CKD

SMF-2012-A

Instruction Manual

ABSODEX

AX Series

TS type

TH type

EtherCAT specification

EtherNet/IP specification

- Read this instruction manual before starting to use our product.
- In particular, read descriptions on safety very carefully.
- Keep this manual at hand so that you can read it when required.

Version 3

CKD Corporation

Contents

ABSODEX

AX Series [TS type, TH type EtherCAT specification, EtherNet/IP specification]

Instruction Manual No.SMF-2012

4. Network Operation Mode

Prepared on December 8, 2016
Revised on May 1, 2018

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Introduction

Thank you for choosing our ABSODEX.

ABSODEX is a direct-drive index unit developed to drive intermittently operated turntables or the likes of general industrial assembling machines, inspection machines, etc. flexibly at a superior precision.

This instruction manual is exclusive for ABSODEX AX Series TS type driver and TH type driver with EtherCAT specification and EtherNet/IP specification.

This manual is not applicable for other types.

For the operation method, precautions on operation, maintenance and inspection items and so on, refer to “Instruction Manual for AX Series TS type, TH type, and XS type” (SMF-2006) contained in the attached CD-ROM.

Items, specifications and appearance specified in this instruction manual are subject to change without prior notice.

1. Specifications

1.1. Product Configuration

Name			Quantity
1	Driver unit		1
2	Accessories	CN5 motor power connector: PC4/3-ST-7.62(Phoenix Contact)	1
		CN4 power supply connector: PC4/5-ST-7.62(Phoenix Contact)	1

1.2. General Specifications of Driver

Item			Description
1. Power	Main	TS	1-Phase or 3-Phase 200 VAC ± 10% to 230 VAC ± 10% [*1)] 1-Phase 100 VAC ± 10% to 115 VAC ± 10% [*2)] (option:J1)
		TH	1-Phase or 3-Phase 200 VAC ± 10% to 230 VAC ± 10% [*1)]
	Control	TS	1-Phase 200 VAC ± 10% to 230 VAC ± 10% 1-Phase 100 VAC ± 10% to 115 VAC ± 10% (option:J1)
		TH	1-Phase 200 VAC ± 10% to 230 VAC ± 10%
2. Frequency			50 Hz /60 Hz
3. Rated input current		TS	1.8 A
		TH	5.0 A
4. Input: Number of phases			1-Phase or 3-Phase [*1)]
5. Output voltage			0 VAC to 230 VAC
6. Output frequency			0 Hz to 50 Hz
7. Rated output current		TS	1.9 A
		TH	5.0 A
8. Output: Number of phases			3-Phase
9. Power system			TN, TT, IT
10. Mass		TS	About 1.6 kg
		TH	About 2.1 kg
11. External dimension		TS	W75*H220*D160
		TH	W95*H220*D160
12. Configuration			Open modular type (Driver and controller)
13. Operation Ambient Temperature			0°C to 50°C
14. Operating Ambient Humidity			20% to 90%RH, No condensation allowed
15. Storage Ambient Temperature			-20°C to 65°C
16. Storage Ambient Humidity			20% to 90%RH, No condensation allowed
17. Atmosphere			Free from corrosive gases and dust
18. Anti-noise			1000 V(P-P), pulse width 11μ sec, startup 1n sec
19. Anti-vibration			4.9 m/s^2
20. Altitude			1,000 m max.
21. Protection			IP2X (Except for CN4 and CN5)

*1) The single phase 100 VAC can be used only for the models with the maximum torque of 45 N•m or less.

If the single phase 200 VAC is used for the models with the maximum torque of 75 N•m or more, the torque limit field needs to be calculated differently from other models. Make inquiries regarding the judgment of usability.

*2) The main power and control power shall be supplied from the same power supply. Do not supply power with different voltage or phase; otherwise, malfunction or damages might occur.

Use the single phase 100 VAC to 115 VAC for the control power.

If the single phase 200 VAC to 230 VAC is connected by mistake, the driver internal circuit would be damaged.

1.3. Performance Specifications of Driver

Item	Description
Number of Controlled Axes	1 axis, 540,672 pulses/rotation
Angle Setting Unit	°(degrees), pulse, and number of indexes
Angle Setting Minimum Unit	0.001°, 1 pulse (= about 2.4 seconds [0.00067 degrees])
Speed Setting Unit	Sec, rpm
Speed Setting Range	0.01 sec to 100 sec/0.11 rpm to 300 rpm
Number of Divisions	1 to 255
Maximum Instruction Value	7 digit input ±9,999,999
Timer	0.01 sec to 99.99 sec
Programming Language	NC language
Programming Method	Data setting through RS-232C port using PC, etc.
Operation Mode	Auto, single block, MID, jog, servo OFF, pulse string input, network operation mode
Coordinate	Absolute and incremental
Acceleration Curve	<Five types> Modified sine (MS), Modified constant velocity (MC, MC2) Modified trapezoid (MT), Trapecloid (TR)
Status Display	LED power lamp display
Motion Display	7-segment LED (2 digits)
Communication Interface	Meets RS-232C specification
EtherCAT Communication Function EtherNet/IP Communication Function	<Input> Origin return command, reset, start, stop, continuous rotation stop, emergency stop, answer, position deviation counter reset, program number selection, jog, brake off, servo ON, program number setting, ready return
	<Output> Alarm 1 and 2, positioning completion, in-position, start input wait, M code 8 points, indexing-in-progress output 1 and 2, origin position output, M code strobe, segment position strobe, servo state, ready state output
Program Capacity	<NC program> About 6,000 characters (256 pcs)
	<Point table> 64 points
Electronic Thermal	Protects the actuator from being overheated

2. Wiring

2.1. Panel Description

2.1.1. EtherCAT Specification

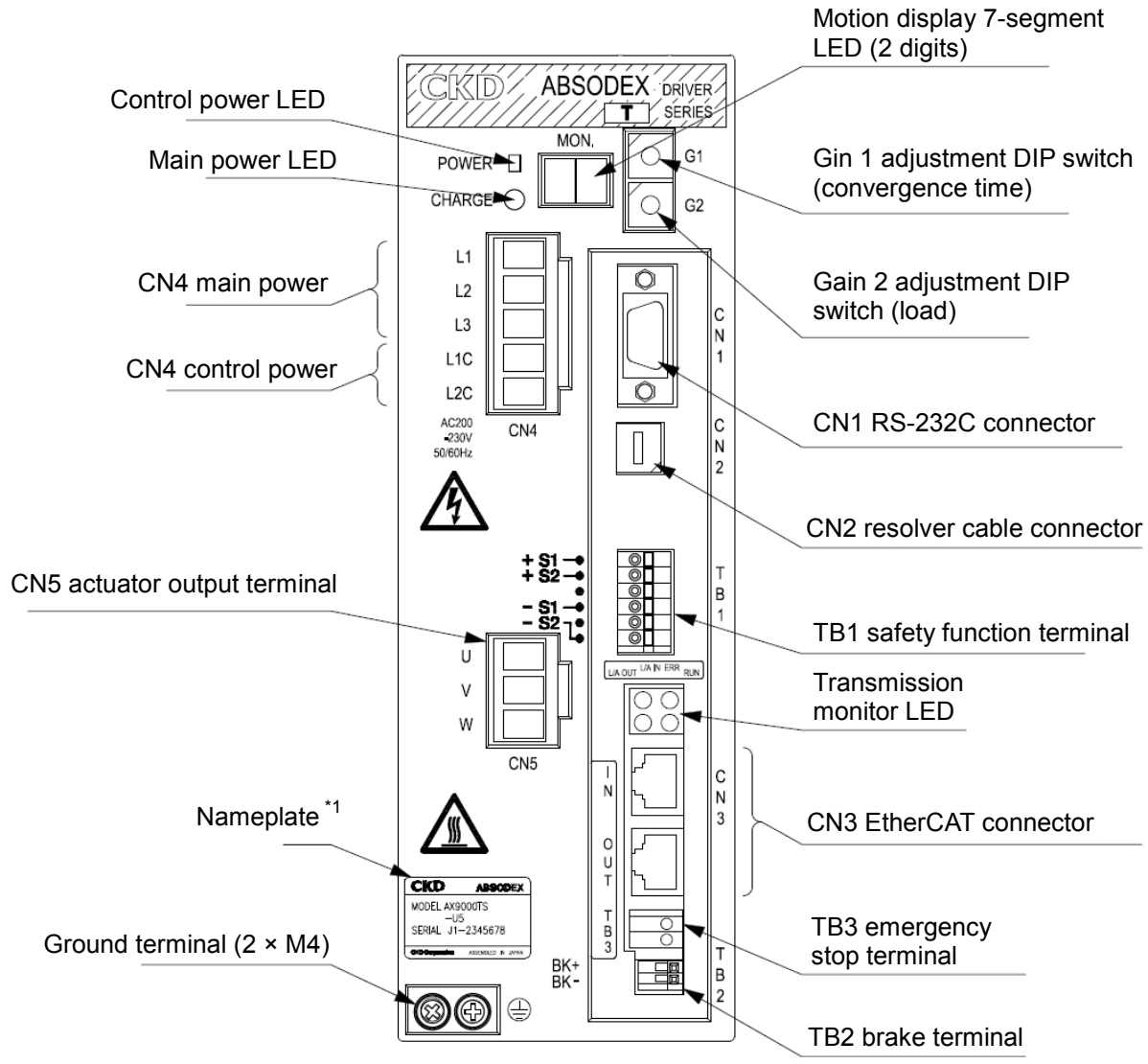


Figure 2.1. Driver panel of TS type and TH type with EtherCAT specification

Note *1: The serial No. on the nameplate is different from that read by EtherCAT master.

