Chapter 15 CANopen Communication Module AH10COPM-5A

15

Table of Contents

15.1 Introduction

AH10COPM-5A is connected to the right side of an AH500 series CPU module, and forms a CANopen master station or CANopen slave station with the AH500 series CPU module.

15.1.1 Characteristics

- AH10COPM-5A and an AH500 series CPU module form CANopen communication, and support a CANopen protocol.
- CANopen Builder provides a simple graphic interface. It automatically scans and identifies all the slave stations on a bus.
- AH10COPM-5A supports CANopen master stations and CANopen slave stations.
- An AH500 series CPU module can be connected to eight AH10COPM-5A modules at most.
- The eight transmission speeds which are supported are 10 kbps, 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, and 1 Mbps.

15.1.2 Functions

AH10COPM-5A can be used as a CANopen master station, or a CANopen slave station.
When AH10COPM-5A is used as a master station, it has the following functions.

- It conforms to the CANopen protocol DS301 V4.02.
- It supports a NMT master.
- Error control: It supports a heartbeat and node guarding protocol.
- It supports PDOs.
  The maximum number of RxPDOs it supports is 200, and the maximum quantity of data it supports is 960 bytes.
  The maximum number of TxPDOs it supports is 200, and the maximum quantity of data it supports is 960 bytes.
  Every slave station can be assigned eight TxPDOs and eight RxPDOs.
  PDO transmission type: The transmission triggered by an event, the transmission triggered by time, synchronous cyclic transmission, and synchronous acyclic transmission are supported.
  PDO mapping: Every PDO can be mapped to 32 parameters at most.
  Data types supported:

Storage	Data type
1-bit	BOOL
8-bit	SINT, USINT, BYTE
16-bit	INT, UINT, WORD
32-bit	DINT, UDINT, REAL, DWORD
64-bit	LINT, ULINT, LREAL, LWORD

- It supports SDOs.
  Number of SDO servers: 0
  Number of SDO clients: 3
  It supports a standard SDO expedited transfer.
  It supports automatic SDO. Twenty automatic SDOs at most can be executed in a slave station.
  In a PLC diagram, SDOs can be used to write data to slave station, and read data from a slave station.
- It supports an emergency protocol.
  It can store five latest emergency messages for every slave station.
  It can indicate that there is an emergency message in a slave station by means of a digital display.
  It can read an emergency message by means of a PLC diagram.
- Sync-Producer (Range: 0~65535 ms)
- It functions as the interface between Delta CANopen Builder and a CANopen network. CANopen builder can directly configure a network through AH10COPM-5A.
- When AH10COPM-5A exchanges PDOs with an AH500 series CPU module, users only need to write a program for the D registers in the AH500 series CPU module which are mapped, and do

not need to use FROM/TO. The users can set the D registers by means of software.

When AH10COPM-5A is used as a slave station, it has the following functions.

- It conforms to the CANopen protocol DS301 V4.02.
- It supports a NMT slave.
- Error control: It supports a heartbeat and node guarding protocol.
- It supports PDOs. Every slave station can be assigned eight TxPDOs and eight RxPDOs.
- PDO transmission type: The transmission triggered by an event, the transmission triggered by time, synchronous cyclic transmission, and synchronous acyclic transmission are supported.
- It supports SDOs.
  Number of SDO servers: 1
  Number of SDO clients: 0
  It supports a standard SDO expedited transfer.
- It supports an emergency protocol.

15.1.3 Functional Specifications

- **AH500 series CPU modules which are supported**

Item	Specifications
Model name	AH500 series CPU modules

- **CANopen interface**

Item	Specifications
Transmission method	CAN
Electrical isolation	500 V DC
Connector	Removable connector (5.08 mm)
Communication cable	It is suggested that users should use the Delta standard cables TAP-CB01 and TAP-CB02. The communication cable used should be away from the power cable used, and the shielded cables used should be connected to the ground.

- **CANopen communication**

Item	Specifications
Message type	PDO, SDO, SYNC, EMCY, NMT
Transmission speed	10 kbps, 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1 Mbps

- **Electrical specifications**

Item	Specifications
Supply voltage	A CPU module supplies 24 V DC (-15%~20%) power through an internal bus.
Electric energy consumption	1.7 W
Insulation voltage	500 V

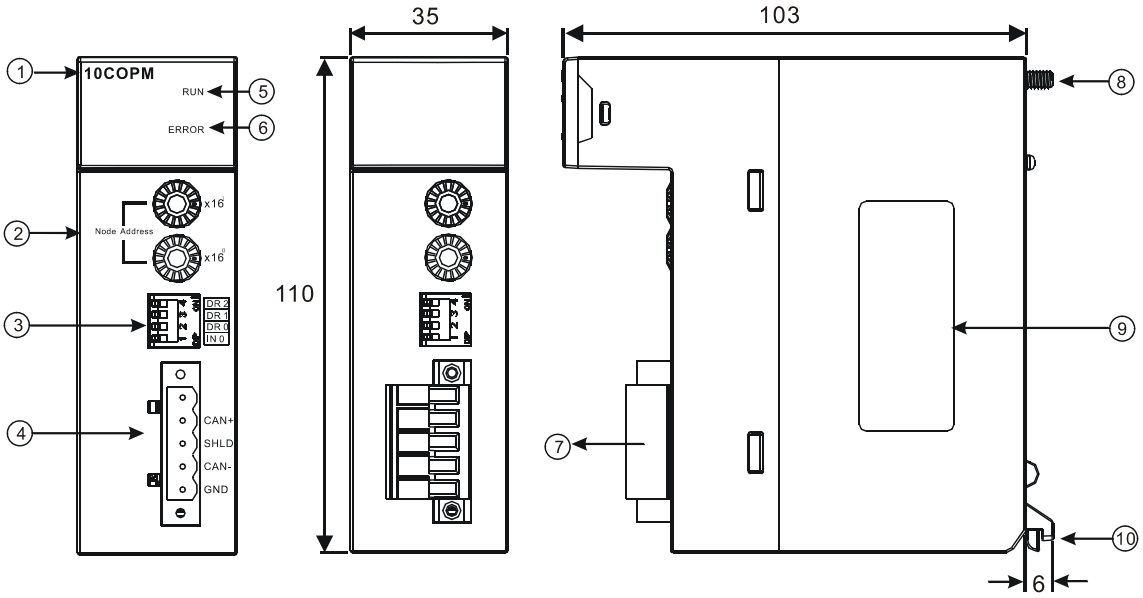
- **Environment**

Item	Specifications
Noise immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8 kV air discharge, 4 kV contact discharge EFT (IEC 61131-2, IEC 61000-4-4): Power line: 2 kV, Digital I/O: 1 kV Analog & Communication I/O: 1 kV Damped-oscillatory wave: Power line: 1 kV, Digital I/O: 1 kV RS (IEC 61131-2, IEC 61000-4-3): 80 MHz~1000 MHz, 1.4 GHz~2.0 GHz, 10 V/m

Item	Specifications
Operation temperature	0ºC~55ºC (Temperature), 5~95% (Humidity), pollution level 2
Storage temperature	-25ºC~70ºC (Temperature), 5~95% (Humidity)
Vibration/ Shock resistance	International standard IEC 61131-2, IEC 68-2-6 (TEST Fc)/IEC 61131-2 & IEC 68-2-27 (TEST Ea)
Certifications	IEC 61131-2, UL508

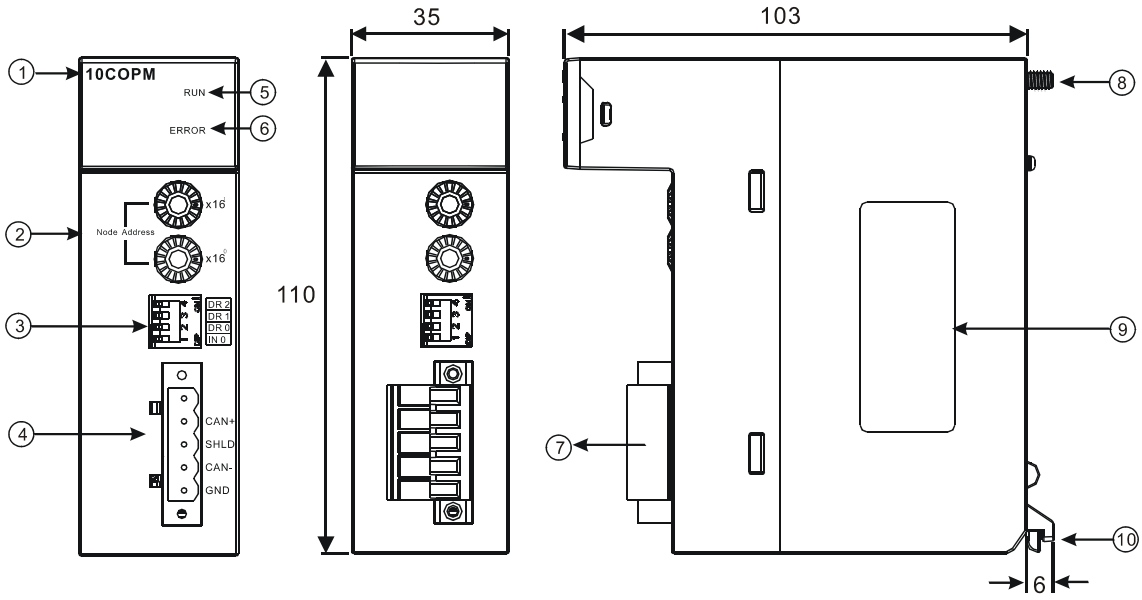
15.2 Profile and Outline

15.2.1 Profile and Dimensions



Unit: mm

15.2.2 Parts



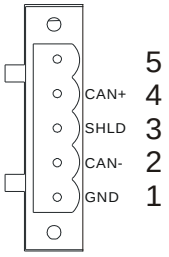
Number	Name	Description
1	Model name	Model name of the module

Number	Name	Description
2	Address switches	For setting an address
3	Function switch	For setting a function
4	CANopen connector	For a CANopen connection
5	RUN LED indicator	Operating status of the module
6	ERROR LED indicator	Error status of the module
7	Removable terminal block	Terminals
8	Set screw	Fixing the module
9	Label	Nameplate
10	Projection	Fixing the module

15.2.3 CANopen Communication Connector

A CANopen connector is connected to a CANopen network. Please wire AH10COPM-5A by using the connector attached to AH10COPM-5A.

