broadcast	8	8	0	16	8	24
1	1	9	9	1	17	9	25
2	2	A	10	2	18	A	26
3	3	B	11	3	19	B	27
4	4	C	12	4	20	C	28
5	5	D	13	5	21	D	29
6	6	E	14	6	22	E	30
7	7	F	15	7	23	F	31

2.3.3 Setting transmission speed

You can set transmission speed using No.1 ~ No.3 in SW2. Make sure that transmission speed is set to same as that of master device
(For delivery: 9600 bps)

SW2-No.3	SW2-No.2	SW2-No.1	Transmission rate (bps)
OFF	OFF	OFF	9,600
OFF	OFF	ON	19,200
OFF	ON	OFF	38,400
OFF	ON	OFF	47,600
ON	OFF	OFF	115,200

[Importance]

- Do not set other switches than those in above table.

2.3.4 Terminating resistance

Make sure to connect terminating resistance to a driver that is installed at terminal from master device If No.7 in SW2 is ON, the terminating resistance (120 Ohm) is connected (For delivery : [OFF])

SW2-No.7	SW2-No.2
OFF	Disabled
ON	Enabled

2.4 Control power connection

If control power is connected to driver, it's possible to communicate with master device even if main power is not connected. Using communication function only, it's possible to set and check operation data, parameter and alarm

[Importance]

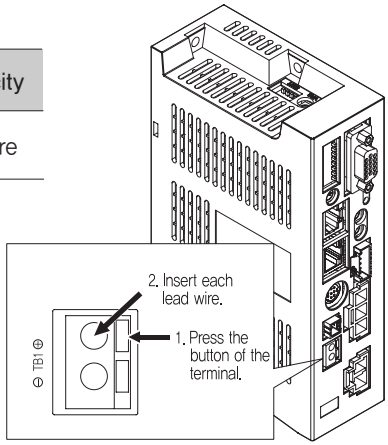
- When control power is connected to driver while main power is not connected, communication function works normally although low voltage alarm is generated.

2.4.1 Specification for control power

Model	Input power supply voltage	Current capacity
XVD200F	24 VDC±10%	300 mA or more
XVD400R	48 VDC±10%	

2.4.2 Applicable lead wire

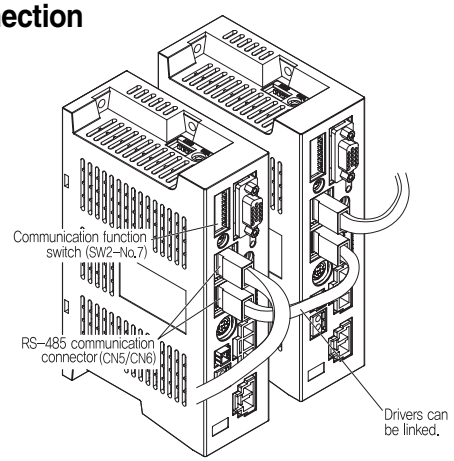
- Make sure to use AWG24 ~ 16 (0.2 ~ 1.25 mm2) for lead wire

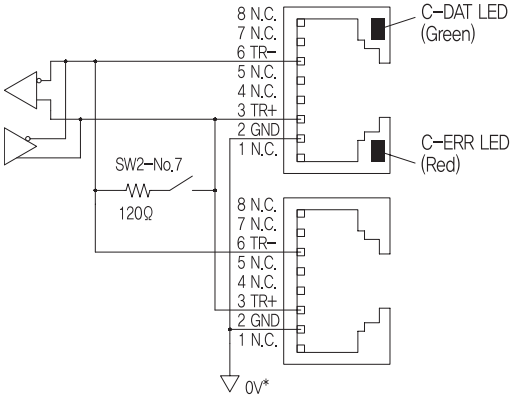


Make sure to connect terminating resistance to a driver that is installed at terminal from master device If No.7 in SW2 is ON, the terminating resistance (120 Ohm) is connected

2.5 RS-485 communication cable connection

Connect RS-485 communication cable to CN5 or CN6 for driver





※ GND line is commonly used for main power terminal (CN1) and control power terminal (TB1) (Not insulated)

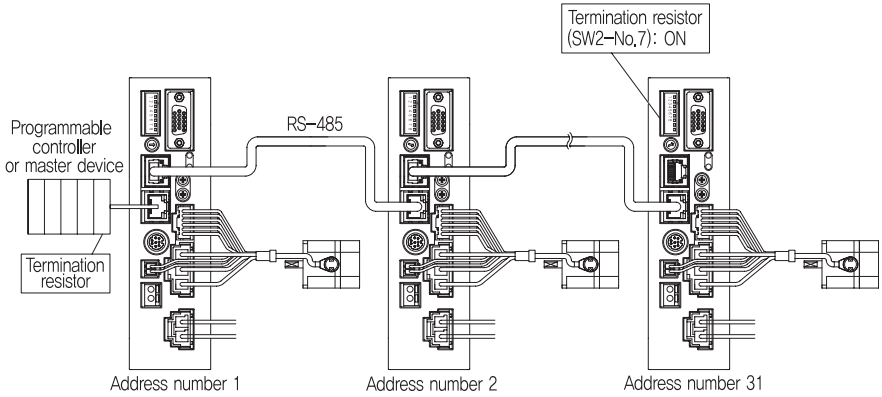
• CN5/CN6 pin assignments

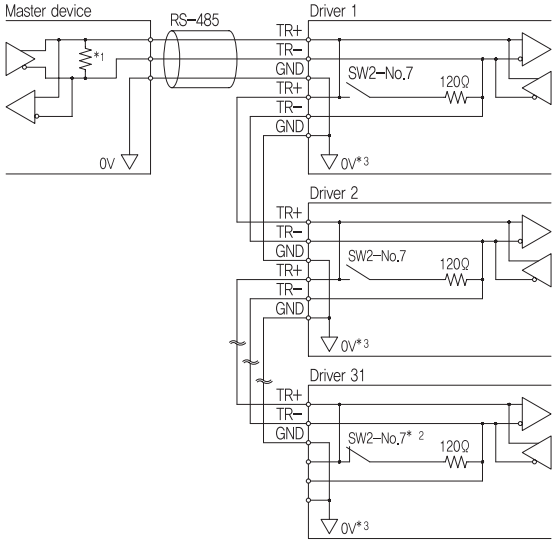
Pin No.	Signal name	Description
1	N.C.	Not used
2	GND	GND
6	TR+	RS-485 communication signal (+)
4	N.C.	Not used
5	N.C.	Not used
6	TR-	RS-485 communication signal (-)
7	N.C.	Not used
8	N.C.	Not used

• LED

Name	Description
C-DAT LED (Green)	This led operates if it is normally communicating with master station
C-ERR LED (Red)	This LED is blinking when there is a communication error with master station

2.5.1 Example for connection





*1 Termination resistor 120Ω

*2 Turn the termination resistor (SW2-No.7) to ON.

*3 The GND line is used in common with main power supply input terminal (CN1) and control power supply input terminal (TB1) [not insulated].

2.6 RS-485 communication setting

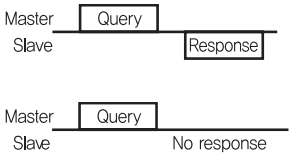
Parameters for RS-485 are shown as following table

Parameter name	Value
Parity	Even number
Stop bit	1 bit
Waiting time for transmission	10 ms

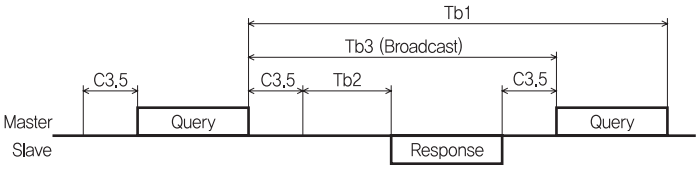
2.7 communication mode

Modus protocol communication is basically carried out by methods of single-master / multiple-slave. Send message by one of following methods referring to below protocol

- Unicast mode
  This sends query by one slave from master. The slave carries out process and responds
- Broadcast mode
  Under this mode, if address for slave at master is set to 0, master is able to send query to all slaves. Each slave carries out process but doesn't respond



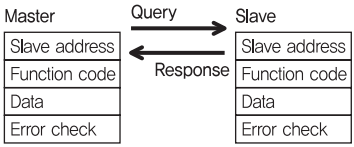
2.8 Communication timing



Type	Name	Description
Tb1	Communication timeout	This occurs when any query is unable to be received within parameter set time for "ommunication timeout" ∗Initial set value: not monitored
Tb2	Waiting time for transmission	Waiting time can be set by the parameter "aiting time for transmission" Actual waiting time for transmission = silent gap + execution time + waiting time for transmission ∗Initial set value : 10ms
Tb3	Broadcasting gap	This indicates a time which is taken to send next query to broadcasting. Time for Tb3 may be longer than silent gap plus 5 ms
C3,5	Silent gap	3.5 character's waiting time should be provided. If waiting time is shorter than 3.5 characters, driver is not responding. If transmission speed is longer than 19200 bps, more than 1.75 ms of waiting time is required.

2.9 Message

Message format is following



2.9.1 Query

Structure for query message is shown as following

Slave address	Function code	Data	Error check
8 bits	8 bits	N×8 bits	16 bits

• Slave address
Set slave address (unicast mode)
If slave address is set to 0, master is able to send query to all slaves (broadcast mode)

• Function code
Function codes and message lengths are shown as following

Function code	Description	Broadcast
03h	Read from a holding register(s).	Impossble
06h	Write to a holding register.	Possible
08h	Perform diagnosis.	Impossible
10h	Write to multiple holding registers.	Possible

• Data
Set data by selecting function code
Data length is varying depending on function codes

• Error
Under Modbus RTU mode, error check is basically carried out by CRC-16.
Slave compares error

check value in a received message by calculating CRC-16 contained in the message. If the calculated CRC-16's value is same as error check value, the slave processes the message as a normal data.

< How to calculate CRC-16>

1) Execute exclusive-OR (XOR) for slave address (8 bit) and default value [FFFFh]
2) Make shift the result of above 1 by 1 bit. Repeat shift until overflow bit becomes "1"
3) When overflow bit is "1", carry out XOR operation against the result of above 2 and [A001h]
4) Repeat above 2 and 3 until shift is carried 8 times.
5) Execute XOR operation against above 4 and function code (8 bit)

- Repeat above 2 ~ above 4 for all bytes
- The last result will become the result of CRC-16 operation

2.9.2 Response

Slave is responding as 3 types: Normal response, No response and Exception response
Structure for response message is same as that of query message

Slave address	Function code	Data	Error check
8 bits	8 bits	N×8 bits	16 bits

- Normal response
  When query is received from master, slave executes process and responds
- No response
  Slave is not responding for master. Examples for "No response" are shown as following

1) Transmission error
   If transmission error is detected, slave discards query and doesn't respond to master

Cause of transmission error	Description
Framing error	Stop bit 0 was detected.
Parity error	A mismatch with the specified parity was detected.
Mismatched CRC	The calculated value of CRC-16 was found not matching the error check value.
Invalid message length	The message length exceeded 256 bytes.

2) Others than transmission error
   Followings are examples which do not respond without detecting other transmission errors

Cause	Description
Broadcast	If the query was broadcast, the slave executes the requested process but does not return a response.
Mismatched slave address	The slave address in the query was found not matching the slave address of the driver.

• Exception response

If slave can't execute process requested by query, it returns exception response. In this case, exception codes are included, which indicates why processes can't be executed for the exception response. Message structure for the exception response is shown as following

Slave address	Function code	Exception code	Error check
8 bits	8 bits	8 bits	16 bits

1) Function code

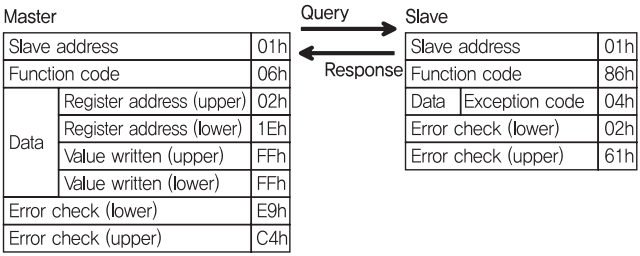
Function code for exception response is sum of query function code and [80h]

Example) query: [03h] -> exception response: [83h]

This displays cases why process can't be executed

Exception code	Communication error code	Cause	Description
01h	88h	Invalid function	. Function code is not supported . Diagnostic sub function code (08h) is different from 00h
02h		Invalid data address	. This address is not supported . Register address and number of register is more than 2000h
03h	8Ch	Invalid data	. Number of registers is more than 0 or 17 . Number of bytes is different from 2 times for number of register . Data length is deviated from designated range
04h	89h 8Ah 8Ch 8Dh	Slave error	. NV memory is under execution . Disable is running for command . Recorded value is out of range

3) Examples for exception response



Master			Query	Slave		
Slave address		01h	→	Slave address		01h
Function code		06h	← Response	Function code		86h
Data	Register address (upper)	02h		Data	Exception code	04h
	Register address (lower)	1Eh		Error check (lower)		02h
	Value written (upper)	FFh		Error check (upper)		61h
	Value written (lower)	FFh				
Error check (lower)		E9h				
Error check (upper)		C4h				

2.10 Function code

2.10.1 Reading holding register [03h]

This function code [03h] is used to decipher (decode) register (16 bit). This can read maximum 16 consecutive register (16*16 bit) At the same time it reads upper / lower data. For reading multiple holding registers, it reads them by the order of register address.

■ Example

It reads operation data for rotation speed No.0 and 1 of slave address.

Description	Register address	Value read	Corresponding decimal
Rotation speed No.0 (upper)	0480h	0000h	100
Rotation speed No.0 (lower)	0481h	0064h	
Rotation speed No.1 (upper)	0482h	0000h	4000
Rotation speed No.1 (lower)	0483h	0FA0h	

1) Query

Field name		Data	Description
Slave address		01h	Slave address 1
Function code		03h	Reading from holding registers
Data	Register address (upper)	04h	Register address to start reading from
	Register address (lower)	80h	
	Number of registers (upper)	00h	Number of registers to be r ead from the starting register address (4 registers=0004h)
	Number of registers (lower)	04h	
Error check (lower)		44h	Calculation result of CRC-16
Error check (upper)		D1h	

2) Response

Field name		Data	Description
Slave address		01h	Same as query
Function code		03h	Same as query
Data	Number of data bytes	08h	Twice the number of registers in the query
	Value read from register address (upper)	00h	Value read from register address 0480h
	Value read from register address (lower)	00h	
	Value read from register address+1 (upper)	00h	Value read from register address 0481h
	Value read from register address+1 (lower)	64h	
	Value read from register address+2 (upper)	00h	Value read from register address 0482h
	Value read from register address+2 (lower)	00h	
	Value read from register address+3 (upper)	0Fh	Value read from register address 0483h
	Value read from register address+3 (lower)	A0h	
Error check (lower)		E1h	Calculation result of CRC-16
Error check (upper)		97h	

2.10.2 Writing holding register [06h]

This function code [06h] is used to write data into specified register address. However, as the result for Upper/lower might be out of data range, make sure to write data simultaneously using "Multiple holding register [10h]"

■ Example

This writes overload warning level (lower) 50 [32h] for slave address 2

Description	Register address	Written value	Corresponding decimal
Overload warning level (lower)	10ABh	32h	50

1) Query

Field name		Data	Description
Slave address		02h	Slave address 2
Function code		06h	Writing to a holding register
Data	Register address (upper)	10h	Register address to be written
	Register address (lower)	ABh	
	Written value (upper)	00h	Written value for the register address
	Written value (lower)	32h	
Error check (lower)		7Dh	Calculation result of CRC-16
Error check (upper)		0Ch	

2) Response

Field name		Data	Description
Slave address		02h	Same as query
Function code		06h	Same as query
Data	Register address (upper)	10h	Same as query
	Register address (lower)	ABh	
	Written value (upper)	00h	Same as query
	Written value (lower)	32h	
Error check (lower)		7Dh	Calculation result of CRC-16
Error check (upper)		0Ch	

2.10.3 Diagnostics [08h]

This function code is used to diagnose communication between master and slave. This checks if communication is normal by transferring arbitrary data and returning it [00h] (query response) is a sub-function which is supported by function code

■ Example

Arbitrary data [1234h] is transferred to slave address 3

1) Query

Field name		Data	Description
Slave address		03h	Slave address 3
Function code		08h	Diagnosis
Data	Sub-functioncode (upper)	00h	Return the query data
	Sub-functioncode (lower)	00h	
	Data value (upper)	12h	Arbitrary data (1234h)
	Data value (lower)	34h	
Error check (lower)		ECh	Calculation result of CRC-16
Error check (upper)		9Eh	

2) Response

Field name		Data	Description
Slave address		03h	Same as query
Function code		08h	Same as query
Data	Sub-functioncode (upper)	00h	Same as query
	Sub-functioncode (lower)	00h	
	Data value (upper)	12h	Same as query
	Data value (lower)	34h	
Error check (lower)		ECh	Same as query
Error check (upper)		9Eh	