2.1.2. EtherNet/IP Specification

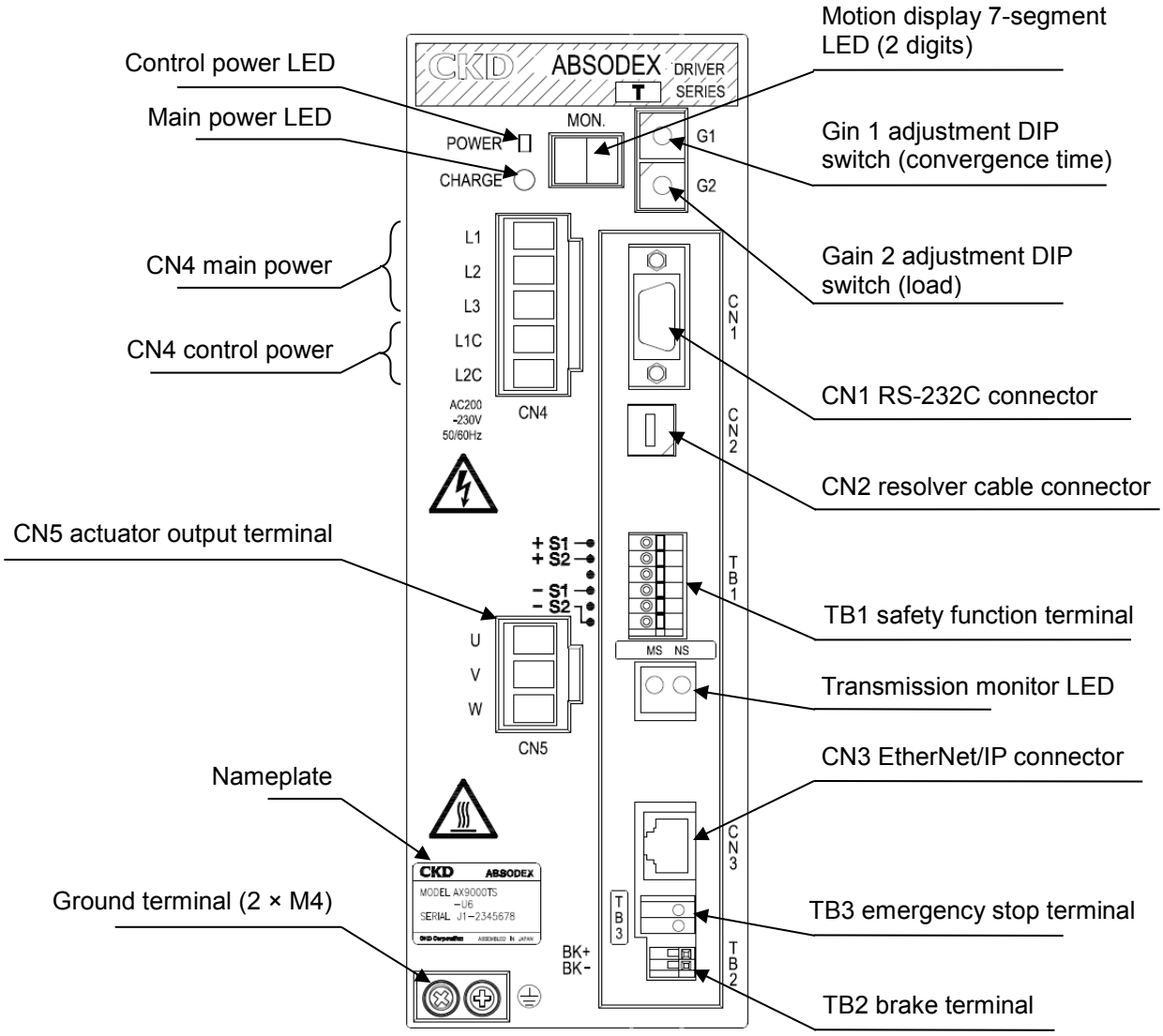


Figure 2.2. Driver panel of TS type and TH type with EtherNet/IP specification

2.2. Communication Connector

2.2.1. EtherCAT Specification

The pin layout of EtherCAT communication connector (CN3) is shown below.

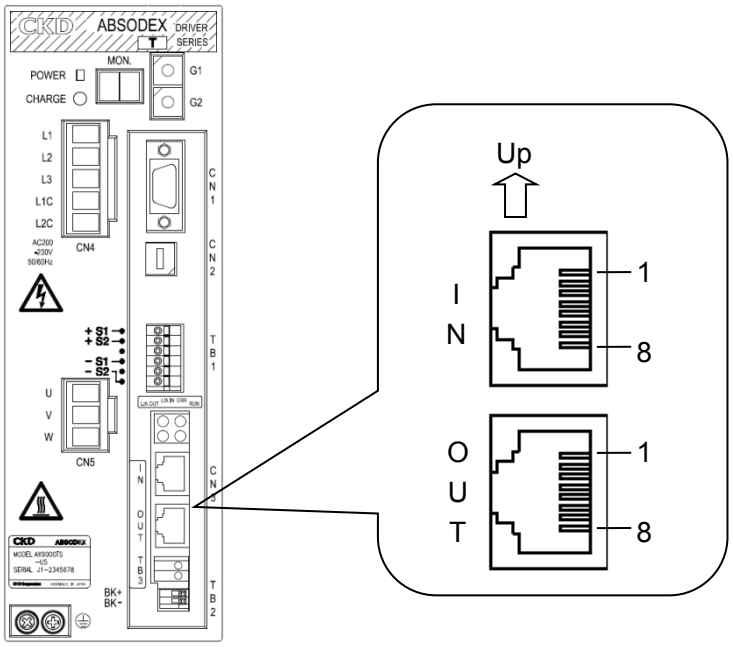


Figure 2.3. Pin layout of communication connector

Table 2.1. Pin layout of CN3

Connector	Pin	Signal name	Function	Description
IN/ OUT	1	TD+	Transmission data plus	Connect TD+ line.
	2	TD-	Transmission data minus	Connect TD- line.
	3	RD+	Receive data plus	Connect RD+ line.
	4	-	Not used	-
	5	-	Not used	-
	6	RD-	Receive data minus	Connect RD- line.
	7	-	Not used	-
	8	-	Not used	-

● We recommend the use of cables and connectors complying with EtherCAT specifications.

<Example of cable>

PNET/B Ethernet cable for industrial use with shield (Double shield) manufactured by JMACS

<Example of connector>

3R104-1110-000 AM RJ45 modular plug for industrial use manufactured by 3M

CAUTION

- Be sure to use special cables complying with EtherCAT specifications.
- Remove the connector vertically to avoid excessive force from being applied to the connector.
- Do not bend the communication cable forcibly. Assure a sufficient bending radius.
- Reserve a sufficient distance between the communication cable and power cable (motor cable).
- If the communication cable is routed near the power cable or if they are tied, noise will enter to make communication unstable, possibly causing communication errors.

For details of the laying of the communication cable, refer to EtherCAT Laying Guideline, etc.

2.2.2. EtherNet/IP Specification

The pin layout of EtherNet/IP communication connector (CN3) is shown below.

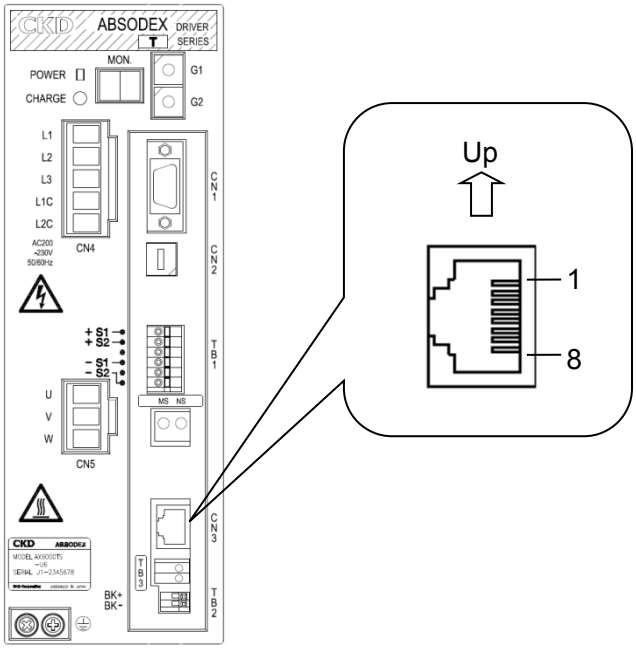


Figure 2.4. Pin layout of communication connector

Table 2.2. Pin layout of CN3

Pin	Signal name	Function	Description
1	TD+	Transmission data plus	Connect TD+ line.
2	TD-	Transmission data minus	Connect TD- line.
3	RD+	Receive data plus	Connect RD+ line.
4	-	Not used	-
5	-	Not used	-
6	RD-	Receive data minus	Connect RD- line.
7	-	Not used	-
8	-	Not used	-

● We recommend the use of cables and connectors complying with EtherNet/IP specifications.

<Example of cable>

PNET/B Ethernet cable for industrial use with shield (Double shield) manufactured by JMACS

<Example of connector>

3R104-1110-000 AM RJ45 modular plug for industrial use manufactured by 3M

CAUTION

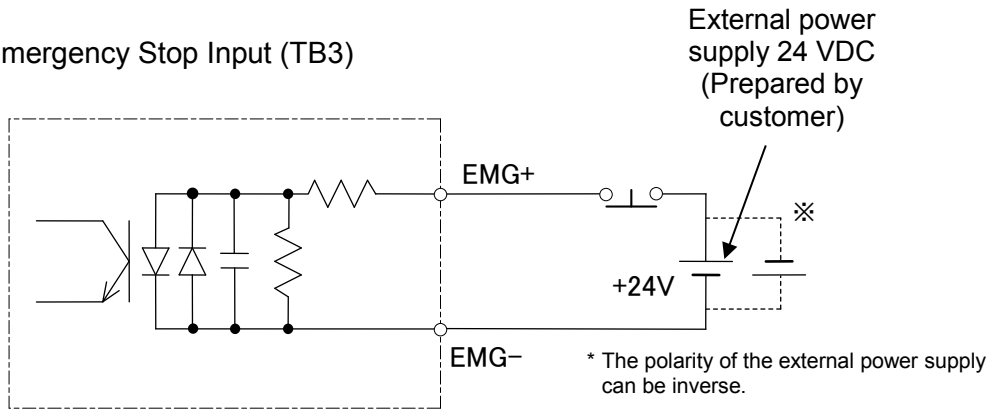
- Be sure to use special cables complying with EtherNet/IP specifications.
- Remove the connector vertically to avoid excessive force from being applied to the connector.
- Do not bend the communication cable forcibly. Assure a sufficient bending radius.
- Reserve a sufficient distance between the communication cable and power cable (motor cable).
- If the communication cable is routed near the power cable or if they are tied, noise will enter to make communication unstable, possibly causing communication errors.

For details of the laying of the communication cable, refer to EtherNet/IP Laying Guideline, etc.

2.3. IO Interface

Connect “emergency stop input (TB3)” in the following way.

2.3.1. Wiring of Emergency Stop Input (TB3)



Rated voltage 24V ±10%, rated current within 5 mA

Figure 2.5. Example of connection of emergency stop input (TB3)

- The emergency stop input will be effective as default setting. Refer to “Instruction manual AX Series TS type, TH type, and XS type” (SMF-2006) for emergency stop setting.
- Emergency stop is a “b” contact input. Thus, it will take effect when emergency stop input (TB3) becomes open.
  Emergency stop using serial communication will be effective when the input data is OFF.