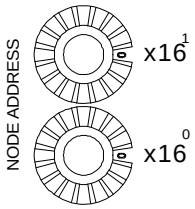
Pin	Signal	Description
5	-	Reserved
4	CAN+	CAN_H
3	SHLD	Shielded cable
2	CAN-	CAN_L
1	GND	0 V DC



15.2.4 Address Switches

The address switches on AH10COPM-5A are used to set the node address of AH10COPM-5A on a CANopen network. Setting range: 1~7F (0 and 80~FF can not be used.)

Setting	Description
1~7F	Valid CANopen node address
0, 80~FF	Invalid CANopen node address



Example: If the station address of AH10COPM-5A is 16#26, users have to rotate the switch corresponding to $x16^1$ to position 2, and rotate the switch corresponding to $x16^0$ to position 6.

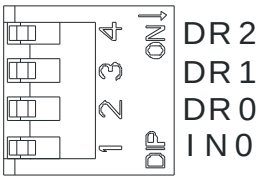
Points for attention:

- After the station address of AH10COPM-5A is changed, users have to power AH10COPM-5A again, otherwise the change will not take effect.
- To prevent the address switches on AH10COPM-5A from being scratched, please carefully use a slotted screwdriver to rotate the address switches on AH10COPM-5A.

15.2.5 Function Switch

The function switch on AH10COPM-5A is used to set the communication speed at which AH10COPM-5A is connected to a CANopen network. There is a limit on the maximum communication distance to which a communication speed corresponds.

DR2	DR1	DR0	Communication speed	Maximum communication distance
OFF	OFF	OFF	10 kbps	5000 m
OFF	OFF	ON	20 kbps	2500 m
OFF	ON	OFF	50 kbps	1000 m
OFF	ON	ON	125 kbps	500 m
ON	OFF	OFF	250 kbps	250 m
ON	OFF	ON	500 kbps	100 m
ON	OFF	ON	800 kbps	50 m
ON	ON	OFF	1 Mbps	25 m
IN0				Reserved



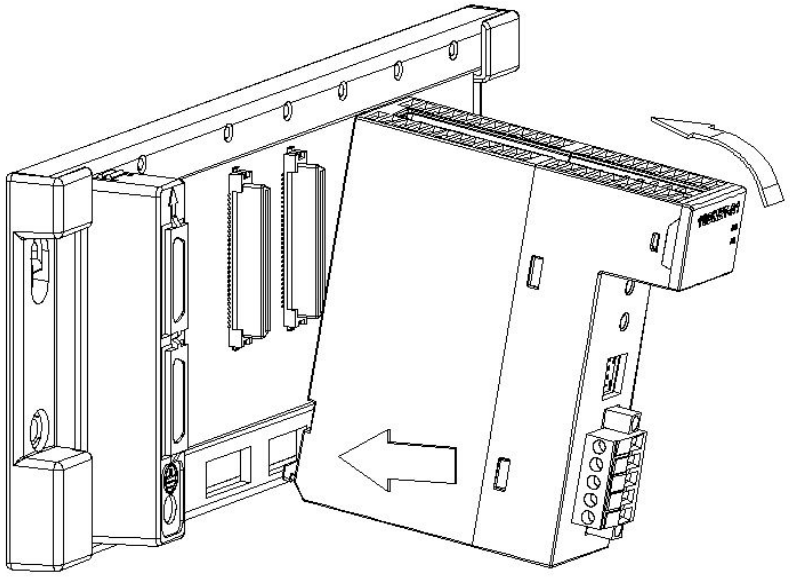
- After users change the communication speed at which AH10COPM-5A is connected to a CANopen network, they have to power AH10COPM-5A again, otherwise the change will not take effect.
- To prevent the DIP switch on AH10COPM-5A from being scratched, please carefully use a slotted screwdriver to rotate the DIP switch on AH10COPM-5A.

15.3 Installation

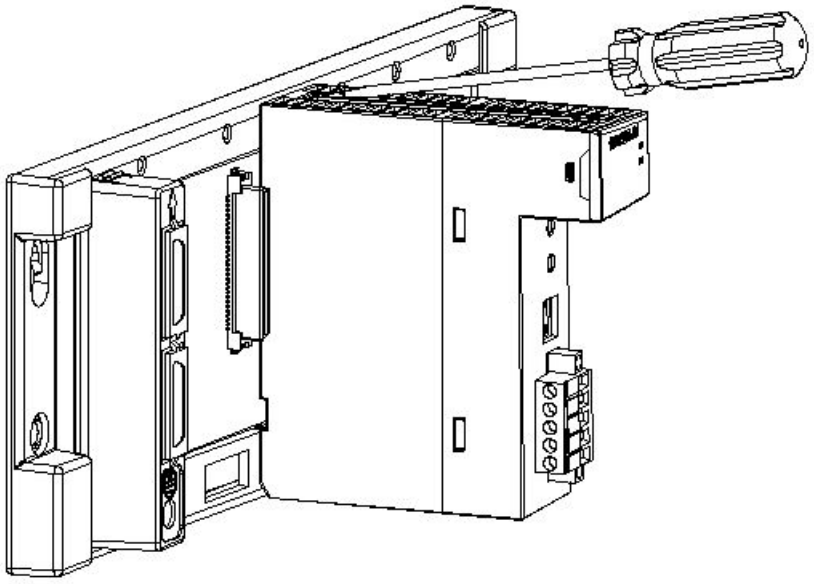
15.3.1 Installing a Module

15

1. Insert the projection under a module into a hole in a backplane.
2. Push the module in the direction indicated by the arrow until it clicks.

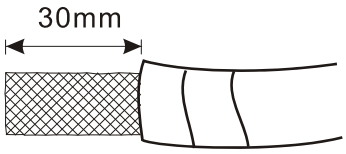


3. Tighten the screw on the module.

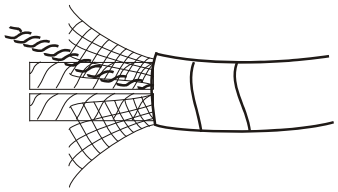


15.3.2 Connecting a CANopen Connector

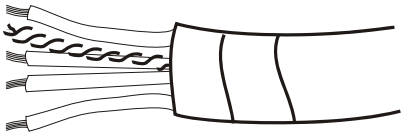
1. Remove the 30 millimeter plastic jacket of a cable with a professional tool. Please do not damage the shielded cable when the plastic jacket is removed.



2. After users remove the metallic shield and the foil, they can see two power cables (in red and black respectively), two signal cables (in blue and white respectively), and one shielded cable.

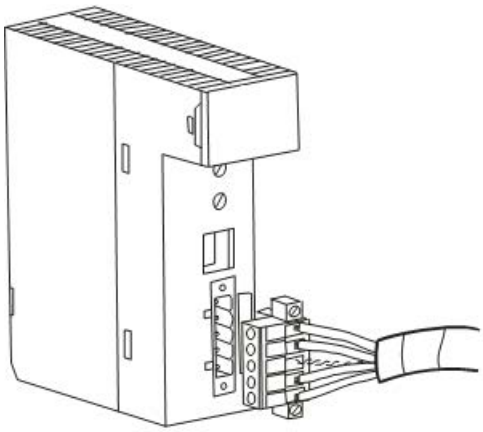


3. After the metallic shield and the foil are removed, the users need to remove the plastic jackets of the power cables and the plastic jackets of the signal cables properly.



4. Insert the communication cable into the holes in the CANopen connector on AH10COPM-5A, and then tighten the screws on the CANopen connector with a slotted screwdriver.
5. SHLD is connected to the shielded cable. In order to strengthen the protection of communication signals, it is suggested that SHLD should be connected to the ground.

6. To reduce the reflection of a communication signal on a network, a terminal resistor must connect CAN+ and CAN-. (Specifications for a terminal resistor: 121 Ω; precision: 1%; power: Greater than 1/4 W)

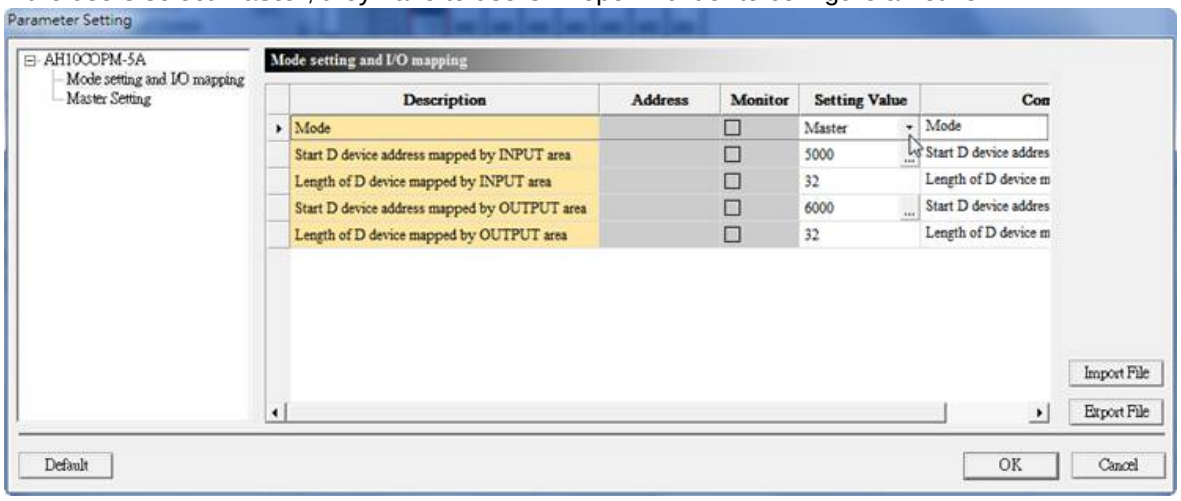


15.4 Configuration

15.4.1 Selecting a Mode

Before AH10COPM-5A operates normally, users have to set AH10COPM-5A to **Master** or **Slave** by means of HWCONFIG in ISPSoft. After AH10COPM-5A is set, the setting needs to be downloaded to AH10COPM-5A.

