

# Communication

## Outline of Communication

You can connect up to 16 MINAS-A4 series with your computer or NC via serial communication based on RS232 and RS484, and can execute the following functions.

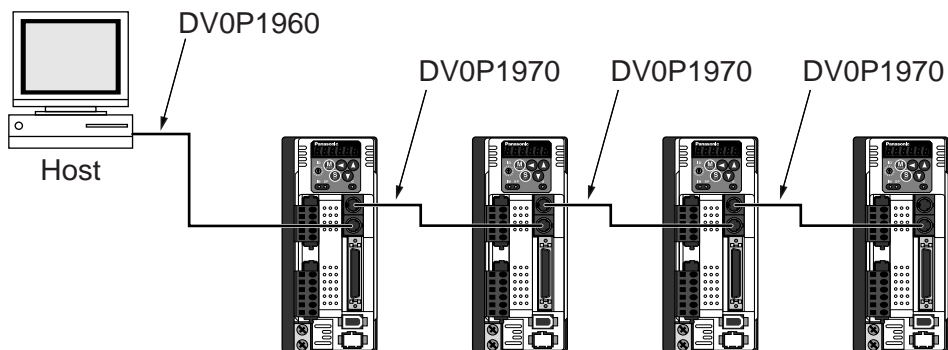
- (1) Change over of the parameters
- (2) Referring and clearing of alarm data status and history
- (3) Monitoring of control conditions such as status and I/O.
- (4) Referring of the absolute data
- (5) Saving and loading of the parameter data

### Merits

- You can write parameters from the host to the driver in batch when you start up the machine.
- You can display the running condition of machine to improve serviceability.
- You can compose multi-axis absolute system with simple wiring.

Following application software and cables are prepared as options. For the operation of the "PANATERM<sup>®</sup>", refer to the instruction manual of the PANATERM<sup>®</sup>.

"PANATERM <sup>®</sup> " Japanese version (Windows 98/Me/2000/XP)	DVOP4230
"PANATERM <sup>®</sup> " English version (Windows 98/Me/2000/XP)	DVOP4240
Connecting cable for PC (DOS/V)	DVOP1960
Connecting cable between drivers	DVOP1970 (200[mm])
	DVOP1971 (500[mm])
	DVOP1972 (1000[mm])



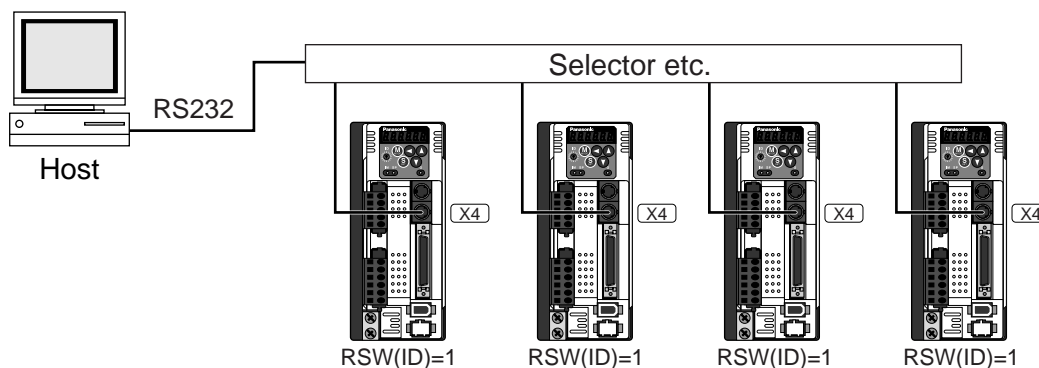
## Communication Specifications

### Connection of Communication Line

MINAS-A4 series provide 2 types of communications ports of RS232 and RS485, and support the following 3 types of connection with the host.

#### • RS232 communication

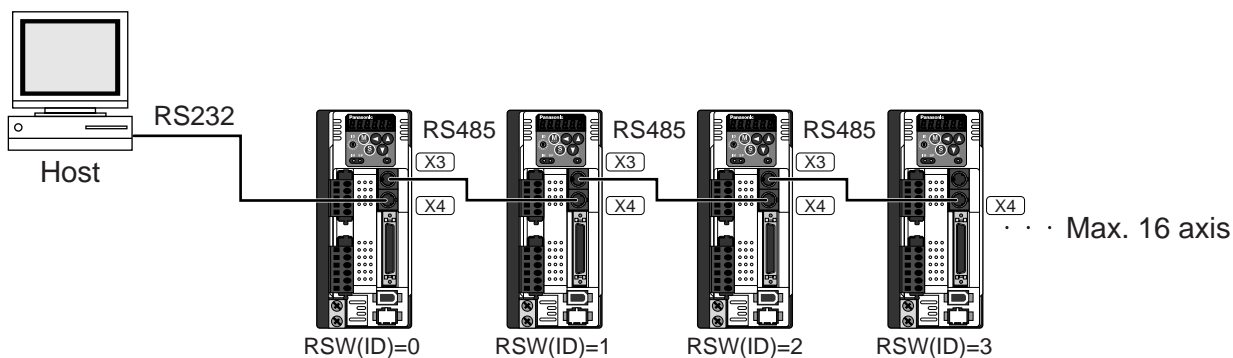
Connect the host and the driver in one to one with RS232, and communicate according to RS232 transmission protocol.



- Set up the module ID of MINAS-A4 to RSW of the front panel. In the above case, you can set any value of 0 to F. You can set the same module ID as long as the host has no difficulty in control.

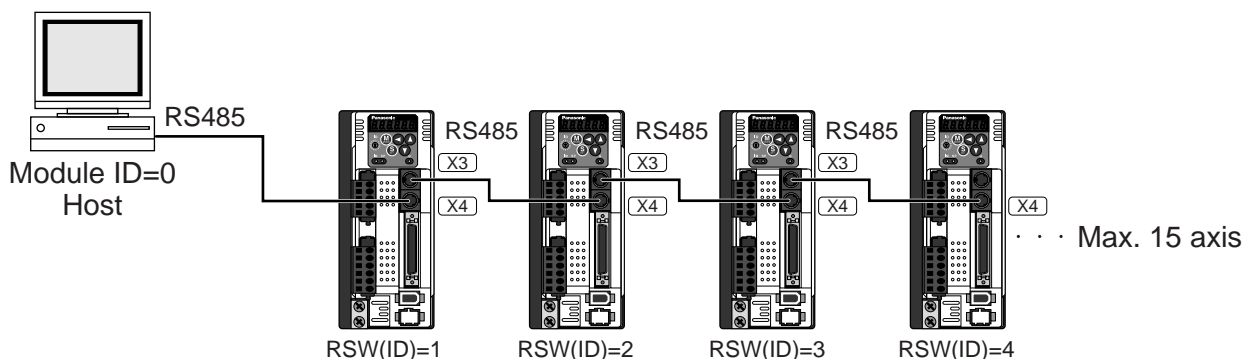
#### • RS232 and RS485 communication

When you connect one host to multiple MINAS-A4s, connect the host to connector X4 of one driver with RS232 communication, and connect each MINAS-A4 with RS485 communication. Set up the RSW of the driver to 0 which is connected to the host, and set up 1 to F to other drivers each.



#### • RS485 communication

Connect the host to multiple MINAS-A4s with RS485 communication, set up the RSW of each front panel of MINAS-A4 to 1 to F.

