CKD

SMF-2009-A

Instruction Manual

ABSODEX

AX Series

XS Type

DeviceNet specification

- Before using this product, be sure to read this Instruction Manual.
- In particular, read the descriptions on safety carefully.
- Store this Instruction Manual so that it can be taken out and read quickly as necessary.

CKD Corporation

Contents

ABSODEX

AX series [XS type DeviceNet specification]

Instruction Manual No. SMF-2009-A

Created on June 1, 2016

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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 dedicated to the ABSODEX AX series XS type driver DeviceNet specification.

It is not applied to other types.

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

The descriptions, specifications and appearances written in this Instruction Manual may be changed without notice in the future.

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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
		CN3 communication connector(DeviceNet): MSTB2.5/5-STF-5.08AUM (Phoenix Contact)	1

1.2. General Specifications of Driver

Item		AX9000XS-U4 (DeviceNet specification)
Power	Main	Single-phase or three-phase: 200V AC ± 10% to 230V AC ± 10% (standard) 1-100V AC - 10% to 115V AC + 10% (J1:option)
	Control	1-200V AC - 10% to 230V AC + 10% (standard) 1-100V AC - 10% to 115V AC + 10% (J1:option)
Frequency		50/60 Hz
Rated input current		1.8 A
Input: Phase number		Single-phase or three-phase
Output voltage		0~230 V
Output frequency		0~50 Hz
Rated output current		1.9 A
Output: Phase number		Three-phase
Power system		TN, TT, IT
Mass		About 1.6 kg
Outside diameter size		W75 * H220 * D160
Configuration		Open modular type (driver, and controller)
Operating Ambient Temperature Range		0 to 50°C
Operating Relative Humidity Range		20 to 90%RH (No condensation allowed)
Storage Ambient Temperature Range		-20~65ºC
Storage Relative Humidity Range		20 to 90%RH (No condensation allowed)
Atmosphere		Free from corrosive gases, and dust
Anti-noise		1,000V (P-P), pulse width 1μsec, startup 1nsec
Anti-vibration		$4.9m/s^2$
Altitude		Altitude: 1,000 m or less
Protection		IP2X (CN4 and CN5 are excluded)

1.3. Performance Specifications of Driver

Item	Description
Number of Controlled Axis	1 axis, 4,194,304 pulses/rotation
Angle Setting Unit	° (degree), pulse, and number of indexes
Angle Setting Minimum Unit	0.001°, 1 pulse (= about 0.31 sec [0.000086 deg.])
Speed Setting Unit	sec, rpm
Speed Setting Range	0.01 to 100 sec/0.11 to 240 rpm
Number of Indexes	1 to 255
Maximum Instruction Value	8 digit input ±99,999,999
Timer	0.01 to 99.99sec
Programming Language	NC language
Programming Method	Data setting through RS-232C port using PC
Operation Mode	Auto, single block, MDI, 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
DeviceNet Communication Function	<Input> Home positioning instruction, reset, start, stop, continuous rotation stop, emergency stop, answer, position deviation counter reset, program number selection, jog, brake release, servo ON, program number setting, ready return
	<Output> Alarm 1 and 2, positioning completion, in-position, standby for start input, M code 8 points, output during indexing 1•2, home position output, M code strobe, segment position strobe, servo status, ready output
Program Capacity	<NC program> About 6,000 characters (256 pcs.)
	<Point table> 64 points
Electronic Thermal	Protects the actuator from being overheated.

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2. Wiring

2.1. Panel Description

A terminal strip and connectors, etc. are located on the front panel of the driver.

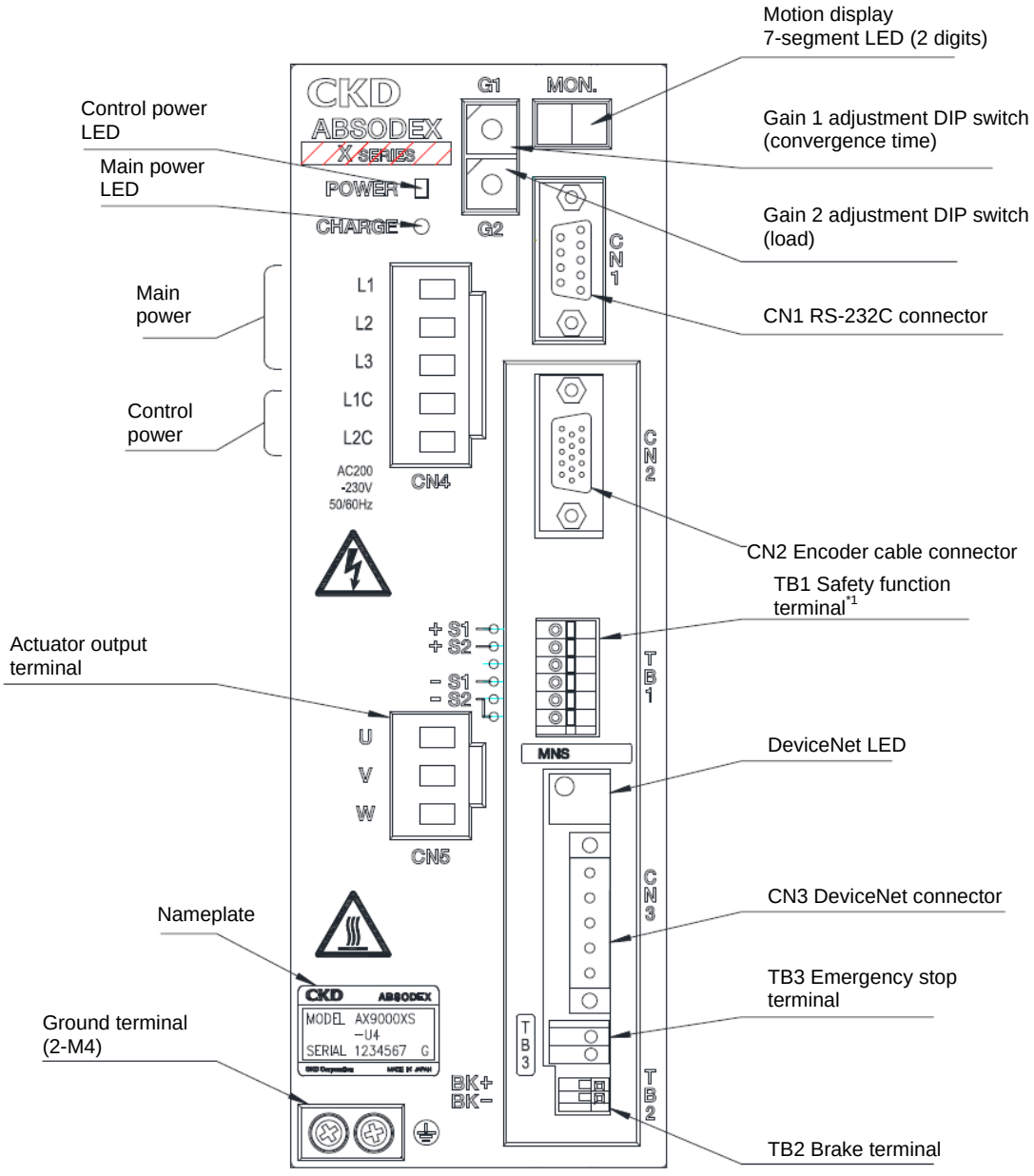


Fig. 2.1 XS type DeviceNet specification, Driver panel

Note *1: The safety function (TB1) of this product does not correspond to the accreditation of the safety standards.

2.2. Communication Connector

The pin layout of DeviceNet communication connector CN3 is shown below.