2.10.4 Writing multiple holding register [10h]

This function is used to write data on several consecutive registers

■ Example

This sets accelerating time No.0~2 operation data for slave address 4

Description	Register address	Written value	Corresponding decimal
Acceleration time No.0 (upper)	0600h	0000h	2
Acceleration time No.0 (lower)	0601h	0002h	
Acceleration time No.1 (upper)	0602h	0000h	50
Acceleration time No.1 (lower)	0603h	0032h	
Acceleration time No.2 (upper)	0604h	0000h	150
Acceleration time No.2 (lower)	0605h	0096h	

1) Query

Field name		Data	Description
Slave address		04h	Slave address 4
Function code		10h	Writing to multiple holding registers
Data	Register address (upper)	06h	Register address to start writing from
	Register address (lower)	00h	
	Number of registers (upper)	00h	Number of registers to be written from the starting register address (6 registers=0006h)
	Number of registers (lower)	06h	
	Number of data bytes	0Ch	Twice the number of registers in the query (6 registers × 2 = 12 registers: 0Ch)
	Written value for register address (upper)	00h	Written value for register address 0600h
	Written value for register address (lower)	00h	
	Written value for register address+1 (upper)	00h	Written value for register address 0601h
	Written value for register address+1 (lower)	02h	
	Written value for register address+2 (upper)	00h	Written value for register address 0602h
	Written value for register address+2 (lower)	00h	
	Written value for register address+3 (upper)	00h	Written value for register address 0603h
	Written value for register address+3 (lower)	32h	
	Written value for register address+4 (upper)	00h	Written value for register address 0604h
	Written value for register address+4 (lower)	00h	
	Written value for register address+5 (upper)	00h	Written value for register address 0605h
	Written value for register address+5 (lower)	96h	
Error check (lower)		85h	Calculation result of CRC-16
Error check (upper)		70h	

2) Response

Field name		Data	Description
Slave address		04h	Same as query
Function code		10h	Same as query
Data	Register address (upper)	06h	Same as query
	Register address (lower)	00h	
	Number of registers (upper)	00h	Same as query
	Number of registers (lower)	06h	
Error check (lower)		40h	Calculation result of CRC-16
Error check (upper)		D6h	

2.11 Register address list

All data that are used for driver is 32 bit. Since register for Modbus protocol is 16 bit, one data consists of 2 registers. Even number of address is upper and odd number of address is lower

2.11.1 Operation command

This is a command related to motor operation. Operation command is not saved at NV memoryread

Register address		READ/WRITE	Name	Description
Dec	Hex			
48	0030h	R/W	Group (upper)	Sets the address number for the group send.
49	0031h		Group (lower)	
124	007Ch	R/W	Driver input command (upper)	Sets the input command to the driver.
125	007Dh		Driver input command (lower)	
126	007Eh	R	Driver output command (upper)	Sets the output status of the driver.
127	007Fh		Driver output command (lower)	

- Group (0030h, 003h)
  Multiple slaves are made by group and query is instantly sent to all slaves
- Driver input command (007Ch, 007Dh)
  This is a driver input signal which makes it possible to connect RS-485 communication Remote I/O (NET-IN0~15) is assigned as following

Address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
007Ch	Upper	–	–	–	–	–	–	–	–
	Lower	–	–	–	–	–	–	–	–
007Dh	Upper	NET-IN15 (Not used)	NET-IN14 (Not used)	NET-IN13 (Not used)	NET-IN12 (Not used)	NET-IN11 (Not used)	NET-IN10 (Not used)	NET-IN9 (Not used)	NET-IN8 (Not used)
	Lower	NET-IN7 (MB-FREE)	NET-IN6 (Not used)	NET-IN5 (STOP-MODE)*	NET-IN4 (REV)*	NET-IN3 (FWD)*	NET-IN2 (M2)	NET-IN1 (M1)	NET-IN0 (M0)

※ "3-wire input mode" is set by parameters in "Operation input mode selection" and signals are given as following
FWD ➞ START/STOP, REV ➞ RUN/BRAKE, STOP MODE ➞ FWD/REV

Followings are assigned input signals for remote output terminal NET-IN 0 – 15 based on parameter setting

Signal name	Functions	Set range
Not used	This is a set where input terminal is not used	–
FWD	**[2-wire input mode]** If FWD input is "1"motor rotates toward the direction of FWD If FWD input is "0"motor stops If REV input is "1"motor rotates toward the directionof REV If REV input is "0"motor stops Select stop mode depending on how to stop motor	0: Stop 1: Rotate to FWD direction
REV		0: Stop 1: Rotate to REV direction
STOP MODE		0: Instantaneous stop 1: Decelerationstop
START / STOP	**[3-wire input mode]** Both START/STOP input and RUN/BRAKE input are "1" motor rotates If START/STOP input is "0"motor decelerates and stops RUN/BRAKE input is "0"motor stops sequentially Select FWD / REV input terminal for motor's rotating direction	0: Decelerationstop 1: Operation
RUN / BRAKE		0: Instantaneous stop 1: Operation
FWD / REV		0: FWD direction 1: REV direction
FREE	If motor stops, select this depending on whether or not brake runs	0: Lock when it stops 1: Release when it stops
M0~M2	Select operation data using 3 bits of M0~M2	0 to 7: Operation data No.

[Note]

- Do not assign same signals onto several input terminals. If same input signals are assigned to several input terminals, function is executed when one of those terminals is activated.
- If a same signal is assigned to both remote I/O and direct I/O (X0~X5), function is executed when one of those terminals is activated
- If HMI input is not assigned to input terminal, HMI input is always [1] (function is limited) When HMI input is assigned to both remote I/O and direct I/O (X0~X5) and all terminals are [1] and then function is limited

• Driver output command (007Eh, 007Fh)
This is driver output signal which makes it possible to communicate via RS-485
Remote I/O (NET-OUT0~15) is assigned as following

Address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
007Eh	Upper	–	–	–	–	–	–	–	–
	Lower	–	–	–	–	–	–	–	–
007Fh	Upper	NET–OUT15 (TLC)	NET–OUT14 (VA)	NET–OUT13 (MOVE)	NET–OUT12 (ALARM–OUT2)	NET–OUT11 (Not used)	NET–OUT10 (Not used)	NET–OUT9 (Not used)	NET–OUT8 (S–BSY)
	Lower	NET–OUT7 (ALARM–OUT1)	NET–OUT6 (WNG)	NET–OUT5 (STOP–MODE_R)*	NET–OUT4 (REV_R)*	NET–OUT3 (FWD_R)*	NET–OUT2 (M2_R)	NET–OUT1 (M1_R)	NET–OUT0 (M0_R)

※ "3-wire input mode" is set by parameters in "Operation input mode selection" and signals are given as following

FWD ➡ START/STOP, REV ➡ RUN/BRAKE, STOP MODE ➡ FWD/REV

Followings are assigned input signals for remote I/O terminal NET-IN 0 – 15 based on parameter setting

Signal name	Functions		Set range
Not used	This is a set where input terminal is not used		–
FWD_R	2–wire input mode	FWD response output	0: FWD=OFF 1: FWD=ON
REV_R		REV response output	0: REV=OFF 1: REV=ON
STOP–MODE_R		STOP mode response output	0: STOP–MODE=OFF 1: STOP–MODE=ON
START/STOP_R	3–wire input mode	START/STOP response output	0: START/STOP=OFF 1: START/STOP=ON
RUN/BRAKE_R		RUN/BRAKE response output	0: RUN/BRAKE=OFF 1: RUN/BRAKE=ON
FWD/REV_R		FWD/REV response output	0: FWD/REV=OFF 1: FWD/REV=ON
MB–FREE_R	FREE response output		0: MB–FREE=OFF 1: MB–FREE=ON
M0_R	M0 response output		0: M0=OFF 1: M0=ON
M1_R	M1 response output		0: M1=OFF 1: M1=ON
M2_R	M2 response output		0: M2=OFF 1: M2=ON
ALARM–OUT1	Alarm output 1		0: Normal operation 1: Alarm present
WNG	Warning output		0: Normal operation 1: Warning present
MOVE	Output while motor is rotating		0: Motor standstill 1: Motor in operation
TLC	Output when torque is achieved		0: Within the torque limiting value 1: Outside the torque limiting value
VA	Output when speed is reached		0: Within the speed attainment band 1: Outside the speed attainment band
S–BSY	Under internal processing		0: Internal processing not in progress 1: Internal processing in progress
ALARM–OUT2	Alarm output 2		0: Normal operation 1: In overload operation
MPS	Main power status output		0: Main power–OFF 1: Main power–ON

2.11.2 Maintenance command

Maintenance commands are used to reset alarm and warning. In addition, they make it possible to process NV memory on batch. All commands are read and written. This is executed when setting is changed from [0] to [1]

Register address		Name	Description	Set range
Dec	Hex			
384	0180h	Reset alarm (upper)	Resetting alarm (Some of alarm can't be reset)	0, 1
385	0181h	Reset alarm (lower)		
388	0184h	Clear alarm records (upper)	Removing alarm	
389	0185h	Clear alarm records (lower)		
390	0186h	Clear warning records (upper)	Removing alarm record	
391	0187h	Clear warning records (lower)		
392	0188h	Clear commun ication error records (upper)	Removing communication records	
393	0189h	Clear commun ication error records (lower)		
396	018Ch	Configuration (upper)	Resetting parameters and execution	
397	018Dh	Configuration (lower)		
398	018Eh	All data initialization (upper)*	Resetting operation data and parameters in NV memory	
399	018Fh	All data initialization (lower)*		
400	0190h	Batch NV memory read (upper)	Read operation data and parameters in NV memory and overwriting them on RAM	
401	0191h	Batch NV memory read (lower)		
402	0192h	Batch NV memory write (upper)	Writing parameters on RAM into NV memory NV memory can be written approximately 100,000 times	
403	0193h	Batch NV memory write (lower)		

[Note]

- Make sure to turn off X0/X1 terminal in direct I/O and NET-IN3/NET-IN4 in remote I/O before initializing all data. Motor may rotate abruptly after initialization

- Configuration (018Ch)

When following conditions are satisfied, configuration is executed

- when alarm is not generated
- When motor doesn't work

Driver status is displayed before and after configuration is executed

Item	Configuration is ready to execute	Configuration is executing	Configuration is completed
POWER LED	Lit	Lit	Based on the driver condition.
ALARM LED	OFF	OFF	
Electromagnetic brake	Hold/Release	Hold/Release	
Output signals	Allowed	Indeterminable	Allowed
Input signals	Allowed	Not allowed	Allowed

[Note]

- Return value for RS-485 communication may not be returned correctly during configuration process

2.11.3 Monitoring commands

This command makes it possible to read all commands such as speed, alarm and warning records

Register address		Name	Description	Set range
Dec	Hex			
128	0080h	Present alarm (upper)	Monitoring current alarm code	00h to FFh
129	0081h	Present alarm (lower)		
130	0082h	Alarm record 1 (upper)	Monitoring alarm records from 1 to 10	
131	0083h	Alarm record 1 (lower)		
132	0084h	Alarm record 2 (upper)		
133	0085h	Alarm record 2 (lower)		
134	0086h	Alarm record 3 (upper)		
135	0087h	Alarm record 3 (lower)		
136	0088h	Alarm record 4 (upper)		
137	0089h	Alarm record 4 (lower)		
138	008Ah	Alarm record 5 (upper)		
139	008Bh	Alarm record 5 (lower)		
140	008Ch	Alarm record 6 (upper)		
141	008Dh	Alarm record 6 (lower)		
142	008Eh	Alarm record 7 (upper)		
143	008Fh	Alarm record 7 (lower)		
144	0090h	Alarm record 8 (upper)		
145	0091h	Alarm record 8 (lower)		
146	0092h	Alarm record 9 (upper)		
147	0093h	Alarm record 9 (lower)		
148	0094h	Alarm record 10 (upper)		
149	0095h	Alarm record 10 (lower)		
150	0096h	Present warning (upper)	Monitoring current warning code	00h to FFh
151	0097h	Present warning (lower)		
152	0098h	Warning record 1 (upper)	Monitoring warning records from 1 to 10	
153	0099h	Warning record 1 (lower)		
154	009Ah	Warning record 2 (upper)		
155	009Bh	Warning record 2 (lower)		
156	009Ch	Warning record 3 (upper)		
157	009Dh	Warning record 3 (lower)		
158	009Eh	Warning record 4 (upper)		
159	009Fh	Warning record 4 (lower)		
160	00A0h	Warning record 5 (upper)		
161	00A1h	Warning record 5 (lower)		
162	00A2h	Warning record 6 (upper)		
163	00A3h	Warning record 6 (lower)		
164	00A4h	Warning record 7 (upper)		
165	00A5h	Warning record 7 (lower)		
166	00A6h	Warning record 8 (upper)		
167	00A7h	Warning record 8 (lower)		
168	00A8h	Warning record 9 (upper)		
169	00A9h	Warning record 9 (lower)		
170	00AAh	Warning record 10 (upper)		
171	00ABh	Warning record 10 (lower)		
172	00ACh	Communication error code (upper)	Monitoring communication error code that is last received	
173	00ADh	Communication error code (lower)		

Register address		Name	Description	Set range
Dec	Hex			
174	00AEh	Communication error code record 1 (upper)	Monitoring communication error records from 1 to 10	00h to FFh
175	00AFh	Communication error code record 1 (lower)		
176	00B0h	Communication error code record 2 (upper)		
177	00B1h	Communication error code record 2 (lower)		
178	00B2h	Communication error code record 3 (upper)		
179	00B3h	Communication error code record 3 (lower)		
180	00B4h	Communication error code record 4 (upper)		
181	00B5h	Communication error code record 4 (lower)		
182	00B6h	Communication error code record 5 (upper)		
183	00B7h	Communication error code record 5 (lower)		
184	00B8h	Communication error code record 6 (upper)		
185	00B9h	Communication error code record 6 (lower)		
186	00BAh	Communication error code record 7 (upper)		
187	00BBh	Communication error code record 7 (lower)		
188	00BCh	Communication error code record 8 (upper)		
189	00BDh	Communication error code record 8 (lower)		
190	00BEh	Communication error code record 9 (upper)		
191	00BFh	Communication error code record 9 (lower)		
192	00C0h	Communication error code record 10 (upper)		
193	00C1h	Communication error code record 10 (lower)		
196	00C4h	Present selected data No. (upper)	Monitoring currently selected operation data no.	0 to 7
197	00C5h	Present selected data No. (lower)		
200	00C8h	Command speed (upper)	Monitoring current command speed	−4010 to +4010 r/min +: Forward −: Reverse 0: Stop
201	00C9h	Command speed (lower)		
206	00CEh	Feedback speed (upper)	Monitoring feedback speed	−5200 to +5200 r/min
207	00CFh	Feedback speed (lower)		
212	00D4h	Direct I/O and electromagnetic brake status (upper)	Monitoring each I/O signal and condition of electronic brake	See next table.
213	00D5h	Direct I/O and electromagnetic brake status (lower)		

I/O and electronic brake conditions (00D4h)

Register address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
00D4h	Upper	−	−	−	−	−	−	−	MB
	Lower	−	−	−	−	−	−	Y1	Y0
00D5h	Upper	−	−	−	−	−	−	−	−
	Lower	−	−	X5	X4	X3	X2	X1	X0

2.11.4 Parameter R/W commands [Operation data]

All commands can be read and written

Register address		Name	Set range	Set unit	Init value	Execution
Dec	Hex					
1152	0480h	Rotation speed No.0 (upper)	0 r/min, and 80 to 4000 r/min	1	0	Instantly
1153	0481h	Rotation speed No.0 (lower)				
1154	0482h	Rotation speed No.1 (upper)				
1155	0483h	Rotation speed No.1 (lower)				
1156	0484h	Rotation speed No.2 (upper)				
1157	0485h	Rotation speed No.2 (lower)				
1158	0486h	Rotation speed No.3 (upper)				
1159	0487h	Rotation speed No.3 (lower)				
1160	0488h	Rotation speed No.4 (upper)				
1161	0489h	Rotation speed No.4 (lower)				
1162	048Ah	Rotation speed No.5 (upper)				
1163	048Bh	Rotation speed No.5 (lower)				
1164	048Ch	Rotation speed No.6 (upper)				
1165	048Dh	Rotation speed No.6 (lower)				
1166	048Eh	Rotation speed No.7 (upper)				
1167	048Fh	Rotation speed No.7 (lower)				
1536	0600h	Acceleration time No.0 (upper)	2 to 150 (1=0.1 s)	0.1	5	
1537	0601h	Acceleration time No.0 (lower)				
1538	0602h	Acceleration time No.1 (upper)				
1539	0603h	Acceleration time No.1 (lower)				
1540	0604h	Acceleration time No.2 (upper)				
1541	0605h	Acceleration time No.2 (lower)				
1542	0606h	Acceleration time No.3 (upper)				
1543	0607h	Acceleration time No.3 (lower)				
1544	0608h	Acceleration time No.4 (upper)				
1545	0609h	Acceleration time No.4 (lower)				
1546	060Ah	Acceleration time No.5 (upper)				
1547	060Bh	Acceleration time No.5 (lower)				
1548	060Ch	Acceleration time No.6 (upper)				
1549	060Dh	Acceleration time No.6 (lower)				
1550	060Eh	Acceleration time No.7 (upper)				
1551	060Fh	Acceleration time No.7 (lower)				
1664	0680h	Acceleration time No.0 (upper)	2 to 150 (1=0.1 s)	0.1	5	
1665	0681h	Acceleration time No.0 (lower)				
1666	0682h	Acceleration time No.1 (upper)				
1667	0683h	Acceleration time No.1 (lower)				
1668	0684h	Acceleration time No.2 (upper)				
1669	0685h	Acceleration time No.2 (lower)				
1670	0686h	Acceleration time No.3 (upper)				
1671	0687h	Acceleration time No.3 (lower)				
1672	0688h	Acceleration time No.4 (upper)				
1673	0689h	Acceleration time No.4 (lower)				
1674	068Ah	Acceleration time No.5 (upper)				
1675	068Bh	Acceleration time No.5 (lower)				
1676	068Ch	Acceleration time No.6 (upper)				
1677	068Dh	Acceleration time No.6 (lower)				
1678	068Eh	Acceleration time No.7 (upper)				
1679	068Fh	Acceleration time No.7 (lower)				