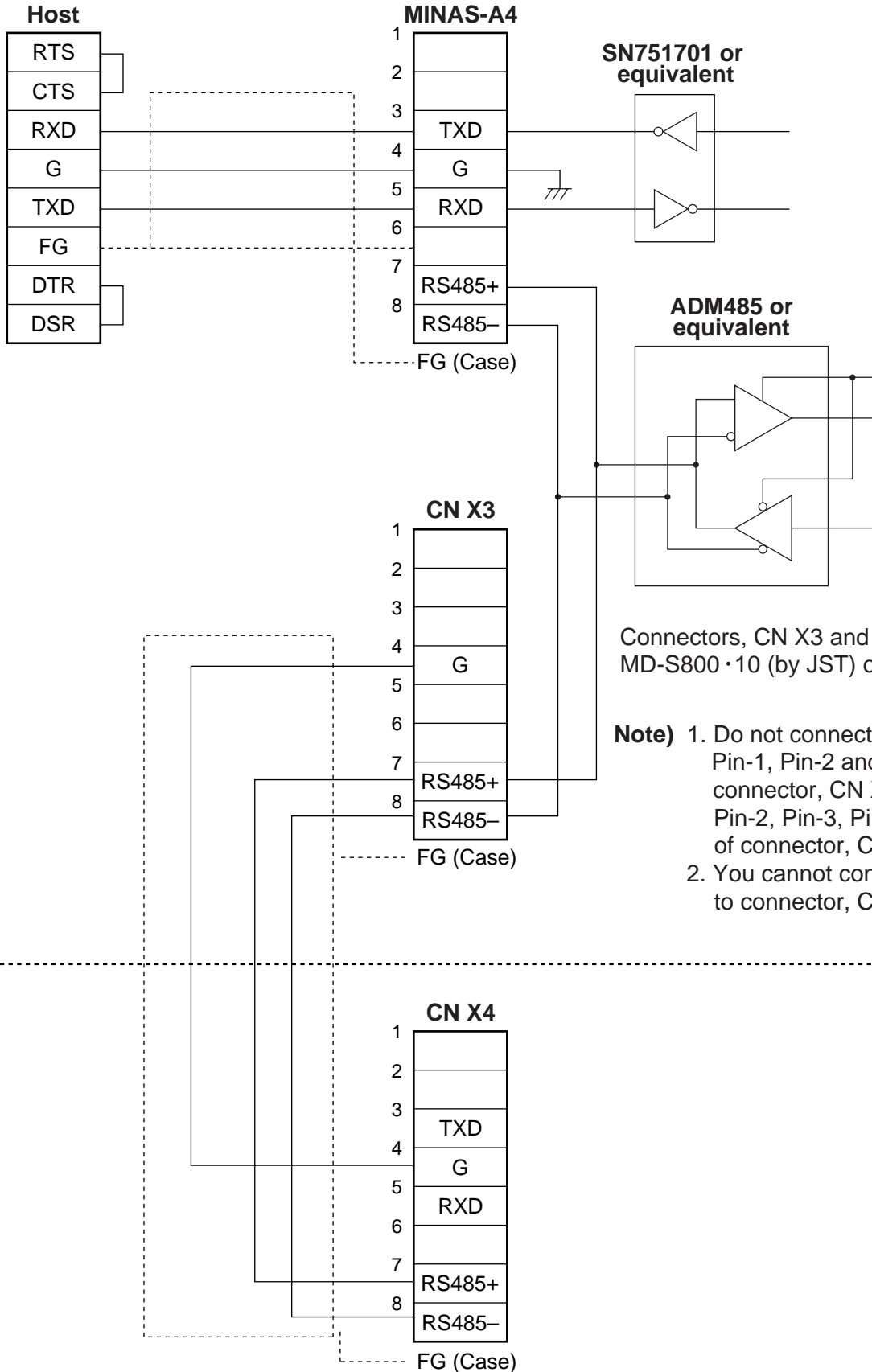


Allow 500ms or longer interval for switching the axes while capturing data of multiple axes.

# Communication

## Interface of Communication Connector

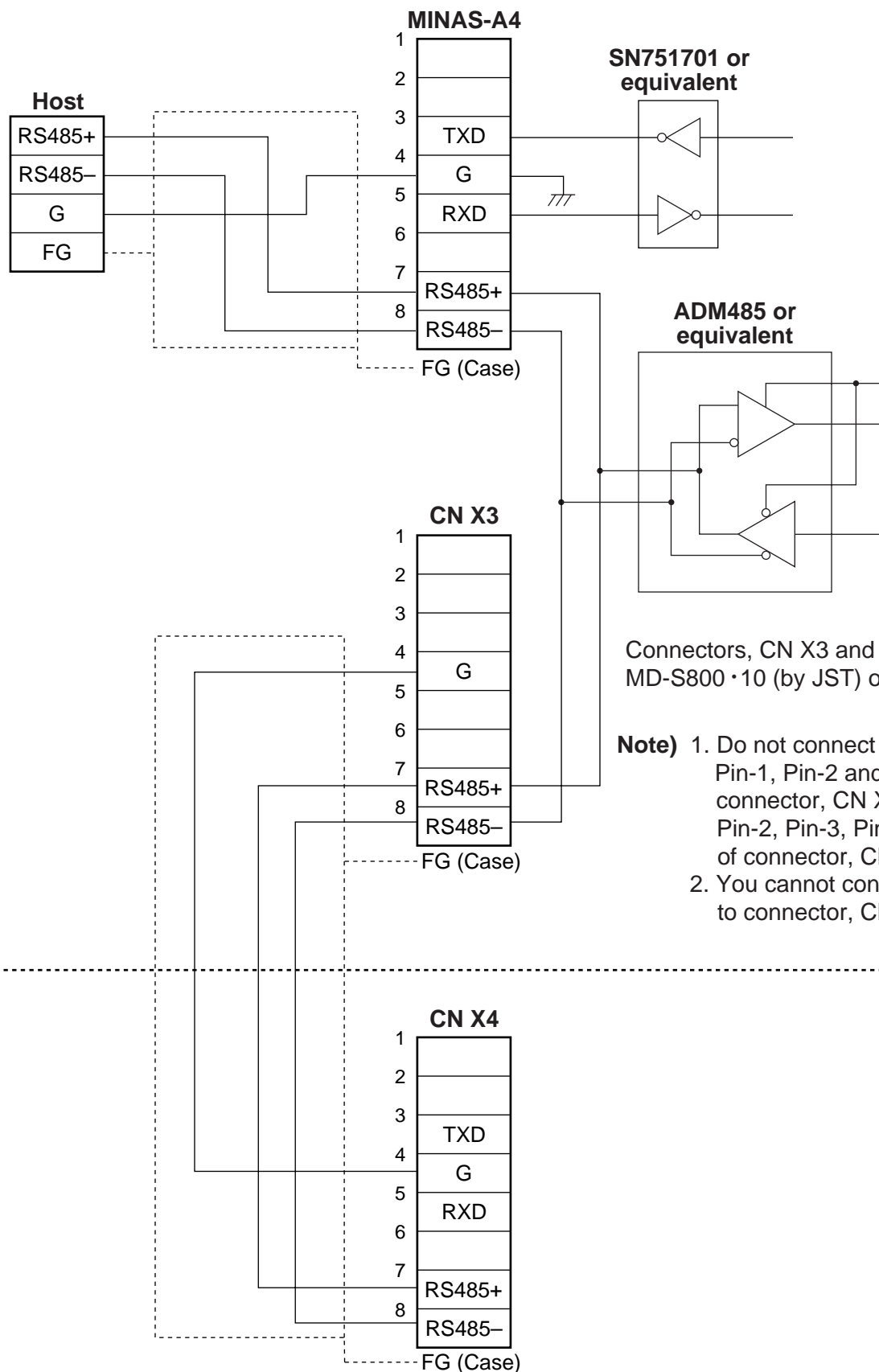
### • Connection to the host with RS232



Connectors, CN X3 and CN X4 are MD-S800 · 10 (by JST) or equivalent.

- Note)**
1. Do not connect anything to Pin-1, Pin-2 and Pin-6 of connector, CN X4 and Pin-1, Pin-2, Pin-3, Pin-5 and Pin-6 of connector, CN X3.
  2. You cannot connect RS232 to connector, CN X3.

• Connection to the host with RS485



Connectors, CN X3 and CN X4 are MD-S800 · 10 (by JST) or equivalent.

- Note)**
1. Do not connect anything to Pin-1, Pin-2 and Pin-6 of connector, CN X4 and Pin-1, Pin-2, Pin-3, Pin-5 and Pin-6 of connector, CN X3.
  2. You cannot connect RS232 to connector, CN X3.

# Communication

## Communication Method

	RS232	RS485
	Full duplex, asynchronous	Half duplex, asynchronous
Communication baud rate	2400,4800,9600,19200,38400,57600bps	2400,4800,9600,19200,38400,57600bps
Data	8 bit	8 bit
Parity	none	none
Start bit	1 bit	1 bit
Stop bit	1 bit	1 bit

- Set up the RS232 communication baud rate with Pr0C, and RS485 communication baud rate with Pr0D. The change of these parameters will be validated after the control power entry. For details, refer to the following list of parameters related to communication.