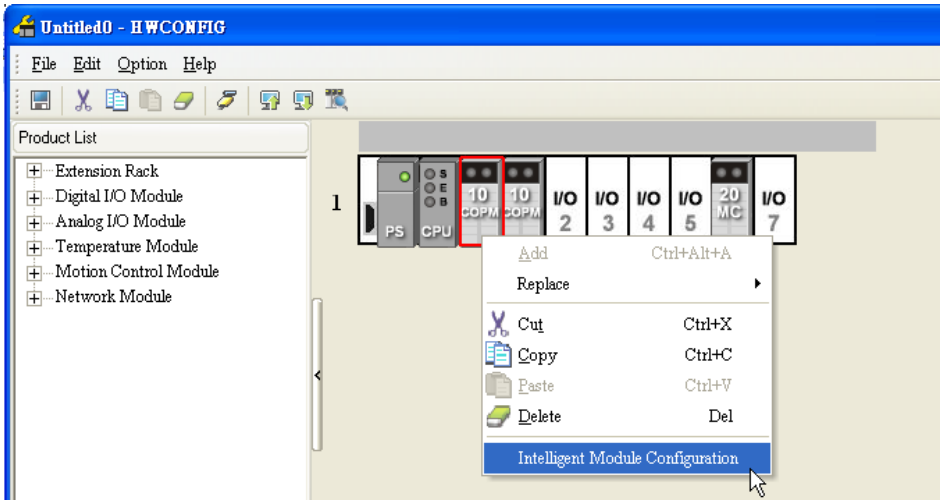
If the users select **Master**, they have to use CANopen Builder to configure a network.



- **Creating a CANopen network**

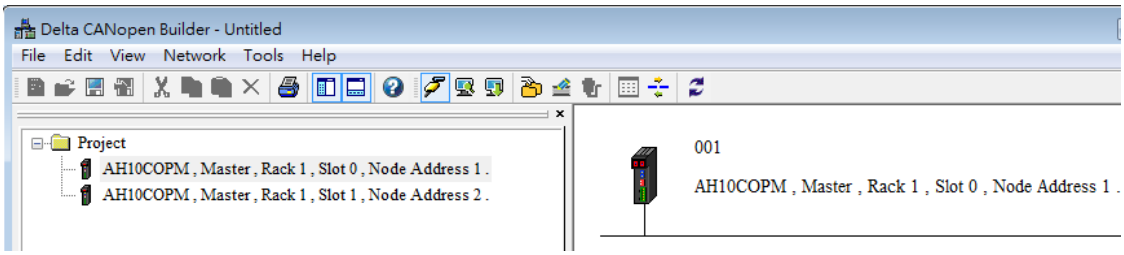
  An AH500 series CPU module can be connected to eight AH10COPM-5A modules at most. Before users create a network, they have to know the requirements for creating the network, and plan data exchange, including the slave stations which need to be used, the data which needs to be exchanged, transmission methods, the total quantity of data which needs to be exchanged, and response time. All the information determines whether the network created is reasonable, and whether the network created meets the requirements. It even affects the maintainability at a later stage, and the convenience of upgrading the capacity of the network created.

  After the users select a mode, and save the setting, they can start CANopen Builder by means of **Intelligent Module Configuration**.

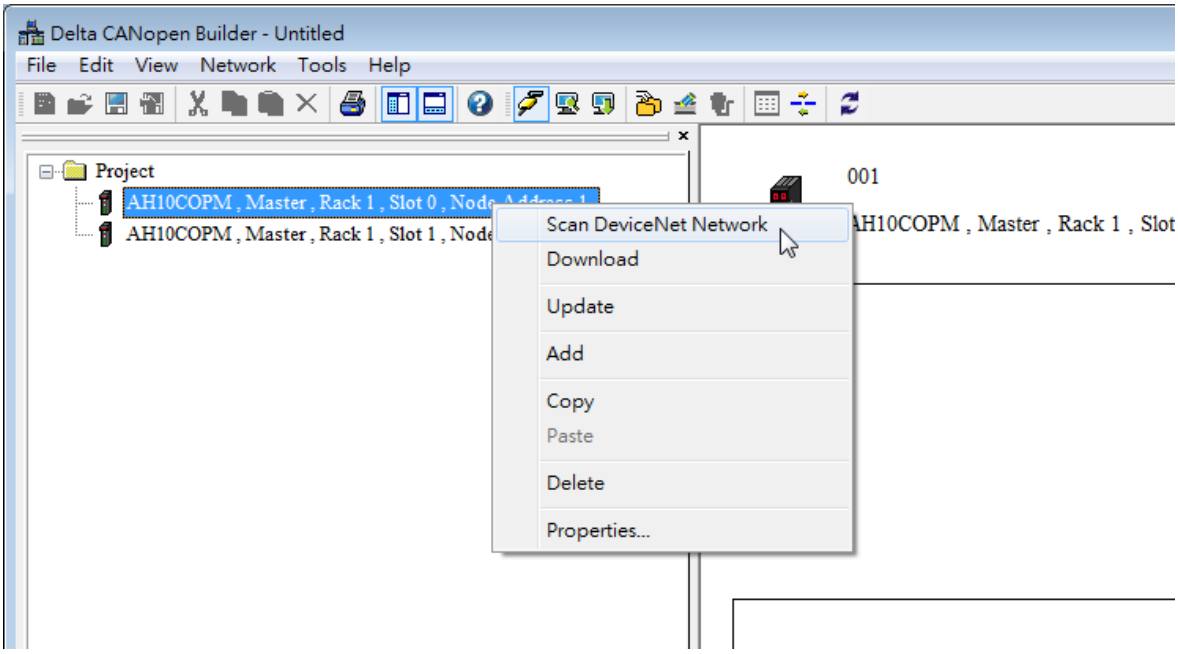


15.4.2 Using CANopen Builder to Configure a Network

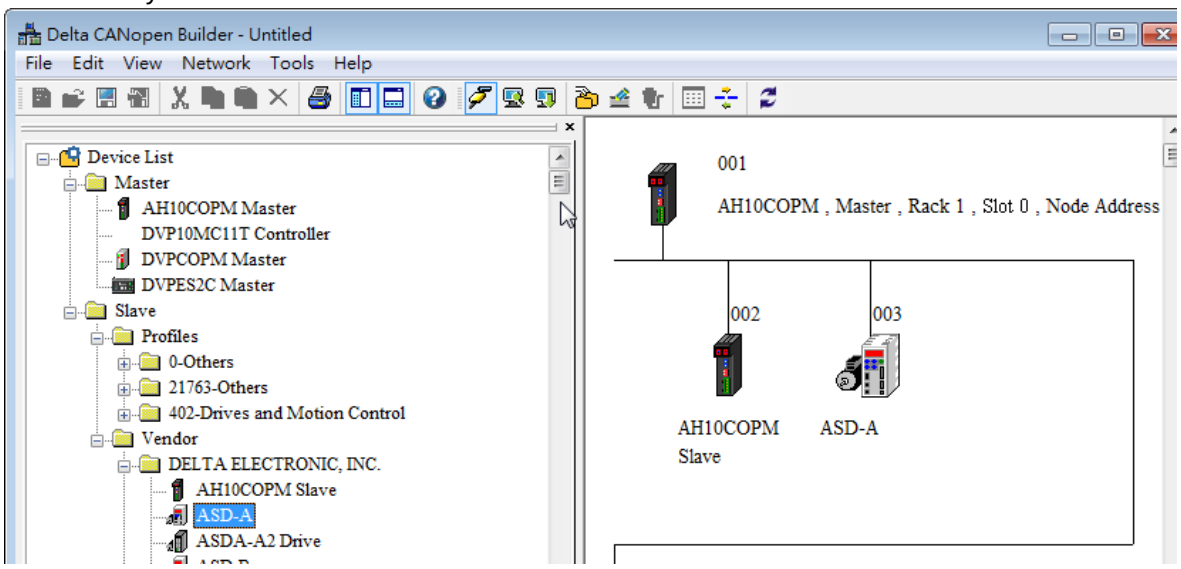
1. After users click **Online**, the software will read the settings in AH10COPM on the backplane used.



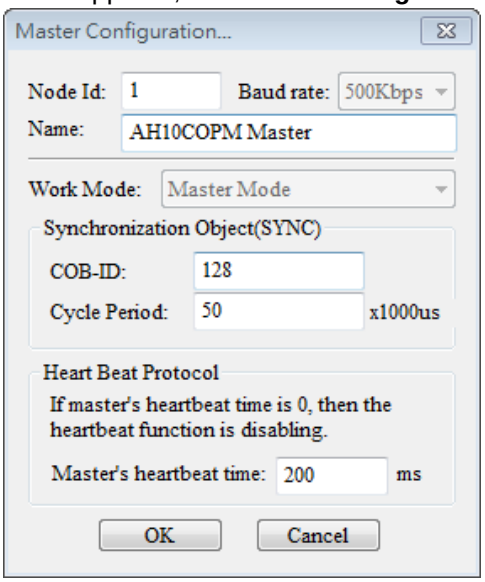
2. After **Online** is clicked, the mode, backplane number, slot number, and node address of the module will be brought out by the software. After the users right-click the master station selected, and click **Scan DeviceNet Network** on the context menu which appears, the information about the node devices on the network created will be scanned.



3. After the scan is complete, the icons representing the slave stations on the CANopen network created will appear. The users can select devices on the device list, and add slave stations manually.