Register address		Name	Set range	Set unit	Init value	Execution
Dec	Hex					
1792	0700h	Torque limitation No.0 (upper)	0 to 200%	1	200	Instantly
1793	0701h	Torque limitation No.0 (lower)				
1794	0702h	Torque limitation No.1 (upper)				
1795	0703h	Torque limitation No.1 (lower)				
1796	0704h	Torque limitation No.2 (upper)				
1797	0705h	Torque limitation No.2 (lower)				
1798	0706h	Torque limitation No.3 (upper)				
1799	0707h	Torque limitation No.3 (lower)				
1800	0708h	Torque limitation No.4 (upper)				
1801	0709h	Torque limitation No.4 (lower)				
1802	070Ah	Torque limitation No.5 (upper)				
1803	070Bh	Torque limitation No.5 (lower)				
1804	070Ch	Torque limitation No.6 (upper)				
1805	070Dh	Torque limitation No.6 (lower)				
1806	070Eh	Torque limitation No.7 (upper)				
1807	070Fh	Torque limitation No.7 (lower)				

2.11.5 Parameter R/W commands [user parameters]

Register address		Name	Description	Set range	Set unit	Init value	Execution
Dec	Hex						
646	0286h	JOG operation speed (upper)	Set JOG operation speed	0 r/min, and 80 to 1000 r/min	1	300	Instantly
647	0287h	JOG operation speed (lower)					
900	0384h	Motor direction seledion (upper)	If FWD input is On, this sets motor rotation direction	0: + side=CCW 1: + side=CW	–	1	After configurationh
901	0385h	Motor direction seledion (lower)					
4160	1040h	Operation input mode selection (upper)	Setting external input mode	0: 2–wire input mode 1: 3–wire input mode	–	0	
4161	1041h	Operation input mode selection (lower)					
4162	1042h	JOG operation torque (upper)	This limits torque value for JOG operation	0 to 200%	1	200	Instantly
4163	1043h	JOG operation torque (lower)					
4170	104Ah	Speed reduction ratio (upper)	Displaying RPM for reduction output shaft by setting its ratio Various setting is available by setting decimal	100 to 9999	1	100	
4171	104Bh	Speed reduction ratio (lower)					
4172	104Ch	Speed reduction ratio decimal digit setting (upper)		0: 1 digit 1: 2 digit 2: 3 digit	–	2	
4173	104Dh	Speed reduction ratio decimal digit setting (lower)					

Register address		Name	Description	Set range	Set unit	Init value	Execution
Dec	Hex						
4174	104Eh	Speed increasing ratio (upper)	This displays RPM for motor shaft by setting accelerating ratio If accelerating ratio is 1, then reduction ratio will be applied. If acceleration ratio is not 1, then acceleration ratio will be appliedh	1 to 5	–	1	Instantly
4175	104Fh	Speed increasing ratio (lower)					
4176	1050h	Conveyor speed reduction ratio (upper)	This displays reduction ratio for conveyor speed	100 to 9999	1	100	
4177	1051h	Conveyor speed reduction ratio (lower)					
4178	1052h	Conveyor speed reduction ratio decimal digit setting (upper)		0: 1 digit 1: 2 digit 2: 3 digit	–	2	
4179	1053h	Conveyor speed reduction ratio decimal digit setting (lower)					
4180	1054h	Conveyor speed increasing ratio (upper)	This displays accelerating ratio for conveyor speed	1 to 5	–	1	
4181	1055h	Conveyor speed increasing ratio (lower)					
4322	10E2h	Analog input signal selection (upper)	This makes it possible to select how to set operation data	0: Mode 0 1: Mode 1 2: Mode 2 3: Mode 3 4: Mode 4 5: Mode 5	–	0	After configurationh
4323	10E3h	Analog input signal selection (lower)					
4430	114Eh	Rotation speed attainment band (upper)	This makes it possible to set reaching speed	0 to 400 r/min	1	200	Instantly
4431	114Fh	Rotation speed attainment band (lower)					

• Setting operation data by selecting analogue input signal You can set operation data using analogue input signal parameter. Refer to combination with mode number and analogue setting / digital setting as following. Other combination excepting following ones is unavailable.

Mode	Operation data No.	VR1	VR2	VR3	External VR	Digital Set
Mode 0 (Initial setting)	0	Rotation speed	Acceleration/ Deceleration time	Torque limiting value	–	–
	1	–	Acceleration/ Deceleration time	Torque limiting value	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 1	0 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 2	0 to 7	–	–	–	Torque limiting value	Rotation speed Acceleration time Deceleration time
Mode 3	0	Acceleration time	Deceleration time	Rotation speed	–	Torque limiting value
	1	Acceleration time	Deceleration time	–	Rotation speed	Torque limiting value
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 4	0	Rotation speed	Torque limiting value	Acceleration/ Deceleration time	–	–
	1	–	Torque limiting value	Acceleration/ Deceleration time	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 5	0	Torque limiting value	Acceleration/ Deceleration time	Rotation speed	–	–
	1	Torque limiting value	Acceleration/ Deceleration time	–	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value

[Note]

• Torque limiting variable resistance (VR3) is set to its maximum value for delivery from factory. When you select Mode No.3, No4 or No.5, make sure to check set value before operating motor. Rotation speed, deceleration / acceleration value is set to their maximum value

2.11.6 Parameter R/W command [Alarm, Warning]

Register address		Name	Description	Set range	Set unit	Init value	Execution
Dec	Hex						
840	0348h	Undervoltage warning level (upper)	Insufficient main power voltage, setting warning level	0 to 480 (=0.1 V)	0.1	24 VDC type: 216 48 VDC type: 432	Instantly
841	0349h	Undervoltage warning level (lower)					
4224	1080h	Electromagnetic brake action at alarm (upper)	This sets actual operation time for electromagnetic brake when there is alarm occurred	0: Lock after coasting to a stop 1: Lock immediately	–	1	After configurationh
4225	1081h	Electromagnetic brake action at alarm (lower)					
4226	1082h	Operation error during initialization alarm function (upper)	This sets enable / disable for operation error during initialization alarm	0: Disable 1: Enable	–	0	
4227	1083h	Operation error during initialization alarm function (lower)					
4228	1084h	Undervoltage alarm latch (upper)	This sets motor operation status when alarm for insufficient voltage is released	0: Disable 1: Enable	–	0	
4229	1085h	Undervoltage alarm latch (lower)					
4258	10A2h	Overload warning function (upper)	This sets enable / disable for overload warning	0: Disable 1: Enable	–	1	Instantly
4259	10A3h	Overload warning function (lower)					
4264	10A8h	Undervoltage warning function (upper)	This sets enable / disable for insufficient voltage warning	0: Disable 1: Enable	–	1	
4265	10A9h	Undervoltage warning function (lower)					
4266	10AAh	Overload warning level (upper)	This sets level of warning for load torque	50 to 100% 1 100	–	100	
4267	10ABh	Overload warning level (lower)					
4608	1200h	Communication timeout (upper)	It sets conditions for communication timeout	0: Not monitored 0 to 10000 ms	–	0	
4609	1201h	Communication timeout (lower)					
4610	1202h	Communication error alarm (upper)	It sets conditions for communication error alarm	1 to 10 times	–	3	
46 11	1203h	Communication error alarm (lower)					

2.11.7 Parameter R/W command [Data setter]

Register address		Name	Description	Set range	Init value	Execution
Dec	Hex					
960	03C0h	Data setter speed display (upper)	Sets the display method of operation speed in the monitor mode. If "0" is set, "–" will be displayed when rotating in REV input direction.	0: Signed 1: Absolute value	0	Instantly
961	03C1h	Data setter speed display (lower)				
4320	10E0h	Data setter initial display (upper)	Select the initial screen when the driver power is turned on.	0: Operation speed 1: Conveyor transfer speed 2: Load factor 3: Operation data number 4: Top screen of monitor mode	0	Execution after re-power up
4321	10E1h	Data setter initial display (lower)				

2.11.8 Parameter R/W command [I/O function (Direct I/O)]

Register address		Name	Set range	Init value	Execution
Dec	Hex				
4352	1100h	X0 input function selection(Upper)	0: Not used 1: FWD (START/STOP)*1 2: REV (RUN/BRAKE) *1 19: STOP–MODE (FWD/REV)*1 20: MB–FREE 21: EXT–ERROR 24: ALARM–RESET 27: HMI 48: M0 49: M1 50: M2	1	Execution after stop
4353	1101h	X0 input function selection(Lower)		2	
4354	1102h	X1 input function selection(Upper)		19	
4355	1103h	X1 input function selection(Lower)		48	
4356	1104h	X2 input function selection(Upper)		24	
4357	1105h	X2 input function selection(Lower)		20	
4358	1106h	X3 input function selection(Upper)			
4359	1107h	X3 input function selection(Lower)			
4360	1108h	X4 input function selection(Upper)			
4361	1109h	X4 input function selection(Lower)			
4362	110Ah	X5 input function selection(Upper)			
4363	110Bh	X5 input function selection(Lower)			
4416	1140h	Y0 output function selection (Upper)	0: Not used 65: ALARM–OUT1 66: WNG 68: MOVE 71: TLC 77: VA 81: ALARM–OUT2	65	Instantly
4417	1141h	Y0 output function selection (Lower)			
4418	1142h	Y1 output function selection (Upper)		66	
4419	1143h	Y1 output function selection (Upper)			

*1 ( ) is available when “3-wire input mode” at “peration input mode selection” is set

2.11.9 Parameter R/W command [I/O function (remote I/O)]

Register address		Name	Set range	Init value	Execution
Dec	Hex				
4448	1160h	NET-IN0 input function selection (Upper)	0: Not used 1: FWD (START/STOP) *1 2: REV (RUN/BRAKE) *1 19: STOP-MODE (FWD/REV) *1 20: MB-FREE 27: HMI 48: M0 49: M1 50: M2	48	Execution after configuration
4449	1161h	NET-IN0 input function selection (Lower)			
4450	1162h	NET-IN1 input function selection (Upper)		49	
4451	1163h	NET-IN1 input function selection (Lower)			
4452	1164h	NET-IN2 input function selection (Upper)		50	
4453	1165h	NET-IN2 input function selection (Lower)			
4454	1166h	NET-IN3 input function selection (Upper)		1	
4455	1167h	NET-IN3 input function selection (Lower)			
4456	1168h	NET-IN4 input function selection (Upper)		2	
4457	1169h	NET-IN4 input function selection (Lower)			
4458	116Ah	NET-IN5 input function selection (Upper)		19	
4459	116Bh	NET-IN5 input function selection (Lower)			
4460	116Ch	NET-IN6 input function selection (Upper)		0	
4461	116Dh	NET-IN6 input function selection (Lower)			
4462	116Eh	NET-IN7 input function selection (Upper)		20	
4463	116Fh	NET-IN7 input function selection (Lower)			
4464	1170h	NET-IN8 input function selection (Upper)		0	
4465	1171h	NET-IN8 input function selection (Lower)			
4466	1172h	NET-IN9 input function selection (Upper)		0	
4467	1173h	NET-IN9 input function selection (Lower)			
4468	1174h	NET-IN10 input function selection (Upper)		0	
4469	1175h	NET-IN10 input function selection (Lower)			
4470	1176h	NET-IN11 input function selection (Upper)		0	
4471	1177h	NET-IN11 input function selection (Lower)			
4472	1178h	NET-IN12 input function selection (Upper)		0	
4473	1179h	NET-IN12 input function selection (Lower)			
4474	117Ah	NET-IN13 input function selection (Upper)		0	
4475	117Bh	NET-IN13 input function selection (Lower)			
4476	117Ch	NET-IN14 input function selection (Upper)		0	
4477	117Dh	NET-IN14 input function selection (Lower)			
4478	117Eh	NET-IN15 input function selection (Upper)		0	
4479	117Fh	NET-IN15 input function selection (Lower)			

*1 ( ) is available when “3-wire input mode” at “peration input mode selection” is set

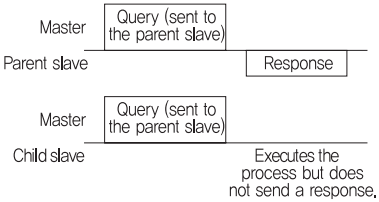
Register address		Name	Set range	Init value	Execution
Dec	Hex				
4480	1180h	NET-OUT0 output function selection (Upper)	0: Not used 1: FWD_R (START/STOP_R) *1 2: REV_R (RUN/BRAKE_R) *1 19: STOP-MODE_R (FWD/REV_R) *1 20: MB-FREE_R 27: HMI_R 48: M0_R 49: M1_R 50: M2_R 65: ALARM-OUT1 66: WNG 68: MOVE 71: TLC 77: VA 80: S-BSY 81: ALARM-OUT2 82: MPS	48	After configuration
4481	1181h	NET-OUT0 output function selection (Lower)			
4482	1182h	NET-OUT1 output function selection (Upper)		49	
4483	1183h	NET-OUT1 output function selection (Lower)			
4484	1184h	NET-OUT2 output function selection (Upper)		50	
4485	1185h	NET-OUT2 output function selection (Lower)			
4486	1186h	NET-OUT3 output function selection (Upper)		1	
4487	1187h	NET-OUT3 output function selection (Lower)			
4488	1188h	NET-OUT4 output function selection (Upper)		2	
4489	1189h	NET-OUT4 output function selection (Lower)			
4490	118Ah	NET-OUT5 output function selection (Upper)		19	
4491	118Bh	NET-OUT5 output function selection (Lower)			
4492	118Ch	NET-OUT6 output function selection (Upper)		66	
4493	118Dh	NET-OUT6 output function selection (Lower)			
4494	118Eh	NET-OUT7 output function selection (Upper)		65	
4495	118Fh	NET-OUT7 output function selection (Lower)			
4496	1190h	NET-OUT8 output function selection (Upper)		80	
4497	1191h	NET-OUT8 output function selection (Lower)			
4498	1192h	NET-OUT9 output function selection (Upper)		0	
4499	1193h	NET-OUT9 output function selection (Lower)			
4500	1194h	NET-OUT10 output function selection (Upper)		0	
4501	1195h	NET-OUT10 output function selection (Lower)			
4502	1196h	NET-OUT11 output function selection (Upper)		0	
4503	1197h	NET-OUT11 output function selection (Lower)			
4504	1198h	NET-OUT12 output function selection (Upper)		81	
4505	1199h	NET-OUT12 output function selection (Lower)			
4506	119Ah	NET-OUT13 output function selection (Upper)		68	
4507	119Bh	NET-OUT13 output function selection (Lower)			
4508	119Ch	NET-OUT14 output function selection (Upper)		77	
4509	119Dh	NET-OUT14 output function selection (Lower)			
4510	119Eh	NET-OUT15 output function selection (Upper)		71	
4511	119Fh	NET-OUT15 output function selection (Lower)			

*1 ( ) is available when “3-wire input mode” at “peration input mode selection” is set

2.12 Group transmission

This is carried out by multiple slaves and query is sent to all slaves at once

- Group structure
  Group consists of one parent slave and child slave. Only parent slave responds
- Group address
  Make sure to assign group address onto child slave in order to perform group transmission



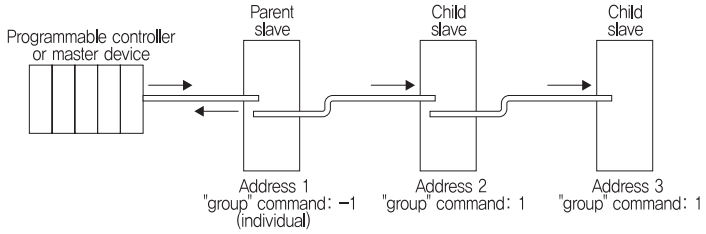
- Parent slave
  There is no special setting for parent slave for group transmission. When group address query is sent to parent slave from master, parent slave carries out process and responds
- Child slave
  Use “Group” command to set group address on each slave. Change group by Unicast mode

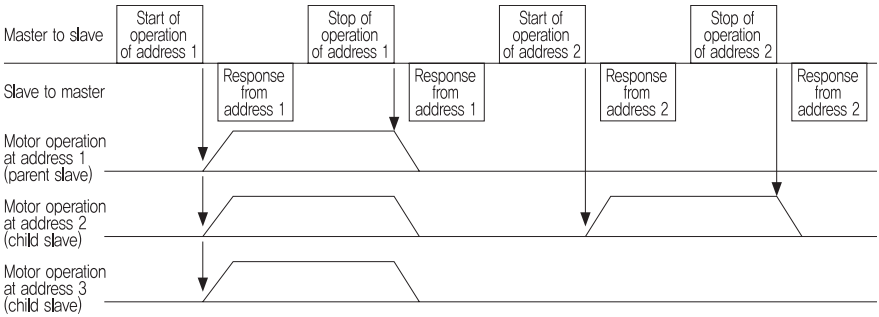
Address	Set range	Init value
0030h	−1: No group specification (Group send is not performed) 1 to 31: Sets a group address.	−1

[Note]

- Group setting [Batch memory writing] becomes unavailable when power is up again because it is not stored into NV memory.
  Make sure to set group every time power is turned On

Function code	Function
10h	Writing to multiple holding registers





2.13 Communication error detection

This function makes it possible to detect error which may occur during RS-485 communication

2.13.1 Communication error

Communication error records are stored into RAM. You can check communication error using [Communication error record]

[Note]

• Communication error record can be removed by turning off driver power

Type of communication error	Error code	Causes
RS-485 communication error	84h	A transmission error was detected. See "No response" on p.14.
Command not yet defined	88h	An exception response (exception code 01h, 02h) was detected. See p.15.
User I/F communication in progress	89h	An exception response (exception code 04h) was detected. See p.15.
NV memory processing in progress	8Ah	
Outside setting range	8Ch	An exception response (exception code 03h, 04h) was detected. See p.15.
Command execute disable	8Dh	An exception response (exception code 04h) was detected. See p.15.