## List of User Parameters for Communication

PrNo.	Title of parameter	Setup range	Functions/contents
00	Axis address	0 – 15	Check the RSW (ID) value of the front panel at control power-on. This value becomes the axis number at serial communication. Setup value of this parameter has no effect to servo action.
0C	Baud rate setup of RS232 communication	0 – 5	Set up the communication speed of RS232C communication. 0 : 2400[bpps], 1 : 4800[bpps], 2 : 9600[bpps], 3 : 19200[bpps], 4 : 38400[bpps], 5 : 57600[bpps] Change will be validated after the control power-on
0D	Baud rate setup of RS485 communication	0 – 5	Set up the communication speed of RS485 communication. 0 : 2400[bpps], 1 : 4800[bpps], 2 : 9600[bpps], 3 : 19200[bpps], 4 : 38400[bpps], 5 : 57600[bpps] Change will be validated after the control power-on

- Required time for data transmission per 1 byte is calculated in the following formula in case of 9600[bpps].

$$1000 / 9600 \times (1 + 8 + 1) = 1.04 \text{ [ms/byte]}$$



Note that the time for processing the received command and time for switching the line and transmission/reception control will be added to the actual communication time.

### • Handshake code

Following codes are used for line control.

Title	Code	Function
ENQ	05h (Module recognition byte of the transmitted)	Enquire for transmission
EOT	04h (Module recognition byte of the transmitted)	Ready for receiving
ACK	06h	Acknowledgement
NAK	15h	Negative acknowledgement

ENQ ... The module (host or driver) sends out ENQ when it has a block to send.

EOT.... The module (host or driver) sends out EOT when it is ready to receive a block. The line enters to a transmission mode when ENQ is transmitted and EOT is received.

ACK.... When the received block is judged normal, the module (host or driver) will send out ACK.

NAK.... When the received block is judged abnormal, NAK will be sent. A judgment is based on checksum and timeout.

### <Caution>

1 byte of module recognition is added to ENQ and EOT at RS485 communication.

Module recognition byte Make the RSW value of the front panel as a module ID, and data which makes its bit7 as 1, becomes a module recognition byte.

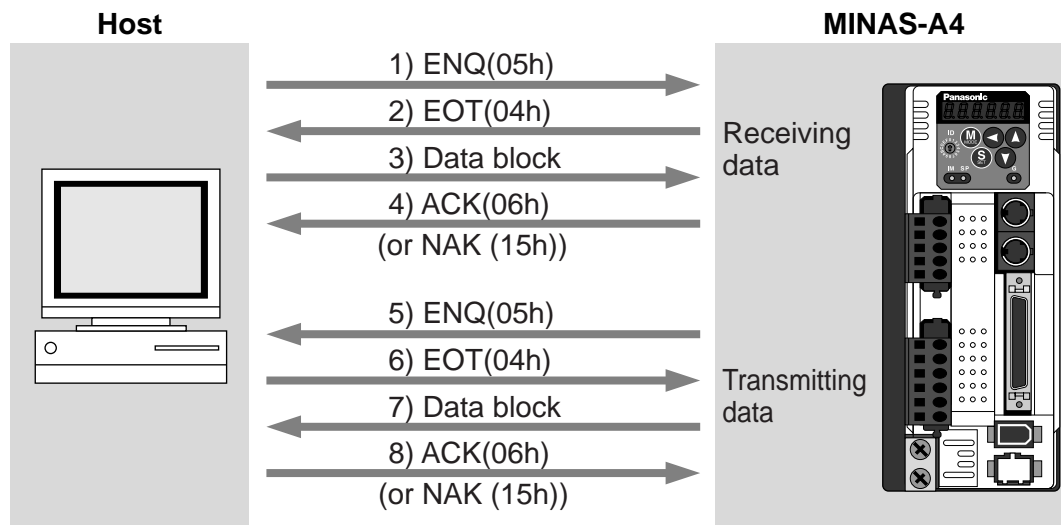
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
1	0	0	0	Module ID			

Module ID : The module ID of the host side will be 0 in case of RS485 communication, therefore set up RSW of MINAS-A4 to 1- F.

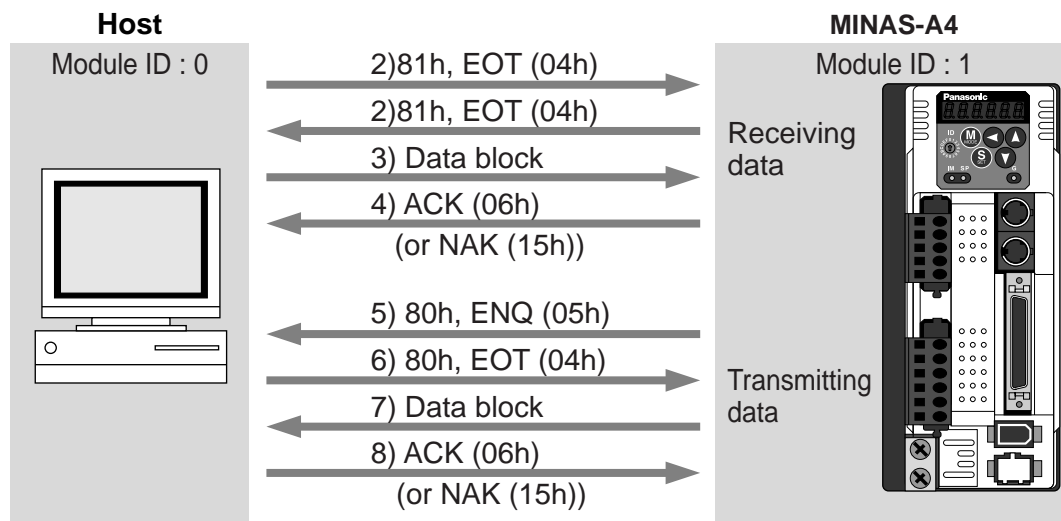
**Transmission Sequence**

• **Transmission protocol**

• **In case of RS232**



• **In case of RS485**



• **Line control**

Decides the direction of transmission and solves the contention.

Reception mode... From when the module (host or driver) returns EOT after receiving ENQ.

Transmission mode... From when the module (host or driver) receives EOT after transmitting ENQ.

At contention of transmission and reception... Slave side will enter to reception mode when it receives ENQ while waiting for EOT after transmitting ENQ, by giving priority to ENQ (of master side).

• **Transmission control**

On entering to transmission mode, the module transmits the command block continuously and then waits for ACK reception. Transmission completes at reception of ACK.. ACK may not be returned at transmission failure of command byte counts. If no ACK is received within T2 period, or other code than NAK or ACK is received, sequence will be retried. Retry will start from ENQ.

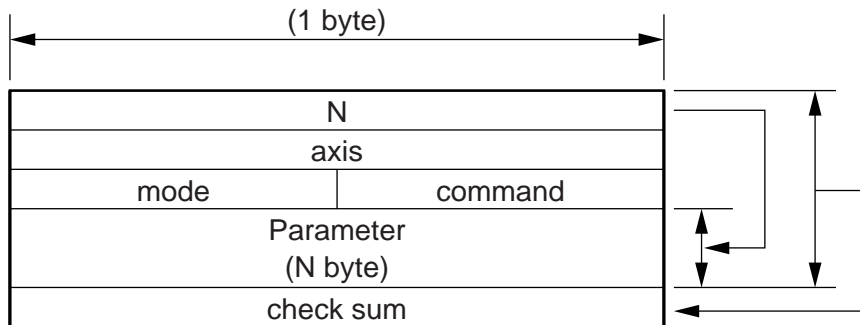
• **Reception control**

On entering to reception mode, the module receives the transmitted block continuously. It will receive the command byte counts from the first byte, and continuously receive extra 3 bytes. It will return ACK when the received data sum becomes 0, by taking this status as normal. In case of a check sum error or a timeout between characters, it will return NAK.

# Communication

## • Data Block Composition

Below shows the composition of data block which is transmitted in physical phase.



- N** : Command byte counts (0 to 240)  
Shows the number of parameters which are required by command.
- axis** : Sets up the value of RSW of the front panel (Module ID,
- command** : Control command (0 to 15)
- mode** : Command execution mode (0 to 15)  
Contents vary depending on the mode.
- check sum** : 2's complement of the total number of bytes, ranging from the top to the end of the block

## • Protocol Parameter

Following parameters are used to control the block transmission. You can set any value with the INIT command (described later).