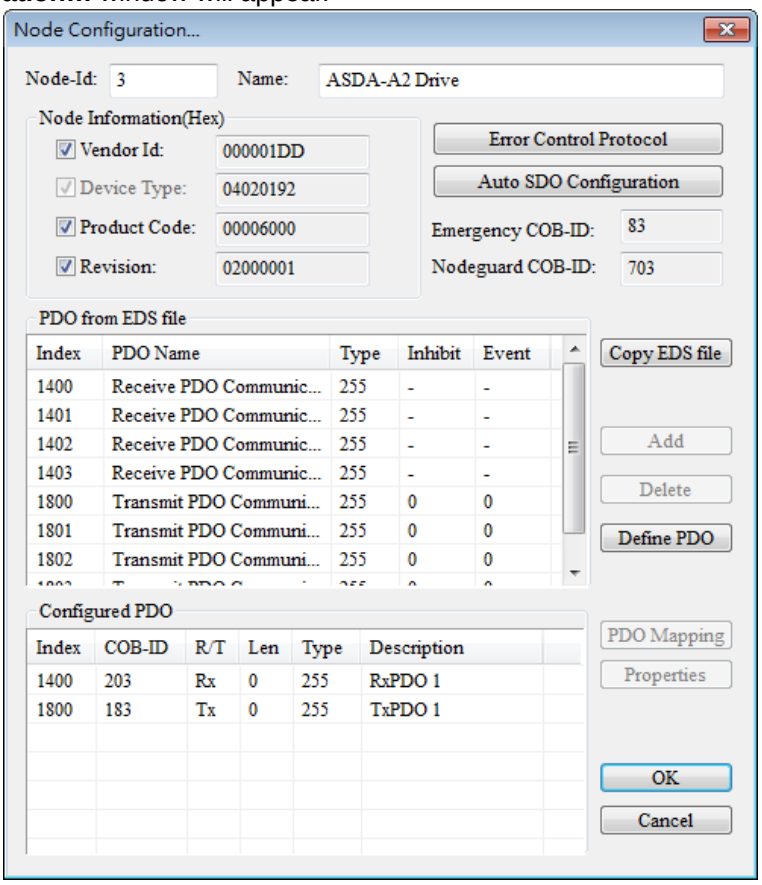


- Setting the parameters in the master station on a CANopen network
  After users click **Master parameter** on the **Network** menu, or right click the icon representing the AH10COPM module functioning as a master, and then click **Properties…** on the context menu which appears, the **Master Configuration…** window will appear.

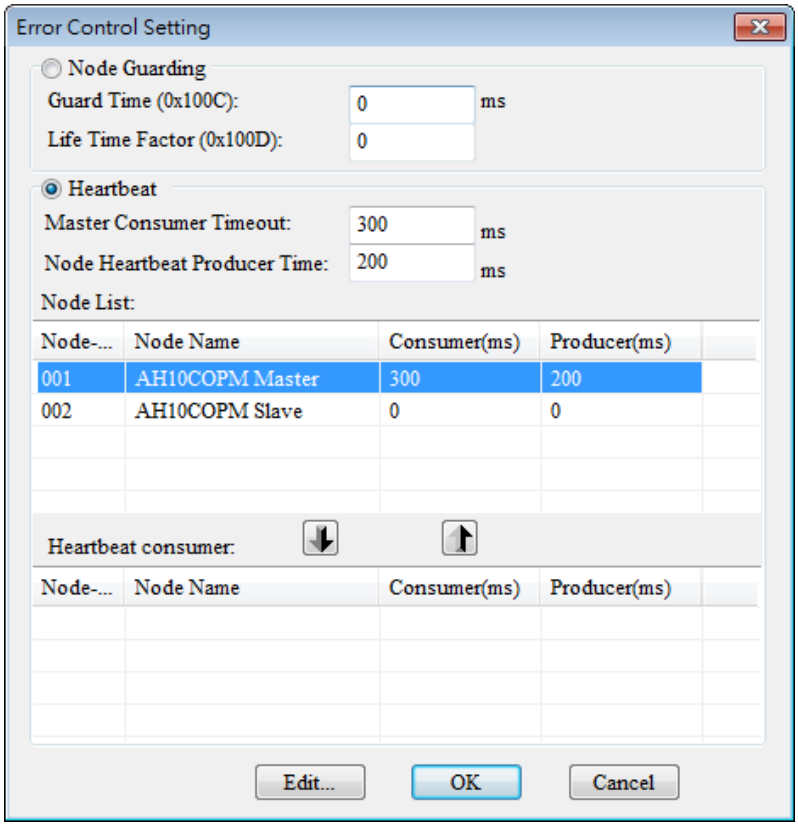


COB-ID: Setting the COB-ID used to send synchronous messages
Cycle Period: Setting the period of time needed for sending synchronous messages
Master's heartbeat time: Setting the period of time needed for AH10COPM-5A to send a heartbeat message
After the users set the parameters in the window, they have to click **OK**.

- Setting the parameters in a slave station on a CANopen network
  Setting the parameters in an ASDA-A2 series AC servo drive: After users double-click the icon representing the ASDA-A2 series AC servo drive functioning as a slave, the **Node Configuration…** window will appear.



Setting the parameters:
Error Control Protocol: After users click **Error Control Protocol**, the **Error Control Setting** window will appear.



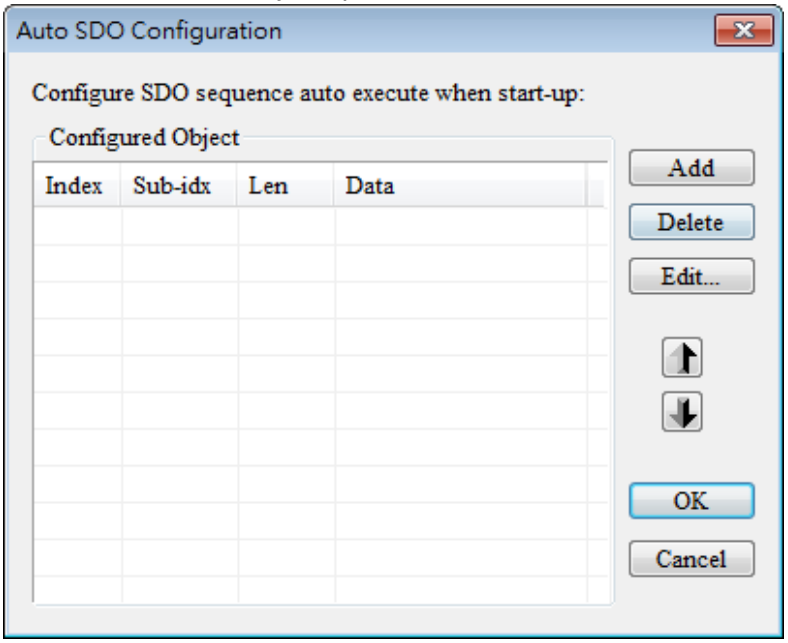
15

The parameters are described below.

Parameter name		Description	Remark
Node Guarding	**Guard Time**	A master station polls slave stations according to the interval set in the **Guard Time** box.	If the **Heartbeat** option button is selected, the **Node Guarding** option button can not be selected.
	Life Time Factor	Life time=Guard time×Life time factor If a slave station does not respond to a master station in a life time, the master station will consider the slave station offline.	
Heartbeat	**Node Heartbeat Producer Time**	A slave station send a heartbeat message to a master station according to the time set in the **Node Heartbeat Producer Time** box.	The time set in the **Master Consumer Timeout** box must be greater than the time set in the **Node Heartbeat Producer Time** box.
	Master Consumer Timeout	If a master station does not receive a heartbeat message from a slave station after the timeout period set in the **Master Consumer Timeout** box, the master station will consider the slave station offline.	

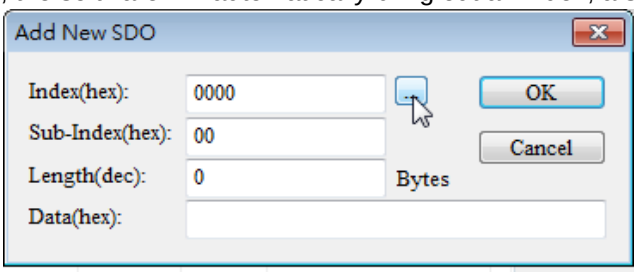
Parameter name		Description	Remark
Node List	All the nodes configured on the CANopen network created are shown on the node list.	--	
Heartbeat consumer	The node which is assigned an error control protocol can monitor whether the nodes under **Heartbeat consumer** are offline.	The number of nodes under **Heartbeat consumer** varies with the device used.	
	After users select a node on the node list, and click  , the node selected will be added to the list under **Heartbeat consumer**.	--	
	After the users select a node on the list under **Heartbeat consumer**, and click  , the node selected will be deleted from the list under **Heartbeat consumer**.	--	
Edit…	After users select a node on the list under **Heartbeat consumer**, and click **Edit…**, they can change the time set in the **Consume Time** box.	--	
OK	After users click **OK**, they will return to the **Node Configuration…** window, and the parameters set in the **Error Control Setting** window will be retained.	--	
Cancel	After users click **Cancel**, they will return to the **Node Configuration…** window, and the parameters set in the **Error Control Setting** window will not take effect.	--	

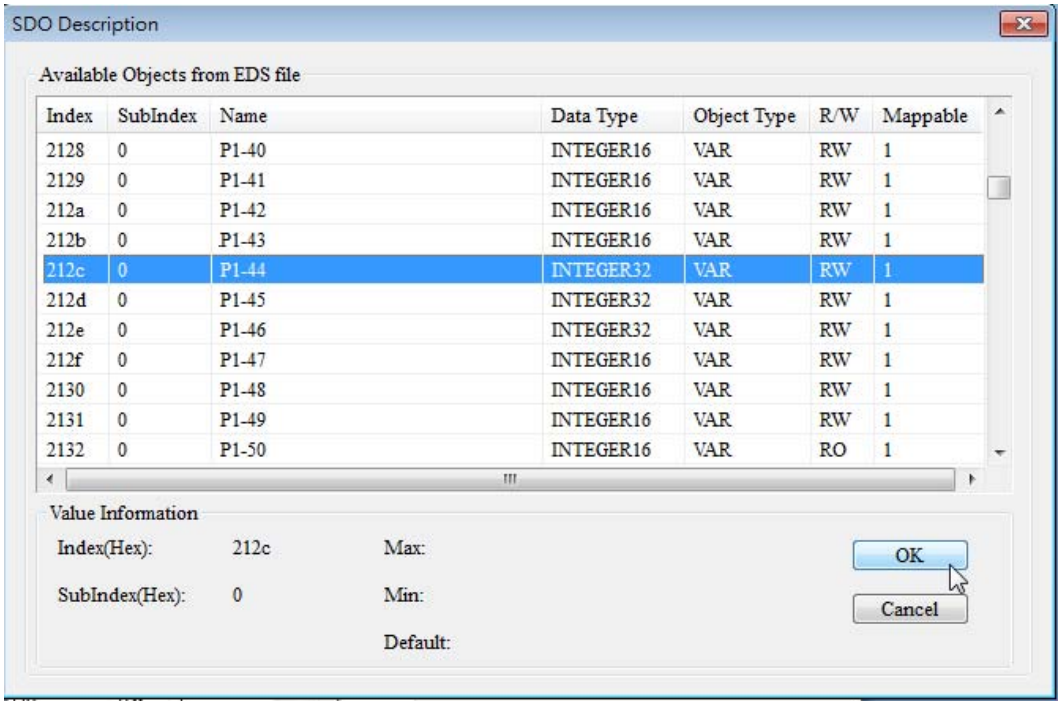
Auto SDO Configuration: After users click **Auto SDO Configuration** in the **Node Configuration…** window, the **Auto SDO Configuration** window will appear. If the users click **Add**, they can add an automatic SDO. If the users click **Edit…**, they can modify the automatic SDO selected. The maximum number of automatic SDOs which can be assigned to a slave station is 20. An automatic SDO can only write parameters, and can not read parameters. It writes parameters to a slave station once only when the slave station is ready to operate for the first time.