2.13.2 Alarm and warning

If any alarm occurs, alarm output is turned [OFF] and motor stops. At the same time, alarm LED is blinking

If warning occurs, WNG output is ON. But motor runs. If cause of warning is removed, WNG output is automatically turned [OFF]

[Note]

• Warning record can be removed by turning off driver power

• Communication switch setting error

If No.4 in communication function switch (SW2) is set to [ON], then transmission speed setting switch error occurs

• RS-485 communication error[84h]

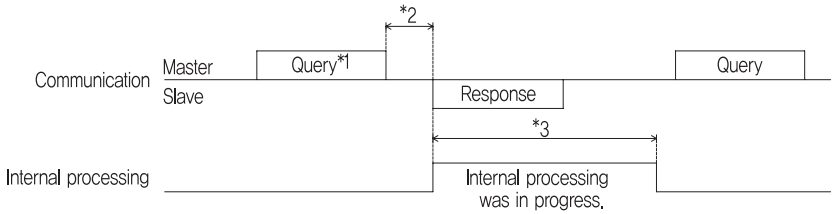
Types	Descriptions
Warning	Warning occurs if communication error (84h) is detected. This is automatically released when communication is normally carried out
Alarm	If the number of occurring errors exceed the value set by "ommunication error alarm parameter"

• RS-485 communication timeout [85h]

If communication is disconnected for hours set by [Communication timeout], then timeout alarm occurs

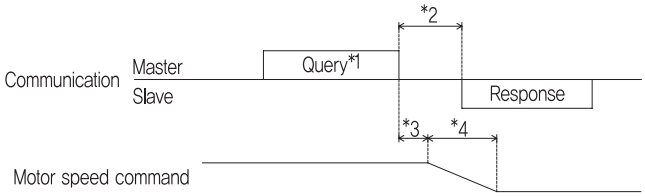
2.14 Timing charts

2.14.1 Communication start



* Tb2 (waiting time for transmission) + C3.5 (interval) + command processing time

2.14.2 Communication start

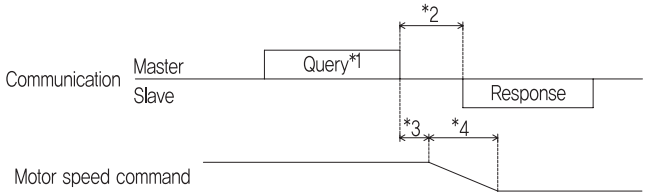


*1 indicates message that includes [START] Query

*2 indicates Tb2 (waiting time for transmission) + C3.5 (Interval) + command processing time

*3 indicates C3.5 (Interval) + less than 4ms

2.14.3 STOP speed variables



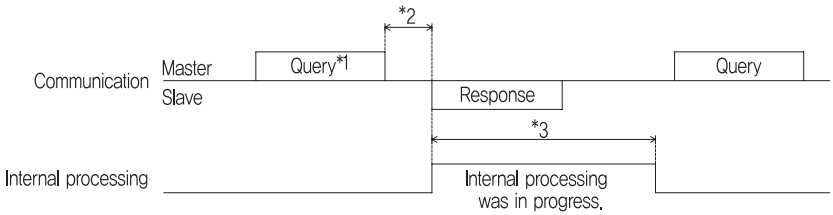
*1 indicates message containing [STOP], [Speed variable] query

*2 indicates Tb2 (waiting time for transmission) + C3.5 (Interval) + command processing time

*3 indicates C3.5 (Interval) + Command processing time

*4 Set time is varying depending on driver梯 command and parameter setting

2.14.4 Configuration



*1 indicates a message containing [Configuration] query

*2 indicates Tb2 (waiting time for transmission) + C3.5 (Interval) + command processing time

*3 indicates C3.5 (Interval) + less than 1 second

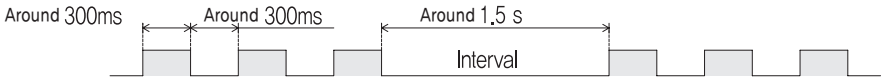
3. Alarm, Warning and ommunication error

Alarm is generated to protect driver against overheat, poor connection and malfunctioning

3.1 Alarm

If an alarm is generated, alarm output is turned [OFF] and motor sops. At the same time, alarm LED is blinking. Causes of alarm can be identified by number of alarm LED blinking

EX) sensor error (number of blinking: 3 times)



3.1.1 Alarm list

Alarm code	Number of alarm blinking	Alarm type	Causes	Solution	A/CLR input
30h	2	Overheat	When overload exceeding motor specification lasted for approximately 5 seconds	* Reduce load * Set accelerating / decelerating time	Available
28h	3	Sensor error	When motor feedback signal is wrong due to poor connection or short circuit on motor cable	Make sure to check wiring between motor and driver	
42h		Initial sensor error	When motor feedback signal is wrong due to poor connection or short circuit on motor cable for initial power supply		
22h	4	Over voltage	Voltage in driver is higher than specification	Make sure to check input voltage	
25h	5	Insufficient voltage	When voltage in driver is lower than specification	Make sure to check input voltage	
31h	6	Over speed	When motor speed exceeded 4800 r/min	* Reduce load * Set accelerating / decelerating time	

Alarm code	Number of alarm blinking	Alarm type	Causes	Solution	A/CLR input
20h	7	Over current	Over current such as grounding current is flowing	Re-check wiring and supply power again	Not available
6Eh	10	External stop*1	EXT input is Off	Check EXT input	Available
46h	11	Initial operation error*2	Power is supplied while FWD or REV input is turned On	Make sure to turn FWD or REV input OFF before power is supplied	
81h	12	Network bus error	Host network bus is Off	Make sure to check wiring	
83h		Communication switch setting error	Communication function switch (SW2-No.4) is turned On	Make sure to check communication function switch (SW2-No.4)	Not available
84h		Communication error	"ommunication error alarm" parameters are set	Make sure to check wiring and communication setting	Available
85h		Communication timeout	"ommunication timeout" parameters are set	Make sure to check wiring and communication setting	
8Eh		Network converter error	Network converter alarm is generated	Make sure to check alarm code for network converter	
2Dh	14	Main circuit output error *3	Disconnected from motor	Make sure to check wiring between motor and driver	

*1 occurs when [EXT ERROR] is assigned to X0-X5

*2 occurs when [Initial operation error] is activated

*3 alarm is not generated when torque limitation value is set to less than 200%

3.1.2 Alarm reset

If you want to reset alarm, make sure to check whether or not safety is guaranteed by turning off input signal and remove causes of alarm and select one of following articles

- Turn A/CLR On and then turn off it
- Reset alarm using RS-485 communication
- Turn off power and then turn on it

[Notes]

- Alarm reset may be impossible via A/CLR or RS-485 communication depending on types of alarms. Make sure to alarm list. Make sure to turn power [OFF] and then [On] before you reset alarm.
- When you reset alarm using RS-485 communication and operation input signal is turned [On] motor may be rotated abruptly, which may cause injuries. Therefore, make sure to turn input signal [Off] before you reset alarm.

3.1.3 Alarm record

Maximum 10 alarm records can be stored into NV memory
If you want to read or remove alarm records, select one of following procedures

- It's possible to check alarm records using monitoring commands via RS-485 communication
- You can remove alarm records using maintenance command

3.2 Warning

When a warning occurs, WNG output is available [On] but motor stops. If cause of warning is removed, WNG output is automatically turned Off

3.2.1 Warning list

Code	Warning type	Causes	Solutions
25h	Insufficient voltage	Input voltage is at least 10% less than nominal voltage	Make sure to check input voltage and wiring
30h	Overload	Load torque is higher than overload warning level	Reduce load and set acceleration / deceleration time
84h	Communication error	When communication error is detected	Make sure to check communication setting and wiring

3.2.2 Warning records

Maximum 10 warning records can be stored into NV memory
If you want to read or remove warning records, select one of following procedures

- It's possible to check warning records using monitoring commands via RS-485 communication
- You can remove warning records using maintenance command

[Note] • You can also remove warning records by turning off driver power

3.3 Communication error

Maximum 10 communication errors can be stored into NV memory
Communication error can be checked via RS-485 communication

3.3.1 Communication error list

Code	Communication error type	Causes	Solutions
84h	Communication error	In the event that following errors are detected	Make sure to check communication setting and wiring
88h	Command is not set	Undefined command can't be executed	Make sure to set commands
8Ah	Execution of NV memory	Command can't be executed while NV memory is being executed	Wait till internal execution is finished
8Ch	Outside setting range	Set data that is out of master can't be executed	Make sure to check set data
8Dh	Command can't be executed	Retry if command can't be executed again	Check status

3.3.2 Communication error records

Maximum 10 communication errors can be stored into NV memory

- It' s possible to check communication error records using monitoring commands via RS-485 communication
- ou can remove communication error records using maintenance command

[Note] • You can also remove communication error records by turning off driver power

21C, for world geared motor!

USER MANUAL

SPG Co., Ltd.

※For further development of the product, specification and design can be changed without notice. For other information, please contact costumer service depot of the head office or sales department.

■ **Head office**

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Tel : 0082-32-820-8200 Fax : 0082-32-812-6218

使用说明书

Brushless DC Motor Driver

XV series

(通讯篇)

OTOR

SPG Co., Ltd.

http://www.spg.co.kr

感谢您购买SPG MOTOR的产品。
请您务必在使用之前熟读本说明书，对产品有充分地了解，并熟知安全内容及注意事项之后使用。

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1. 安全注意事项

本说明书将安全等级分为【警告】、【注意】。

⚠ 【警告】	• 因使用不当发生危险状况，导致死亡或重伤时。
⚠ 【注意】	• 因使用不当发生危险状况，导致轻伤时。

即使【注意】事项，也会随着情况变化带来严重后果。
无论哪种情况，请务必熟记并遵守安全注意事项。

⚠ 【警告】

- 勿在有易爆、易燃、易腐和可燃物及有水的地方使用。否则会引起火灾、触电、受伤等。
- 勿在有易爆、易燃、易腐和可燃物及有水的地方使用。否则会造成火灾、触电、受伤等。
- 勿用湿手操作，否则会有触电危险。
- 安装、移动、检查排线时务必关掉电源，否则会有触电危险。
- 安装、接线、运转、操作及检查等工作务必由专家进行，否则会有触电危险。
- 在设备上安装马达、驱动器时，务必连接接地线，否则会有触电危险。
- 必须遵守驱动器的电源输入电压额定电压。
- 接线结束后，请在电源接线端子、输入输出信号接线端子上套上端子盖，否则会造成火灾、触电等。
- 请勿强行扭曲或用力拉扯电源电缆或马达电缆，否则会造成火灾、触电等。
- 停电时，请务必关闭驱动器的电源。

  否则恢复电源时，马达的突然启动会导致受伤、装置破损等。
- 请勿用于升降机。驱动器保护功能的启动致使马达停止、活动元件掉落，会导致受伤及设备破损。
- 在通电的情况下，请勿在关闭电源30秒内接触驱动器的端子，否则会有触电危险。
- 请勿拆卸或改造马达、减速器、驱动器。否则会造成火灾、触电、装置破损等。
- 需要内部检修和修理时，请与就近的销售代理商或者本社联系。

【注意】
- 请勿使用超规的马达和驱动器，否则会造成火灾、触电、装置破损等。
- 请勿拉扯马达的输出轴或电缆，否则会导致受伤。
- 请勿将可燃物放在马达和驱动器的周围，否则会造成火灾、触电、装置破损等。
- 请在马达的回转部(输出轴)安装外壳，否则会导致受伤。
- 请勿将异物放在开口部，否则会造成火灾、触电、装置破损等。
- 在组装马达(齿轮型轴)和减速器时，请注意勿将手指夹在马达和减速器之间，否则会导致受伤。
- 将马达或减速器安装在设备上时，请注意勿将手指夹在设备和马达或减速器之间，否则会造成导致危险。
- 请按照规定使用配套的马达和驱动器，否则会造成火灾、触电、破坏装置破损等。
- 在试运行时，务必做好可随时紧急停止的准备，否则会导致受伤。
- 出现异常时，请立即停止运转后关掉驱动器的电源，否则会造成火灾、触电、装置破损等。
- 保护功能启动时，请务必关掉电源解除原因后，再重新打开电源。如果未解除原因继续运转时，会使马达、驱动器发生故障或装置破损。
- 设定驱动器SLOW RUN/SLOW STOP时间设定仪时，请务必使用绝缘螺丝刀，否则会有触电危险。
- 进行绝缘电阻测定或绝缘耐压测试时，请勿触摸端子，否则会有触电危险。
- 销毁马达、驱动器时，请以工业用废弃物处理。
- 马达、驱动器在运转时其表面温度可能会超过70℃，因此在运转中或者停止之后，请勿马上触摸马达、驱动器，否则会导致高温烫伤。

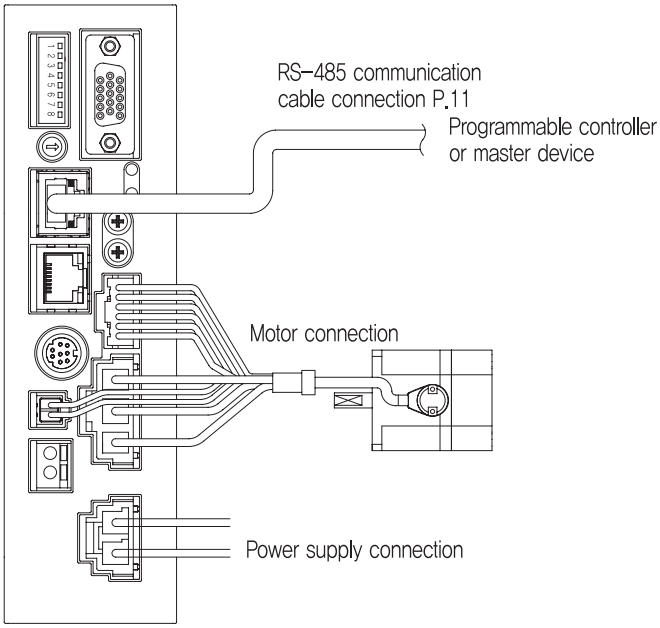
【重要】
- XVD系列是本公司XVM系列马达的专用驱动器。不可与其他马达一起使用，请务必使用配套的驱动器和马达。
- 关闭电源后重开电源时，需间隔5秒以上。