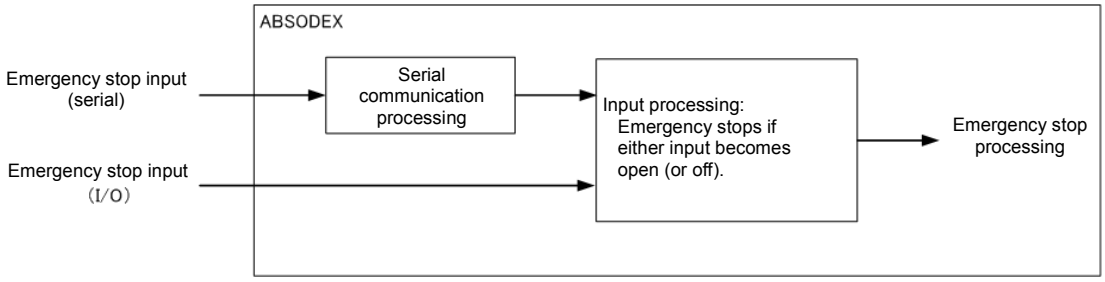


Figure 2.6. Specification of emergency stop input

- Emergency stop can be inputted by TB3's input terminal or CN3's serial communications and if one of the inputs becomes open (or off), it will be recognized as emergency stop. Consequently, input to TB3 is necessary to release the emergency stop.

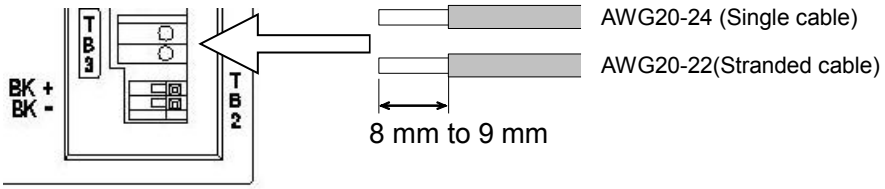


Figure 2.7. Applicable cables to TB3 and peeling method

- The cable sheath peeling length should be 8 mm or 9 mm.
- The applicable cable is AWG20 to 24 (single cable) or AWG20 to 22 (stranded cable).

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3. Communication Function

3.1. Communication Specifications

3.1.1. EtherCAT Communication Specifications

Table 3.1. Communication specifications

Item	Specifications
Communication protocol	EtherCAT
Communication speed	100 Mbps (Fast EtherNet, full duplex)
Process data	Fixed PDO mapping
Maximum PDO data length	RxPDO: 40 byte TxPDO: 40 byte
Station alias	0 to 65535 (set using parameters)
Connection cable	Cable compatible with EtherCAT (CAT5e or higher twisted-pair cable (aluminum foil braided double shielded) recommended)
Node address	Automatically allocated by master

3.1.2. EtherNet/IP Communication Specifications

Table 3.2. Communication specifications

Item	Specifications
Communication protocol	EtherNet/IP
Communication speed	Automatic setting (100 Mbps/10 Mbps, full duplex/half duplex)
Number of bytes occupied	Input: 32 bytes/Output: 32 bytes
IP address	0.0.0.0 to 255.255.255.255 (set using parameters)
Subnet mask	0.0.0.0 to 255.255.255.255 (set using parameters)
Default gateway	0.0.0.0 to 255.255.255.255 (set using parameters)
RPI (Packet interval)	10msec to 1000msec
Connection cable	Cable compatible with EtherNet/IP (CAT5 or higher twisted-pair cable (aluminum foil braided double shielded) recommended)

If it is connected with PLC, the EDS file of Absodex must be registered to the setting software on the PLC side.
Please use the EDS file in the attached CD-ROM.

3.2. Input/Output

3.2.1. EtherCAT Specifications

i) PDO Mapping

Table 3.3. RxPDO

Index	Sub Index	Name	Content
0x1600	0x00	Number of PDO objects	10
	0x01	Input signal 1	0x2001-0x01
	0x02	Input signal 2	0x2001-0x02
	0x03	Input data 1	0x2003-0x01
	0x04	Input data 2	0x2003-0x02
	0x05	Input data 3	0x2003-0x03
	0x06	Input data 4	0x2003-0x04
	0x07	Input data 5	0x2003-0x05
	0x08	Input command 1	0x2003-0x06
	0x09	Input command 2	0x2003-0x07
	0x0A	Input command 3	0x2003-0x08

Table 3.4. TxPDO

Index	Sub Index	Name	Content
0x1A00	0x00	Number of PDO objects	10
	0x01	Output signal 1	0x2005-0x01
	0x02	Output signal 2	0x2005-0x02
	0x03	Output data 1	0x2007-0x01
	0x04	Output data 2	0x2007-0x02
	0x05	Output data 3	0x2007-0x03
	0x06	Output data 4	0x2007-0x04
	0x07	Output data 5	0x2007-0x05
	0x08	Output command 1	0x2007-0x06
	0x09	Output command 2	0x2007-0x07
	0x0A	Output command 3	0x2007-0x08

ii) Input/Output Signals

Table 3.5. List of Input Signals (EtherCAT Specifications)

PLC → AX(Input)

Index	Sub Index	Name	Bit	Signal name	Logic	Judgment
0x2001	0x01	Input signal 1	0	Program number selection input (bit 0)	True	Level
			1	Program number selection input (bit 1)	True	Level
			2	Program number selection input (bit 2)	True	Level
			3	Program number selection input (bit 3)	True	Level
			4	Program number setting input, second digit/: Program number selection input (bit 4)	True	Level/Edge
			5	Program number setting input, first digit/ Program number selection input (bit 5)	True	Level/Edge
			6	Reset input	True	Edge
			7	Origin return command input	True	Edge
			8	Start input	True	Edge
			9	Servo-on input/ Program stop input	True	Level/Edge
			10	Ready return input/ Continuous rotation stop input	True	Edge
			11	Answer input/ Position deviation counter reset	True	Edge
			12	Emergency stop input	False	Level
			13	Brake off input	True	Level
			14	Jog operation input (CW direction)*1	True	Level
			15	Jog operation input (CCW direction)*1	True	Level
			16	Reserved*2/ Travel unit selection input (bit 0)*3	True	Level
			17	Reserved*2/ Travel unit selection input (bit 1)*3	True	Level
			18	Reserved*2/ Travel speed unit selection input*3	True	Level
			19	Table operation, data input operation Switching input	True	Level
			20 to 31	Reserved		
	0x02	Input signal 2	0	Monitor output execution request	True	Level
			1	Command code execution request	True	Edge
			2 to 31	Reserved		
0x2003	0x01	Input data 1	-	Monitor code 1		
	0x02	Input data 2	-	Monitor code 2		
	0x03	Input data 3	-	Monitor code 3		
	0x04	Input data 4	-	Monitor code 4		
	0x05	Input data 5	-	Monitor code 5		
	0x06	Input command 1	-	Command code		
	0x07	Input command 2	-	Written data *2 /A code or P code *3		
	0x08	Input command 3	-	Data designation *2 /F code *3		

Note *1: Only the network operation mode can be used.
*2: Selected when table operation is (Input signal 1 – bit 19 = OFF)
*3: Selected when data input operation is (Input signal 1 – bit 19 = ON)

[SMF-2012]

Table 3.6. List of Output Signals (EtherCAT Specifications)

AX(Output) → PLC

Index	Sub Index	Name	Bit	Signal name	Logic
0x2005	0x01	Output signal 1	0	M code output (bit 0)	True
			1	M code output (bit 1)	True
			2	M code output (bit 2)	True
			3	M code output (bit 3)	True
			4	M code output (bit 4)	True
			5	M code output (bit 5)	True
			6	M code output (bit 6)	True
			7	M code output (bit 7)	True
			8	In-position output	True
			9	Positioning completion output	True
			10	Start input wait output	True
			11	Alarm output 1	False
			12	Alarm output 2	False
			13	Indexing-in-progress output 1/ Origin position output	True
			14	Indexing-in-progress output 2/ Servo state output	True
			15	Ready state output	True
			16	Segment position strobe output	True
			17	M code strobe output	True
			18 to 31	Reserved	
	0x02	Output signal 2	0	Monitoring	True
			1	Command code execution complete	True
			2 to 31	Reserved	
0x2007	0x01	Output data 1	-	Monitor code 1	
	0x02	Output data 2	-	Monitor code 2	
	0x03	Output data 3	-	Monitor code 3	
	0x04	Output data 4	-	Monitor code 4	
	0x05	Output data 5	-	Monitor code 5	
	0x06	Output command 1	-	Response code	
	0x07	Output command 2	-	Loaded data	
	0x08	Output command 3	-	Reserved	

3.2.2. EtherNet/IP Specifications

Table 3.7. List of Input Data (EtherNet/IP Specifications) (1/2)

PLC → AX（Input）

Byte	Bit	Signal name	Logic	Judgment
0	0	Program number selection input (bit 0)	True	Level
	1	Program number selection input (bit 1)	True	Level
	2	Program number selection input (bit 2)	True	Level
	3	Program number selection input (bit 3)	True	Level
	4	Program number setting input, second digit/Program number selection input (bit 4)	True	Level/Edge
	5	Program number setting input, first digit /Program number selection input (bit 5)	True	Level/Edge
	6	Reset input	True	Edge
	7	Origin return command input	True	Edge
1	0	Start input	True	Edge
	1	Servo-on input /Program stop input	True	Level/Edge
	2	Ready return input /Continuous rotation stop input	True	Edge
	3	Answer input /Position deviation counter reset input	True	Edge
	4	Emergency stop input	False	Level
	5	Brake off input	True	Level
	6	Jog operation input (CW direction)*1	True	Level
	7	Jog operation input (CCW direction)*1	True	Level
2	0	Reserved *2 /Travel unit selection input (bit 0)*3	True	Level
	1	Reserved *2 /Travel unit selection input (bit 1)*3	True	Level
	2	Reserved *2 /Travel speed unit selection input*3	True	Level
	3	Table operation, data input operation Switching input	True	Level
	4 to 7	Reserved		
3	-	Reserved		
4	0	Monitor output execution request	True	Level
	1	Command code execution request	True	Edge
	2 to 7	Reserved		
5	-	Reserved		
6	-	Reserved		
7	-	Reserved		

Note *1: Only the network operation mode can be used.
*2: Selected when table operation (Input data Byte 2 – bit 3 = OFF).
*3: Selected when data input operation (Input data Byte 2 – bit 3 = ON).