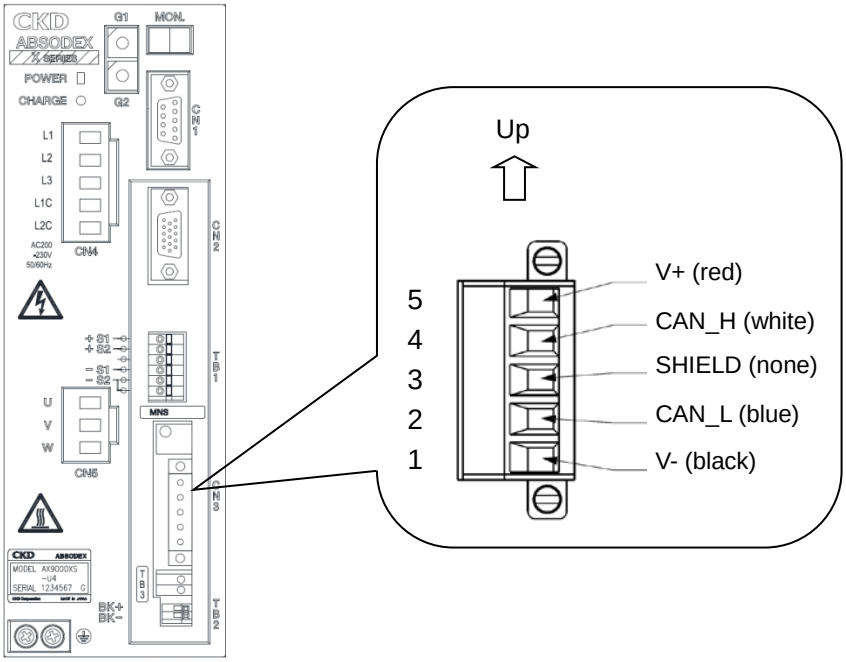


Fig. 2.2 Communication connector, Pin layout

Table 2.1 Pin layout of CN3

Pin	Signal name	Function	Description
1	V-	Communication power (-)	Power supply (DC11 to 25V) with less noise is used.
2	CAN_L	Communication terminal (L)	This terminal is connected to the communication line “CAN_L” of the master station or other slave station.
3	Drain	Shield terminal	The shield line of the cable is connected to this terminal.
4	CAN_H	Communication terminal (H)	This terminal is connected to the communication line “CAN_H” of the master station or other slave station.
5	V+	Communication power (+)	Power supply (DC11 to 25V) with less noise is used.

- It is not connected with the drain (shield terminal) and ground terminal (heat sink section) of the driver.
- We recommend the use of cables and connectors dedicated for DeviceNet.

If this product is the termination of the network, connect a terminating connector between “CAN_L” and “CAN_H”.

2.3. Connecting the communication cable

Follow the procedure below to connect the special DeviceNet cable to the module.

(1) Peel the sheath of the cable off without causing a broken wire (length of peeled cable sheath: 7mm). Do not solder the bare cable. Otherwise poor continuity may be caused. The solderless terminals specified below are recommended. Note that the peeling size of the cable sheath varies according to the type of the solderless terminal (see the figures below).

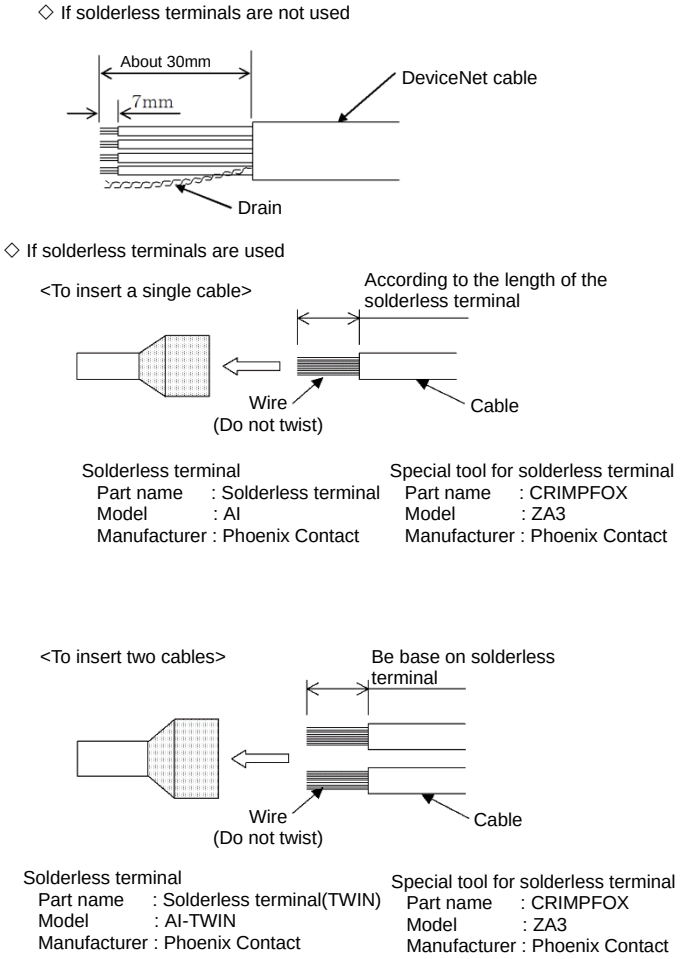


Fig. 2.3 Peeling size of communication cable

(2) Insert the CAN_H (white), CAN_L (blue), V+ (red), V- (black), and Drain (bare) lines of the DeviceNet cable into relevant holes (CAN_H, CAN_L, V+, V-, Drain) while referring to the orientation of the connection connector (MSTB2.5/5-STF-5.08AUM). (For details, see the following Figure.)
The recommended connector is MSTB2.5/5-STF-5.08AUM manufactured by Phoenix Contact.

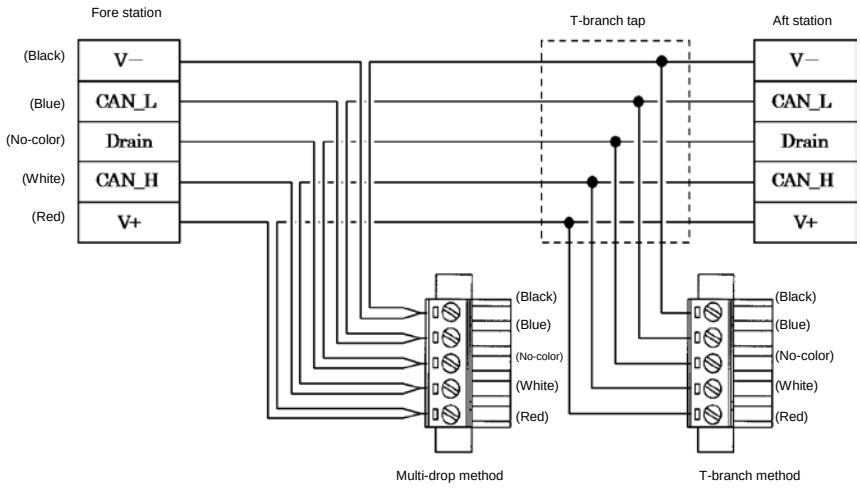


Fig. 2.4 Connection example of communication cable

(3) Secure each line firmly using the cable fixing screws of the connection connector. (Proper tightening torque: 0.5 N•m)
(4) Make sure that the cable colors are matched with those shown on the connector. Insert the connection connectors into the slave station and secure them using the connector fixing screws. (Proper tightening torque: 0.3 N•m)

CAUTION

- Be sure to use special signal cables complying with the DeviceNet specifications.
- For those provided with a connector fixing screw, securely tighten the connector fixing screw when inserting the connector. Otherwise the connector may be dislocated and cause malfunction. For those not provided with a connector fixing screw, check that the catch of the connector snaps in position.
- For those provided with a connector fixing screw, securely tighten the connector fixing screw when inserting the connector. Otherwise the connector may be dislocated and cause malfunction. For those not provided with a connector fixing screw, check that the catch of the connector snaps in position. Loosen the two fixing screws before removing the connector. The connector may be damaged if excess force is applied to the connector without the two screws loosened.
- Remove the connector vertically to avoid excess 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 frequent communication errors and/or communication retries.