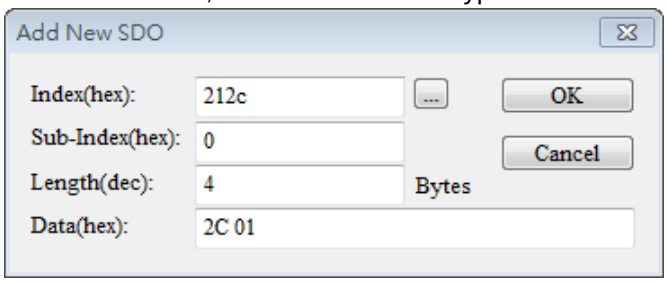
15

After the users click **Add**, the **Add New SDO** window will appear. The index in the **Index (hex)** box is the index of the parameter which will be accessed, and the subindex in the **Sub-Index (hex)** box is the subindex of the parameter which will be accessed. The length in the **Length (dec**) box is determined by the data type of the parameter which will be accessed. A byte is a unit of measurement for length. The users can click  , and select an object in the object dictionary defined by the EDS in the slave station selected. After the users click **OK**, the software will automatically bring out an index, a subindex, and a length.

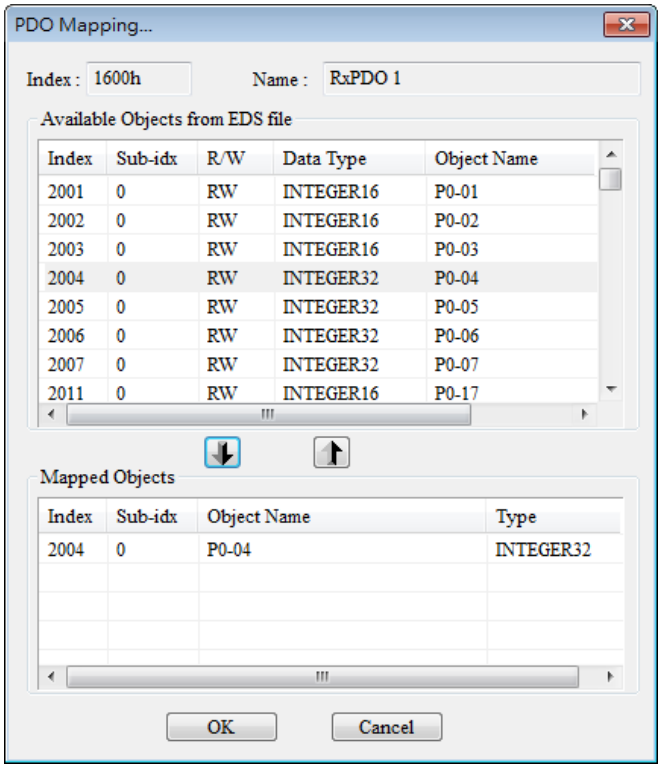




The data in the **Data (hex)** box is the data which will be written. (It is a hexadecimal value.) If the data which will be written occupies two bytes, the low byte will precede the high byte in the **Data (hex)** box, and the two bytes will be separated by a space. For example, if the data which will be written is 0x012C, “2C 01”needs to be typed in the **Data (hex)** box.

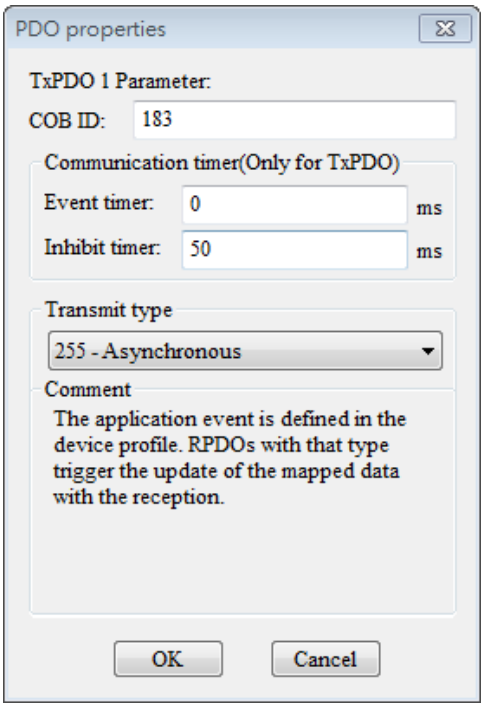


PDO Mapping: After users click the TxPDO or the RxPDO under **Configured PDO**, and click **PDO Mapping**, the **PDO Mapping…** window will appear.



The users can add parameters in the **Available Objects from EDS file** section to the **Mapped Objects** section. The total of the data lengths of the parameters added to a PDO can not exceed eight bytes. After the users add parameters to the **Mapped Objects** section, they have to click **OK**. After the users click the TxPDO or the RxPDO under **Configured PDO**, and click **Properties**, they can modify the information in the **COB ID** box and the **Transmit type** drop-down list box in the **PDO properties** window. After the users click Define PDO, they can define a RxPDO or a TxPDO by themselves.

In this example, the default configuration is used. Finally, the users have to click **OK** in the **Node Configuration…** window.



Rule of setting a COB-ID:

RxPDO number	COB-ID (Hex)	TxPDO number	COB-ID (Hex)
RxPDO1	200+Slave station address	TxPDO1	180+Slave station address
RxPDO2	300+Slave station address	TxPDO2	280+Slave station address
RxPDO3	400+Slave station address	TxPDO3	380+Slave station address
RxPDO4	500+Slave station address	TxPDO4	480+Slave station address

Note: The COB-IDs of RxPDO5~RxPDO8 and TxPDO5~TxPDO8 can be the COB-IDs of RxPDO1~RxPDO4 and TxPDO1~TxPDO4 in an unused slave station, but they can not be the same.

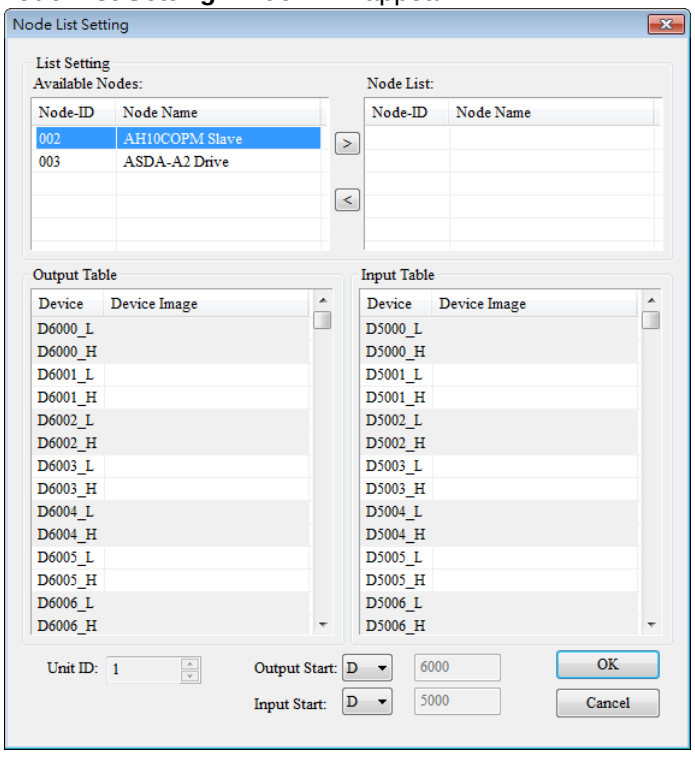
Descriptions of transmission types:

Transmission type		Description	Remark
0	RxPDO	A master station sends a synchronous message to a slave station every period of synchronization. After a RxPDO is changed, the new RxPDO will be sent to the slave station. The new RxPDO that the slave station receives will not take effect until the next synchronous message is received. If a RxPDO is not changed, the master station will not send the RxPDO to the slave station.	Synchronous acyclic
	TxPDO	A master station sends a synchronous message to a slave station every period of synchronization. After a TxPDO is changed, and the slave station receives a synchronous message, the new TxPDO will be sent to the master station. The new TxPDO will take effect immediately after the master station receives it. If a TxPDO is not changed, the slave station will not send the TxPDO to the master station.	
1	RxPDO	A master station sends a synchronous message to a slave station every period of synchronization. The master station sends a RxPDO every period of synchronization. The RxPDO will not take effect until the next synchronous message is received.	Synchronous cyclic
	TxPDO	A master station sends a synchronous message to a slave station every period of synchronization. After the slave station receives a synchronous message, it will send a TxPDO to the master station. The TxPDO will take effect immediately after the master station receives it.	
2	RxPDO	A master station sends a synchronous message to a slave station every period of synchronization. It sends a RxPDO every two periods of synchronization. The RxPDO that the slave station receives will not take effect until the next synchronous message is received.	Synchronous cyclic
	TxPDO	A master station sends a synchronous message to a slave station every period of synchronization. After the slave station receives two synchronous messages, it will send a TxPDO to the master station. The TxPDO will take effect immediately after the master station receives it.	