Table 3.7. List of Input Data (EtherNet/IP Specifications) (2/2)

PLC → AX（Input）

Byte	Bit	Signal name	Logic	Judgment
8	-	Monitor code 1 *1		
9	-			
10	-			
11	-			
12	-	Monitor code 2 *1		
13	-			
14	-			
15	-			
16	-	Monitor code 3 *1		
17	-			
18	-			
19	-			
20	-	Command code *1		
21	-			
22	-			
23	-			
24	-	Written data *1 *2 /A code or P code *1 *3		
25	-			
26	-			
27	-			
28	-	Data designation *1 *2 /F code *1 *3		
29	-			
30	-			
31	-			

Note *1: 4 bytes in total are treated as one data.
The byte data sequence is little endian.
*2: Selected when table operation (Input data Byte 2 – bit 3 = OFF).
*3: Selected when data input operation (Input data Byte 2 – bit 3 = ON).

Table 3.8. List of Output Data (EtherNet/IP Specifications)

AX (Output) → PLC

Byte	Bit	Signal name	Logic
0	0	M code output (bit 0)	True
	1	M code output (bit 1)	True
	2	M code output (bit 2)	True
	3	M code output (bit 3)	True
	4	M code output (bit 4)	True
	5	M code output (bit 5)	True
	6	M code output (bit 6)	True
	7	M code output (bit 7)	True
1	0	In-position output	True
	1	Positioning completion output	True
	2	Start input wait output	True
	3	Alarm output 1	False
	4	Alarm output 2	False
	5	Indexing-in-progress output 1 /Origin position output	True
	6	Indexing-in-progress output 2 /Servo state output	True
	7	Ready state output	True
2	0	Segment position strobe output	True
	1	M code strobe output	True
	2 to 7	Reserved	
3	-	Reserved	
4	0	Monitoring	True
	1	Command code execution complete	True
	2 to 7	Reserved	
5	-	Reserved	
6	-	Reserved	
7	-	Reserved	
8	-	Monitor data 1 *1	
9	-		
10	-		
11	-		
12	-	Monitor data 2 *1	
13	-		
14	-		
15	-		
16	-	Monitor data 3 *1	
17	-		
18	-		
19	-		
20	-	Response code*1	
21	-		
22	-		
23	-		
24	-	Loaded data*1	
25	-		
26	-		
27	-		
28	-	Reserved	
29	-		
30	-		
31	-		

Note *1: 4 bytes in total are treated as one data.
The byte data sequence is little endian.

3.3. Monitor Code/Command Code

Table 3.9. Monitor code list

Code No.*1	Monitored item	Data Length	Unit	Range
1h	Current position in full rotation (deg.)	32 bits	×1,000 [deg.]	0 to 359,999
3h	Current position in full rotation (pulse)	32 bits	[pulse]	0 to 540,671
5h	Position deviation amount	32 bits	[pulse]	-540,672 to 540,671
7h	Program number	16 bits	[No.]	0 to 999
8h	Electronic thermal relay	16 bits	×100 [°C]	0 to 65,535
9h	Rotation speed	16 bits	[rpm]	-32,768 to 32,767
Ah	Point table number	16 bits	[No.]	0 to 63
Bh	Torque load	16 bits	[%]	0 to 110
Ch	Angular acceleration	16 bits	[rad/s^2]	-32,768 to 32,767

Note *1: If numeric characters and alphabetical characters are followed by lower-case h, for example "**h", it is a value in hexadecimals.

Table 3.10. Response code list *2

Code No.	Description	Details
0	Normal	The command code is executed normally.
1	Code error	A code not listed is executed.
2	Parameter selection error	A parameter number which cannot be read or set is specified.
3	Error in writing range	An excessive value is executed.
4	Timing error	The write command code is executed during processing of the CN1 communication function.

Note *2: The response code is shared in the monitor, load command and write command.

Table 3.11. Load command code list

Code No.*1	Item/Function	Loaded data		Loaded data designation
10h	Current alarm loading	EtherCAT specifications	0 to 7 bit: Alarm loading 1 8 to 15 bit: Alarm loading 2 16 to 23 bit: Alarm loading 3 24 to 31 bit: Alarm loading 4	-
		EtherNet/IP specifications	Byte 24: Alarm loading 1 Byte 25: Alarm loading 2 Byte 26: Alarm loading 3 Byte 27: Alarm loading 4	
20h	Operation mode loading	Current operation mode No.		-
23h	Parameter loading (RAM data)	Parameter set value		Parameter number
25h	Parameter loading	Parameter set value		Parameter number

Note *1: If numeric characters and alphabetical characters are followed by lower-case h, for example “**h”, it is a value in hexadecimals.

Current alarm loading (10h)

The current alarm number is loaded.
It is set as loaded data. Each byte indicates the type, and up to four alarms are specified.
Alarm indication is consistent to the 7-segment LED indication. The first digit indicates details of the alarm and the second digit indicates the alarm number.
For alarms not expressed in 0 to F,

Alarm H →"d"
Alarm L →"b"
Alarm P, U and others →"8"

and alarms are set in the order from "F" to "0."
In case of "no alarm," "00" is set.

Operation mode loading (20h)

The current operation mode is loaded.
The number of the operation mode is set in the loaded data.

Table 3.12. Loadable operation mode list

Operation mode	Loaded data set value
Automatic operation mode	1
Single block mode	2
MDI (manual data input) mode	3
Jog mode	4
Servo OFF mode	5
Pulse string input mode	6
Network operation mode	7

Parameter loading (23h, 25h)

The set value of the parameter designated with the data is loaded using an integer value.
The set value of the parameter designated with the parameter number (Input Command 3) is loaded using an integer value.
A parameter with a decimal value is loaded using a value multiplied by 100 or 10,000.
For details, refer to the “Parameter List” on page 3-8.

Table 3.13. Write command code list

Code No.*1	Item/Function	Written data	Written data designation
21h	Operation mode switching	Automatic operation number	-
27h	Parameter setting (RAM data only)	Parameter set value	Parameter number
29h	Parameter setting	parameter set value	Parameter number
30h	Point table initialization	Table number initialized	-
31h	Parameter initialization	999	-

Note *1: If numeric characters and alphabetical characters are followed by lower-case h, for example “**h”, it is a value in hexadecimals.

Operation mode switching (21h)

The mode is switched to the operation mode designated with written data.
The switchable modes and set values are as shown in the following.

Table 3.14. Switchable operation mode list

Operation mode	Written data Set value
Automatic operation mode	1
Single block mode	2
Servo OFF mode	5
Network operation mode	7

Parameter setting (27h, 29h)

The set value of the parameter designated with the data is rewritten to the value of written data.
The set value of the parameter designated with the parameter number (Input command 3) is rewritten to the value of written data.
Written data are integer values only.
As for a parameter with a decimal value, set a value multiplied by 100 or 10,000.
For details, refer to the “Parameter list” on page 3-11.
In the command code of the parameter setting (RAM data only), only data on the RAM are rewritten.

Point table initialization (30h)

Point tables designated with written data are initialized.
When the written data are 999, all point tables including common tables are initialized.
The value after initialization is as shown in the following.

Table 3.15. Point tables after initialization

Type	Instruction	Travel unit	Travel speed unit	A code/P code	F code
Common table	Absolute	x 1,000 [deg.]	x 1,000 [rpm]	-	-
Table number 0 to 63	Common table	Common table	Common table	0	2,000

Parameter initialization (31h)

The set values of all parameters are initialized.
However, parameter 61 (station number and baud rate setting), parameter 103 (IP address), parameter 104 (subnet mask) and parameter 105 (default gateway) are not applicable i.e. not initialized.

● The number of times at which the program and parameter can be rewritten is 100,000 times.

Table 3.16. Parameter List (1/2) *1

PRM Number	Name		Set range	Initial value	Unit
1	Cam curve		1 to 5	1	-
2	Acceleration/Deceleration time of MC2 curve		1 to 5,000	100	×100[sec]
3	Origin offset amount		-540,672 to 540,671	0	[Pulse]
4	Origin return direction		1 to 3	1	-
5	Origin return speed		100 to 2,000	200	×100[rpm]
6	Acceleration/Deceleration time of origin return		10 to 200	100	×100[sec]
7	Origin return stop		1, 2	2	-
8	Soft limit, Coordinate A (+ direction)		-9,999,998 to 9,999,999	9,999,999	[Pulse]
9	Soft limit, Coordinate B (− direction)		-9,999,999 to 9,999,998	-9,999,999	[Pulse]
10	Effective/Ineffective of soft limit		1, 2	2	-
11	No answer time		1 to 100, 999	999	[sec]
12	Necessity/Unnecessity of M answer		1, 2	2	-
13	Answer input at time of positioning and origin return completion		1, 2	2	-
14	Jog speed		1 to 10,000	200	×100[rpm]
15	Jog acceleration/deceleration time		10 to 200	100	×100[sec]
16	In-position range		1 to 10,000	2,000	[Pulse]
17	Number of times of in-position sampling		1 to 2,000	1	[Times]
18	Position deviation amount		Cannot be set	-	[Pulse]
19	Upper limit value of position deviation amount		1 to 540,672	4,000	[Pulse]
20	Speed over limit	AX2006TS AX2012TS AX2018TS	1 to 5,947	5,947	[Pulse]
		AX1022TS AX1045TS AX4009TS AX4022TS AX4045TS	1 to 4,866	4,866	
		AX1075TS AX4075TS	1 to 2,883	2,883	
		AX1150TH AX1210TH	1 to 2,522	2,522	
		AX4150TH AX4300TH	1 to 1,982	1,982	
		AX4500TH	1 to 1,441	1,441	
		AX410WTH	1 to 630	630	
21	Deceleration rate during emergency stop		1 to 180, 999	999	[Pulse/2msec^2]
22	Delay time of emergency stop servo OFF		0 to 2,000	1,000	[msec]
23	Emergency stop input		1 to 3	3	-
24	Actuator temperature increase		Cannot be set	-	×100[℃]
25	Upper limit value of actuator temperature		Cannot be set	7,000	×100[℃]
27	Delay time after brake output	AX1000T Series AX2000T Series AX4009T AX4022T AX4045T	0 to 1,000	100	[msec]
		AX4075T AX4150T AX4300T AX4500T AX410WT		250	
28	Initial state of brake		1, 2	2	-
29	Mode when power is turned ON		1, 2, 6, 7	1	-
33	Indexing-in-progress output 1		0 to 99	0	[%]
34	Indexing-in-progress output 2		0 to 99	0	[%]
36	Switching of I/O program number selection method		1 to 5	1	-
37	Segment position range width of designation of indexes		1 to 270,336	1,500	[Pulse]
38	Rotation direction at time of designation of indexes		1 to 4	3	-
39	Torque limitation		1 to 100	100	[%]

Note *1: Refer to the “AX Series TS, TH, XS Type manual” (SMF-2006) for the function of each parameter.