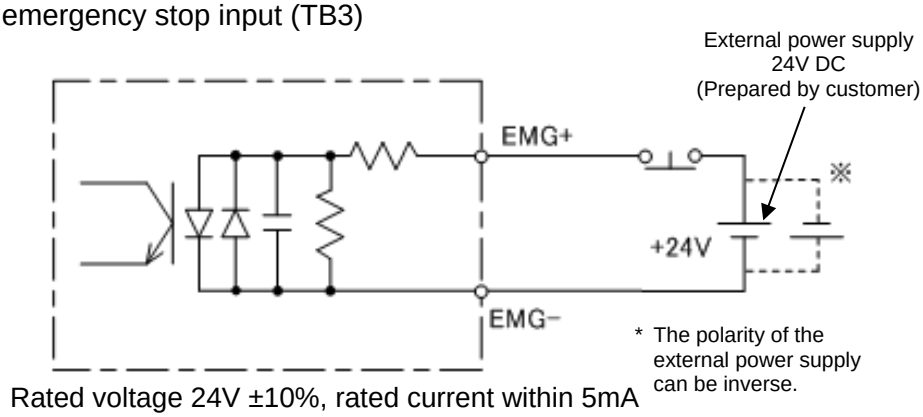
- Only one section of the drain (shielding wire) of the DeviceNet cable must be grounded to avoid ground loop problems. Also, ground the wire as close to the center of the network as possible.
- Primary AC power supply for the communication power supply must not be used among components such as motors and inverters. Those components must be driven by control power supply instead. . Always insert a noise filter to the AC power supply input section as well.

For details of the laying of the communication cable, refer to the DeviceNet Laying Manual, etc.

2.4. IO interface

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

2.4.1. Wiring of emergency stop input (TB3)



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

Fig. 2.5 Connection example of emergency stop input (TB3)

- The emergency stop input will be effective as default setting. Refer to the “AX Series TS, TH, XS Type manual” (SMF-2006) for setting instructions.

- Emergency stop is a “b” contact input. Thus it will take effect when emergency stop input (TB3) becomes open. (Emergency stop using DeviceNet will be effective when the input data is OFF)

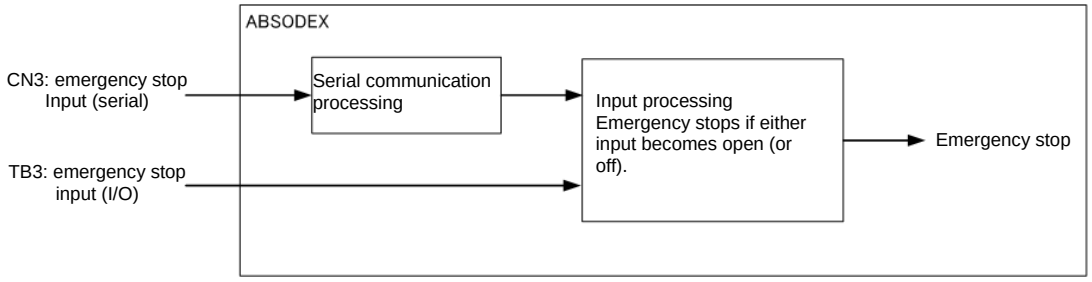


Fig. 2.6 Specification of emergency stop input

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

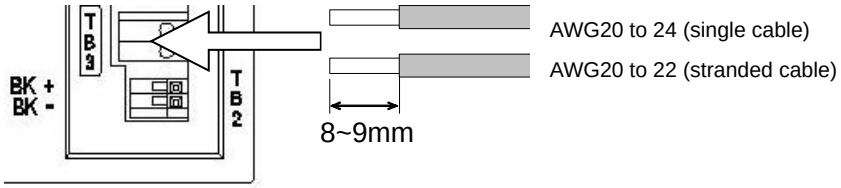


Fig. 2.7 Applicable cable to TB3 and peeling size

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

3. DeviceNet Communication Function

3.1. Communication Specifications

Table 3.1. Communication specifications

Item	Specification
Power voltage (communication power)	DC11V to 25V
Consumption current (communication power)	50 mA or less
Communication Protocol	DeviceNet conformed (remote I/O)
Number of occupied nodes	Input 8 byte/ output 8 byte
Communication speed	500k/250 k/125 kbps (Configured with parameter)
Connection cable	Cable compatible with DeviceNet (5-wire cable with shield: 2 single lines, 2 power lines and 1 shield line)
Node address	0 to 63 (Configured with parameter)
Number of connected modules	Max. 64 stations (Including master)

3.2. Remote I/O

3.2.1. Basic format

The table below shows the basic format of command data sent from the host component (such as PLC) to a DeviceNet unit (Absodex) and response data sent from an Absodex to a host component.

Command data, response data are both 8 byte data.
With 3 bytes occupation, bytes 0 to 2 will be used and others will not be available.

Table 3.2. Format of command data (8 byte)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0
1	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.0
2	2.7	2.6	-	-	2.3	2.2	2.1	2.0
3	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0
4	Monitor code							
5	Written data, lower 8 bits							
6	Command code							
7	Written data, upper 8 bits							

Table 3.3. Format of response data (8 byte)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0.0
1	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.0
2	2.7	2.6	-	-	-	-	2.1	2.0
3	Response code							
4	Monitor data, lower 8 bits							
5	Monitor data, upper 8 bits							
6	Loaded data, lower 8 bits							
7	Loaded data, upper 8 bits							

3.2.2. 8 byte occupied (Input 8 byte/ output 8 byte)

Table 3.4. Memory layout list (8 byte occupied)

PLC → AX(command)

Byte No.	Signal name	Logic	Judgment
0.0	Program number selection input (bit 0)	Positive	Level
0.1	Program number selection input (bit 1)	Positive	Level
0.2	Program number selection input (bit 2)	Positive	Level
0.3	Program number selection input (bit 3)	Positive	Level
0.4	Program number selection input (bit 4) / Program number setting input, second digit	Positive	Level / Edge
0.5	Program number setting input, first digit / Program number selection input (bit 5)	Positive	Level / Edge
0.6	Reset input	Positive	Edge
0.7	Home return command input	Positive	Edge
1.0	Start input	Positive	Edge
1.1	Servo-on input / Program stop input	Positive	Level / Edge
1.2	Ready return input / Continuous rotation stop input	Positive	Edge
1.3	Answer input / Position deviation counter reset	Positive	Edge
1.4	Emergency stop input	Negative	Level
1.5	Brake release input	Positive	Level
1.6	Jog operation input (CW direction) *1	Positive	Edge
1.7	Jog operation input (CCW direction) *1	Positive	Edge
2.0	Parameter number (bit 8) *2 / Movement unit selection input (bit 0) *3	Positive	Level
2.1	Parameter number (bit 9) *2 / Movement unit selection input (bit 1) *3	Positive	Level
2.2	Parameter number (bit 10) *2 / Movement speed unit selection input *3	Positive	Level
2.3	Table operation, data input operation Switching input	Positive	Level
2.4 2.5	Reserved	-	-
2.6	Monitor output execution request	Positive	Level
2.7	Command code execution request	Positive	Edge
3.0	Parameter number (bit 0) *2 /Reserved *3	Positive	Level
3.1	Parameter number (bit 1) *2 /Reserved *3	Positive	Level
3.2	Parameter number (bit 2) *2 /Reserved *3	Positive	Level
3.3	Parameter number (bit 3) *2 /Reserved *3	Positive	Level
3.4	Parameter number (bit 4) *2 /Reserved *3	Positive	Level
3.5	Parameter number (bit 5) *2 /Reserved *3	Positive	Level
3.6	Parameter number (bit 6) *2 /Reserved *3	Positive	Level
3.7	Parameter number (bit 7) *2 /Reserved *3	Positive	Level

AX → PLC(response)

Byte No.	Signal name	Logic
0.0	M code output (bit 0)	Positive
0.1	M code output (bit 1)	Positive
0.2	M code output (bit 2)	Positive
0.3	M code output (bit 3)	Positive
0.4	M code output (bit 4)	Positive
0.5	M code output (bit 5)	Positive
0.6	M code output (bit 6)	Positive
0.7	M code output (bit 7)	Positive
1.0	In-position output	Positive
1.1	Positioning completion output	Positive
1.2	Start input wait output	Positive
1.3	Alarm output 1	Negative
1.4	Alarm output 2	Negative
1.5	Indexing-in-progress output 1 / Home position output	Positive
1.6	Indexing-in-progress output 2 / Servo state output	Positive
1.7	Ready state output	Positive
2.0	Segment position strobe output	Positive
2.1	M code strobe output	Positive
2.2 ～ 2.5	Reserved	-
2.6	Monitoring	Positive
2.7	Command code execution complete	Positive
3.0 ～ 3.7	Reserved	-

Note *1: Only the network operation mode can be used.
*2: Selected in the case of a table operation (command 2.3 = OFF).
*3: Selected in the case of a data input operation (command 2.3 = ON).