Title	Function		Initial value	Setup range	Unit
T1	Time out between characters	RS232	5 (0.5 sec)	1-255	0.1 sec
		RS485	1 (0.1 sec)		
T2	Protocol time out	RS232	5 (0.5 sec)	1-255	1 sec
		RS485	1 (0.1 sec)		
RTY	Retry limit		1 (once)	1-8	
M/S	Master/Slave		0 (Slave)	0, 1 (Master)	Once

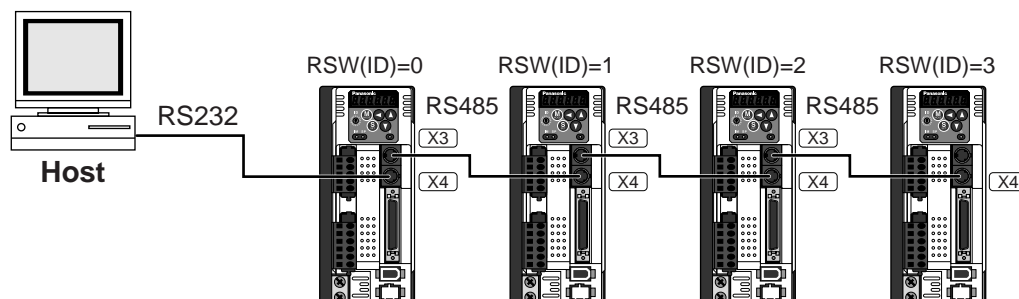
- T1** ..... • Permissible time interval for this driver to receive the consecutive character codes which exists between the module recognition bytes and ENQ/EOT, or in the transmission/reception data block. Time out error occurs and the driver returns NAK to the transmitter when the actual reception time has exceeded this setup time
- T2** ..... • Permissible time interval for the driver to transmit ENQ and to receive EOT. If the actual reception time exceeds this setup, this represents that the receiver is not ready to receive, or it has failed to receive ENQ code in some reason, and the driver will re-transmit ENQ code to the receiver. (retry times)
  - Permissible time interval for the driver to transmit EOT and to receive the reception of the 1st character code. The driver will return NAK and finishes the reception mode if the actual reception has exceeded this setup time.
  - Permissible time interval for the module to transmit the check sum bytes and to receive ACK. The module will re-transmit ENQ code to the receiver in the same way as the NAK reception, if the actual reception time exceeds this setup time.
- RTY** .... Maximum value of retry times. Transmission error occurs if the actual retry has exceeds this setup value.
- M/S** .... Switching of master and slave. When contention of ENQ has occurred, the module decides which is to be given priority.  
Priority is given to the transmitter which is set up as a master. (0: Slave mode, 1 : Master mode)

**Example of Data Communication**

• **e.g. Reference of Absolute Data**

When you connect the host to one driver with RS232 communication, and connect multiple MINAS-A4s with RS485 communication. Following flow chart describes the actual flow of the communication data when you want to capture the absolute data of the module ID=1.

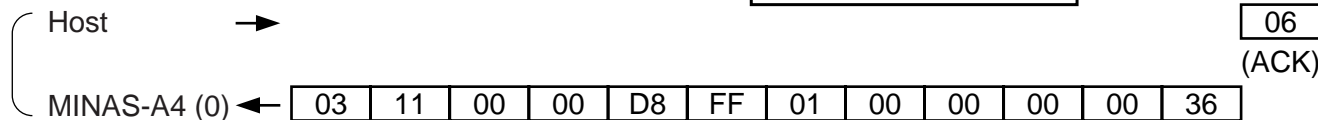
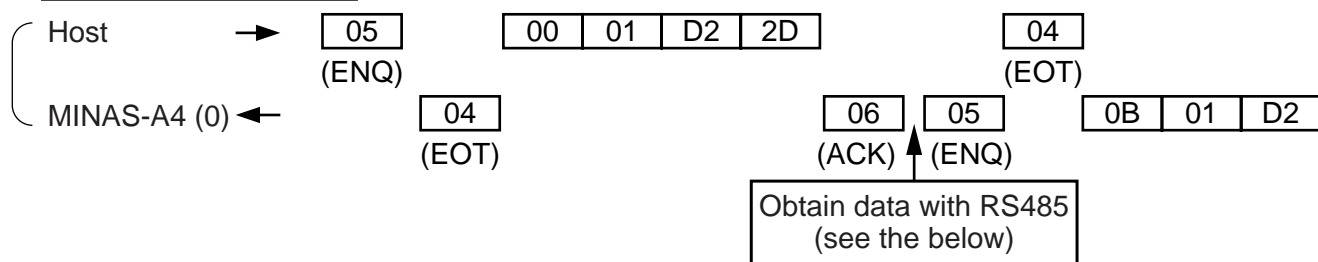
**e.g. of system composition**



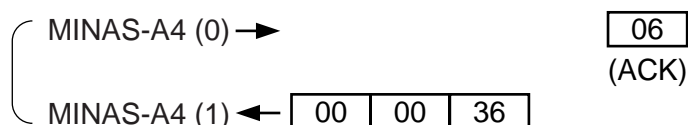
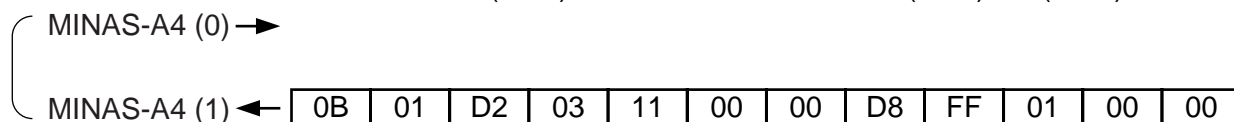
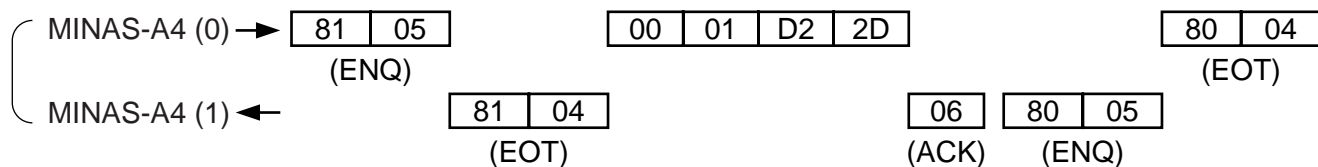
**e.g. of capturing the absolute data**

Following shows the communication data in time series when you want to capture the absolute data. Data is presented in hexadecimals.

**RS232 communication**



**\* RS485 communication**



**<Caution>**

See the below for the captured data. Refer to P.299, "Read out of Absolute Encoder " of details of communication command, for the data composition.

- Multi-turn data : 0000h = 0
- Single turn data : 01FFD8h = 131032

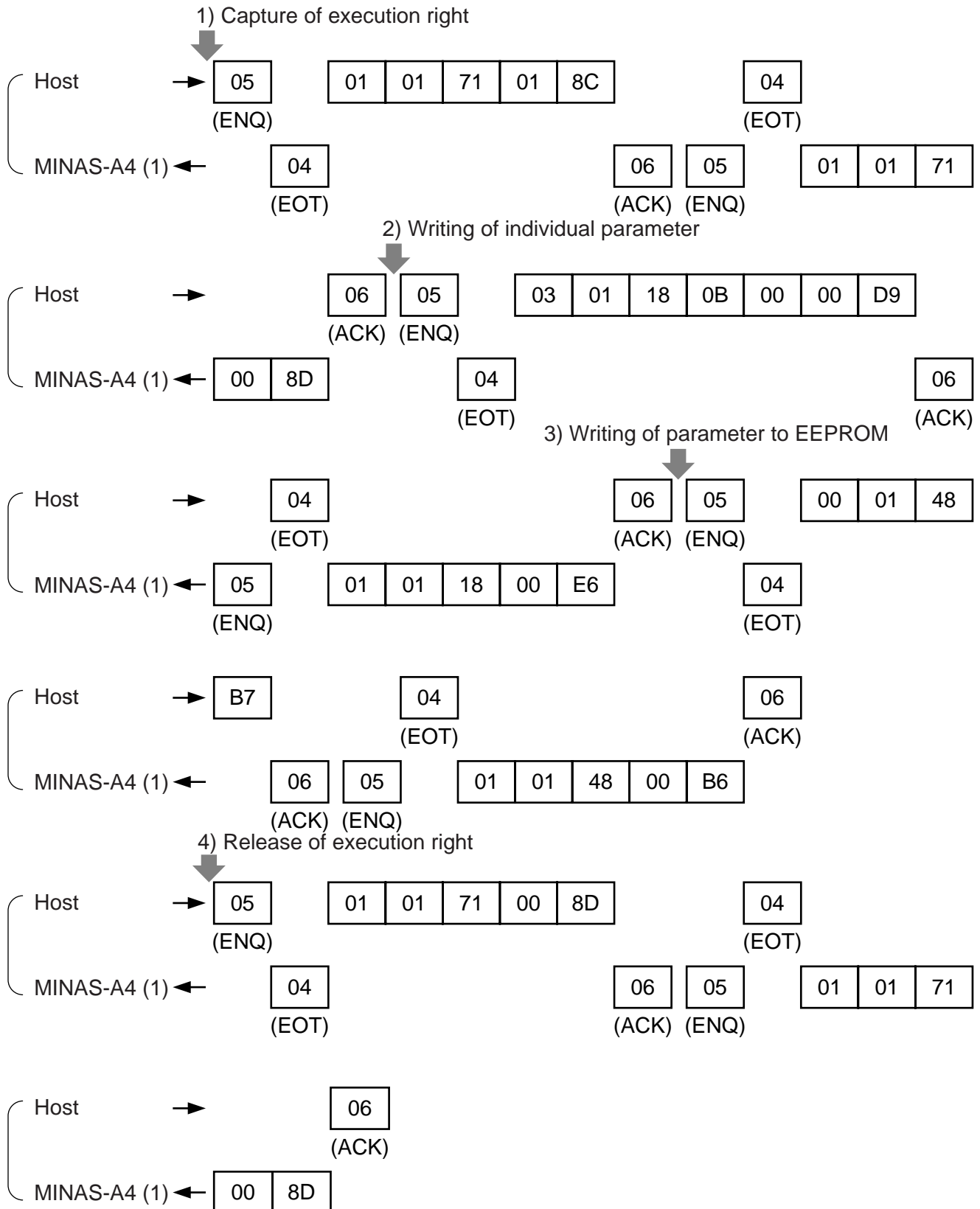
**Allow 500ms or longer interval for switching the axis while capturing data of multiple axes.**