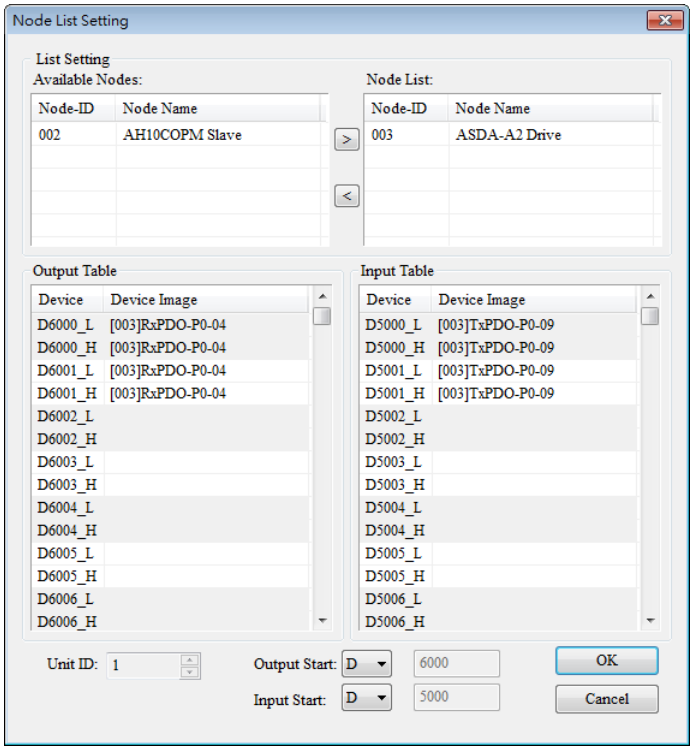
Transmission type		Description	Remark
3~240	RxPDO	They can be described by analogy with transmission type 1 and transmission type 2.	Synchronous cyclic
	TxPDO	They can be described by analogy with transmission type 1 and transmission type 2.	
254	RxPDO	After a RxPDO is changed, the new RxPDO will be sent to a slave station. The new RxPDO will take effect immediately after the slave station receives it. If a RxPDO is not changed, it will not be sent to the slave station.	Asynchronous
	TxPDO	The value in the **Event timer** box is 0, and the value in the **Inhibit timer** box is 0. After a TxPDO is changed, the new TxPDO will be sent to a master station. The new TxPDO will take effect immediately after the master station receives it. If a TxPDO is not changed, it will not be sent to the master station. The value in the **Event timer** box is not 0, and the value in the **Inhibit timer** box is not 0. The slave station selected sends a TxPDO to a master station according to the interval set in the **Event timer** box. (After a TxPDO is sent, it can not be send again during the time set in the **Inhibit timer** box. After a TxPDO is changed, the new TxPDO will be send to the master station. The new TxPDO will take effect immediately after the master station receives it.	
255	RxPDO	Same as transmission type 254	Asynchronous
	TxPDO	Same as transmission type 254	

- Setting a node list

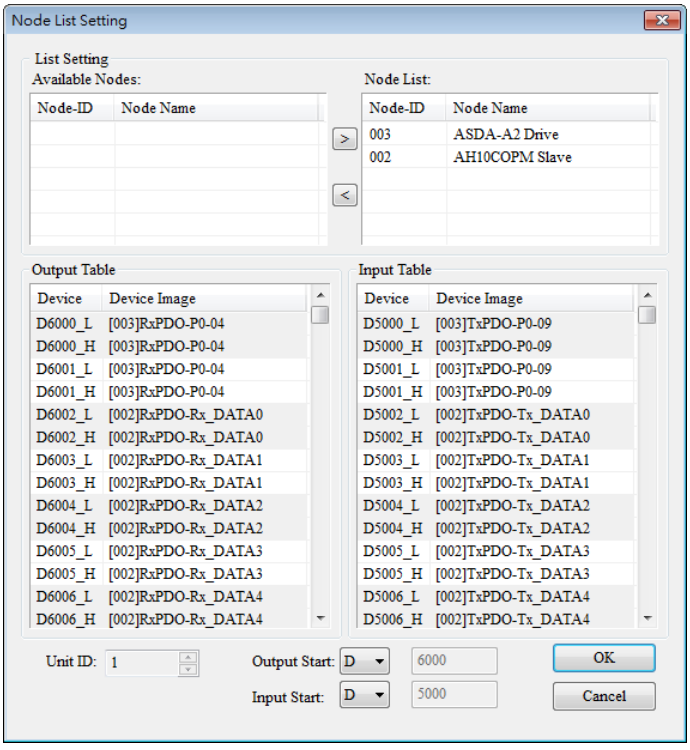
  After users double-click the icon representing the AH10COPM module functioning as a master, the **Node List Setting** window will appear.



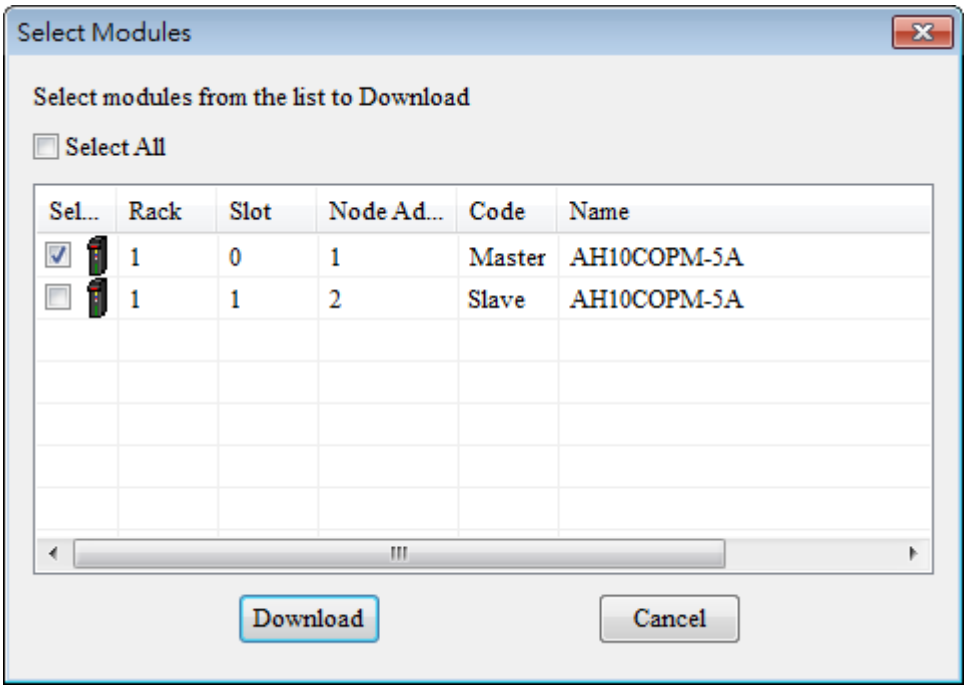
In this example, the ASDA-A2 series AC servo drive whose node ID is 3 is selected. After [>] is clicked, node ID 3 will be added to the list under **Node List**. When node ID 3 on the list under **Node List** is selected, the data registers in an AH500 series module onto which the I/O data in node ID 3 is mapped are shown in the **Output Table** section and the **Input Table** section.



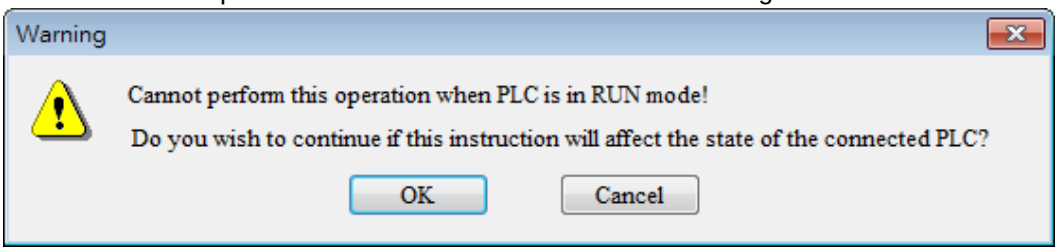
The users can add node ID 2 to the list under **Node List** in the same way. When node ID 2 on the list under **Node List** is selected, the data registers in the AH500 series module onto which the I/O data in node ID 2 is mapped are shown in the **Output Table** section and the **Input Table** section.



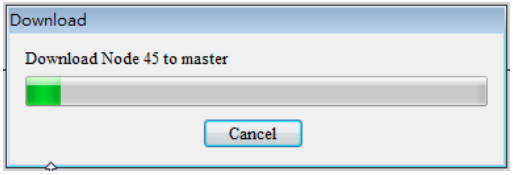
- Downloading data to a master module
  Users have to click **Download** on the **Network** menu, and then select the AH10COPM-5A module to which the configuration data set will be downloaded in the **Select Modules** window.



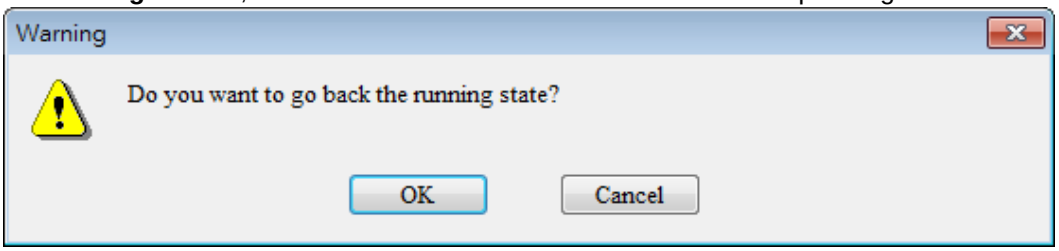
After the users click **Download**, the configuration data set will be downloaded to the AH10COPM-5A module selected. If the AH10COPM-5A module is operating, the users will be asked to stop the AH10COPM-5A module before the configuration data is downloaded.



After the users click **OK**, the AH10COPM-5A module will stop running, and the configuration will be downloaded.