Table 3.5. Monitor code (command byte 4) list

Code No.	Monitored item	Data length	Unit	Range
01h	Current position in full rotation (deg.)	16bit	×10 [deg.]	0 to 3,599
03h	Current position in full rotation (pulse)	16bit	1/128 [pulse]	0 to 32,767
05h	Position deviation amount	16bit	[pulse]	-32,768 to 32,767
07h	Program number	16bit	[No.]	0 to 999
08h	Electronic thermal relay	16bit	×100 [°C]	0 to 65,535
09h	Rotation speed	16bit	[rpm]	-32,768 to 32,767
0Ah	Point table number	16bit	[No.]	0 to 63

Table 3.6. Response code (response: byte 3) list *1

Code No.	Description of error	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 loaded or set is specified.
3	Error in writing range	An excessive value is executed.
4	Timing error	The writing command code is executed during processing of the CN1 communication function.

Note *1: The response code is shared in the monitor, load command and writing command.

Table 3.7. Load command code (command byte 6) list

Code No.	Item/Function	Loaded data	
		Response: Byte 6	Response: Byte 7
10h	Current alarm loading	Alarm loading 1	Alarm loading 2
20h	Operation mode loading	Current operation mode No.	0 (fixed)
24h	Parameter loading (upper 16 bits)	Parameter set value [bit 23-16]	Parameter set value [bit 31-24]
25h	Parameter loading (lower 16 bits)	Parameter set value [bit 7-0]	Parameter set value [bit 15-8]

Current alarm loading (10h)

Currently occurring alarm No. is loaded.
It is set as loaded data. Each byte indicates the type, and up to two 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. Alarms not expressed in 0 to F

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

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 3.8. 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 (24h, 25h)

The set value of the parameter designated with the parameter number (command 3.7-3.0, 2.2-2.0) 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 3-7.

Table 3.9. Writing command code (command byte 6) list

Code No.	Item/Function	Written data	
		Command: Byte 5	Command: Byte 7
21h	Operation mode switching	Automatic operation number	0 (fixed)
28h	Parameter setting (upper 16 bits)	Parameter set value [bit 23-16]	Parameter set value [bit 31-24]
29h	Parameter setting (lower 16 bits)	Parameter set value [bit 7-0]	Parameter set value [bit 15-8]
30h	Point table initialization	Table number initialized	0 (fixed)
31h	Parameter initialization	999 (lower 8bits) = E7h	999 (upper 8bits) = 03h

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 3.10. 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 (28h, 29h)

The set value of the parameter designated with the parameter number (command 3.7-3.0, 2.2-2.0) 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 3-7.

Point table initialization (30h)

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

Table 3.11. Point tables after initialization

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

Parameter initialization (31h)

The set values of all parameters are initialized.
Parameter 61 (station number and baud rate setting) is not targeted.

Table 3.12. Parameter list [*1]

PRM number	Name	Set range	Initial value	Unit
1	Cam curve	1~5	1	-
2	Acceleration/Deceleration time of MC2 curve	1~5,000	100	x 100 [sec]
3	Home position offset amount	-2,097,152~2,097,151	0	[Pulse]
4	Home positioning direction	1~3	1	-
5	Home positioning speed	100~2,000	200	x 100 [rpm]
6	Acceleration/Deceleration time of home positioning	10~200	100	x 100 [sec]
7	Home positioning stop	1, 2	2	-
8	Soft limit, Coordinate A (+ direction)	-99,999,998~99,999,999	99,999,999	[Pulse]
9	Soft limit, Coordinate B (− direction)	-99,999,999~99,999,998	-99,999,999	[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 home positioning completion	1, 2	2	-
14	Jog speed	1~10,000	200	x 100 [rpm]
15	Jog acceleration/deceleration time	10~200	100	x 100 [sec]
16	In-position range	1~80,000	15,000	[Pulse]
17	Number of times of in-position sampling	1~2,000	1	[Times]
18	Position deviation amount	Cannot be set	-	[Pulse]
19	Upper limit value of position deviation amount	1~4,194,304	30,000	[Pulse]
20	Speed over limit	1~37,749	37,749	[rpm]
21	Deceleration rate during emergency stop	1 to 1,396, 9,999	9,999	[Pulse/2 msec^2]
22	Delay time of emergency stop servo OFF	0~2,000	1,000	[msec]
23	Emergency stop input	1~3	3	-
24	Actuator temperature increase	Cannot be set	-	x 100 [°C]
25	Upper limit value of actuator temperature	Cannot be set	7,000	x 100 [°C]
27	Delay time after brake output	0~1,000	100	[msec]
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	0~99	0	[%]
34	Indexing-in-progress output 2	0~99	0	[%]
36	Switching of I/O program number selection method	1~5	1	-
37	Segment position range width of designation of indexes	1~2,097,152	10,000	[Pulse]
38	Rotation direction at time of designation of indexes	1~4	3	-
39	Torque limitation	1~100	100	[%]
45	Coordinate recognition range when power is turned ON	0~4,194,303	2,097,151	[Pulse]
46	Home position output range	0~80,000	15,000	[Pulse]
47	Positioning completion output time	0~1,000	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	1,000~100,000	20,000	x 100 [Hz]
63	Cut OFF frequency of low-pass filter 2	1,000~100,000	50,000	x 100 [Hz]
64	Cut OFF frequency of notch filter 1	1,000~100,000	50,000	x 100 [Hz]
65	Cut OFF frequency of notch filter 2	1,000~100,000	50,000	x 100 [Hz]
66	Filter switch	0~15	1	-
67	Integration limiter	1~4,194,304	770,000	[Pulse]
70	Value Q for notch filter 1	10~990	100	x 100 [–]
71	Value Q for notch filter 2	10~990	100	x 100 [–]
72	Integration gain magnification	10~1,000	100	x 100 [–]
80	Integration gain	0~320,000	0	x 10,000 [–]
81	Proportion gain	0~5,120,000	0	x 10,000 [–]
82	Differentiation gain	0~20,480,000	0	x 10,000 [–]
83	Auto tuning command	1~32	0	-
87	Auto tuning torque	0~8,192	1,000	-
88	Auto tuning measurement start speed	0~8,000	800	[Pulse/msec]
89	Auto tuning measurement completion speed	0~8,000	5,500	[Pulse/msec]

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

3.2.3. 3 byte occupied (Input 3 byte/output 3 byte)

Table 3.13. Memory layout list (3 byte occupied)

PLC → AX (command)

Byte No.	Signal name	Logic	Judgment
0.0	Program number selection input (bit 0)	Positive	Level
0.1	Program number selection input (bit 1)	Positive	Level
0.2	Program number selection input (bit 2)	Positive	Level
0.3	Program number selection input (bit 3)	Positive	Level
0.4	Program number setting input, second digit / Program number selection input (bit 4)	Positive	Edge Level
0.5	Program number setting input, first digit / Program number selection input (bit 5)	Positive	Edge Level
0.6	Reset input	Positive	Edge
0.7	Home return command input	Positive	Edge
1.0	Start input	Positive	Edge
1.1	Servo-on input / Program stop input	Positive	Level Edge
1.2	Ready return input / Continuous rotation stop input	Positive	Edge
1.3	Answer input / Position deviation counter reset input	Positive	Edge
1.4	Emergency stop input	Negative	Level
1.5	Brake release input	Positive	Level
1.6	Jog operation input (CW direction) *1	Positive	Edge
1.7	Jog operation input (CCW direction) *1	Positive	Edge
2.0 ~ 2.7	Reserved *2	-	-

AX → PLC (response)

Byte No.	Signal name	Logic
0.0	M code output (bit 0)	Positive
0.1	M code output (bit 1)	Positive
0.2	M code output (bit 2)	Positive
0.3	M code output (bit 3)	Positive
0.4	M code output (bit 4)	Positive
0.5	M code output (bit 5)	Positive
0.6	M code output (bit 6)	Positive
0.7	M code output (bit 7)	Positive
1.0	In-position output	Positive
1.1	Positioning completion output	Positive
1.2	Start input wait output	Positive
1.3	Alarm output 1	Negative
1.4	Alarm output 2	Negative
1.5	Indexing-in-progress output 1 / Home position output	Positive
1.6	Indexing-in-progress output 2 / Servo state output	Positive
1.7	Ready state output	Positive
2.0	Segment position strobe output	Positive
2.1	M code strobe output	Positive
2.2 ~ 2.7	Reserved	-

Note *1: Only the network operation can be used.
*2: Monitor function can not be used with 3 bytes occupation.