● “PRM” in this Instruction Manual means “parameter”.

Table 3.16. Parameter List (2/2) [*1]

PRM Number	Name		Set range	Initial value	Unit
45	Coordinate recognition range when power is turned ON		0 to 540,671	270,335	[Pulse]
46	Origin position output range		0 to 10,000	2,000	[Pulse]
47	Positioning completion output time		0 to 1,000	100	[msec]
48	Alarm deceleration stop		1, 2	2	-
51	In-position signal output mode		0, 1	0	-
52	I/O input signal, Function selection of CN3-14 (bit 9)		0, 1	0	-
53	I/O input signal, Function selection of CN3-15 (bit 10)		0, 1	0	-
54	I/O input signal, Function selection of CN3-16 (bit 11)		0, 1	0	-
56	I/O output signal, Function selection of CN3-46 (bit 13)		0, 1	0	-
57	I/O output signal, Function selection of CN3-47 (bit 14)		0, 1	0	-
62	Cut OFF frequency of low-pass filter 1	AX1000T Series AX2000T Series AX4009T AX4022T AX4045T	1,000 to 100,000	20,000	×100[Hz]
		AX4075T AX4150T AX4300T AX4500T AX410WT		10,000	
63	Cut OFF frequency of low-pass filter 2		1,000 to 100,000	50,000	×100[Hz]
64	Cut OFF frequency of notch filter 1		1,000 to 100,000	50,000	×100[Hz]
65	Cut OFF frequency of notch filter 2		1,000 to 100,000	50,000	×100[Hz]
66	Filter switch		0 to 15	1	-
67	Integration limiter		1 to 540,672	100,000	[Pulse]
70	Value Q for notch filter 1		10 to 990	100	×100[－]
71	Value Q for notch filter 2		10 to 990	100	×100[－]
72	Integration gain magnification	AX1000T Series AX2000T Series AX4009T AX4022T AX4045T	10 to 1,000	100	×100[－]
		AX4075T AX4150T AX4300T AX4500T AX410WT		30	
80	Integration gain		0 to 320,000	0	×10,000[－]
81	Proportion gain		0 to 5,120,000	0	×10,000[－]
82	Differentiation gain		0 to 20,480,000	0	×10,000[－]
83	Auto tuning command		1 to 32	0	-
87	Auto tuning torque	AX1022T AX1045T AX2000T Series	0 to 8,192	500	-
		AX1075T AX1150T AX1210T AX4000T Series		1,000	
88	Auto tuning measurement start speed		0 to 1,000	100	[Pulse/msec]
89	Auto tuning measurement completion speed		0 to 1,000	700	[Pulse/msec]

Note *1: Refer to the “AX Series TS, TH, XS Type manual” (SMF-2006) for the function of each parameter.

3.4. Data Communication Timing Chart

3.4.1. Monitor Code

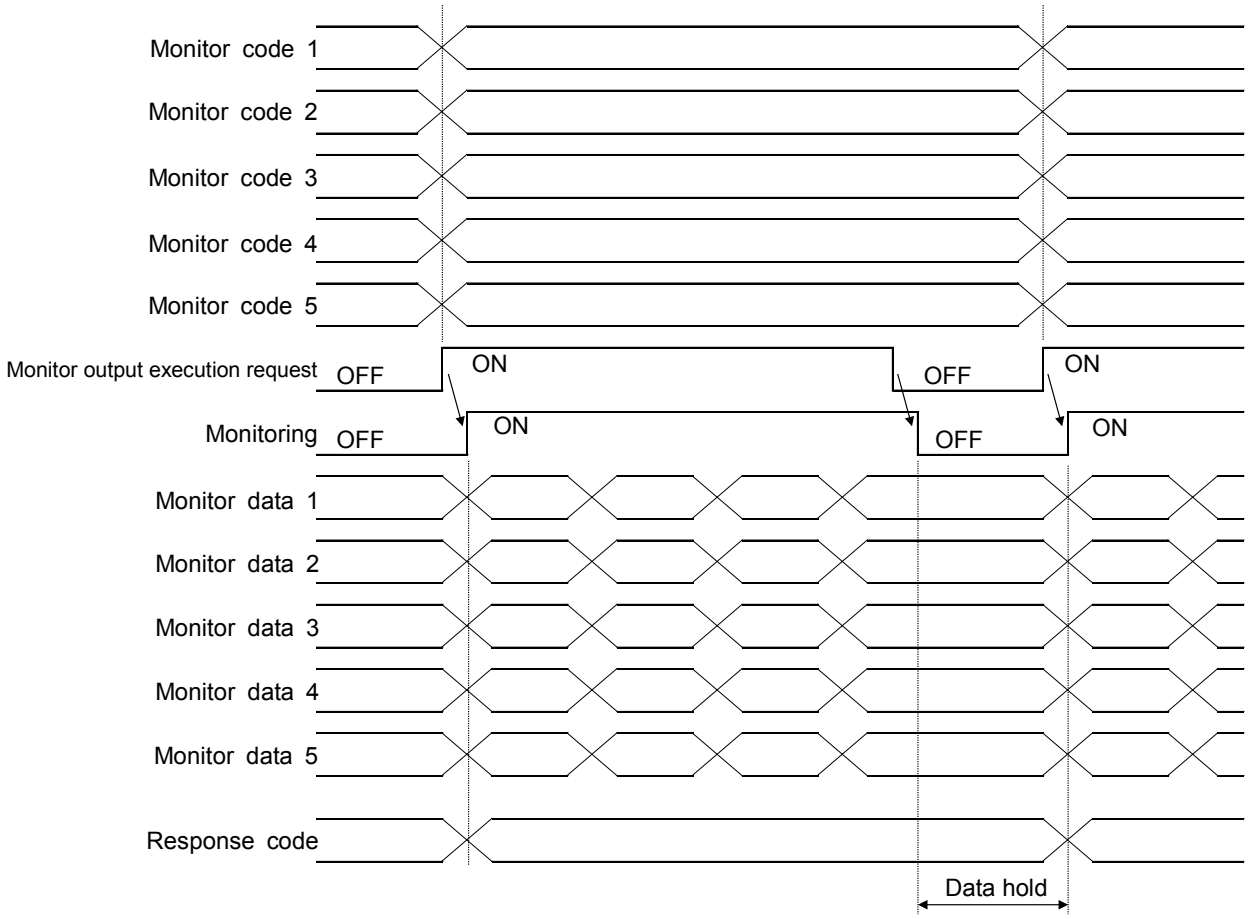

Figure 3.1. Timing chart for monitor code execution

Enter monitor code 1 to 5 as monitor codes and turn the monitor output execution request on.
Obtained data is stored in remote registers.
All data is in hexadecimals. At the time, the monitoring signal is turned on simultaneously.

Monitor data 1 : Data requested with Monitor code 1
Monitor data 2 : Data requested with Monitor code 2
Monitor data 3 : Data requested with Monitor code 3
Monitor data 4 : Data requested with Monitor code 4
Monitor data 5 : Data requested with Monitor code 5

The monitor data are always updated while the monitoring signal remains turned on.
If the monitoring signal is turned off, monitor data 1 to 5 is held.
If a monitor code not included in specifications is monitor code 1 to 5, an error code (□□□□□□□1) is set in the response code.

Table 3.17. List of allocation of input/output data used for monitor code execution

Input/Output	Signal name	EtherCAT specifications	EtherNet/IP specifications
Input (PLC→AX)	Monitor code 1	Input data 1	Input data Byte 8 to 11
	Monitor code 2	Input data 2	Input data Byte 12 to 15
	Monitor code 3	Input data 3	Input data Byte 16 to 19
	Monitor code 4	Input data 4	-
	Monitor code 5	Input data 5	-
	Monitor output execution request	Input signal 2 – bit0	Input data Byte 4 – bit 0
Output (AX→PLC)	Monitoring	Output signal 2 – bit0	Output data Byte 4 – bit 0
	Monitor data 1	Output data 1	Output data Byte 8 to 11
	Monitor data 2	Output data 2	Output data Byte 12 to 15
	Monitor data 3	Output data 3	Output data Byte 16 to 19
	Monitor data 4	Output data 4	-
	Monitor data 5	Output data 5	-
	Response code	Output command 1	Output data Byte 20 to 23

3.4.2. Command Code

i) Load command code

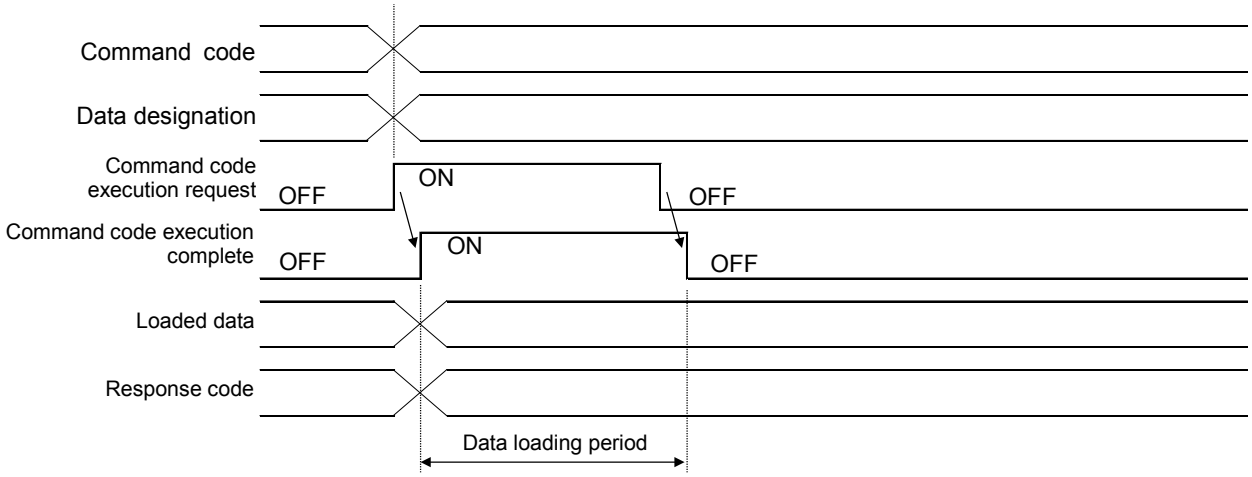

Figure 3.2. Timing chart for load command code execution

Enter the load command code as command code, enter the data designation as necessary and turn the command code execution request on to acquire the data corresponding to the specified loading code in loaded data.
All data is in hexadecimals. At the time, command code execution completion is turned on simultaneously.
Load data from while the command code execution request remains turned on. The data is held until the next load command code is entered and the command code execution request is turned on.
If a command code not included in specifications is set as a command code, an error code (□□□□□□1□) is set in the response code. If a parameter that cannot be used is loaded, an error (□□□□□□2□) is set.
Turn the command code execution request off after data loading is finished.