2. Modbus协议

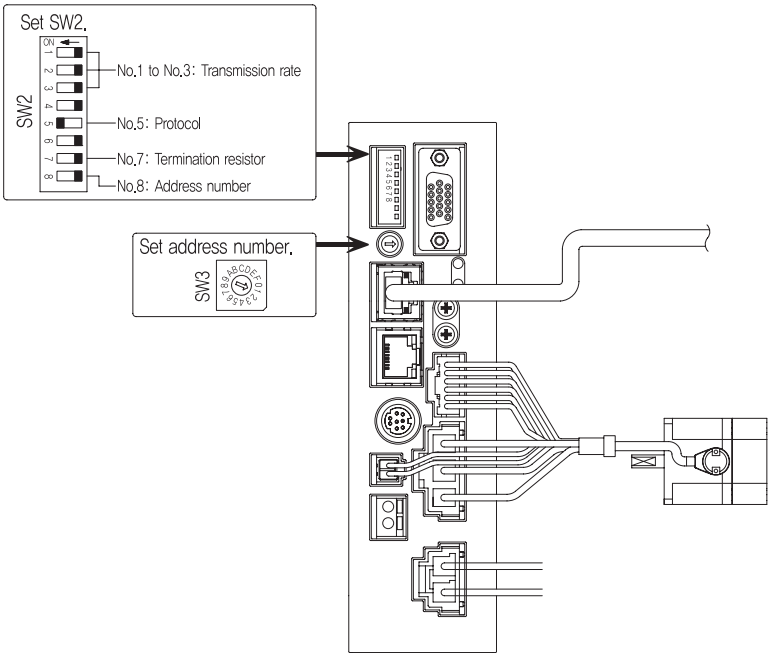
下面是利用RS-485通讯(Modubus协议)启动程序的说明。

2.1 指南

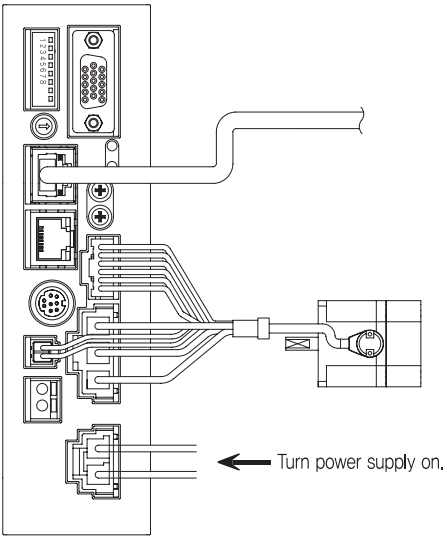
2.1.1 安装及连接



2.1.2 设定开关



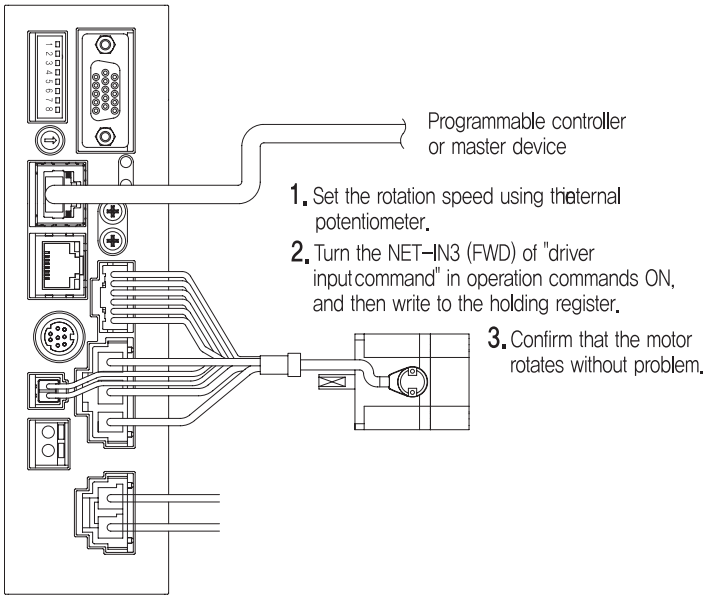
2.1.3 设定电源连接及参数



2.1.4 重新供电

为使通讯奇偶(parity)、通讯停止位(stop bit)、传送等待时间等参数有效，请重新供电。

2.1.5 操作马达



2.1.6 操作马达时确认事项

马达不正常启动时，请确认下列事项。

- 是否发生警报?
- 是否打开电源?
- 马达和RS-485通讯电缆是否连接正确?
- 从机地址(Slave address)、传送速度、终端阻抗连接是否正确?

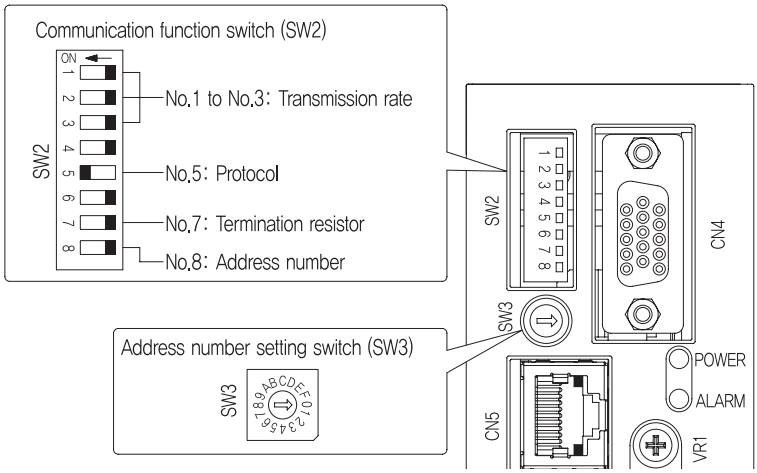
2.2 通讯规格

Electrical characteristics	In conformance with EIA-485 Use a twisted pair cable (TIA/EIA-568B CAT5e or higher is recommended) and keep the total wiring distance including extension to 50 m (164 ft.) or less.
Transmission mode	Half duplex
Transmission rate	Selectable from 9600 bps, 19200 bps, 38400 bps, 57600 bps and 115,200 bps.
Physical layer	Asynchronous mode (Data: 8 bits, stop bit: 1 bit, parity: even number)
Protocol	Modbus RTU mode
Connection pattern	Up to 31 drivers can be connected to one programmable controller (master device).

2.3 设定开关

【重要】• 设定开关之前请务必关闭电源。如打开电源设定开关时，新设定的开关无效。
设定完开关后，必须重新打开电源。

• SW2的No.4和No.6请勿放置[ON]



2.3.1 设定协议

请将SW2的No.5放置[ON]，选择Modbus协议。
(出厂时：SW2-No.5为[OFF])

2.3.2 设定Address number(从机地址)

使用SW2的No.8和address设定开关(SW3), 设定Address number(从机地址)。
因为Address number(从机地址)0为Broadcast, 请勿设定此address。
(出厂时: SW3为[0], SW2-No.8为[OFF])

SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF	SW3	SW2-No.8 : OFF
0	Broadcast	8	8	0	16	8	24
1	1	9	9	1	17	9	25
2	2	A	10	2	18	A	26
3	3	B	11	3	19	B	27
4	4	C	12	4	20	C	28
5	5	D	13	5	21	D	29
6	6	E	14	6	22	E	30
7	7	F	15	7	23	F	31

2.3.3 设定传送速度

利用SW2的No.1~No.3可以设定传送速度。
传送速度必须与主设备设定一致。
(出厂时: 9600bps)

SW2-No.3	SW2-No.2	SW2-No.1	Transmission rate (bps)
OFF	OFF	OFF	9,600
OFF	OFF	ON	19,200
OFF	ON	OFF	38,400
OFF	ON	OFF	47,600
ON	OFF	OFF	115,200

【重要】• 请勿设定上述Table以外的开关。

2.3.4 终端电阻

主设备与终端驱动器间必须连接终端电阻。
SW2的No.7放置[ON]时, 连接适用于RS-485通讯的终端电阻(120Ω)。
(出厂时: [OFF])

SW2-No.7	SW2-No.2
OFF	Disabled
ON	Enabled

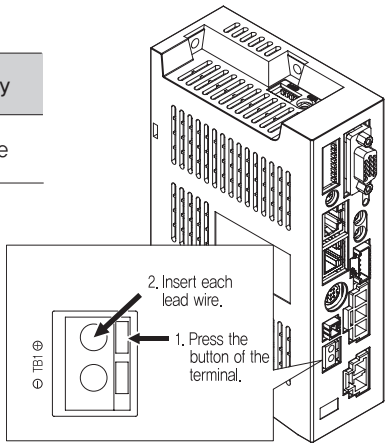
2.4 连接控制电源

驱动器连接控制电源时，即使未连接主电源也可与主设备通讯。只使用通讯功能便可设定并确认操作数据、参数和警报。

【重要】• 连接主电源之前连接上驱动器控制电源时，会发生低电压警报，但通讯功能正常运作。

2.4.1 控制电源规格

Model	Input power supply voltage	Current capacity
XVD200F	24 VDC±10%	300 mA or more
XVD400R	48 VDC±10%	



2.4.2 适用引线

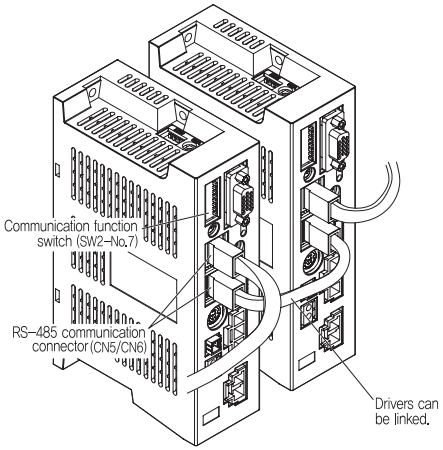
• 请使用AWG24~16(0.2~1.25mm2)引线。

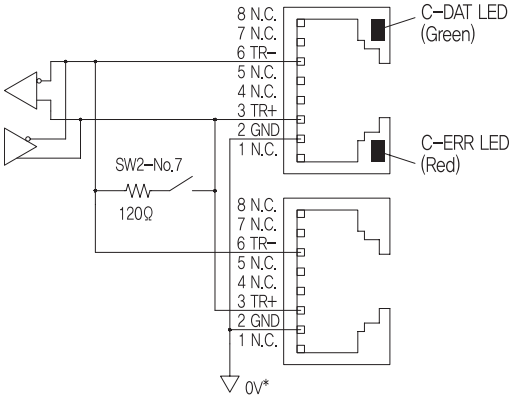
安装在主设备终端的驱动器必须连接终端电阻。

SW2的No.7放置[ON]时，连接适用于RS-485通讯的终端电阻(120Ω)。

2.5 连接RS-485通讯电缆

请将RS-485通讯电缆连接到驱动器的CN5或CN6。





GND线、主电源端子(CN1)、控制电源端子(TB1)共同使用。(不绝缘)

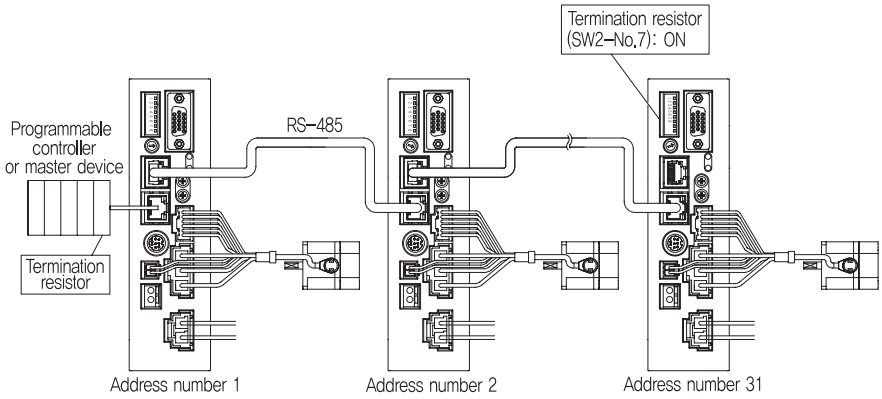
• UCN5/CN6 pin assignments

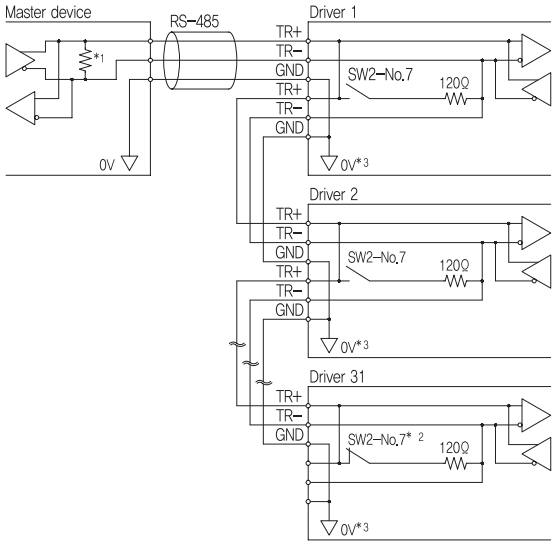
Pin No.	Signal name	Description
1	N.C.	Not used
2	GND	GND
6	TR+	RS-485 communication signal (+)
4	N.C.	Not used
5	N.C.	Not used
6	TR-	RS-485 communication signal (-)
7	N.C.	Not used
8	N.C.	Not used

• ULED

Name	Description
C-DAT LED (Green)	与主台的信息互通正常时运作。
C-ERR LED (Red)	与主台的信息互通失败时运作。

2.5.1 连接图示





*1 Termination resistor 120Ω

*2 Turn the termination resistor (SW2–No.7) to ON.

*3 The GND line is used in common with main power supply input terminal (CN1) and control power supply input terminal (TB1) [not insulated].

2.6 设定RS-485通讯

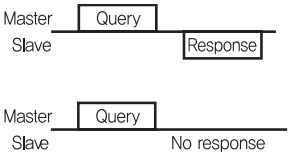
RS-485通讯参数如下图所示。

Parameter name	Value
Parity	even number
Stop bit	1 bit
传送等待时间	10 ms

2.7 通讯模式

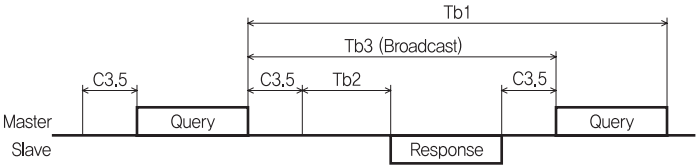
Modbus协议通讯以Single-master/multiple-slave方法为基础。
参照下列协议，选择其中一种方法传送信息。

• 单播模式(Unicast mode)
Master向一个slave传送query。
Slave完成process并响应。



• 广播模式(Broadcast mode)
在master中slave的地址设置为0时，master可向所有slave传送query。
各个slave完成process，但不响应。

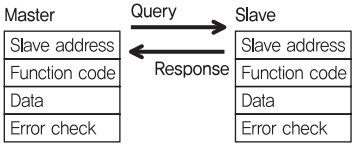
2.8 通讯计时



区分	名称	说明
Tb1	通讯超时	“通讯超时”参数的设定时间内接收不到 query 时，发生通讯超时警报。 * 设定初值：Not monitored
Tb2	传送等待时间	传送等待时间可在“传送等待时间”参数里设定。 实际传送等待时间=Silent间隔+实行时间+传送等待时间 * 设定初值: 10ms
Tb3	Broadcasting间隔	指向Broadcasting发送下一个query时的时间。 Tb3 time可能会比Silent间隔+5ms长。
C3.5	Silent间隔	须提供3.5 character的等待时间。如果在3.5 character以下的等待时间时驱动器不做响应。传送速度在19200bps以上时，需要1.75ms以上的等待时间。

2.9 信息

信息格式化如下。



2.9.1 Query

Query message结构如下。

Slave address	Function code	Data	Error check
8 bits	8 bits	N×8 bits	16 bits

• 从机地址

请设定从机地址(单播模式)。

从机地址设为0时, master可向所有slave传送query(广播模式)。

• 功能码(Function code)

功能码和信息长度如下。

Function code	Description	Broadcast
03h	Read from a holding register(s).	Impossble
06h	Write to a holding register.	Possible
08h	Perform diagnosis.	Impossible
10h	Write to multiple holding registers.	Possible

• 数据(Data)

选择功能码设定数据。

按照功能码的不同数据的长度不同。

• 差错检验(Error check)

在Modbus RTU模式内差错检验以CRC-16方式为基础。

slave将收到的信息CRC-16演算, 与包括信息的差错检验值相比较。

演算的CRC-16数据与差错检验数据相同时, slave将信息处理为正常数据。

< CRC-16演算方法>

1) 从机地址(8bit)和默认值[FFFFH]进行exclusive-OR(XOR)演算。
2) 上面1)项的结果向右移动1bit。直到溢出位达到 "1" 为止反复移动。
3) 溢出位达到 "1" 时, 上面2)项的结果与[A001h]进行XOR演算。
4) 直到移动8次, 反复上面2)项和3)项。
5) 上面4)项的结果与功能码(8bit)进行XOR演算。

• 对所有byte重复上面2)项到4)项。
• 最后的结果是CRC-16演算结果。

2.9.2 响应(Response)

slave以正常响应、无响应、异常响应三种响应。
响应信息结构与query信息结构相同。

Slave address	Function code	Data	Error check
8 bits	8 bits	N×8 bits	16 bits

• 正常响应

从master收取query时, slave完成process并响应。

• 无响应

slave对master无响应。"无响应" 情况如下。

1) 传送差错

察觉出如下差错时, slave废除query对不向master做出响应。

Cause of transmission error	Description
Framing error	Stop bit 0 was detected.
Parity error	A mismatch with the specified parity was detected.
Mismatched CRC	The calculated value of CRC-16 was found not matching the error check value.
Invalid message length	The message length exceeded 256 bytes.