3.3. Data Communication Timing Chart

3.3.1. Monitor code

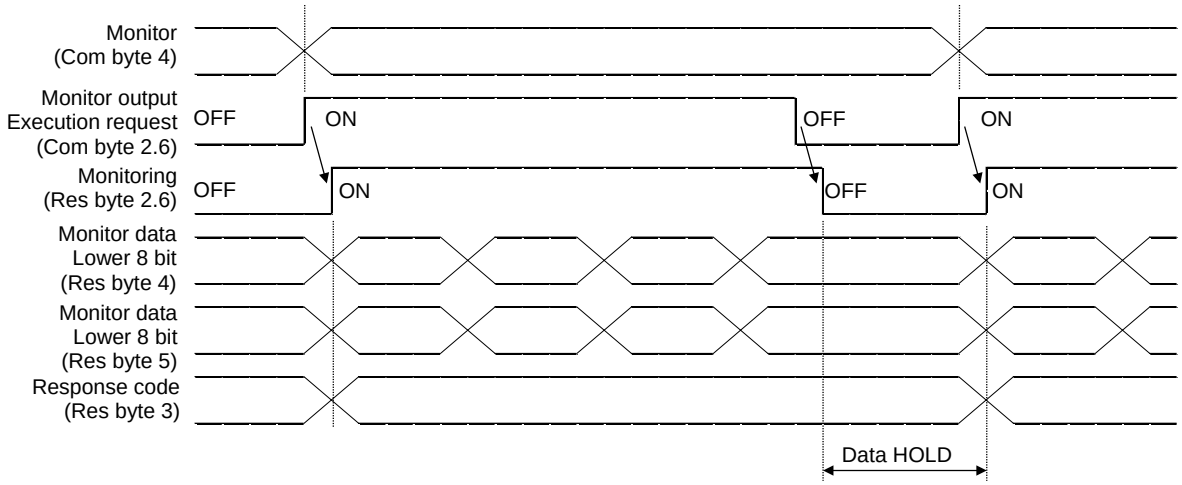


Fig. 3.1. Timing chart for monitor code execution

Entering monitor (command byte 4) and monitor output execution request (command byte 2.6) as monitor codes will set the following data. All 16-bit data pieces will be divided into the upper 8 bits and lower 8 bits and stored in the memory. All data is in hexadecimals. At the time, the monitoring signal (response byte 2.6) is turned on simultaneously.

Monitor data, lower 8 bits (response byte 4): Lower 8 bits of data requested with monitor (command byte 4)
Monitor data, upper 8 bits (response byte 5): Upper 8 bits of data requested with monitor (command byte 4)

If there is no data at “response byte 5”, the sign is acquired. The sign is "00" in case of "+" while it is "FF" in case of "-."
The monitor data acquired in remote registers are always updated while the monitoring signal (response byte 2.6) remains turned on.
If the monitoring signal (response byte 2.6) is turned off, monitor data (response byte 4 and 5) will be held.
If a monitor code not included in specifications is set on monitor (command byte 4), an error code (□1) will be set in the response code.

3.3.2. Command code

i) Load command code (00h to 10h)

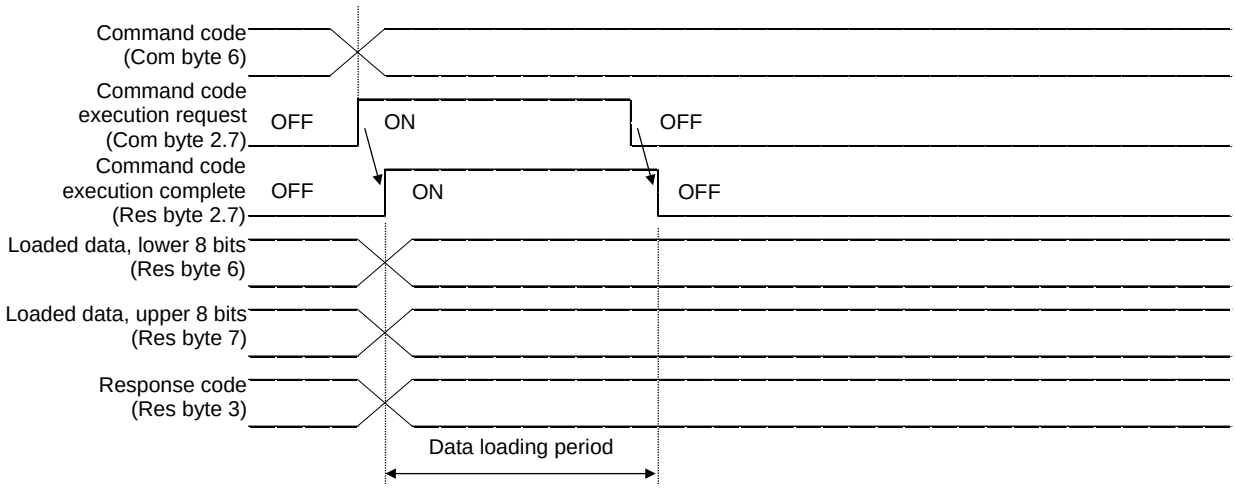


Fig. 3.2. Timing chart for load command code execution

Enter the load command code as command code (command byte 6), enter the parameter number as necessary and turn the command code execution request (command byte 2.7) on to acquire the data corresponding to the specified loading code in load data (response byte 6,7).
16-bit data pieces will be divided into the upper 8 bits and lower 8 bits and stored in the memory. All data is in hexadecimals.
At the time, the command code execution completion (response byte 2.7) is turned on simultaneously.
Load data from (response byte 6,7) while the command code execution request (command byte 2.7) remains turned on.
The data is held until the next load command code is entered and the command code execution request (command byte 2.7) is turned on.
If a command code not included in specifications is set as a command code (command byte 6), 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 (command byte 2.7) off after data loading is finished.