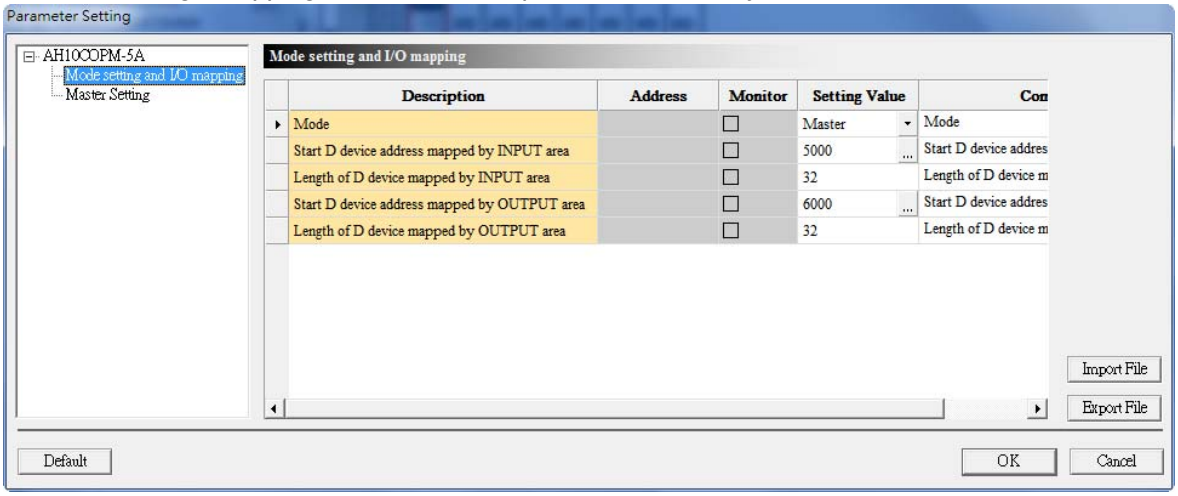


After the downloading of the configuration data is complete, the users will be asked whether they want to run the AH10COPM-5A module again. If the users click **OK** in the **Warning** window, the AH10COPM-5A module will continue operating. If the users click **Cancel** in the **Warning** window, the AH10COPM-5A module will not continue operating.



15.4.3 Assigning Mapping Areas

Users can assign mapping areas to a CANopen master/slave by means of HWCONFIG.



AH10COPM-5A functions as a master station. If the start input address set is D5000, and the start output address set is D6000, the mapping areas assigned will be as described below. The data lengths that the users can set must be in the range of 0 words to 480 words.

Input area: Slave station⇨Master station			Output area: Master station⇨Slave station		
Register numbers in an AH500 series CPU module	**Purpose**	**Data length**	**Register numbers in an AH500 series CPU module**	**Purpose**	**Data length**
D5000~D5479	A CANopen slave station sends data.	0~480 words	D6000~D6479	Data is sent to a CANopen slave station.	0~480 words

AH10COPM-5A functions as a slave station. The data lengths that the users can set must be in the range of 0 words to 32 words. The relation between the object dictionary in AH10COPM-5A and registers in an AH500 series CPU module is shown below.

Index	Subindex range	Input/Output mapping area	Access permission
H'2000	H'01~H'20	Output mapping area	Read/Write
H'2001	H'01~H'20	Input mapping area	Read-only

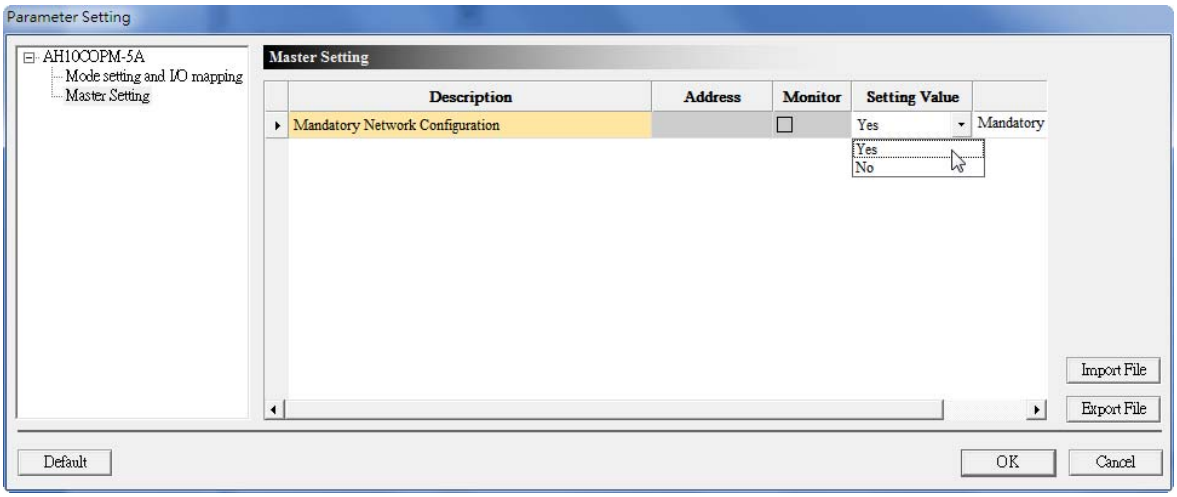
Besides, AH10COPM-5A is assigned a two-word normal exchange area. For example, D0~D1 are assigned to AH10COPM-5A.

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range
-	AHPS05-5A	-	AH Power Supply Module	None	None
-	AHCPU530-EN	1.00	Basic CPU module building with Et	None	None
0	AH10COPM-5A	1.00	CANopen Communication Module	D0 ~ D1	

The mapping areas assigned are described below.

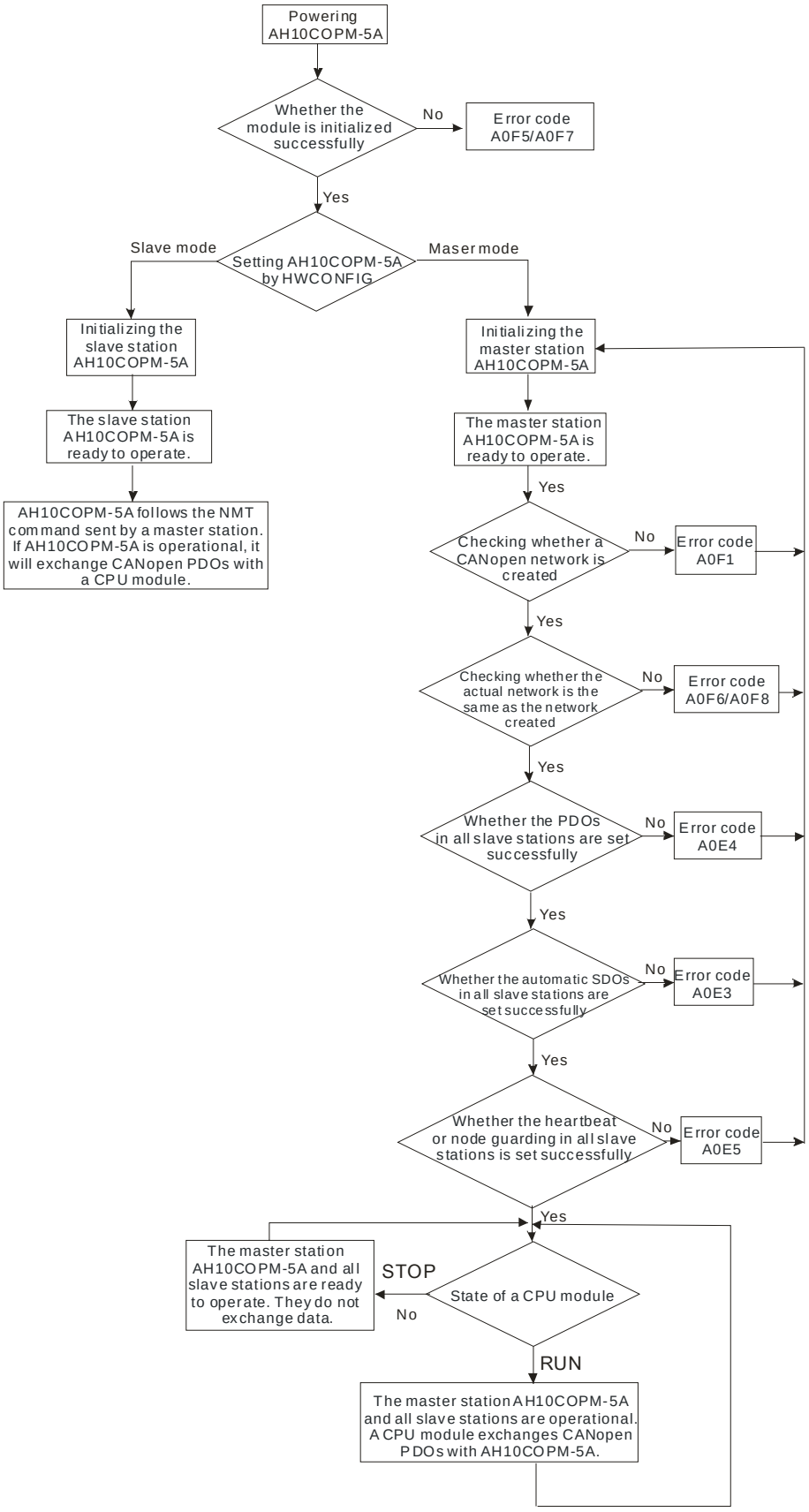
Register number in an AH500 series CPU module	Purpose	Data length
D0	State of AH10COPM-5A: 0x00: AH10COPM-5A is being initialized. 0x04: AH10COPM-5A stops running. 0x05: AH10COPM-5A is running. 0x7F: AH10COPM-5A is preparing to run. 0x0F: AH10COPM-5A is in an unknown state.	1 word
D1	Module error code	1 word

15.4.4 Setting a Master Station



If AH10COPM-5A functions as a master station, users can determine whether the network configuration loaded is a necessary network configuration. If the network configuration loaded is a necessary network configuration, AH10COPM-5A checks whether every slave station is online and set successfully when it operates for the first time. If every slave station is online and set successfully, it is allowed to operate. If the network configuration loaded is not a necessary network configuration, AH10COPM-5A can allow the slave stations which are not online or set successfully to operate, but it will exchange data with the other slave stations which are set successfully on the network created.