# Communication

## • Example of Parameter Change

Following shows the communication data in time series when you change parameters. Communication in general will be carried out in sequence of (1) Request for capturing of execution right, (2) Writing of individual parameter, and (3) Writing to EEPROM when saving of data is required, and (4) Release of execution right. Here the hardware connection shows the case that the driver (user ID=1) is directly connected to the host with RS232C. Data is presented in hexadecimal.

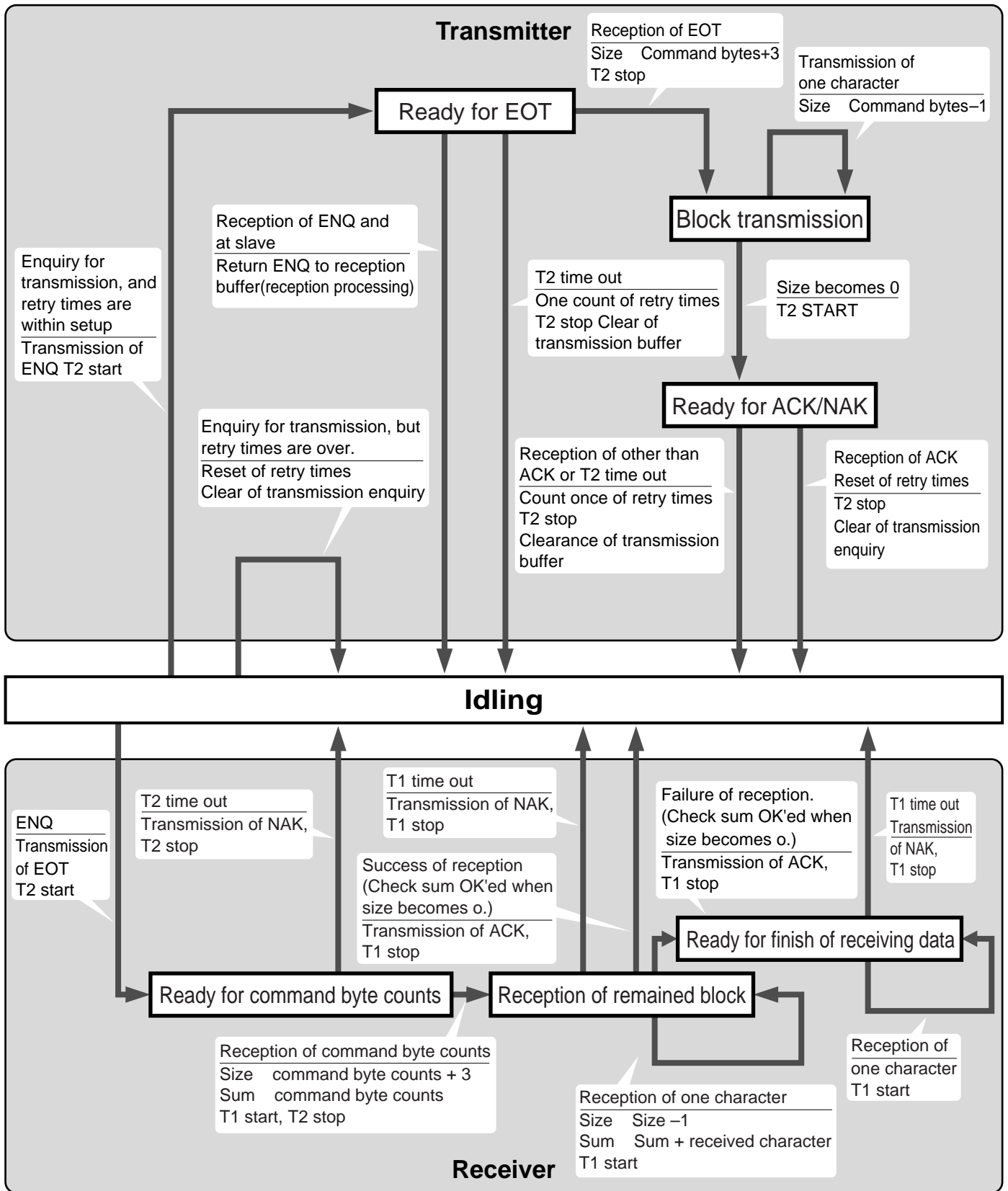


### <Caution>

For details of command, refer to P.290, "Details of Communication Command".