2) 传送差错以外

如出现下列情况, 无须察觉其他传送差错不做响应。

Cause	Description
Broadcast	If the query was broadcast, the slave executes the requested process but does not return a response.
Mismatched slave address	The slave address in the query was found not matching the slave address of the driver.

• 异常响应

Slaver不能履行query要求的进程时，返还异常响应。该异常响应包括无法履行进程理由的异常码。异常响应的信息结构如下。

Slave address	Function code	Exception code	Error check
8 bits	8 bits	8 bits	16 bits

1) 功能码

异常响应的功能码是query的功能码和[80h]的合计。

例）query：[03h]→异常响应：[83h]

2) 异常码

显示无法履行进程的理由。

异常码	通讯差错码	原因	说明
01h	88h	Invalid function	・不支持功能码。 ・诊断子功能码(08h)与00h不同。
02h		Invalid data address	・不支持的地址。 ・寄存器地址和寄存器数超过2000h以上。
03h	8Ch	Invalid data	・寄存器的数为0或17以上。 ・byte数与寄存器数的2倍不同。 ・数据的长度超过指定范围。
04h	89h 8Ah 8Ch 8Dh	Slave error	・NV存储器操作中。 ・禁止命令操作中。 ・记录值超过设定范围。

3) 异常响应例子

Master				Query →	Slave		
Slave address			01h		Slave address		01h
Function code			06h	← Response	Function code		86h
Data	Register address (upper)		02h		Data	Exception code	04h
	Register address (lower)		1Eh		Error check (lower)		02h
	Value written (upper)		FFh		Error check (upper)		61h
	Value written (lower)		FFh				
Error check (lower)			E9h				
Error check (upper)			C4h				

2.10 功能码

2.10.1 读保持寄存器[03h]

此功能码[03h]用于读寄存器(16bit)。最多可连续读16寄存器(16*16 bit)。同时还可以读upper/lower数据。读大多数保持寄存器时按照寄存器地址顺序。

■ 例子

解读从机地址1的回转速度No.0和1操作数据。

Description	Register address	Value read	Corresponding decimal
Rotation speed No.0 (upper)	0480h	0000h	100
Rotation speed No.0 (lower)	0481h	0064h	
Rotation speed No.1 (upper)	0482h	0000h	4000
Rotation speed No.1 (lower)	0483h	0FA0h	

1) Query

Field name		Data	Description
Slave address		01h	Slave address 1
Function code		03h	Reading from holding registers
Data	Register address (upper)	04h	Register address to start reading from
	Register address (lower)	80h	
	Number of registers (upper)	00h	Number of registers to be r ead from the starting register address (4 registers=0004h)
	Number of registers (lower)	04h	
Error check (lower)		44h	Calculation result of CRC-16
Error check (upper)		D1h	

2) 响应

Field name		Data	Description
Slave address		01h	Same as query
Function code		03h	Same as query
Data	Number of data bytes	08h	Twice the number of registers in the query
	Value read from register address (upper)	00h	Value read from register address 0480h
	Value read from register address (lower)	00h	
	Value read from register address+1 (upper)	00h	Value read from register address 0481h
	Value read from register address+1 (lower)	64h	
	Value read from register address+2 (upper)	00h	Value read from register address 0482h
	Value read from register address+2 (lower)	00h	
	Value read from register address+3 (upper)	0Fh	Value read from register address 0483h
	Value read from register address+3 (lower)	A0h	
Error check (lower)		E1h	Calculation result of CRC-16
Error check (upper)		97h	

2.10.2 写保持寄存器[06h]

此功能码[06h]用于记录指定的寄存器地址数据。由于Upper/lower的结果可能超过数据范围, 同时要使用 "多重保持寄存器[10h]" 记录。

■ 例子

记录从机地址2的超负荷警告level(lower)50[32h]。

Description	Register address	Written value	Corresponding decimal
Overload warning level (lower)	10ABh	32h	50

1) Query

Field name		Data	Description
Slave address		02h	Slave address 2
Function code		06h	Writing to a holding register
Data	Register address (upper)	10h	Register address to be written
	Register address (lower)	ABh	
	Written value (upper)	00h	Written value for the register address
	Written value (lower)	32h	
Error check (lower)		7Dh	Calculation result of CRC-16
Error check (upper)		0Ch	

2) 响应

Field name		Data	Description
Slave address		02h	Same as query
Function code		06h	Same as query
Data	Register address (upper)	10h	Same as query
	Register address (lower)	ABh	
	Written value (upper)	00h	Same as query
	Written value (lower)	32h	
Error check (lower)		7Dh	Calculation result of CRC-16
Error check (upper)		0Ch	

2.10.3 诊断[08h]

此功能码[08h]用于检查master和query间的通讯。传送或返还随意数据确认通讯是否正常。

[00h](query响应)是功能码支持的子功能。

■ **例子**

往从机地址3传送随意的数据[1234h]。

1) Query

Field name		Data	Description
Slave address		03h	Slave address 3
Function code		08h	Diagnosis
Data	Sub-functioncode (upper)	00h	Return the query data
	Sub-functioncode (lower)	00h	
	Data value (upper)	12h	Arbitrary data (1234h)
	Data value (lower)	34h	
Error check (lower)		ECh	Calculation result of CRC-16
Error check (upper)		9Eh	

2) 响应

Field name		Data	Description
Slave address		03h	Same as query
Function code		08h	Same as query
Data	Sub-functioncode (upper)	00h	Same as query
	Sub-functioncode (lower)	00h	
	Data value (upper)	12h	Same as query
	Data value (lower)	34h	
Error check (lower)		ECh	Same as query
Error check (upper)		9Eh	

2.10.4 写多个保持寄存器[10h]

此功能码[10h]用于记录多个连续寄存器的数据。

■ **例子**

设定从机地址4的加速时间No.0~2操作数据。

Description	Register address	Written value	Corresponding decimal
Acceleration time No.0 (upper)	0600h	0000h	2
Acceleration time No.0 (lower)	0601h	0002h	
Acceleration time No.1 (upper)	0602h	0000h	50
Acceleration time No.1 (lower)	0603h	0032h	
Acceleration time No.2 (upper)	0604h	0000h	150
Acceleration time No.2 (lower)	0605h	0096h	

1) Query

Field name		Data	Description
Slave address		04h	Slave address 4
Function code		10h	Writing to multiple holding registers
Data	Register address (upper)	06h	Register address to start writing from
	Register address (lower)	00h	
	Number of registers (upper)	00h	Number of registers to be written from the starting register address (6 registers=0006h)
	Number of registers (lower)	06h	
	Number of data bytes	0Ch	Twice the number of registers in the query (6 registers × 2 = 12 registers: 0Ch)
	Written value for register address (upper)	00h	Written value for register address 0600h
	Written value for register address (lower)	00h	
	Written value for register address+1 (upper)	00h	Written value for register address 0601h
	Written value for register address+1 (lower)	02h	
	Written value for register address+2 (upper)	00h	Written value for register address 0602h
	Written value for register address+2 (lower)	00h	
	Written value for register address+3 (upper)	00h	Written value for register address 0603h
	Written value for register address+3 (lower)	32h	
	Written value for register address+4 (upper)	00h	Written value for register address 0604h
	Written value for register address+4 (lower)	00h	
	Written value for register address+5 (upper)	00h	Written value for register address 0605h
	Written value for register address+5 (lower)	96h	
Error check (lower)		85h	Calculation result of CRC-16
Error check (upper)		70h	

2) 响应

Field name		Data	Description
Slave address		04h	Same as query
Function code		10h	Same as query
Data	Register address (upper)	06h	Same as query
	Register address (lower)	00h	
	Number of registers (upper)	00h	Same as query
	Number of registers (lower)	06h	
Error check (lower)		40h	Calculation result of CRC-16
Error check (upper)		D6h	

2.11 寄存器地址列表

驱动器使用的所有数据均为32bit。由于Modbus协议寄存器为16bit，因此两个寄存器组成一个数据。双数地址为upper，单数地址为lower。

2.11.1 运转命令

与马达运转有关的命令。运转命令不储存到NV存储器。

Register address		READ/WRITE	Name	Description
Dec	Hex			
48	0030h	R/W	Group (upper)	Sets the address number for the group send.
49	0031h		Group (lower)	
124	007Ch	R/W	Driver input command (upper)	Sets the input command to the driver.
125	007Dh		Driver input command (lower)	
126	007Eh	R	Driver output command (upper)	Sets the output status of the driver.
127	007Fh		Driver output command (lower)	

• 分组(0030h, 0031h)
multiple slave组成分组，query一次向分组的所有slave发送。
• 驱动器输入命令(007Ch, 007Dh)
是连接RS-485通讯的驱动器输入信号。
分配下列remote I/O (NET-IN0~15)。

Address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
007Ch	Upper	-	-	-	-	-	-	-	-
	Lower	-	-	-	-	-	-	-	-
007Dh	Upper	NET-IN15 (Not used)	NET-IN14 (Not used)	NET-IN13 (Not used)	NET-IN12 (Not used)	NET-IN11 (Not used)	NET-IN10 (Not used)	NET-IN9 (Not used)	NET-IN8 (Not used)
	Lower	NET-IN7 (MB-FREE)	NET-IN6 (Not used)	NET-IN5 (STOP-MODE)※	NET-IN4 (REV)※	NET-IN3 (FWD)※	NET-IN2 (M2)	NET-IN1 (M1)	NET-IN0 (M0)

※“三线输入模式”根据“运转输入模式选择”的参数设定，认可下列信号。
FWD → START/STOP, REV → RUN/BREAK, STOP MOD → FWD/REV

根据参数设定分配给remote I/O输出端子NET-IN 0 -15的输入信号。

信号名称	功能	设定范围
Not used	不使用输入端子时-set	-
FWD	[双线输入模式] FWD输入为“1”时，马达按FWD方向回转。 FWD输入为“0”时，停止。 REV输入为“1”时，马达按REV方向回转。 REV输入为“0”时，停止。 根据马达的停止方法，选择停止模式。	0: Stop 1: Rotate to FWD direction
REV		0: Stop 1: Rotate to REV direction
STOP MODE		0: Instantaneous stop 1: Decelerationstop
START / STOP	[三线输入模式] START/STOP输入和RUN/BRAKE输入均为“1”时，马达回转。 START/STOP输入为“0”时，马达减速停止。 RUN/BRAKE输入为“0”时，马达瞬时停止。 马达停止时，方向根据FWD/REV输入端子选择。	0: Decelerationstop 1: Operation
RUN / BRAKE		0: Instantaneous stop 1: Operation
FWD / REV		0: FWD direction 1: REV direction
FREE	马达停止时，根据电磁制动的动作选择。	0: Lock when it stops 1: Release when it stops
M0~M2	使用M0~M2的3bit选择动作数据。	0 to 7: Operation data No.

【重要】• 请勿给多个端子分配同一个输入信号。如果将同一个输入信号分配给多个端子，激活其中一个端子，功能启动。
• 同一输入信号都分配给remote I/O和direct I/O(X0~X5)，激活其中一个端子，功能启动。
• 人机界面输入未分配给输入端子时，人机界面输入总是[1]（限制功能）。人机界面输入均分配给remote I/O和direct I/O(X0~X5)时，所有端子为[1]，功能受到限制。

• 驱动器输出命令(007Eh, 007Fh)

是连接RS-485通讯的驱动器输出信号。

如图所示, 分配remote I/O (NET-OUT0~15)。

Address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
007Eh	Upper	–	–	–	–	–	–	–	–
	Lower	–	–	–	–	–	–	–	–
007Fh	Upper	NET-OUT15 (TLC)	NET-OUT14 (VA)	NET-OUT13 (MOVE)	NET-OUT12 (ALARM-OUT2)	NET-OUT11 (Not used)	NET-OUT10 (Not used)	NET-OUT9 (Not used)	NET-OUT8 (S-BSY)
	Lower	NET-OUT7 (ALARM-OUT1)	NET-OUT6 (WNG)	NET-OUT5 (STOP-MODE_R)*	NET-OUT4 (REV_R)*	NET-OUT3 (FWD_R)*	NET-OUT2 (M2_R)	NET-OUT1 (M1_R)	NET-OUT0 (M0_R)

※“三线输入模式”根据“运转输入模式选择”的参数设定，认可下列信号。
FWD → START/STOP, REV → RUN/BREAK, STOP MOD → FWD/REV

根据参数设定分配remote I/O输出端子NET-IN 0~15的输入信号。

信号名称	功能		设定范围
Not used	不使用输入端子时的set		–
FWD_R	双线输入模式	FWD响应输出	0: FWD=OFF 1: FWD=ON
REV_R		REV响应输出	0: REV=OFF 1: REV=ON
STOP-MODE_R		停止模式响应输出	0: STOP-MODE=OFF 1: STOP-MODE=ON
START/STOP_R	三线输入模式	START/STOP响应输出	0: START/STOP=OFF 1: START/STOP=ON
RUN/BRAKE_R		RUN/BRAKE响应输出	0: RUN/BRAKE=OFF 1: RUN/BRAKE=ON
FWD/REV_R		FWD/REV响应输出	0: FWD/REV=OFF 1: FWD/REV=ON
MB-FREE_R	FREE响应输出		0: MB-FREE=OFF 1: MB-FREE=ON
M0_R	M0响应输出		0: M0=OFF 1: M0=ON
M1_R	M1响应输出		0: M1=OFF 1: M1=ON
M2_R	M2响应输出		0: M2=OFF 1: M2=ON
ALARM-OUT1	警报输出1		0: Normal operation 1: Alarm present
WNG	警告输出		0: Normal operation 1: Warning present
MOVE	马达回转中输出		0: Motor standstill 1: Motor in operation
TLC	Torque到达输出		0: Within the torque limiting value 1: Outside the torque limiting value
VA	速度到达输出		0: Within the speed attainment band 1: Outside the speed attainment band
S-BSY	内部处理中		0: Internal processing not in progress 1: Internal processing in progress
ALARM-OUT2	警报输出2		0: Normal operation 1: In overload operation
MPS	主电源状态输出		0: Main power-OFF 1: Main power-ON

2.11.2 维修命令

警报和警告复位时使用维修命令。另外还可一次处理NV存储器。所有的命令既可读又可写。设定[0]到[1]时实行。

寄存器地址		名称	说明	设定范围
Dec	Hex			
384	0180h	Reset alarm (upper)	警报复位。 (部分警报无法复位)	0, 1
385	0181h	Reset alarm (lower)		
388	0184h	Clear alarm records (upper)	删除警报记录。	
389	0185h	Clear alarm records (lower)		
390	0186h	Clear warning records (upper)	删除警告记录。	
391	0187h	Clear warning records (lower)		
392	0188h	Clear commun ication error records (upper)	删除通讯差错记录。	
393	0189h	Clear commun ication error records (lower)		
396	018Ch	Configuration (upper)	参数复位后实行。	
397	018Dh	Configuration (lower)		
398	018Eh	All data initialization (upper)*	将储存在NV存储器的动作数据和参数复位为初始值。	
399	018Fh	All data initialization (lower)*		
400	0190h	Batch NV memory read (upper)	认读储存在NV存储器的动作数据和参数，覆盖到随机存储器。	
401	0191h	Batch NV memory read (lower)		
402	0192h	Batch NV memory write (upper)	将随机存储器的参数写到NV存储器。 NV存储器大约可写10万次。	
403	0193h	Batch NV memory write (lower)		

【重要】• 所有数据实行初始化之前，direct I/O的X0/X1端子和remote I/O的NETIN3/NET–IN4端子信号放置[OFF]。初始化后马达会突然转动。

• 配置 (018Ch)

满足下列所有条件时，实行配置。

– 未发生警报时

– 马达停止运转时

显示实行配置前后的驱动器状态。

Item	Configuration is ready to execute	Configuration is executing	Configuration is completed
POWER LED	Lit	Lit	Based on the driver condition.
ALARM LED	OFF	OFF	
Electromagnetic brake	Hold/Release	Hold/Release	
Output signals	Allowed	Indeterminable	Allowed
Input signals	Allowed	Not allowed	Allowed