Table 3.18. List of allocation of input/output data used for command code execution

Input/Output	Signal name	EtherCAT specifications	EtherNet/IP specifications
Input (PLC→AX)	Command code	Input command 1	Input data Byte 20 to 23
	Written data	Input command 2	Input data Byte 24 to 27
	Data designation	Input command 3	Input data Byte 28 to 31
	Command code execution request	Input signal 2 – bit1	Input data Byte 4 – bit 1
Output (AX→PLC)	Command code execution complete	Output signal 2 – bit1	Output data Byte 4 – bit 1
	Loaded data	Output command 2	Output data Byte 24 to 27
	Response code	Output command 1	Output data Byte 20 to 23

ii) Write command code

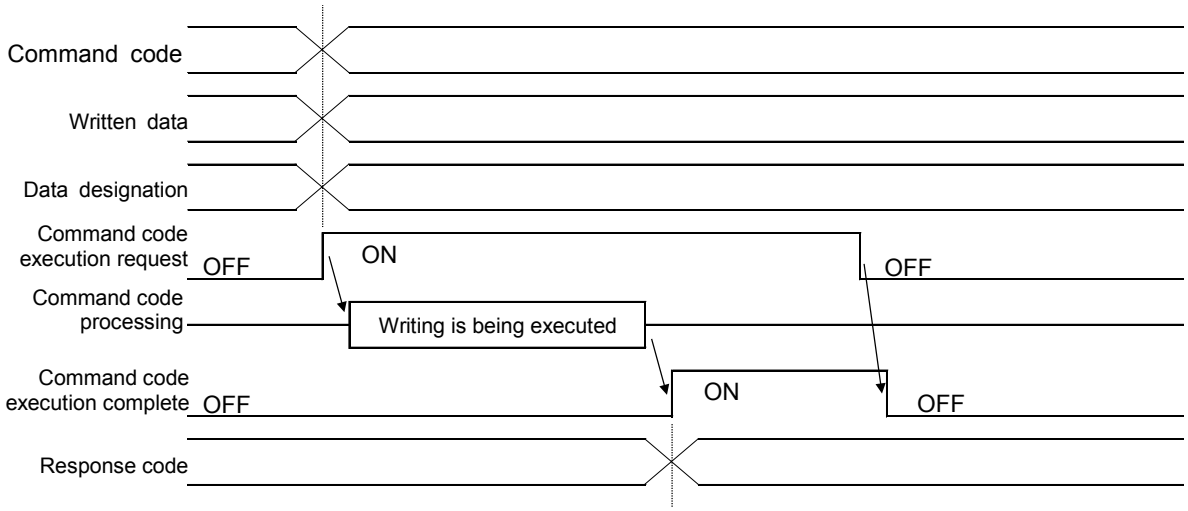

Figure 3.3. Timing chart for write command code execution

Set the write command code as a command code and set the written data as written data and, as necessary, a date designation.
Turn on the command code execution request and write into data designated with the command code.
All data is in hexadecimals. At this time, after writing, the command code execution completion is turned on.
If a command code not included in specifications is set as a command code, an error code (□□□□□□1□) is set in the response code. If a user tries to write into a parameter that cannot be set by parameter setting, an error code (□□□□□□2□) is set. If a user tries to write an excessive value, an error code (□□□□□□3□) is set.
If the write command code is executed during the processing of the communication command input into CN1, an error code (□□□□□□4□) is set.
Turn the command code execution request off after the command code execution completion is turned on.

3.4.3. Response Code

If the monitor code or command code is out of the allowable setting range, an error code is specified as a response code. If they are normal, "00" is set.

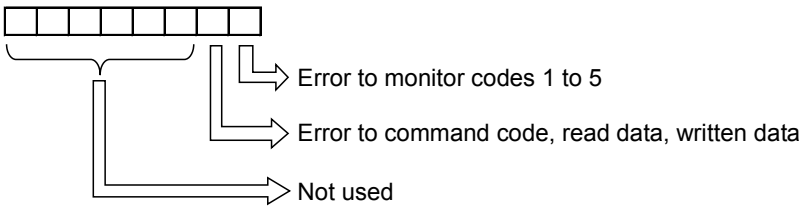

Figure 3.4. Description of error of response code

3.5. Defining the Register

3.5.1. EtherCAT Specifications

“Device ID” and “Setting of Device ID to Station Alias register” are configured using AX Tools Ver. 2.12 or later. Default settings are “Device ID: 0” and “Setting of Device ID to Station Alias register: Set”.

i) EtherCAT setting screen

Select "Set"- "Field Bus setting" - "EtherCAT setting" from the menu of the AX Tools to open "EtherCAT Register" screen.

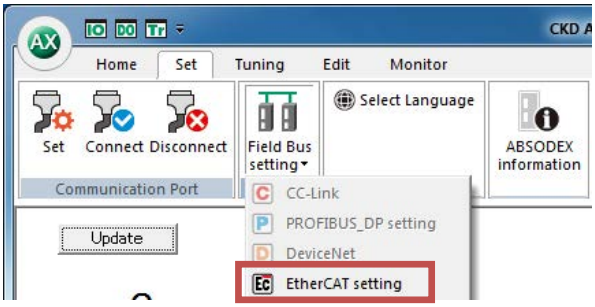

Figure 3.5. Setting menu of AX Tools

ii) EtherCAT register

Check that a value is displayed in the EtherCAT register and select “Set (ABSODEX)”.

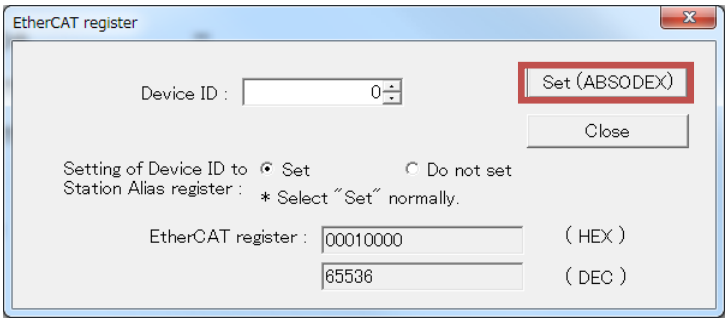

Figure 3.6. Setting screen of EtherCAT register

< Device ID >
Current device ID setting is displayed. Enter device ID in the range from 0 to 65535.

< Setting of Device ID to Station Alias register >
Currently selected item is displayed. If “Set” is selected, value entered in Device ID is set for both Device ID and Station Alias register.

< EtherCAT register >
Values set for “Device ID” and “Setting of Device ID to Station Alias register” are shown.

<Set (ABSODEX)>
Click on this button to transfer new data to the register of ABSODEX.

< Close >
Click on this button to close the screen.

iii) End of setting

After the settings are normally entered, a completion screen is displayed.
Shutdown and restart the power after finishing configuration.
Settings for “Device ID” and “Setting of Device ID to Station Alias register” will take effect after the power has been restarted.

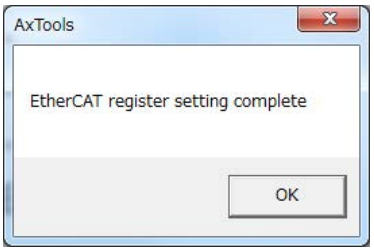

Figure 3.7. Screen for end of setting

iv) Error in setting

The following screen is displayed if there is an error in the device ID setting

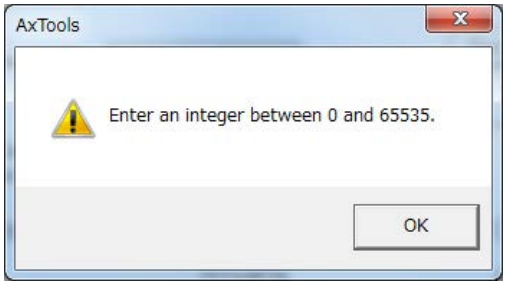

Figure 3.8. Warning screen at time of error setting of device ID

If the system is initialized, EtherCAT register settings will return to default settings. Set the EtherCAT register again after initializing the system.

3.5.2. EtherNet/IP Specifications

"IP address", "Subnet mask" and "Default gateway" are configured using AX Tools Ver. 2.20 or later. Default settings are "IP address: 0.0.0.0", "Subnet mask: 0.0.0.0" and "Default gateway: 0.0.0.0".

i) EtherNet/IP setting screen

Select "Set"- "Field Bus setting" - "EtherNet/IP setting" from the menu of the AX Tools to open "EtherNet/IP Register" screen.

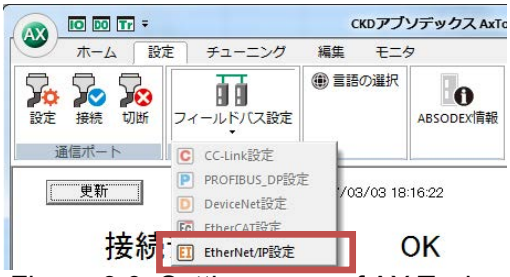

Figure 3.9. Setting menu of AX Tools

ii) EtherNet/IP register

Check that a value is displayed in the EtherNet/IP register and select "Set (ABSODEX)".

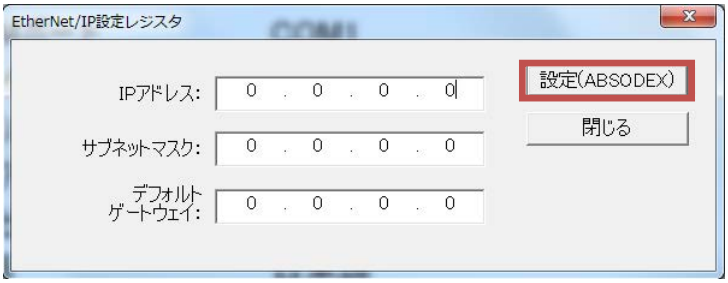

Figure 3.10. Setting screen of EtherNet/IP register

<IP address>
Current IP address setting is displayed. Enter IP address in the range from 0.0.0.0 to 255.255.255.255.

<Subnet mask>
Current subnet mask setting is displayed. Enter subnet mask in the range from 0.0.0.0 to 255.255.255.255.

<Default gateway>
Current default gateway setting is displayed. Enter default gateway in the range from 0.0.0.0 to 255.255.255.255.