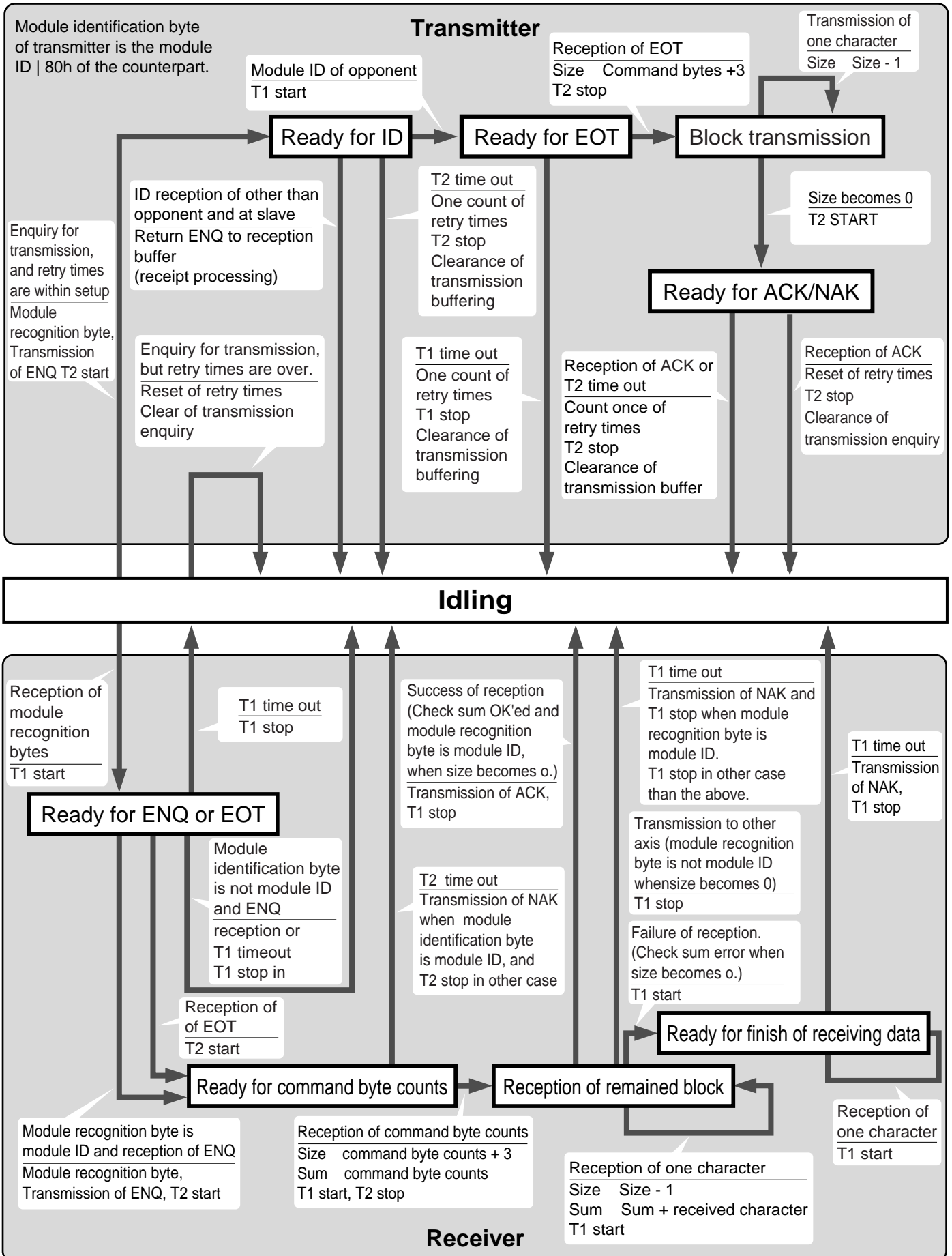
Status Transition Chart

• RS232 Communication



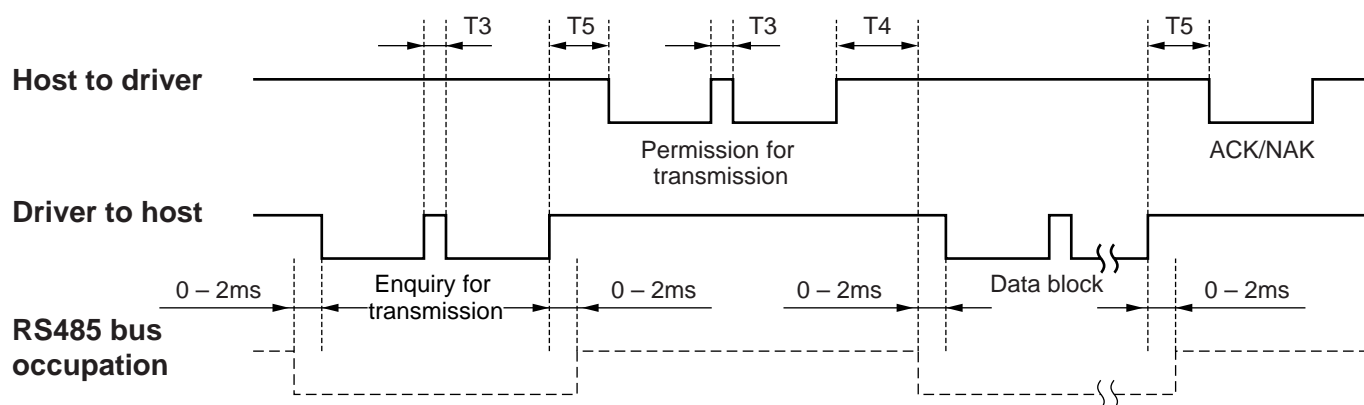
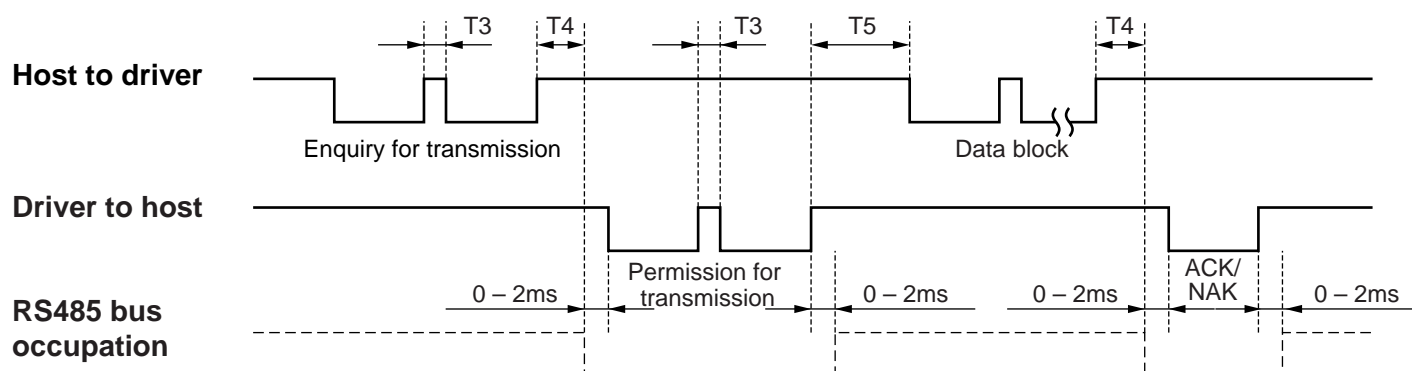
# Communication

## • RS485 Communication



**Timing of Data Communication**

• In case of RS485 (RS232 to follow)



Symbol	Title	Minimum	Maximum
T3	Continuous inter-character time	Stop bit length	Protocol parameter T1
T4	Response time of driver	4ms	Protocol parameter T2
T5	Response time of host	2ms	Protocol parameter T2

**<Caution>**

Above time represents a period from the rising edge of the stop bit.

# Communication

## List of Communication Command

command	mode	Content
0		NOP
	1	Read out of CPU version
	5	Read out of driver model
	6	Read out of motor model
1		INIT
	1	Setup of RS232 protocol parameter
	2	Setup of RS485 protocol parameter
	7	Capture and release of execution right
2		POS, STATUS, I/O
	0	Read out of status
	1	Read out of command pulse counter
	2	Read out of feedback pulse counter
	4	Read out of present speed
	5	Read out of present torque output
	6	Read out of present deviation counter
	7	Read out of input signal
	8	Read out of output signal
	9	Read out of present speed, torque and deviation counter
	A	Read out of status, input signal and output signal
	C	Read out of external scale
	D	Read out of absolute encoder
E	Read out of external scale deviation and sum of pulses	
8		PARAMETER®
	0	Individual read out of parameter
	1	Individual writing of parameter
	4	Writing of parameter to EEPROM
9		ALARM
	0	Read out of present alarm data
	1	Individual read out of user alarm history
	2	Batch read out of alarm history
	3	Clear of user alarm history (in EEPROM as well)
	4	Alarm clear
B	Absolute clear	
B		PARAMETER®
	0	Individual read out of user parameter
	1	Page read out of user parameter
	2	Page writing of parameter

- Use the above commands only. If you use other commands, action of the driver cannot be guaranteed.
- When the reception data counts are not correct in the above command, transmission byte1 (Error code only) will be returned regardless of communication command.

## Details of Communication Command

command	mode	
0	1	• Read out of CPU Version Information

Reception data

0	
axis	
1	0
checksum	

Transmission data

3	
axis	
1	0
Version (upper)	
Version (lower)	
Error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Version information will be returned in upper data and lower data. (Decimal point will be returned by making the lower 4 bit of the upper data as 0.)
- Version will be displayed in figures from 0 to 9. (e.g. Version 3.1 will be upper data 30h, lower data 13h.)

command	mode
0	5

### • Read out of Driver Model

0
axis
5   0
checksum

0Dh
axis
5   0
Model of ,driver (upper)
-----
Model of driver (lower)
Error code
checksum

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Driver model consist of 12-characters, and will be transmitted in ASCII code.  
(e.g.) "MADDT1503\*\*\*\*"

command	mode
0	6

### • Read out of Motor Model

0
axis
6   0
checksum

0Dh
axis
6   0
Model of ,motor (upper)
-----
Model of motor (lower)
Error code
checksum

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Motor model consist of 12-characters, and will be transmitted in ASCII code.  
(e.g.) "MSMD012S1\*\*\*\*"

command	mode
1	1

### • Setup of RS232 Protocol Parameter

3
axis
1   1
T1
T2
M/S   RTY
checksum

1
axis
1   1
Error code
checksum

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error	RTYerror	T2error	T1error	M/Serror
1 : Error							