【重要】• 配置实行期间，RS–485通讯监视器数值可能无法返还。

2.11.3 维监视器命令

可读速度、警报、警告记录等所有命令。

寄存器地址		名称	说明	设定范围
Dec	Hex			
128	0080h	Present alarm (upper)	监测现在的警报码。	00h to FFh
129	0081h	Present alarm (lower)		
130	0082h	Alarm record 1 (upper)	监测1~10的警报记录。	
131	0083h	Alarm record 1 (lower)		
132	0084h	Alarm record 2 (upper)		
133	0085h	Alarm record 2 (lower)		
134	0086h	Alarm record 3 (upper)		
135	0087h	Alarm record 3 (lower)		
136	0088h	Alarm record 4 (upper)		
137	0089h	Alarm record 4 (lower)		
138	008Ah	Alarm record 5 (upper)		
139	008Bh	Alarm record 5 (lower)		
140	008Ch	Alarm record 6 (upper)		
141	008Dh	Alarm record 6 (lower)		
142	008Eh	Alarm record 7 (upper)		
143	008Fh	Alarm record 7 (lower)		
144	0090h	Alarm record 8 (upper)		
145	0091h	Alarm record 8 (lower)		
146	0092h	Alarm record 9 (upper)		
147	0093h	Alarm record 9 (lower)		
148	0094h	Alarm record 10 (upper)		
149	0095h	Alarm record 10 (lower)		
150	0096h	Present warning (upper)	监测现在的警告码。	00h to FFh
151	0097h	Present warning (lower)		
152	0098h	Warning record 1 (upper)	监测1~10的警告记录。	
153	0099h	Warning record 1 (lower)		
154	009Ah	Warning record 2 (upper)		
155	009Bh	Warning record 2 (lower)		
156	009Ch	Warning record 3 (upper)		
157	009Dh	Warning record 3 (lower)		
158	009Eh	Warning record 4 (upper)		
159	009Fh	Warning record 4 (lower)		
160	00A0h	Warning record 5 (upper)		
161	00A1h	Warning record 5 (lower)		
162	00A2h	Warning record 6 (upper)		
163	00A3h	Warning record 6 (lower)		
164	00A4h	Warning record 7 (upper)		
165	00A5h	Warning record 7 (lower)		
166	00A6h	Warning record 8 (upper)		
167	00A7h	Warning record 8 (lower)		
168	00A8h	Warning record 9 (upper)		
169	00A9h	Warning record 9 (lower)		
170	00AAh	Warning record 10 (upper)		
171	00ABh	Warning record 10 (lower)		
172	00ACh	Communication error code (upper)	最后接收的通讯差错码监视器。	
173	00ADh	Communication error code (lower)		

寄存器地址		名称	说明	设定范围
Dec	Hex			
174	00AEh	Communication error code record 1 (upper)	监测1~10的通讯差错记录。	00h to FFh
175	00AFh	Communication error code record 1 (lower)		
176	00B0h	Communication error code record 2 (upper)		
177	00B1h	Communication error code record 2 (lower)		
178	00B2h	Communication error code record 3 (upper)		
179	00B3h	Communication error code record 3 (lower)		
180	00B4h	Communication error code record 4 (upper)		
181	00B5h	Communication error code record 4 (lower)		
182	00B6h	Communication error code record 5 (upper)		
183	00B7h	Communication error code record 5 (lower)		
184	00B8h	Communication error code record 6 (upper)		
185	00B9h	Communication error code record 6 (lower)		
186	00BAh	Communication error code record 7 (upper)		
187	00BBh	Communication error code record 7 (lower)		
188	00BCh	Communication error code record 8 (upper)		
189	00BDh	Communication error code record 8 (lower)		
190	00BEh	Communication error code record 9 (upper)		
191	00BFh	Communication error code record 9 (lower)		
192	00C0h	Communication error code record 10 (upper)		
193	00C1h	Communication error code record 10 (lower)		
196	00C4h	Present selected data No. (upper)	监测当前选择的云转数据号码。	0 to 7
197	00C5h	Present selected data No. (lower)		
200	00C8h	Command speed (upper)	监测当前的命令速度。	−4010 to +4010 r/min +: Forward −: Reverse 0: Stop
201	00C9h	Command speed (lower)		
206	00CEh	Feedback speed (upper)	监测反馈速度。	−5200 to +5200 r/min
207	00CFh	Feedback speed (lower)		
212	00D4h	Direct I/O and electromagnetic brake status (upper)	监测各个I/O信号和电子Brake状态。	See next table.
213	00D5h	Direct I/O and electromagnetic brake status (lower)		

I/O及电磁制动状态(00D4h)

Register address (Hex)		bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
00D4h	Upper	−	−	−	−	−	−	−	MB
	Lower	−	−	−	−	−	−	Y1	Y0
00D5h	Upper	−	−	−	−	−	−	−	−
	Lower	−	−	X5	X4	X3	X2	X1	X0

2.11.4 参数R/W命令[Operation data]

所有的命令既可读又可写。

寄存器地址		名称	设定范围	设定单位	初始值	实行
Dec	Hex					
1152	0480h	回转速度 No.0 (upper)	0 r/min, and 80 to 4000 r/min	1	0	立即实行
1153	0481h	回转速度 No.0 (lower)				
1154	0482h	回转速度 No.1 (upper)				
1155	0483h	回转速度 No.1 (lower)				
1156	0484h	回转速度 No.2 (upper)				
1157	0485h	回转速度 No.2 (lower)				
1158	0486h	回转速度 No.3 (upper)				
1159	0487h	回转速度 No.3 (lower)				
1160	0488h	回转速度 No.4 (upper)				
1161	0489h	回转速度 No.4 (lower)				
1162	048Ah	回转速度 No.5 (upper)				
1163	048Bh	回转速度 No.5 (lower)				
1164	048Ch	回转速度 No.6 (upper)				
1165	048Dh	回转速度 No.6 (lower)				
1166	048Eh	回转速度 No.7 (upper)				
1167	048Fh	回转速度 No.7 (lower)				
1536	0600h	加速时间 No.0 (upper)	2 to 150 (1=0.1 s)	0.1	5	
1537	0601h	加速时间 No.0 (lower)				
1538	0602h	加速时间 No.1 (upper)				
1539	0603h	加速时间 No.1 (lower)				
1540	0604h	加速时间 No.2 (upper)				
1541	0605h	加速时间 No.2 (lower)				
1542	0606h	加速时间 No.3 (upper)				
1543	0607h	加速时间 No.3 (lower)				
1544	0608h	加速时间 No.4 (upper)				
1545	0609h	加速时间 No.4 (lower)				
1546	060Ah	加速时间 No.5 (upper)				
1547	060Bh	加速时间 No.5 (lower)				
1548	060Ch	加速时间 No.6 (upper)				
1549	060Dh	加速时间 No.6 (lower)				
1550	060Eh	加速时间 No.7 (upper)				
1551	060Fh	加速时间 No.7 (lower)				
1664	0680h	减速时间 No.0 (upper)	2 to 150 (1=0.1 s)	0.1	5	
1665	0681h	减速时间 No.0 (lower)				
1666	0682h	减速时间 No.1 (upper)				
1667	0683h	减速时间 No.1 (lower)				
1668	0684h	减速时间 No.2 (upper)				
1669	0685h	减速时间 No.2 (lower)				
1670	0686h	减速时间 No.3 (upper)				
1671	0687h	减速时间 No.3 (lower)				
1672	0688h	减速时间 No.4 (upper)				
1673	0689h	减速时间 No.4 (lower)				
1674	068Ah	减速时间 No.5 (upper)				
1675	068Bh	减速时间 No.5 (lower)				
1676	068Ch	减速时间 No.6 (upper)				
1677	068Dh	减速时间 No.6 (lower)				
1678	068Eh	减速时间 No.7 (upper)				
1679	068Fh	减速时间 No.7 (lower)				

寄存器地址		名称	设定范围	设定单位	初始值	实行
Dec	Hex					
1792	0700h	Torque 限制 No.0 (upper)	0 to 200%	1	200	立即实行
1793	0701h	Torque 限制 No.0 (lower)				
1794	0702h	Torque 限制 No.1 (upper)				
1795	0703h	Torque 限制 No.1 (lower)				
1796	0704h	Torque 限制 No.2 (upper)				
1797	0705h	Torque 限制 No.2 (lower)				
1798	0706h	Torque 限制 No.3 (upper)				
1799	0707h	Torque 限制 No.3 (lower)				
1800	0708h	Torque 限制 No.4 (upper)				
1801	0709h	Torque 限制 No.4 (lower)				
1802	070Ah	Torque 限制 No.5 (upper)				
1803	070Bh	Torque 限制 No.5 (lower)				
1804	070Ch	Torque 限制 No.6 (upper)				
1805	070Dh	Torque 限制 No.6 (lower)				
1806	070Eh	Torque 限制 No.7 (upper)				
1807	070Fh	Torque 限制 No.7 (lower)				

2.11.5 参数R/W命令[User parameters]

寄存器地址		名称	说明	设定范围	设定单位	初始值	实行
Dec	Hex						
646	0286h	JOG operation speed (upper)	设定JOG运转的回转速度	0 r/min, and 80 to 1000 r/min	1	300	立即实行
647	0287h	JOG operation speed (lower)					
900	0384h	Motor direction seledion (upper)	FWD输入放置ON时，设定马达的回转方向	0: + side=CCW 1: + side=CW	–	1	配置后实行
901	0385h	Motor direction seledion (lower)					
4160	1040h	Operation input mode selection (upper)	设定外部输入模式	0: 2–wire input mode 1: 3–wire input mode	–	0	
4161	1041h	Operation input mode selection (lower)					
4162	1042h	JOG operation torque (upper)	设定JOG运转的Torque限制值	0 to 200%	1	200	立即实行
4163	1043h	JOG operation torque (lower)					
4170	104Ah	Speed reduction ratio (upper)	设定减速比，标记减速器输出shaft的回转速度。设定小数点的位置，可设定多种减速比。	100 to 9999	1	100	
4171	104Bh	Speed reduction ratio (lower)					
4172	104Ch	Speed reduction ratio decimal digit setting (upper)		0: 1 digit 1: 2 digit 2: 3 digit	–	2	
4173	104Dh	Speed reduction ratio decimal digit setting (lower)					

寄存器地址		名称	说明	设定范围	设定单位	初始值	实行
Dec	Hex						
4174	104Eh	Speed increasing ratio (upper)	设定加速比，标志马达shaft的输出回转速度。 加速比为1时，适用减速比。 加速比不是1时，适用加速比。	1 to 5	–	1	立即实行
4175	104Fh	Speed increasing ratio (lower)					
4176	1050h	Conveyor speed reduction ratio (upper)	可标记传送机的返送速度的减速比率。	100 to 9999	1	100	
4177	1051h	Conveyor speed reduction ratio (lower)					
4178	1052h	Conveyor speed reduction ratio decimal digit setting (upper)		0: 1 digit 1: 2 digit 2: 3 digit	–	2	
4179	1053h	Conveyor speed reduction ratio decimal digit setting (lower)					
4180	1054h	Conveyor speed increasing ratio (upper)	可标记传送机的返送速度的加速比率。	1 to 5	–	1	
4181	1055h	Conveyor speed increasing ratio (lower)					
4322	10E2h	Analog input signal selection (upper)	可选择运转数据的设定方法。	0: Mode 0 1: Mode 1 2: Mode 2 3: Mode 3 4: Mode 4 5: Mode 5	–	0	配置后实行
4323	10E3h	Analog input signal selection (lower)					
4430	114Eh	Rotation speed attainment band (upper)	可设定速度到达范围。	0 to 400 r/min	1	200	立即实行
4431	114Fh	Rotation speed attainment band (lower)					

• 选择模拟输入信号设定运转数据

运转数据的设定方法可使用参数选择模拟输入信号更改。

如下图所示，参照模式号码及模拟设定/数码设定组合。除下列组合外，不可使用其他设定。

Mode	Operation data No.	VR1	VR2	VR3	外部VR	数码设定
Mode 0 (Initial setting)	0	Rotation speed	Acceleration/ Deceleration time	Torque limiting value	–	–
	1	–	Acceleration/ Deceleration time	Torque limiting value	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 1	0 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 2	0 to 7	–	–	–	Torque limiting value	Rotation speed Acceleration time Deceleration time
Mode 3	0	Acceleration time	Deceleration time	Rotation speed	–	Torque limiting value
	1	Acceleration time	Deceleration time	–	Rotation speed	Torque limiting value
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 4	0	Rotation speed	Torque limiting value	Acceleration/ Deceleration time	–	–
	1	–	Torque limiting value	Acceleration/ Deceleration time	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value
Mode 5	0	Torque limiting value	Acceleration/ Deceleration time	Rotation speed	–	–
	1	Torque limiting value	Acceleration/ Deceleration time	–	Rotation speed	–
	2 to 7	–	–	–	–	Rotation speed Acceleration time Deceleration time Torque limiting value

【重要】• Torque限制可变阻抗(VR3)出厂时设定为最大值。

选择No.3、No.4或No.5模式时，启动马达前请首先确认设定值。回转速度、减速/加速值设定为最大值。

2.11.6 参数R/W命令[警报、警告]

寄存器地址		名称	说明	设定范围	设定单位	初始值	实行
Dec	Hex						
840	0348h	Undervoltage warning level (upper)	设定主电源的电压不足时的警告等级。	0 to 480 (=0.1 V)	0.1	24 VDC type: 216 48 VDC type: 432	立即实行
841	0349h	Undervoltage warning level (lower)					
4224	1080h	Electromagnetic brake action at alarm (upper)	发生警报时，设定电磁制动的实际动作时间。	0: Lock after coasting to a stop 1: Lock immediately	–	1	配置后实行
4225	1081h	Electromagnetic brake action at alarm (lower)					
4226	1082h	Operation error during initialization alarm function (upper)	警报初始化期间，设定运转差错的enable/disable	0: Disable 1: Enable	–	0	
4227	1083h	Operation error during initialization alarm function (lower)					
4228	1084h	Undervoltage alarm latch (upper)	解除电压不足警报时，设定马达的运转状态。	0: Disable 1: Enable	–	0	
4229	1085h	Undervoltage alarm latch (lower)					
4258	10A2h	Overload warning function (upper)	设定超负荷警告功能的enable/disable。	0: Disable 1: Enable	–	1	立即实行
4259	10A3h	Overload warning function (lower)					
4264	10A8h	Undervoltage warning function (upper)	设定电压不足警告的enable/disable。	0: Disable 1: Enable	–	1	
4265	10A9h	Undervoltage warning function (lower)					
4266	10AAh	Overload warning level (upper)	设定负荷Torque的警告等级。	50 to 100% 1 100	–	100	
4267	10ABh	Overload warning level (lower)					
4608	1200h	Communication timeout (upper)	设定通讯超时条件。	0: Not monitored 0 to 10000 ms	–	0	
4609	1201h	Communication timeout (lower)					
4610	1202h	Communication error alarm (upper)	设定通讯差错警报发生条件。	1 to 10 times	–	3	
46 11	1203h	Communication error alarm (lower)					

2.11.7 参数R/W命令[Data setter]

寄存器地址		名称	说明	设定范围	初始值	实行
Dec	Hex					
960	03C0h	Data setter speed display (upper)	Sets the display method of operation speed in the monitor mode. If "0" is set, "–" will be displayed when rotating in REV input direction.	0: Signed 1: Absolute value	0	立即实行
961	03C1h	Data setter speed display (lower)				
4320	10E0h	Data setter initial display (upper)	Select the initial screen when the driver power is turned on.	0: Operation speed 1: Conveyor transfer speed 2: Load factor 3: Operation data number 4: Top screen of monitor mode	0	重新供电后实行
4321	10E1h	Data setter initial display (lower)				

2.11.8 参数R/W命令[I/O功能(直接I/O)]

寄存器地址		名称	设定范围	初始值	实行
Dec	Hex				
4352	1100h	选择X0输入功能(upper)	0: Not used 1: FWD (START/STOP)*1 2: REV (RUN/BRAKE) *1 19: STOP–MODE (FWD/REV)*1 20: MB–FREE 21: EXT–ERROR 24: ALARM–RESET 27: HMI 48: M0 49: M1 50: M2	1	停止后实行
4353	1101h	选择X0输入功能(upper)		2	
4354	1102h	选择X1输入功能(upper)		19	
4355	1103h	选择X1输入功能(upper)		48	
4356	1104h	选择X2输入功能(upper)		24	
4357	1105h	选择X2输入功能(upper)		20	
4358	1106h	选择X3输入功能(upper)			
4359	1107h	选择X3输入功能(upper)			
4360	1108h	选择X4输入功能(upper)			
4361	1109h	选择X4输入功能(upper)			
4362	110Ah	选择X5输入功能(upper)			
4363	110Bh	选择X5输入功能(upper)			
4416	1140h	选择YO输出功能(upper)	0: Not used 65: ALARM–OUT1 66: WNG 68: MOVE 71: TLC 77: VA 81: ALARM–OUT2	65	立即实行
4417	1141h	选择YO输出功能(upper)			
4418	1142h	选择Y1输出功能(upper)		66	
4419	1143h	选择Y1输出功能(upper)			

* 1 ( )适用于“运转输入模式选择”参数的“三线输入模式”设定完为止。

2.11.9 参数R/W命令[I/O功能(远程I/O)]