<Set (ABSODEX)>
Click on this button to transfer new data to the register of ABSODEX.

<Close>
Click on this button to close the screen.

iii) End of setting

After the settings are normally entered, a completion screen is displayed.
Shutdown and restart the power after finishing configuration.
Settings for “IP address”, “Subnet mask” and “Default gateway” will take effect after the power has been restarted.

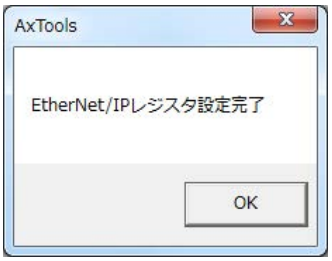

Figure 3.11. Screen for end of setting

If the system is initialized, EtherNet/IP register settings will return to default settings.
Set the EtherNet/IP register again after initializing the system.

3.6. Monitoring the Communication Status

The I/O status after communication establishment can be monitored using AX Tools Ver. 2.12 or later.

i) I/O display

Select “Monitor” - “I/O signal status display” from the menu of the AX Tools to display the screen for “I/O display”

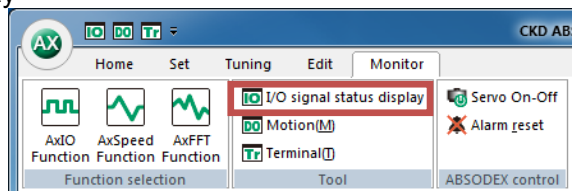

Figure 3.12. AX Tools monitor menu

ii) Checking of I/O

The I/O status after communication establishment can be monitored.
“*” indicates false logic signals; thus, the I/O display will indicate ON when it is open.

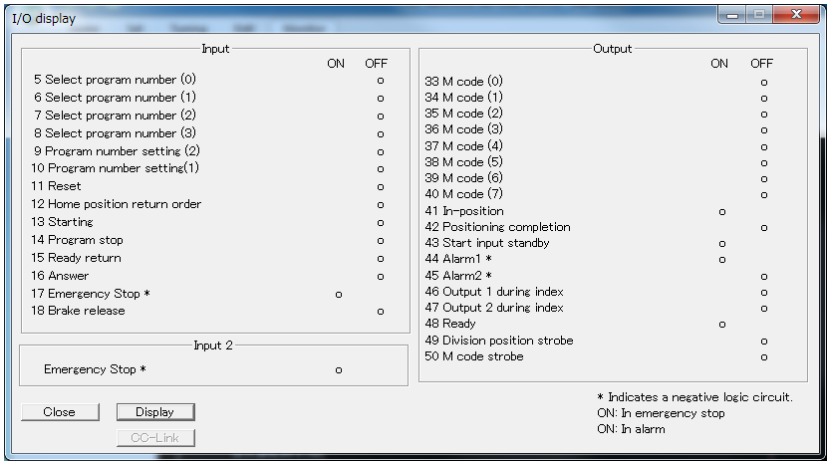

Figure 3.13. Screen example of I/O display

3.7. LED Indications

3.7.1. EtherCAT Specifications

The status of the module and that of the network can be displayed. See the description in the following table for the LED indications.

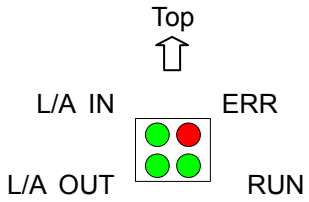

Figure 3.14. Name of LED

Table 3.19. List of LED indications

Name of LED	Color	Description
RUN	Green	Indicates slave status
ERR	Red	Indicates communication status
L/A IN	Green	Indicates link status of IN-side of CN3 connector
L/A OUT	Green	Indicates link status of OUT-side of CN3 connector

Table 3.20. LED status list

Name of LED	LED status	Description
RUN	●	Init
	◎	Pre-Operational
	◎(Flash)	Safe Operational
	◎(Rapid)	Bootstrap
	○	Operational
ERR	●	Normal Communication
	◎(Double flash)	Communication Error (WD time out)
	◎	Communication Error
L/A IN	●	No Link, No Activity
	○	Link, No Activity
	◎(Rapid)	Link, Activity
L/A OUT	●	No Link, No Activity
	○	Link, No Activity
	◎(Rapid)	Link, Activity

○: Lit, ●: Unlit, ◎: Blink

3.7.2. EtherNet/IP Specifications

The status of the module and that of the network can be displayed. See the description in the following table for the LED indications.

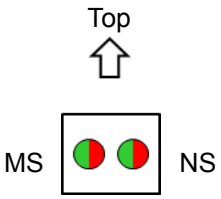

Figure 3.15. Name of LED

Table 3.21. List of LED indications

Name of LED	Color	Description
MS	Green/Red	Indicates status of network module of this product
NS	Green/Red	Indicates status of network

Table 3.22. LED status list

Name of LED	LED status	Description
MS	●	Power Off
	○ Green	Normal Operation
	◎ Green	Connection Establishment Wait from Master
	◎ Red	Recoverable Error Occurs
	○ Red	Unrecoverable Error Occurs
NS	●	Power Off or IP Address Not Set
	◎ Green	Connection Not Established
	○ Green	Normal Communication
	◎ Red	Error (time out)
	○ Red	Error (IP address overlapping)

○: Lit, ●: Unlit, ◎: Blink

3.8. 7-Segment LED Indication

The 7-segment LED displays the device ID (in case of EtherCAT specifications) or IP address (in case of EtherNet/IP specifications). The flow after the power is turned on is as shown below.

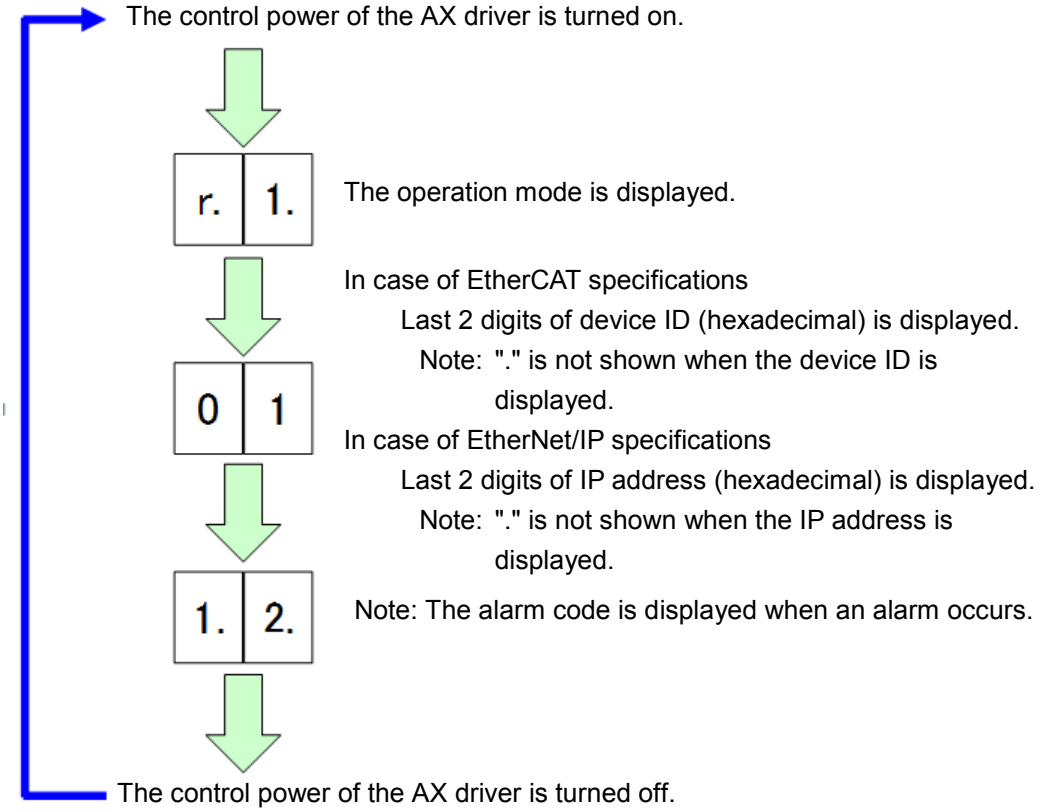

Figure 3.16. Specification of 7-segment LED indication

The 7-segment LED displays the device ID set using AX Tools.
The 7-segment LED does not display device ID set from EtherCAT master unit.
Device ID set from the master unit can be checked from the master unit.

4. Network Operation Mode

Network Operation Mode is an operation mode that can be used for reduced-wiring specifications-U5 (EtherCAT) and -U6 (EtherNet/IP).

4.1. Point Table Operation

Point table operation is performed using point table data in the Absodex driver.
Point table data can be viewed and set using the PLC.

4.1.1 Operating Procedures

i) Setting the point table
Make the setting using AX Tools version 2.12 or later or using command codes.

ii) Switching the operation mode
Switch the operation mode to Network Operation Mode.
The mode can be switched using one of the methods below.
- Send the communication command "M7"
- Set PRM29 (mode at power-on) = 7, and turn the control power off and on again.
- Switch using command code (21h)

iii) Switching to table operation
Set table operation and data input operation switching input to OFF.
OFF: Table operation
ON: Data input operation

iv) Selection of point table
Use program number selection input to make the selection.
The selection method is set to the method that was set in PRM36 (I/O program number selection method selector). The selection range of the point tables is 0 to 63.

v) Starting of point table
Turning on start input executes the selected point table.

4.1.2. Point Table Data

Point tables include common table and table 0 to 63 data.
Each data value can be read and written using communication codes in the same way as parameters or using command codes from the PLC.