- Until this command completes, previous set up protocol parameter will be processed.  
After this command has been executed, this parameter setup will be valid from the next command.  
For M/S, 0 represents SLAVE and 1 represents MASTER.
- RTY is 4-bit, and M/S is 1-bit.
- Unit... T1 : 0.1s, T2 : 1s

# Communication

command	mode
1	2

## • Setup of RS485 Protocol Parameter

Reception data	
3	
axis	
2	1
T1	
T2	
M/S	RTY
checksum	

Transmission data	
1	
axis	
2	1
Error code	
checksum	

### Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error	RTYerror	T2error	T1error	M/Serror
1 : Error							

- Until this command completes, previously set up protocol parameter will be processed.  
After this command has been executed, this parameter setup will be valid from the next command.  
For M/S, 0 represents SLAVE and 1 represents MASTER.
- RTY is 4-bit, and M/S is 1-bit.

command	mode
1	7

## • Capture and Release of Execution Right

Reception data	
1	
axis	
7	1
mode	
checksum	

Transmission data	
1	
axis	
7	1
Error code	
checksum	

### Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error	modeerror			in use
1 : Error							

- Capture the execution right to prevent the conflict of the operation via communication and that with the front panel.
- Enquires for the capture of the execution right at parameter writing and EEPROM writing, and release the execution right after the action finishes.
- mode = 1 : Enquires for the capture of the execution right    mode = 0 : Enquires for the release of the execution right
- You cannot operate with the front panel at other than monitor mode while the execution right is captured via communication.
- When the module fails to capture the execution right, it will transmit the error code of in use.

command	mode
2	0

• Readout of Status

0		
axis		
0		2
checksum		

3		
axis		
0		2
control mode		
status		
error code		
checksum		

status

bit7	6	5	4	3	2	1	0
		CCW torque generating	CW torque generating	CCW running	CW running	Slower than DB permission	Torque in-limit

Error code

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error	RS485 error				

- Control modes are defined as follows.

0	Position control mode
1	Velocity control mode
2	Torque control mode
3	Full-closed control mode

- CCW/CW torque generating : This becomes 1 when torque command is positive (CCW) or negative (CW).
- CCW/CW running : This becomes 1 when motor speed (after converted to r/min) is positive (CCW or negative (CW)).
- Slower than DB permission : This becomes 1 when motor speed (after converted to r/min) is below 30r/min.
- Torque in-limit : This becomes 1 when torque command is limited by analog input or parameter.

command	mode
2	1

• Read out of Command Pulse Counter

0		
axis		
1		2
checksum		

5		
axis		
1		2
counter value L		
-----		
-----		
H		
error code		
checksum		

Error code

bit7	6	5	4	3	2	1	0
0 : Normal 1 : Error		Command error	RS485 error				

- Module returns the present position in absolute coordinates from the starting point. (Total sum of accumulated command pulses)
- Counter value in 32 bit.
- Counter value will be "-" for CW and "+" for CCW.



# Communication

command	mode
2	2

### • Read out of Feedback Pulse Counter

0	
axis	
2	2
checksum	

5	
axis	
2	2
counter value L	
-----	
-----	
-----	
-----	
-----	
-----	
H	
error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Module returns the present position of feedback pulse counter in absolute coordinates from the starting point.
- Counter value will be "-" for CW and "+" for CCW.
- Feedback pulse counter is the total pulse counts of the encoder and represents the actual motor position traveled

command	mode
2	4

### • Read out of Present Speed

0	
axis	
4	2
checksum	

3	
axis	
4	2
Data (present speed) L	
-----	
-----	
-----	
-----	
-----	
-----	
H	
error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Reads out the present speed. (Unit : [r/min])
- Output value in 16 bit
- Speed will be "-" for CW and "+" for CCW.

command	mode
2	5

### • Read out of Present Torque Output

0	
axis	
5	2
checksum	

3	
axis	
5	2
Data (present torque) L	
-----	
-----	
-----	
-----	
-----	
-----	
-----	
H	
error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Reads out the present torque output. (Unit : Converted with "Rated motor torque = 2000)
- Output value in 16 bit
- Torque command will be "-" value for CW and "+" value for CCW.

command	mode
2	6

• Read out of Deviation Counter

Reception data	
0	
axis	
6	2
checksum	

Transmission data	
5	
axis	
6	2
data (deviation) L	
-----	
-----	
H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Reads out the present deviation counter value. (Unit : [pulse])
- Output value in 32 bit
- Becomes "+" when the encoder is located at CW direction against position command, and "-" when it is located at CCW direction.

command	mode
2	7

• Read out of Input Signal

Reception data	
0	
axis	
7	2
checksum	

Transmission data	
5	
axis	
7	2
data L	
-----	
-----	
data H	
Error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

Data

bit7	6	5	4	3	2	1	0
Reserved	Switching of electronic gear	Speed zero clamp	Control mode switching	CCW over-travel inhibit	CW over-travel inhibit	Alarm clear	Servo-ON

bit15	14	13	12	11	10	9	8
Reserved	Reserved	Internal speed command selection 2	Internal speed command selection 1	Reserved	Counter clear	Gain switching	Command pulse input inhibition

bit23	22	21	20	19	18	17	16
Reserved	Reserved	Torque limit switching	Internal speed command selection 3	Damping control switching	Reserved	Reserved	Reserved

bit31	31	29	28	27	26	25	24
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

- CW over-travel inhibit, CCW over-travel inhibit, speed zero clam and command pulse input inhibition become 1 when opened.
- Other input signals are 0 when opened.

# Communication

command	mode
2	8

## • Read out of Deviation Counter

### Reception data

0	
axis	
8	2
checksum	

### Transmission data

7	
axis	
8	2
data L	
-----	
data H	
-----	
alarm data L	
H	
error code	
checksum	

### alarm data

bit8 External scale
bit7 Over-load
bit6 Fan lock
bit5 Over-regeneration
bit0 Battery

### error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

### Data

bit7	6	5	4	3	2	1	0
Reserved	In-speed	Torque in-limit	Zero speed detection	Release of mechanical brake	Positioning complete (In-position)	Servo-Alarm	Servo-Ready

bit15	14	13	12	11	10	9	8
Reserved	Reserved	Dynamic brake engagement	Reserved	Reserved	Full-closed positioning complete	At-speed	Reserved

bit23	22	21	20	19	18	17	16
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

bit31	31	29	28	27	26	25	24
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

• The table below shows the relation of the signals and actions.

Signal title	0	1
Servo-Ready	Servo-Not Ready	At Servo-Ready
Servo-Alarm	Normal	At Servo-Alarm
Positioning completed	Positioning not completed	Positioning in-complete
Release of mechanical brake	Mechanical brake engaged	Mechanical brake released
Zero speed detection	Zero speed not detected	Zero speed detected
Torque in-limit	Torque not in-limit	Torque in-limit
At-speed (Speed arrival)	Not at-speed(Speed not arrived)	Speed arriving
In-speed (Speed coincidence)	Not in-speed(Speed not coincided)	In-speed (Speed coincided)
Full-closed positioning complete	Full-closed positioning not completed	Full-closed positioning completed
Dynamic brake engagement	Dynamic brake released	Dynamic brake engaged

command	mode
2	9

• Read out of Present Speed, Torque and Deviation Counter

Reception data	
0	
axis	
9	2
checksum	

Transmission data	
9	
axis	
9	2
data L	
(speed) H	
data L	
(torque) H	
data L	
-----	
(deviation) H	
error code	
checksum	

Error cod

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Output value of speed and torque are in 16 bit and deviation in 32 bit.
- Unit and sign of the output data is as same as that of command No. 24, 25 and 26.

command	mode
2	A

• Read out of Status, Input Signal and Output Signal

Reception data	
0	
axis	
A	2
checksum	

Transmission data	
0Dh	
axis	
A	2
control mode	
status	
-----	
input signal H	
output signal L	
-----	
output signal H	
alarm data L	
alarm data H	
error code	
checksum	

Error cod

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Meaning of each bit of control mode, status, input signal, output signal and alarm data is as same as that of command No. 20 (command = 2, mode = 0), 27 (mode = 7) and 28 (mode =8).

# Communication

command	mode
2	C

## • Read out of External Scale

### Reception data

0	
axis	
C	2
checksum	

### Transmission data

0Bh	
axis	
C	2
encoder ID (L)	
(H)	
status (L)	
(H)	
(L)	
absolute position data (48bit)	
(H)	
error code	
checksum	

### Encoder ID

	Encoder ID (L)	Encoder ID (H)
ST771	Address "0" data of EEPROM	32h
AT500series	Address "0" data of EEPROM	31h

- Command error occurs at other control modes than full-closed control.