寄存器地址		名称	设定范围	初始值	实行
Dec	Hex				
4448	1160h	选择NET-IN0输入功能(upper)	0: Not used 1: FWD (START/STOP) *1 2: REV (RUN/BRAKE) *1 19: STOP-MODE (FWD/REV) *1 20: MB-FREE 27: HMI 48: M0 49: M1 50: M2	48	配置后实行
4449	1161h	选择NET-IN0输入功能(upper)			
4450	1162h	选择NET-IN1输入功能(upper)		49	
4451	1163h	选择NET-IN1输入功能(upper)			
4452	1164h	选择NET-IN2输入功能(upper)		50	
4453	1165h	选择NET-IN2输入功能(upper)			
4454	1166h	选择NET-IN3输入功能(upper)		1	
4455	1167h	选择NET-IN3输入功能(upper)			
4456	1168h	选择NET-IN4输入功能(upper)		2	
4457	1169h	选择NET-IN4输入功能(upper)			
4458	116Ah	选择NET-IN5输入功能(upper)		19	
4459	116Bh	选择NET-IN5输入功能(upper)			
4460	116Ch	选择NET-IN6输入功能(upper)		0	
4461	116Dh	选择NET-IN6输入功能(upper)			
4462	116Eh	选择NET-IN7输入功能(upper)		20	
4463	116Fh	选择NET-IN7输入功能(upper)			
4464	1170h	选择NET-IN8输入功能(upper)		0	
4465	1171h	选择NET-IN8输入功能(upper)			
4466	1172h	选择NET-IN9输入功能(upper)		0	
4467	1173h	选择NET-IN9输入功能(upper)			
4468	1174h	选择NET-IN10输入功能(upper)		0	
4469	1175h	选择NET-IN10输入功能(upper)			
4470	1176h	选择NET-IN11输入功能(upper)		0	
4471	1177h	选择NET-IN11输入功能(upper)			
4472	1178h	选择NET-IN12输入功能(upper)		0	
4473	1179h	选择NET-IN12输入功能(upper)			
4474	117Ah	选择NET-IN13输入功能(upper)		0	
4475	117Bh	选择NET-IN13输入功能(upper)			
4476	117Ch	选择NET-IN14输入功能(upper)		0	
4477	117Dh	选择NET-IN14输入功能(upper)			
4478	117Eh	选择NET-IN15输入功能(upper)		0	
4479	117Fh	选择NET-IN15输入功能(upper)			

* 1 ( )适用于 “运转输入模式选择” 参数的 “三线输入模式” 设定完为止。

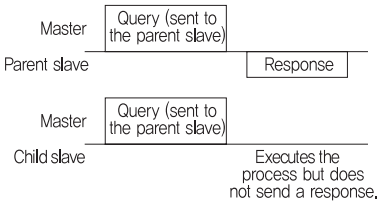
寄存器地址		名称	设定范围	初始值	实行
Dec	Hex				
4480	1180h	选择NET-OUT0输出功能(upper)	0: Not used 1: FWD_R (START/STOP_R) *1 2: REV_R (RUN/BRAKE_R) *1 19: STOP-MODE_R (FWD/REV_R) *1 20: MB-FREE_R 27: HMI_R 48: M0_R 49: M1_R 50: M2_R 65: ALARM-OUT1 66: WNG 68: MOVE 71: TLC 77: VA 80: S-BSY 81: ALARM-OUT2 82: MPS	48	配置后实行
4481	1181h	选择NET-OUT0输出功能(upper)			
4482	1182h	选择NET-OUT1输出功能(upper)		49	
4483	1183h	选择NET-OUT1输出功能(upper)			
4484	1184h	选择NET-OUT2输出功能(upper)		50	
4485	1185h	选择NET-OUT2输出功能(upper)			
4486	1186h	选择NET-OUT3输出功能(upper)		1	
4487	1187h	选择NET-OUT3输出功能(upper)			
4488	1188h	选择NET-OUT4输出功能(upper)		2	
4489	1189h	选择NET-OUT4输出功能(upper)			
4490	118Ah	选择NET-OUT5输出功能(upper)		19	
4491	118Bh	选择NET-OUT5输出功能(upper)			
4492	118Ch	选择NET-OUT6输出功能(upper)		66	
4493	118Dh	选择NET-OUT6输出功能(upper)			
4494	118Eh	选择NET-OUT7输出功能(upper)		65	
4495	118Fh	选择NET-OUT7输出功能(upper)			
4496	1190h	选择NET-OUT8输出功能(upper)		80	
4497	1191h	选择NET-OUT8输出功能(upper)			
4498	1192h	选择NET-OUT9输出功能(upper)		0	
4499	1193h	选择NET-OUT9输出功能(upper)			
4500	1194h	选择NET-OUT10输出功能(upper)		0	
4501	1195h	选择NET-OUT10输出功能(upper)			
4502	1196h	选择NET-OUT11输出功能(upper)		0	
4503	1197h	选择NET-OUT11输出功能(upper)			
4504	1198h	选择NET-OUT12输出功能(upper)		81	
4505	1199h	选择NET-OUT12输出功能(upper)			
4506	119Ah	选择NET-OUT13输出功能(upper)		68	
4507	119Bh	选择NET-OUT13输出功能(upper)			
4508	119Ch	选择NET-OUT14输出功能(upper)		77	
4509	119Dh	选择NET-OUT14输出功能(upper)			
4510	119Eh	选择NET-OUT15输出功能(upper)		71	
4511	119Fh	选择NET-OUT15输出功能(upper)			

* 1 ( )适用于“运转输入模式选择”参数的“三线输入模式”设定完为止。

2.12 分组传送

多重slave组成分组，query一次向分组的所有slave传送。

- 分组结构
  分组由parent slave和child slave构成，只有parent slave响应。
- 分组地址
  为实行分组传送，在属于分组的child slave设定分组地址。

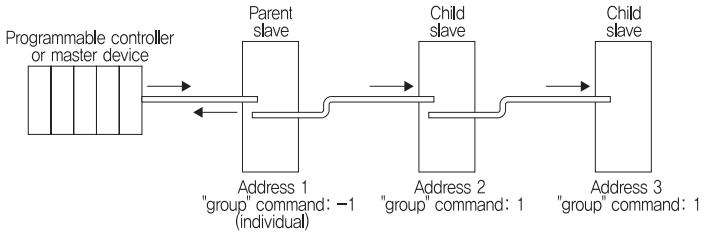


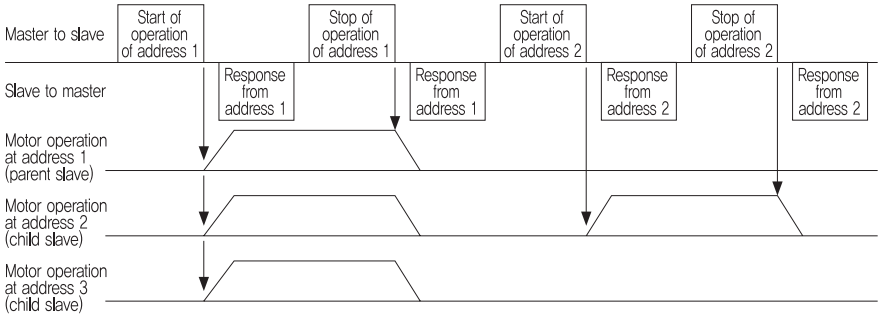
- Parent slave
  为了分组传送，parent slave无需进行特别设定。
  分组地址query从master向parent slave传送，parent slave执行处理并作响应。
- Child slave
  为在各个child slave设定分组地址，请使用“分组”命令。
  在单播模式改变分组。

地址	设定范围	初始值
0030h	−1: No group specification (Group send is not performed) 1 to 31: Sets a group address.	−1

【重要】• 分组设定即使执行[写配置NV存储器]，因为不储存到NV存储器里，重新供电时分组设定自动解除。每打开电源时需要重新设定分组。

功能码	功能
10h	Writing to multiple holding registers





2.13 检测通讯差错

此功能检测使用RS-485通讯时可出现的差错。

2.13.1 通讯差错

通讯差错记录储存到随机存储器。使用[通讯差错记录]命令确认通讯差错。

【重要】• 分断绝驱动器电源也可删除通讯差错记录。

通讯差错类型	错误代码	原因
RS-485 communication error	84h	A transmission error was detected. See "No response" on p.14.
Command not yet defined	88h	An exception response (exception code 01h, 02h) was detected. See p.15.
User I/F communication in progress	89h	An exception response (exception code 04h) was detected. See p.15.
NV memory processing in progress	8Ah	
Outside setting range	8Ch	An exception response (exception code 03h, 04h) was detected. See p.15.
Command execute disable	8Dh	An exception response (exception code 04h) was detected. See p.15.

2.13.2 警报及警告

发生警报时ALARM OUT输出关闭马达停止运转，同时警报灯闪烁。
发生警告时，WNG输出虽打开，马达继续运转。解除警告原因后WNG输出自动关闭。

【重要】• 断绝驱动器电源，也可删除警告记录。

• 通讯开关设定差错

通讯功能开关（SW2）的No.4放置[ON]时，传送速度设定开关出现差错。

• RS-485通讯差错[84h]

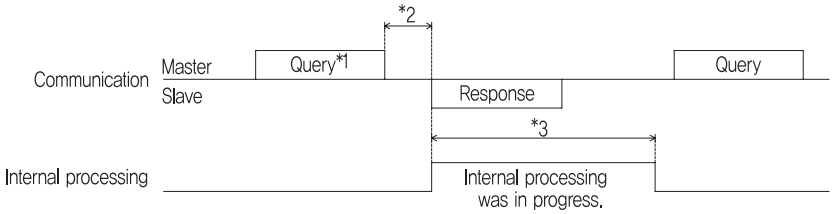
区分	说明
Warning	查出通讯差错(84h)时，发生警告。恢复正常时警告自动解除。
Alarm	超过在“通讯差错警报”参数上设定的次数以上查出差错时，发生警报。

• RS-485通讯超时[85h]

在[通讯超时]设定的时间内通讯断绝时，发生超时警报。

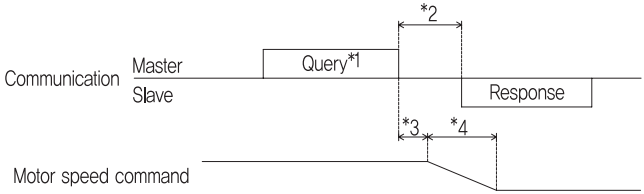
2.14 计时图

2.14.1 通讯开始



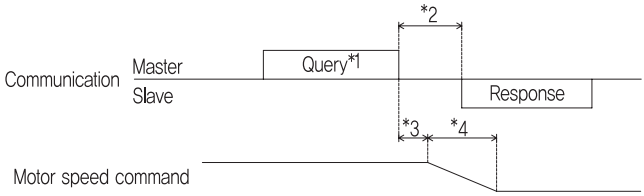
* Tb2（传送等待时间）+ C3.5（间隔）+ 命令处理时间

2.14.2 通讯开始



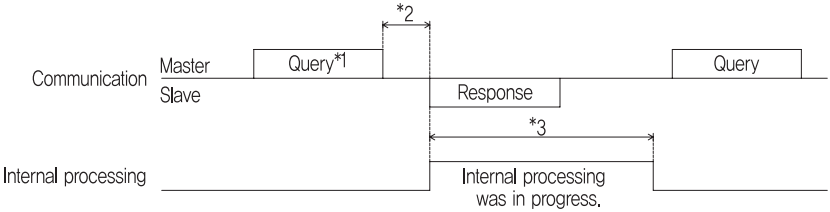
*1：包括[开始]query的信息。
*2：Tb2(传送等待时间)+C3.5(间隔)+命令处理时间
*3：C3.5(间隔)+4ms以下

2.14.3 停止、变速



*1: 包括[停止]、[变速]query的信息。
*2: Tb2(传送等待时间)+C3.5(间隔)+命令处理时间
*3: C3.5(间距)+命令处理时间
*4: 设定时间根据驱动器输入命令或参数的设定变化。

2.14.4 停配置



*1: 包括[配置]query的信息。
*2: Tb2(传送等待时间) + C3.5(间隔) + 命令处理时间
*3: C3.5(间隔) + 1秒以下

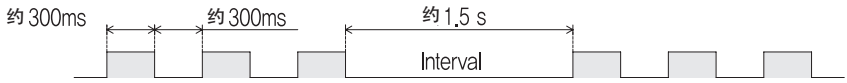
3. 警报、警告、通讯差错

过热、接触不良、运转不正常时，为保护驱动器发生警报。

3.1 警报

发生警报时，ALARM OUT输出关闭马达停止运转，同时警报灯闪烁。警报的原因可根据警报灯闪烁的次数确认。

EX) 传感器差错警报(闪烁次数：三次)



3.1.1 警报目录

警报码	警报灯闪烁次数	报警类型	原因	解决方法	A/CLR 输入
30h	2	超负荷	马达负荷超过额定范围5秒以上时	确认马达和驱动器间的排线	可以
28h	3	传感器差错	马达电缆断线或连接器的接触不良导致马达反馈信号出现异常时	查看输入电压	
42h		初期传感器差错	初期供电时马达电缆断线或连接器的接触不良导致马达反馈信号出现异常时		
22h	4	过电压	向驱动器供应的电压比额定电压高时	马达负荷超过额定范围5秒以上时	
25h	5	电压不足	向驱动器供应的电压比额定电压低时	查看输入电压	
31h	6	超速	发生马达速度超过4800r/min的异常速度现象时	* 减轻负荷 * 设定加减速时间	

警报码	警报灯闪烁次数	报警类型	原因	解决方法	A/CLR 输入
20h	7	过电流	由于接地故障电流等导致过电流	重新确认排线并重新供电	不可以
6Eh	10	外部停止*1	外部输入关闭	确认外部输入	可以
46h	11	初始动作差错*2	在打开FWD或REV输入端口的情况下供电	供电前，关闭FWD或REV输入端口	
81h	12	Network bus error	Host network bus关闭	确认排线	
83h		通讯开关设定差错	通讯功能开关(SW2–No.4)打开	确认通讯功能开关 (SW2–No.4)	不可以
84h		通讯差错	设定“通讯差错警报”参数	查看排线及通讯设定	可以
85h		通讯超时	设定“通讯超时”参数	查看排线及通讯设定	
8Eh		网络转换器差错	网络转换器发生警报	确认网络转换器的警报码	
2Dh	14	主回路输出差错*3	未与马达连接	确认马达和驱动期间的排线	

*1: [EXT ERROR]在X0–X5范围内时发生警报。
*2: 激活[Initial operation error]时发生警报。
*3: Torque限定值设定为200%以下时，不发生警报。

3.1.2 复位警报

复位警报时，首先关闭输入信号确认是否安全后，去除警报原因选择下列方法中的一种。

- 先打开A/CLR输入后关闭。
- 利用RS-485通讯复位警报。
- 关闭电源后重新打开电源。

【重要】• 根据警报种类，用A/CLR或RS-485通讯有时会无法复位警报。请确认警报目录。如要复位警报，先关闭电源后再重新打开。
• 利用RS-485通讯复位警报时，如果打开操作输入信号马达会突然回转导致受伤。必须在复位之前关闭输入信号。

3.1.3 警报记录

警报记录储存到NV存储器，最多可储存10个。
查看或删除警报时选择下列方法中的一种。

- 通过RS-485通讯利用监视器命令可确认警报。
- 使用维修命令可删除警报记录。

3.2 警告

出现警告时，虽然打开WNG输出，马达继续运转；解除警告原因后，WNG输出自动关闭。

3.2.1 警告目录

代码	警告类型	原因	解决方法
25h	电压不足	输入电压比定额电压约低10%以上	确认输入电压和排线
30h	超负荷	扭矩负荷超过超负荷警告时	减轻负荷 设定加减速时间
84h	通讯差错	查出通讯差错时	确认通讯设定和排线

3.2.2 警告记录

警告记录储存到NV存储器, 最多可储存10个。
查看或删除警告记录时选择下列方法中的一种。

- 可通过RS-485通讯利用监视器命令确认警告记录。
- 利用维修命令删除警告记录。

【重要】• 断绝驱动器电源也可删除警告记录。

3.3 通讯差错

通讯差错储存到NV存储器, 最多可储存10个.
可利用RS-485通讯确认。

3.3.1 通讯差错目录

代码	通讯差错类型	原因	解决方法
84h	通讯差错	查出下列差错时 · Framing error · BCC error	确认通讯设定和排线
88h	未设定命令	未经定义的命令无法实行	设定命令
8Ah	实行NV存储器	实行NV存储器时无法执行命令	等到内部实行结束
8Ch	Outside setting range	设定数据超出Master的设定范围无法实行	确认设定数据
8Dh	无法实行命令	无法实行命令时, 重试。	确认Status

3.3.2 通讯差错记录

通讯差错储存到NV存储器, 最多可储存10个。
可查看储存到随机存储器里通讯差错记录, 或操作下列中的一项删除记录。

- 通过RS-485通讯利用监视器命令确认通讯差错记录。
- 使用维修命令删除通讯差错记录。

【重要】• 断绝驱动器电源可删除通讯差错记录。

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USER MANUAL

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■ **总部**

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