ii) Writing command code

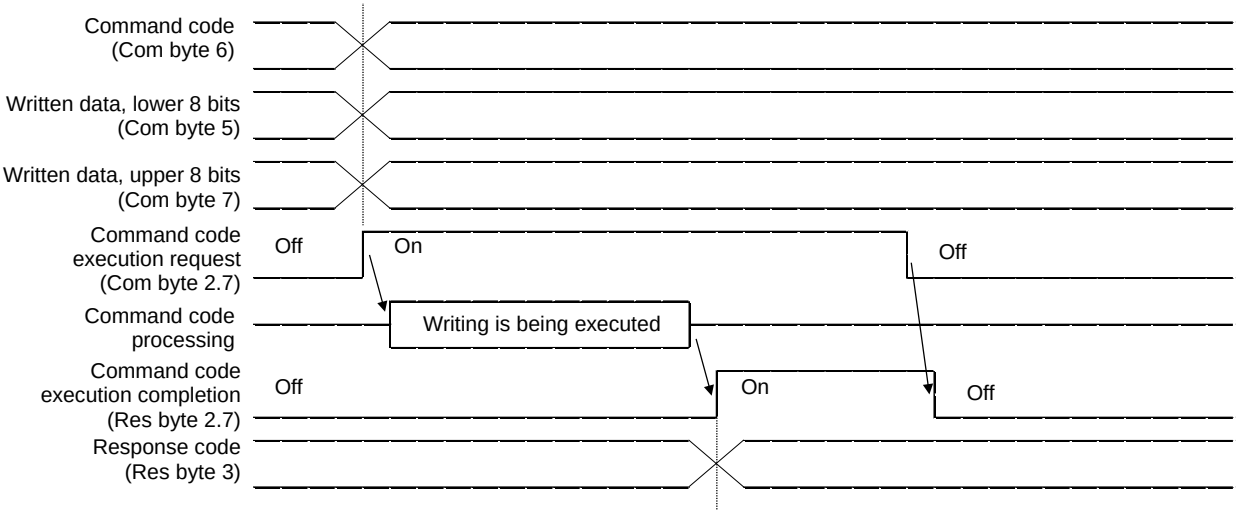


Fig. 3.3. Timing chart for writing command code execution

Set the writing command code as a command code (command byte 6) and set the written data as written data (command byte 5,7) and, as necessary, a parameter number.
Turn on the command code execution request (command byte 2.7) and write into data designated with the command code. Written 16-bit data pieces will be divided into the upper 8 bits and lower 8 bits and stored in the memory.
All data is in hexadecimals. After writing, the command code execution completion (response byte 2.7) is turned on. If a command code not included in specifications is set as a command code (command byte 6), 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 writing 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 (command byte 2.7) off after the command code execution completion (response byte 2.7) is turned on.

3.3.3. Response code

If the monitor code or command code specified in the memory is out of the allowable setting range, an error code is specified as a response code (response byte 3). If they are normal, "00" is set.

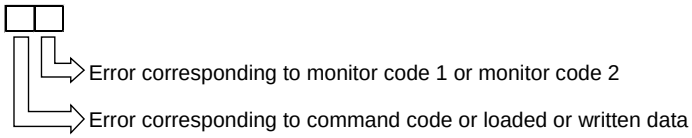


Fig. 3.4. Description of error of response code

3.4. Defining the DeviceNet Register

Enter the station number and baud rate using AX Tools Ver 2.10 or later.
The default station number is 63, the default baud rate is 2 (500 kbps) and the default I/O size is 0 (8 byte).

i) DeviceNet setting screen
Select "Setting" - "DeviceNet" from the menu of the AX Tools to open the "DeviceNet Setting Register" screen.

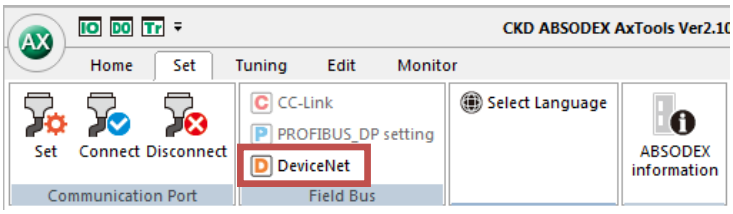


Fig. 3.5. Setting menu of AX Tools

ii) DeviceNet register
Check that a value is displayed on the DeviceNet register setting and select “Setting (ABSODEX)”.

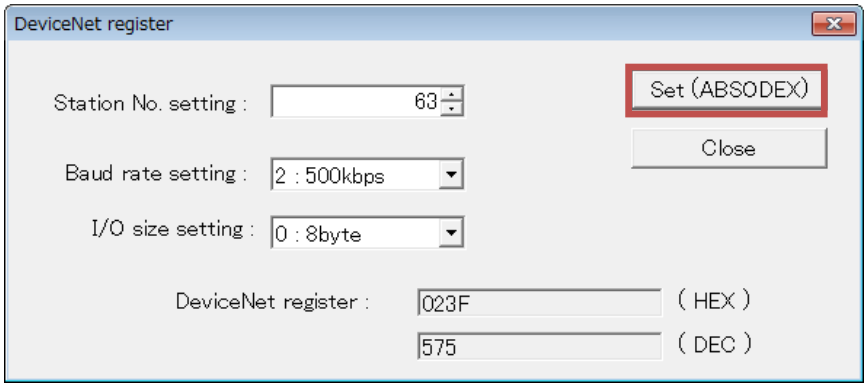


Fig. 3.6. Setting screen of DeviceNet register

<Station No. setting>
The current station number setting is displayed. Enter the new station number in the range from 0 to 63.
<Baud rate setting>
The current baud rate setting is displayed. Select the desired one among 0 (125kbps), 1 (250kbps), 2 (500kbps).
<I/O size setting>
The current I/O size setting is displayed. Select the desired one among 0 (8byte), 1 (3byte).
* The default setting of the EDS file is 8 bytes. Change the setting of the host (PLC) manually when using with 3 bytes.
<DeviceNet register>
The specified values of the station number, baud rate and I/O registers are displayed.
<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 station No. and baud rate will take effect after the power has been restarted.

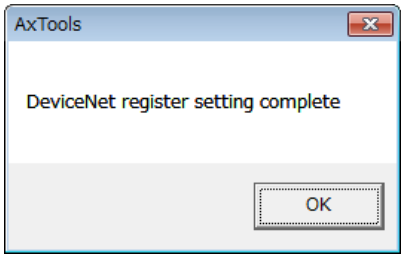


Fig. 3.7. Screen for end of setting

iv) Error in setting
The following screen is displayed if there is an error in the station number setting.

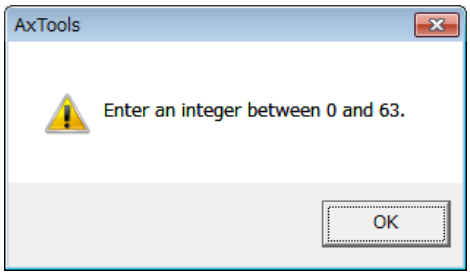


Fig. 3.8. Warning screen at time of error setting of station number

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

3.5. Monitoring the DeviceNet Communication State

The communication state can be monitored using AX Tools Ver 2.10 or later.

i) I/O view
Select “Monitor” - “I/O signal state indication” from the menu of the AX Tools to display the screen for “I/O indication”.

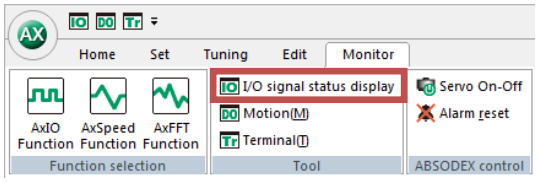


Fig. 3.9. AX Tools monitor menu

ii) I/O check
The I/O state by DeviceNet communication can be monitored.
“*” shows negative logic, thus, the I/O indication will indicate ON when it is open.

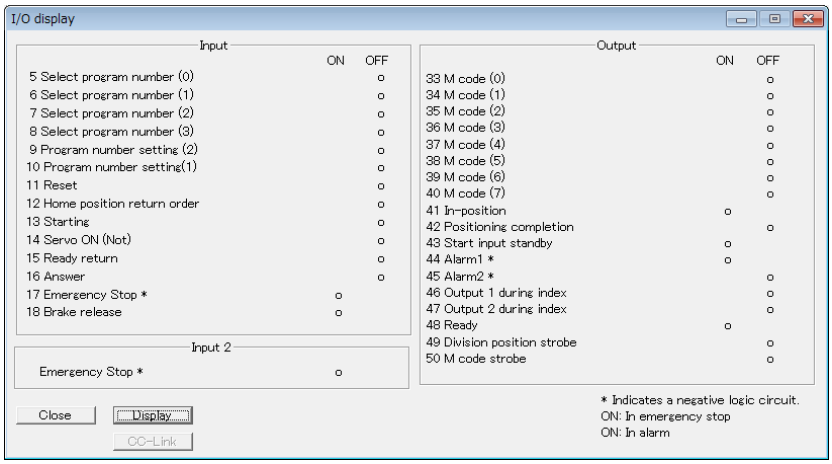


Fig. 3.10. Screen example of I/O indication

3.6. LED Indication

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

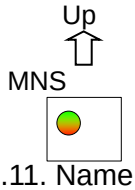


Fig. 3.11. Name of LED

Table 3.14. LED specification list

LED	Color	Description of indication
MNS	Green /Red	The Module/Network status is indicated with a combination of the green and red LEDs. The error status is indicated.