Table 4.1. Point Table Data (1/2)

Table number	Corresponding PRM number	Description	Setting range	Initial value
-	197	Common table command	1 to 6	1
		1: Absolute coordinates (G90) 2: Single rotation absolute coordinates (G90.1) 3: Clockwise rotation absolute coordinates (G90.2) 4: Counter-clockwise rotation absolute coordinates (G90.3) 5: Incremental coordinates (G91) 6: Single rotation incremental coordinates (G91.1)		
-	198	Common table travel units	1 to 3	1
		1: Angle units (G105) 2: Pulse units (G104) 3: Indexing units (G106)		
-	199	Common table travel speed units	1 to 2	1
		1: Rotational speed (G10) 2: Time (G11)		
0	200	Command	0 to 11	0
		0: Command set in common table 1: Absolute coordinates (G90) 2: Single rotation absolute coordinates (G90.1) 3: Clockwise rotation absolute coordinates (G90.2) 4: Counter-clockwise rotation absolute coordinates (G90.3) 5: Incremental coordinates (G91) 6: Single rotation incremental coordinates (G91.1) 7: Origin return (G28) 8: Select number of divisions (G101) 9: Change gain multiplier (G12) 10: Brake On (M68) 11: Brake Off (M69)		
	201	Travel units	0 to 3	0
		0: Travel units set in common table 1: Angle units (G105) 2: Pulse units (G104) 3: Indexing units (G106)		
	202	Travel speed units	0 to 2	0
		0: Travel speed units set in common table 1: Rotational speed (G10) 2: Time (G11)		

Table 4.1. Point Table Data (2/2)

Table number	Corresponding PRM number	Description	Setting range	Initial value
0	203	A code/P code	-540,672 to 540,672	0
		Set the angle and other setting values based on the command and travel units (values corresponding to A code and P code of NC program) within the ranges below. Angle: -360,000 to 360,000 ×1,000 (degrees) Pulse: -540,672 to 540,672 (pulses) Indexing and number of divisions: 1 to 255 (indexing, number of divisions) Gain multiplier: 0, 50 to 200 (%)		
	204	F code[*1]	10 to 300,000	2,000
		Set the rotational speed and other setting values based on the command and travel speed units (values corresponding to F code of NC program) within the ranges below. Rotational speed: 110 to 300,000 ×1,000 (rpm) Time: 10 to 100,000 ×1,000 (seconds)		
n (1 to 63)	200 +5×n	Command	0 to 11	0
		See the description on commands for table 0.		
	201 +5×n	Travel units	0 to 3	0
		See the description on travel units for table 0.		
	202 +5×n	Travel speed units	0 to 2	0
		See the description on travel speed units for table 0.		
	203 +5×n	A code/P code	-540,672 to 540,672	0
		See the description on A code/P code for table 0.		
	204 +5×n	F code	10 to 300,000	2,000
		See the description on F code for table 0.		

Note [*]1: The initial value of the travel speed units in the NC program is the travel time (seconds), but the initial value in the point table is the rotational speed (rpm).

A single table consists of the following five elements: Commands, Travel Units, Travel Speed Units, A Code/P Code, and F code. The required items vary depending on the content of the command.

Table 4.2. Network Operation Mode Command Combinations

Command	Travel units	Travel speed units	A code /P code	F code
Absolute (G90)	Yes	Yes	Yes	Yes
Single rotation absolute (G90.1)	Yes	Yes	Yes	Yes
Clockwise absolute (G90.2)	Yes	Yes	Yes	Yes
Counter-clockwise absolute (G90.3)	Yes	Yes	Yes	Yes
Incremental (G91)	Yes	Yes	Yes	Yes
Single rotation incremental (G91.1)	Yes	Yes	Yes	Yes
Origin return (G28)	No	No	No	No
Select number of divisions (G101)	No	No	Yes	No
Change gain multiplier (G12)	No	No	Yes	No
Brake On (M68)	No	No	No	No
Brake Off (M69)	No	No	No	No

4.1.3. Examples of Point Table Settings

● Rotation operation using common table

Table 4.3. Operation Commands Corresponding to NC Program G90G105G11A90F3

Table	Description	Setting value	Operation
Common table	Command	1	Absolute coordinates
	Travel units	1	Angle units
	Travel speed units	2	Time
n	Command	0	Move to absolute coordinates of 90° in 3 seconds (Absolute, angle units, and speed units that were set in the common table are used.)
	Travel units	0	
	Travel speed units	0	
	A code /P code	90,000	
	F code	3,000	

When the setting values of the table 0 to 63 commands, travel units, and travel speed units are 0 (initial value), the settings that were set in the common table are used. In this case, the operation content of tables 0 to 63 can be changed by simply changing the setting values of the common table.
To perform operation different from the common table, set the setting values of the table 0 to 63 commands, travel units, and travel speed units to a value other than 0.

● Operation not using common table

Table 4.4. Operation Commands Corresponding to NC Program G91G104G11A-50,000F1

Table	Description	Setting value	Operation
Common table	Command	1	Absolute coordinates
	Travel units	1	Angle units
	Travel speed units	1	Rotational speed
n	Command	5	Move from current position to -50,000 pulse position in 1 second (Command, travel units, and speed units different from the common table are used.)
	Travel units	2	
	Travel speed units	2	
	A code /P code	-50,000	
	F code	1,000	

● Origin return

Table 4.5. Operation Commands Corresponding to NC Program G28

Table	Description	Setting value	Operation
n	Command	7	Origin return
	Travel units	-	Setting values are ignored These appear as "—" below.
	Travel speed units	-	
	A code /P code	-	
	F code	-	

● Select number of divisions

Table 4.6. Operation Commands Corresponding to NC Program G101A4

Table	Description	Setting value	Operation
n	Command	8	Select number of divisions
	Travel units	-	-
	Travel speed units	-	
	A code /P code	4	4 divisions
	F code	-	-

● Change gain multiplier

Table 4.7. Operation Commands Corresponding to NC Program G12P0

Table	Description	Setting value	Operation
n	Command	9	Change gain multiplier
	Travel units	-	-
	Travel speed units	-	
	A code /P code	0	0%
	F code	-	-

● Brake On

Table 4.8. Operation Commands Corresponding to NC Program M68

Table	Description	Setting value	Operation
n	Command	10	Brake On
	Travel units	-	-
	Travel speed units	-	
	A code /P code	-	
	F code	-	

● Brake Off

Table 4.9. Operation Commands Corresponding to NC Program M69

Table	Description	Setting value	Operation
n	Command	11	Brake Off
	Travel units	-	-
	Travel speed units	-	
	A code /P code	-	
	F code	-	

4.2. Data Input Operation

In data input operation, Absodex is operated using the data received from the PLC.
As a result, the operation content of Absodex can be changed by simply changing the communication data from the PLC.

4.2.1 Operating Procedures

i) Switching the operation mode
Switch the operation mode to Network Operation Mode.
The mode can be switched d using one of the methods below.
- Send the communication command "M7"
- Set PRM29 (mode at power-on) = 7, and turn the control power off and on again.
- Switch using command code (21h)

ii) Switching to data input operation
Set table operation and data input operation change input to ON.
OFF: Table operation
ON: Data input operation

iii) Setting the operation content
Set the commands, travel units, and travel speed units.
Then, set the values corresponding to the A code/P code and F code.

iv) Startup by data input operation
Turning on startup input performs the operation content that was set in iii).

4.2.2 Input Data

Table 4.10. Commands

Setting value				Description
Program number selection input				
bit 3	bit 2	bit 1	bit 0	
0	0	0	0	Absolute coordinates (G90)
0	0	0	1	Single rotation absolute coordinates (G90.1)
0	0	1	0	Clockwise rotation absolute coordinates (G90.2)
0	0	1	1	Counter-clockwise rotation absolute coordinates (G90.3)
0	1	0	0	Incremental coordinates (G91)
0	1	0	1	Single rotation incremental coordinates (G91.1)
0	1	1	0	Origin return (G28)
0	1	1	1	Select number of divisions (G101)
1	0	0	0	Change gain multiplier (G12)
1	0	0	1	Brake On (M68)
1	0	1	0	Brake Off (M69)

Table 4.11. Travel Units

Setting value		Description
Travel unit selection input		
bit 1	bit 0	
0	0	Angle units (G105)
0	1	Pulse units (G104)
1	0	Indexing units (G106)

Table 4.12. Travel Speed Units

Setting value	Description
Travel speed unit selection input	
0	Rotational speed (G10)
1	Time (G11)

Table 4.13. A Code/P Code

Setting value A code/P code	Description	
32 bit	Angle:	-360,000 to 360,000 ×1,000 (degrees)
	Pulse	: -540,672 to 540,672 (pulses)
	Indexing and number of divisions: 1 to 255 (indexing, number of divisions)	
	Gain multiplier	: 0, 50 to 200 (%)

Table 4.14. F Code

Setting value F code	Description
32 bit	Rotational speed: 11 to 30,000 ×100 (rpm)
	Time: 10 to 30,000×1,000 (seconds)

The input data used in data input operation are the following five items: Commands, Travel Units, Travel Speed Units, A Code/P Code, and F Code.

The required input data items vary depending on the content of the command. For details, see "Network Operation Mode: Command Combinations" on page 4-4.

Table 4.15. List of allocation of input data used for data input operation execution

Input/Output	Signal name	EtherCAT specifications	EtherNet/IP specifications
Input (PLC→AX)	Program number selection input (bit 0)	Input signal 1 – bit0	Input data Byte 0 – bit 0
	Program number selection input (bit 1)	Input signal 1 – bit1	Input data Byte 0 – bit 1
	Program number selection input (bit 2)	Input signal 1 – bit2	Input data Byte 0 – bit 2
	Program number selection input (bit 3)	Input signal 1 – bit3	Input data Byte 0 – bit 3
	Travel unit selection input (bit 0)	Input signal 1 – bit16	Input data Byte 2 – bit 0
	Travel unit selection input (bit 1)	Input signal 1 – bit17	Input data Byte 2 – bit 1
	Travel speed unit selection input	Input signal 1 – bit18	Input data Byte 2 – bit 2
	A code/P code	Input command 2	Input data Byte 24 to 27
	F code	Input command 3	Input data Byte 28 to 31
	Table operation, data input operation Switching input	Input signal 1 – bit19	Input data Byte 2 – bit 3
	Start input	Input signal 1 – bit8	Input data Byte 1 – bit 0

4.2.3. Examples of Input Data Settings

- Move from current position to 90° in clockwise direction in 1 second

Table 4.16. Operation Commands Corresponding to NC Program G91.1G105G11A90F1

Display name	bit	Setting value*1	Description
Program number selection input	0	1	Single rotation incremental coordinates (G91.1)
	1	0	
	2	1	
	3	0	
Travel unit selection input	0	0	Angle units (G105)
	1	0	
Travel speed unit selection input	-	1	Time (G11)
A code/P code	-	1 5F90h	1 5F90h = 90,000 （units:×1,000 (degrees)) = 90 degrees
F code	-	3E8h	3E8h = 1,000 (units: ×1,000 (seconds)) = 1 second

Note *1: If numeric characters and alphabetical characters are followed by lower-case h, for example “**h”, it is a value in hexadecimals.

- Change gain multiplier to 100

Table 4.17. Operation Commands Corresponding to NC Program G12P100

Display name	bit	Setting value*1	Description
Program number selection input	0	0	Change gain multiplier (G12)
	1	0	
	2	0	
	3	1	
Travel unit selection input	0	-	-
	1	-	
Travel speed unit selection input	-	-	
A code/P code	-	64h	64h = 100%
F code	-	-	-

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