### • ST771

#### Status (L)

bit7	6	5	4	3	2	1	0
Thermal alarm	Signal intensity alarm	Signal intensity error	Transducer error	ABS detection error	Hardware error	Initialization error	Over speed

#### Status (H)

bit7	6	5	4	3	2	1	0
0	0	Encoder error *1	Encoder error *2	0	0	0	0

\*1 bit5 : Logical sum of bit0 to bit 5 of status (L)

\*2 bit4 : logical sum of bit6 and bit 7 of status (L)

### • AT500 series

#### Status (L)

bit7	6	5	4	3	2	1	0
Thermal alarm	0	Communication error	CPU, memory error	Capacity and photoelectric error	Encoder non-matching error	Initialization error	Over speed

#### Status (H)

bit7	6	5	4	3	2	1	0
0	0	Encoder error *3	Encoder alarm *4	0	0	0	0

\*3 bit5 : Logical sum of bit0 to bit 5 of status (L)

\*4 bit4 : logical sum of bit6 and bit 7 of status (L)

#### Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Absolute position data = 48bit (0 x 800000000000 to 0 x 7FFFFFFFFFh)

command	mode
2	D

• Read out of Absolute Encoder

Reception data	
0	
axis	
D	2
checksum	

Transmission data	
0Bh	
axis	
D	2
encoder ID (L)	
(H)	
status (L)	
(H)	
single-turn data	
(H)	
multi-turn data (L)	
(H)	
0	
Error code	
checksum	

	Encoder ID (L)	Encoder ID (H)
17bit absolute	3	11h

Status (L)

bit7	6	5	4	3	2	1	0
Battery alarm	System down	Multi-turn error	0	Counter overflow	Count error	Full absolute status	Over speed

Status (H)

- bit4 : System down
- bit5 : Battery alarm, multi-turn error, counter overflow, count error, full absolute status and logical sum of over speed

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Command error will occur when you use the above encoder or absolute encoder as an incremental encoder.
- Single turn data = 17bit (000000h to 01FFFFh)
- Multi-turn data = 16bit (0000h to FFFFh)

command	mode
2	E

• Read out of External Scale Accumulation and Deviation

Reception data	
0	
axis	
E	2
checksum	

Transmission data	
9	
axis	
E	2
(L)	
external scale	
FB pulse sum	
(H)	
(L)	
external scale deviation	
(H)	
error code	
checksum	

Error code

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- External scale FB pulse sum will return the present position of the external scale counter in absolute coordinates from the starting point.
- External scale FB pulse sum will be "-" for CW and "+" for CCW.

# Communication

command	mode
8	0

### • Individual Read out of Parameter

1
axis
0   8
parameter No.
checksum

3
axis
0   8
parameter value L
H
error code
checksum

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error	No.Error			
1 : Error							

• If the parameter No. is not within the range of 0 x 00 to 0 x 7F, No. error will be returned.

command	mode
8	1

### • Individual Writing of Parameter

3
axis
1   8
parameter No.
parameter value L
H
checksum

1
axis
1   8
error code
checksum

**Error code**

bit77	6	5	4	3	2	1	0
0 : Normal	Data Error	Command error	RS485 error	No.Error			
1 : Error							

• If the parameter No. is not within the range of 0 x 00 to 0 x 7F, No. error will be returned.  
 • This command change parameters only temporarily. If you want to write into EEPROM, execute the parameter writing to EEPROM (mode = 4).  
 • Set up parameters not in use to 0 without fail, or it leads to data error. Data error also occurs when the parameter value exceeds the setup range.

command	mode
8	4

### • Writing of Parameters to EEPROM

0
axis
4   8
checksum

1
axis
4   8
error code
checksum

**Error code**

bit77	6	5	4	3	2	1	0
0 : Normal	Data Error	Command error	RS485 error			Control LV	
1 : Error							

• Writes the preset parameters to EEPROM.  
 • Transmission data will be returned after EEPROM writing completes. It may take max. 5sec for EEPROM writing (when all parameters have been changed.)  
 • Data error will occur when writing fails.  
 • When under-voltage occurs, error code of control LV will be returned instead of executing writing.

command	mode
9	0

### • Read out of Present Alarm Data

0	
axis	
0	9
checksum	

2	
axis	
0	9
alarm No.	
error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	Command error				
1 : Error							

- If no alarm occurs, alarm No. becomes 0.  
(For alarm No., refer to P.252, "Protective function (What is alarm code ?)" of When in Trouble.

command	mode
9	1

### • Individual Read out of Alarm History

1	
axis	
1	9
history No.	
checksum	

3	
axis	
1	9
history No.	
alarm No.	
error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	Command error	No.Error			
1 : Error							

- History No. 1 to 14 represents latest to 14th latest error event.
- No. error will occur when you enter other value than 1 to 14.

command	mode
9	2

### • Batch Read out of Alarm History

0	
axis	
2	9
checksum	

0Fh	
axis	
2	9
alarm No.	
alarm No.	
-	
alarm No.	
Error code	
checksum	

latest

2nd. latest

14th. latest

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	Command error				
1 : Error							

- You can read out last 14 error events.



# Communication

command	mode
9	3

### • Alarm History Clear

0	
axis	
3	9
checksum	

1	
axis	
3	9
Error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal	Data Error	Command error	RS485 error			Control LV	
1 : Error							

- Clears the alarm data history.
- Data error will occur when you fail to clear.
- When under-voltage of control power supply occurs, error code of control LV will be returned instead of executing writing.

command	mode
9	3

### • Alarm Clear

0	
axis	
4	9
checksum	

1	
axis	
4	9
Error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Clears the present alarm. (only those you can clear)

command	mode
9	B

### • Absolute Clear

0	
axis	
B	9
checksum	

1	
axis	
B	9
Error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error				
1 : Error							

- Clears absolute encoder error and multi-turn data
- Command error will be returned when you use other encoder than 17bit absolute encoder.

command	mode
B	0

• Individual Read out of User Parameter

**Reception data**

1	
axis	
0	B
parameter No.	
checksum	

**Transmission data**

9	
axis	
0	B
parameter value L	
-----	
H	
MIN. value L	
-----	
H	
MAX. value L	
-----	
H	
Property L	
-----	
H	
Error code	
checksum	

**Property**

bit7	6	5	4	3	2	1	0
Parameter not in use	Display inhibited	(for special customer)	Change at initialization	System related			
bit15	14	13	12	11	10	9	8
							Read only

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error	No.Error			
1 : Error							

- If the parameter No. is not within the range of 0 x 00 to 0 x 7F, No. error will be returned.

command	mode
B	1

• Page Read out of User Parameter

**Reception data**

1	
axis	
1	B
page No.	
checksum	

**Transmission data**

82h	
axis	
1	B
page No.	
parameter value L	
-----	
(No. 0) H	
MIN. value L	
-----	
(No. 0) H	
MAX. value L	
-----	
(No. 0) H	
Property L	
-----	
(No. 0) H	
parameter value L	
-----	
(No.0fh) H	
MIN. value L	
-----	
(No.0fh) H	
MAX. value L	
-----	
(No.0fh) H	
Property L	
-----	
(No.0fh) H	
error code	
checksum	

**Property**

bit7	6	5	4	3	2	1	0
Parameter not in use	Display inhibited	(for special customer)	Change at initialization	System related			
bit15	14	13	12	11	10	9	8
							Read only

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal		Command error	RS485 error	No.Error			
1 : Error							

- Designate 0 to 7 to page No. and read out 16 parameters from each specified page.
- No. error will be returned when other No. than 0 to 7 is entered to page No.

# Communication

command	mode
B	2

• Page Writing of User Parameter

21h	
axis	
2	B
page No.	
parameter L	
(value of No. 0) H	
parameter value L	
(value of No. 1) H	
-	
parameter value L	
(value of No. 0th) H	
checksum	

2	
axis	
2	B
page No.	
Error code	
checksum	

**Error code**

bit7	6	5	4	3	2	1	0
0 : Normal	Data Error	Command error	RS485 error	No.Error			
1 : Error							

- Designate 0 to 7 to page No. and write 16 parameters from each specified page.
- Set up 0 to parameters not in use without fail, or data error will occur. Data error will also occurs when data exceeding the setup range is transmitted.
- No. error will be returned when other No. than 0 to 7 is entered to page No.

MEMO

A series of horizontal dashed lines for writing.