Table 3.15. LED state list

MNS	Contents	Remarks
●	Device Not Powered/Not On–line → The device may not be powered.	After checking that the control power and communication power are wire correctly, turn ON the power.
○Green	This shows the correct status.	-
◎Green	Waiting for establishment of the connection from the master	-
◎Red	Any one or more of the following conditions: • Recoverable fault • One or more I/O Connections are in the Timed-Out state • No network power present	After checking the following items, restart the slave. • Check that the communication speed of the master is the same as that of the slave. • Check that the cable length (main line and branch line) is proper. • Check that the cable does not have any faulty wiring and it is not loose. • Check that the terminating resistors are connected only to both ends of the main line. • Check that the noise is small.
○Red	The device has an unrecoverable fault → Bus-off	
○Red	The device has an unrecoverable fault → Duplicate MAC ID	After correcting the settings so that the node address is not duplicated, turn ON the control power.
◎Red/ Green	Network Access error	After checking that the status of master, turn ON the communication power.

○: Lit, ●: Unlit, ◎: Blink

3.7. 7-segment LED Indication

A station number is indicated on the 7-segment LED. The flow after the power is turned on is as shown in the following.

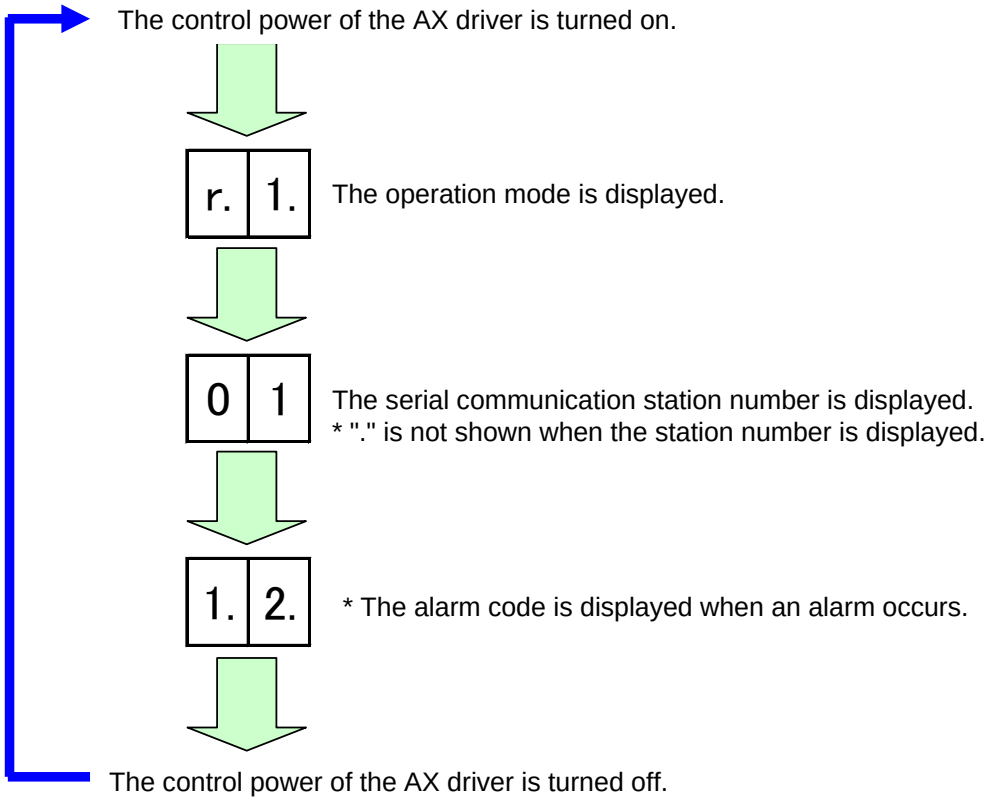


Fig. 3.12. 7-segment LED indication specifications

4. Network Operation Mode

The network operation mode is an operation mode which can be used for wiring saving specification-U4 (DeviceNet).

4.1. Point Table Operation

The point table operation use point table data in the ABSODEX driver to operate.
As for point table data, point table data can be referred to and set from the PLC.

4.1.1. Operation method

i) Set a point table.
Set it using AX Tools Ver 2.10 or later or a command code.
A command code can be used only in the network operation mode.

ii) Operation mode switching
Switch the operation mode to the “network operation mode”.
The switching method can be performed by any of the following.
- Send communication command “M7”.
- Set PRM29 (mode when power is turned on) = 7 and restart the control power.
- Switch using a command code (21h).

iii) Switch to a table operation.
Turn off the table operation and data input operation switching input (command byte 2.3).
OFF : Table operation
ON : Data input operation

iv) Selection of point table
For selection, use a program number selection input (command byte 0.0 to 0.5).
The selection method is a method set in PRM36 (switching of I/O program number selection method). The selection range of a point table is 0 to 63.

v) Start of point table
Execute the point table being selected by turning on the start input.

4.1.2. Point table data

In the point tables, there are data of shared tables and tables 0 to 63.
Respective data can load and write values with communication codes and command codes from the PLC as with parameters.

Table 4.1. Point table data list (1/2)

Table number	Corresponding PRM number	Description	Set range	Initial value
-	197	Instruction of shared table	1~6	1
		1: Absolute dimension (G90) 2: Full rotation absolute dimension (G90.1) 3: CW direction rotation absolute dimension (G90.2) 4: CCW direction rotation absolute dimension (G90.3) 5: Incremental dimension (G91) 6: Full rotation incremental dimension (G91.1)		
-	198	Movement unit of shared table	1~3	1
		1: Angle unit (G105) 2: Pulse unit (G104) 3: Index unit (G106)		
-	199	Movement speed unit of shared table	1~2	1
		1: Rotation speed (G10) 2: Time (G11)		
0	200	Instruction	0~11	0
		0: Instruction set to shared table 1: Absolute dimension (G90) 2: Full rotation absolute dimension (G90.1) 3: CW direction rotation absolute dimension (G90.2) 4: CCW direction rotation absolute dimension (G90.3) 5: Incremental dimension (G91) 6: Full rotation incremental dimension (G91.1) 7: Home positioning (G28) 8: Designation of number of segments (G101) 9: Change of magnification of gain (G12) 10: Brake activation (M68) 11: Brake release (M69)		
	201	Movement unit	0~3	0
		0: Movement unit set to shared table 1: Angle unit (G105) 2: Pulse unit (G104) 3: Index unit (G106)		
	202	Movement speed unit	0~2	0
		0: Movement speed unit set to shared table 1: Rotation speed (G10) 2: Time (G11)		

Table 4.1. Point table data list (2/2)

Table number	Corresponding PRM number	Description	Set range	Initial value
0	203	A code/P code	-4,194,304 ~4,194,304	0
		Set the set values (values equivalent to A code and P code of NC program) such as the angle depending on the descriptions of the instruction and movement unit within the following range. In case of angle :-360,000~360,000 x 1,000 [deg.] In case of pulse :-4,194,304~4,194,304 [Pulse] In case of number of indexes and segments :1~255 [Number of indexes and segments] In case of gain magnification : 0, 50 to 200 [%]		
	204	F code *1	10~240,000	2,000
		Set the set values (values equivalent to F code of NC program) such as the rotation speed depending on the descriptions of the instruction and movement speed unit within the following range. In case of rotation speed :110~240,000 x 1,000 [rpm] In case of time :10~100,000 x 1,000 [sec]		
n (1~63)	200 + 5 x n	Instruction	0~11	0
		Refer to the explanation of the instruction of table 0.		
	201 + 5 x n	Movement unit	0~3	0
		Refer to the explanation of the movement unit of table 0.		
	202 + 5 x n	Movement speed unit	0~2	0
		Refer to the explanation of the movement speed unit of table 0.		
	203 + 5 x n	A code/P code	-4,194,304 ~4,194,304	0
		Refer to the explanation of the A code/P code of table 0.		
	204 + 5 x n	F code	10~240,000	2,000
		Refer to the explanation of the F code of table 0.		

Note *1: In the NC program, the initial value of the movement speed unit is the movement time [sec]. In the point table, the initial value is the rotation speed [rpm].

One table consists of five items, “Instruction”, “Movement unit”, “Movement speed unit”, “A code/P code” and “F code”. Required items vary depending on the description of the instruction.

Table 4.2. Network operation mode instruction combination list

Instruction	Movement unit	Movement speed unit	A code /P code	F code
Absolute (G90)	○	○	○	○
Full rotation absolute (G90.1)	○	○	○	○
CW direction absolute (G90.2)	○	○	○	○
CCW direction absolute (G90.3)	○	○	○	○
Incremental (G91)	○	○	○	○
Full rotation incremental (G91.1)	○	○	○	○
Home positioning (G28)	×	×	×	×
Designation of number of segments (G101)	×	×	○	×
Change of magnification of gain (G12)	×	×	○	×
Brake activation (M68)	×	×	×	×
Brake release (M69)	×	×	×	×

4.1.3. Point table setting example

- Turning operation using shared table

Table 4.3. NC program, Operation instruction equivalent to G90G105G11A90F3

Table	Description	Set value	Operation
Shared table	Instruction	1	Absolute dimension
	Movement unit	1	Angle unit
	Movement speed unit	2	Time
n	Instruction	0	Moves to 90 degrees of the absolute coordinate in 3 sec (the absolute, angle unit and speed unit set to the shared table are used).
	Movement unit	0	
	Movement speed unit	0	
	A code /P code	90,000	
	F code	3,000	

When the set values of the instruction, movement unit and movement speed unit of tables 0 to 63 are 0 (initial value), the setting set to the shared table is used. In this case, the operation descriptions of tables 0 to 63 can be changed only by changing the set values of the shared table.
If you want to execute an operation different from the shared table, set the set values of the instruction, movement unit and movement speed unit of tables 0 to 63 to values other than 0.

- Operation not using shared table

Table 4.4. NC program, Operation instruction equivalent to G91G104G11A-50,000F1

Table	Description	Set value	Operation
Shared table	Instruction	1	Absolute dimension
	Movement unit	1	Angle unit
	Movement speed unit	1	Rotation speed
n	Instruction	5	Moves to the position of −50,000 pulses from the current position in 1 sec (the instruction, movement unit and speed unit different from the shared table are used).
	Movement unit	2	
	Movement speed unit	2	
	A code /P code	-50,000	
	F code	1,000	

- Home positioning

Table 4.5. NC program, Operation instruction equivalent to G28

Table	Description	Set value	Operation
n	Instruction	7	Home positioning
	Movement unit	-	Set values are ignored. Hereinafter written as "–"
	Movement speed unit	-	
	A code /P code	-	
	F code	-	

- Designation of number of segments

Table 4.6. NC program, Operation instruction equivalent to G101A4

Table	Description	Set value	Operation
n	Instruction	8	Designation of number of segments
	Movement unit	-	-
	Movement speed unit	-	
	A code /P code	4	Number of segments 4
	F code	-	-

- Change of magnification of gain

Table 4.7. NC program, Operation instruction equivalent to G12P0

Table	Description	Set value	Operation
n	Instruction	9	Change of magnification of gain
	Movement unit	-	-
	Movement speed unit	-	
	A code /P code	0	0%
	F code	-	-

- Brake activation

Table 4.8. NC program, Operation instruction equivalent to M68

Table	Description	Set value	Operation
n	Instruction	10	Brake activation
	Movement unit	-	-
	Movement speed unit	-	
	A code /P code	-	
	F code	-	

- Brake release

Table 4.9. NC program, Operation instruction equivalent to M69

Table	Description	Set value	Operation
n	Instruction	11	Brake release
	Movement unit	-	-
	Movement speed unit	-	
	A code /P code	-	
	F code	-	

4.2. Data Input Operation

In a data input operation, ABSODEX is operated using reception data from the PLC. Consequently, the operation description of ABSODEX can be changed only by changing the communication data from the PLC.

4.2.1. Operation method

i) Switch the operation mode.
Switch the operation mode to the “network operation mode”.
The switching method can be performed by any of the following.
- Send communication command “M7”.
- Set PRM29 (mode when power is turned on) = 7 and restart the control power.
- Switch using a command code (21h).

ii) Switch to a table operation.
Turn on the table operation and data input operation switching input (command byte 2.3).
OFF : Table operation
ON : Data input operation

iii) Setting of operation description
Set the instruction, movement unit and movement speed unit.
Then send values equivalent to the A code/P code and F code.

iv) Start by data input operation
The operation description set in iii) is executed by turning on the start input.

4.2.2. Input data

Table 4.10. Instruction list

Set value (command)				Description
0.3	0.2	0.1	0.0	
0	0	0	0	Absolute dimension (G90)
0	0	0	1	Full rotation absolute dimension (G90.1)
0	0	1	0	CW direction rotation absolute dimension (G90.2)
0	0	1	1	CCW direction rotation absolute dimension (G90.3)
0	1	0	0	Incremental dimension (G91)
0	1	0	1	Full rotation incremental dimension (G91.1)
0	1	1	0	Home positioning (G28)
0	1	1	1	Designation of number of segments (G101)
1	0	0	0	Change of magnification of gain (G12)
1	0	0	1	Brake activation (M68)
1	0	1	0	Brake release (M69)

Table 4.11. Movement unit list

Set value (command)		Description
2.1	2.0	
0	0	Angle unit (G105)
0	1	Pulse unit (G104)
1	0	Index unit (G106)

Table 4.12. Movement speed unit

Set value (command)	Description
2.2	
0	Rotation speed (G10)
1	Time (G11)

Table 4.13. A code/P code list

Set value (command)		Description		
Byte 6	Byte 7			
Lower 8 bits	Upper 8 bits	In case of angle In case of pulse	:-3,600~3,600 :-32,768~32,767	x 10 [deg.] 1/128 [pulse]
		In case of number of indexes and segments	:1~255	[Number of indexes and segments]
		In case of gain magnification	: 0, 50 to 200	[%]

Table 4.14. F code list

Set value		Description		
Byte 3	Byte 5			
Lower 8 bits	Upper 8 bits	In case of rotation speed	11~24,000	x 100 [rpm]
		In case of time	10~30,000	x 1,000 [sec]

In input data used for a data input operation, there are five items, “Instruction”, “Movement unit”, “Movement speed unit”, “A code/P code” and “F code”.
Required input data items vary depending on the description of the instruction. For details, refer to “Network Operation Mode, Instruction Combination List” on page 4-4.

4.2.3. Input data setting examples

- Moves 90 degrees from the current position in the CW direction in 1 sec.

Table 4.15. NC program, Operation instruction equivalent to G91.1G105G11A90F1

Command	Set value	Description
0.0	1	Full rotation incremental dimension (G91.1)
0.1	0	
0.2	1	
0.3	0	
2.0	0	Angle unit (G105)
2.1	0	
2.2	1	Time (G11)
Byte 6	84h	0384h = 900 (unit: x 10 [deg.]) = 90 degrees
Byte 7	03h	
Byte 3	E8h	03E8h = 1,000 (unit: x 1,000 [sec]) = 1 sec
Byte 5	03h	

- Change the gain magnification to 100.

Table 4.16. NC program, Operation instruction equivalent to G12P100

Command	Set value	Description
0.0	0	Change of magnification of gain (G12)
0.1	0	
0.2	0	
0.3	1	
0.4	-	-
0.5	-	
0.6	-	
0.7	0064h	0000 0064h = 100%
0.8	0000h	
0.9	-	-

--- MEMO ---