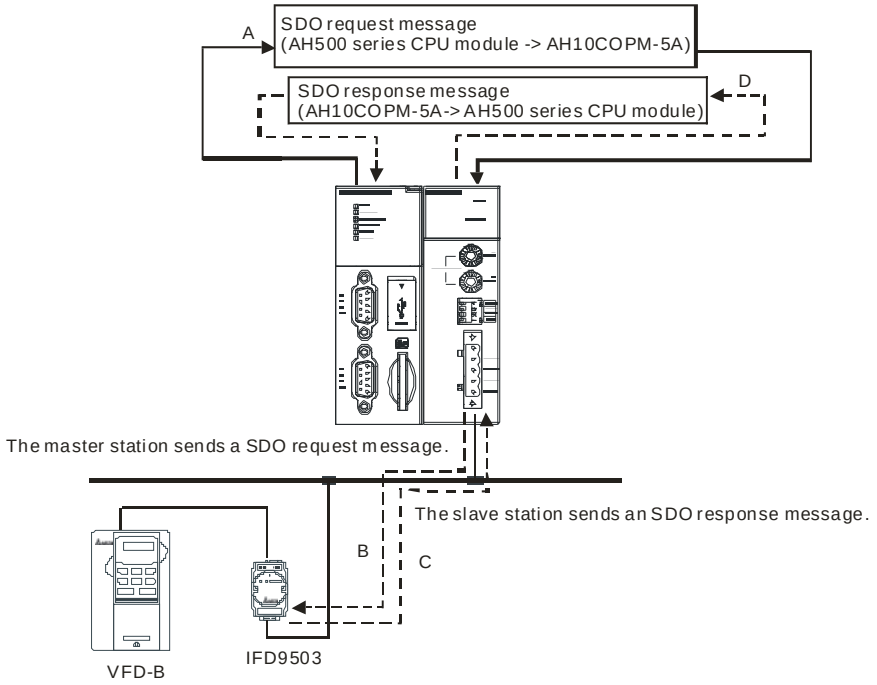
15.4.5 Flowchart Representing the Action of a CANopen Master Station



15.5 Sending SDOs and NMT, and Reading Emergencies by Functions Blocks

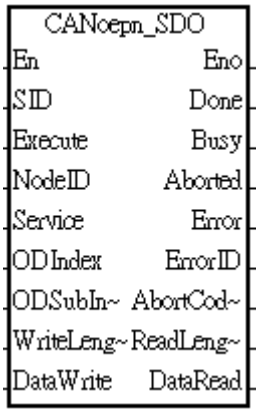
15.5.1 Principle

The principle of sending SDOs by means of a program is described below.



A: An AH500 series CPU module sends request information to the master station AH10COPM-5A.
B: The master station AH10COPM-5A sends the request information to target equipment.
C: The target equipment processes the request information, and sends response information to the master station AH10COPM-5A.
D: The AH500 series CPU module received the response information (SDOs, NMT, and emergencies).

15.5.2 Sending an SDO Command



1. Function block
   The AH10COPM-5A module which functions as a master station in a slot on the main backplane used can send an SDO command by means of the function block CANopen_SDO in ISPSoft.
2. Input pins/Output pins

Input pin				
Name	**Function**	**Data type**	**Setting value**	**Time when a value is valid**
SID	Slot number	WORD	K0~K11	The value of the SID input pin is valid when there is a transition in the Execute input pin's signal from low to high.
Execute	The function block is executed when there is a transition in the Execute input pin's signal from low to high.	BOOL	True/False	-
NodeID	Node address	WORD	K1~K127	-
Service	Service type	WORD	1: Reading 2: Writing	-
ODIndex	Index	WORD	-	-
ODSubIndex	Subindex	WORD	-	-
WriteLength	Length of the data which is written	WORD	K1~K8 (Unit: Byte)	The value of the WriteLength input pin is valid when there is a transition in the Execute input pin's signal from low to high.
DataWrite	Data which is written	DWORD[2]	-	The value of the DataWrite input pin is valid when there is a transition in the Execute input pin's signal from low to high.

Output pin				
Name	**Function**	**Data type**	**Time when there is a transition in an output pin's signal from low to high**	**Time when there is a transition in an output pin's signal from high to low**
Done	The execution of the function block is complete.	BOOL	• There is a transition in the Done output pin's signal from low to high when the execution of the function block is complete.	• There is a transition in the Done output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when the execution of the function block is complete, the Done output pin will be set to False in the next cycle.
Busy	The function block is being executed.	BOOL	• There is a transition in the Busy output pin's signal from low to high when there is a transition in the Execute input pin's signal from low to high.	• There is a transition in the Busy output pin's signal from high to low when there is a transition in the Done output pin's signal from low to high. • There is a transition in the Busy output pin's signal from high to low when there is a transition in the Error output pin's signal from low to high. • There is a transition in the Busy output pin's signal from high to low when there is a transition in the Aborted output pin's signal from low to high.
Aborted	The execution of the function block is interrupted by a command.	BOOL	• The execution of the function block is interrupted by a command.	• There is a transition in the Aborted output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when the execution of the function block is interrupted, the Aborted output pin will be set to False in the next cycle.

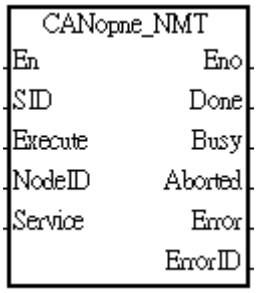
Output pin				
Name	**Function**	**Data type**	**Time when there is a transition in an output pin's signal from low to high**	**Time when there is a transition in an output pin's signal from high to low**
Error	An error occurs in the function block.	BOOL	• An error occurs when the function block is executed.	• There is transition in the Error output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when an error occurs, the Aborted output pin will be set to False in the next cycle.

Output pin				
Name	**Function**	**Data type**	**Output range**	**Update**
ErrorID	Error code	WORD	• Please see the status code table below. • 0B: A parameter is incorrect. 0C: The module does not support the function. • AH500 series CPU module error code	• When there is a transition in the Error output pin's signal from low to high, or a transition in the Done output pin's signal from low to high, the value of the ErrorID output pin is updated.
AbortCode	SDO interruption code	WORD		• When there is a transition in the Error output pin's signal from low to high, or a transition in the Done output pin's signal from low to high, the value of the AbortCode output pin is updated.
ReadLength	Length of the data which is read	WORD	K0~K8 (Unit: Byte)	• When there is a transition in the Done output pin's signal from low to high, the value of the ReadLength output pin is updated.
DataRead	Data which is read	DWORD[2]		• When there is a transition in the Done output pin's signal from low to high, the value of the DataRead output pin is updated.

- Status codes

Status code	Description
0	No request for data transmission
1	The sending of the SDO is successful.
2	The SDO is being transmitted.
3	Error: SDO transmission timeout
4	Error: Illegal command
5	Error: The request message is illegal.
6	Error: The response message is illegal.
7	Error: The equipment which will send a message is busy.
8	Error: Illegal type
9	Error: Incorrect node address
0A	Error message (Please see the error code in the SDO response message.)

15.5.3 Sending an NMT Command



15

1. Function block
   The AH10COPM-5A module which functions as a master station in a slot on the main backplane used can send an NMT command by means of the function block CANopen_NMT in ISPSoft.
2. Input pins/Output pins

Input pin				
Name	**Function**	**Data type**	**Setting value**	**Time when a value is valid**
SID	Slot number	WORD	K0~K11	The value of the SID input pin is valid when there is a transition in the Execute input pin's signal from low to high.
Execute	The function block is executed when there is a transition in the Execute input pin's signal from low to high.	BOOL	True/False	-
NodeID	Node address	WORD	K1~K127	-

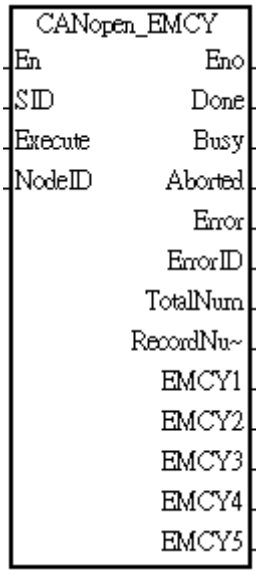
Input pin				
Name	**Function**	**Data type**	**Setting value**	**Time when a value is valid**
Service	Service type	WORD	01 (Hex): Enabling a remote node 02 (Hex): Stopping a remote node 80 (Hex): Ready to operate 81 (Hex): Resetting application 82 (Hex): Resetting communication	-

Output pin				
Name	**Function**	**Data type**	**Time when there is a transition in an output pin's signal from low to high**	**Time when there is a transition in an output pin's signal from high to low**
Done	The execution of the function block is complete.	BOOL	• There is a transition in the Done output pin's signal from low to high when the execution of the function block is complete.	• There is a transition in the Done output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when the execution of the function block is complete, the Done output pin will be set to False in the next cycle.
Busy	The function block is being executed.	BOOL	• There is a transition in the Busy output pin's signal from low to high when there is a transition in the Execute input pin's signal from low to high.	• There is a transition in the Busy output pin's signal from high to low when there is a transition in the Done output pin's signal from low to high. • There is a transition in the Busy output pin's signal from high to low when there is a transition in the Error output pin's signal from low to high. • There is a transition in the Busy output pin's signal from high to low when there is a transition in the Aborted output pin's signal from low to high.

Output pin				
Name	**Function**	**Data type**	**Time when there is a transition in an output pin's signal from low to high**	**Time when there is a transition in an output pin's signal from high to low**
Aborted	The execution of the function block is interrupted by a command.	BOOL	• The execution of the function block is interrupted by a command.	• There is a transition in the Aborted output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when the execution of the function block is interrupted, the Aborted output pin will be set to False in the next cycle.
Error	An error occurs in the function block.	BOOL	• An error occurs when the function block is executed.	• There is a transition in the Error output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low.

Output pin				
Name	**Function**	**Data type**	**Output range**	**Update**
ErrorID	Error code	WORD	• 0B: A parameter is incorrect. 0C: The module does not support the function. • AH500 series CPU module error code	• When there is a transition in the Error output pin's signal from low to high, or a transition in the Done output pin's signal from low to high, the value of the ErrorID output pin is updated.

15.5.4 Reading Emergency Messages



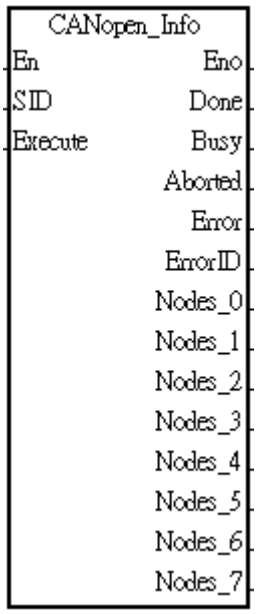
1. Function block
   The AH10COPM-5A module which functions as a master station in a slot on the main backplane used can read the emergency messages received from slave stations by means of the function block CANopen_NMT in ISPSoft.
2. Input pins/Output pins

Input pin				
Name	**Function**	**Data type**	**Setting value**	**Time when a value is valid**
SID	Slot number	WORD	K0~K11	The value of the SID input pin is valid when there is a transition in the Execute input pin's signal from low to high.
Execute	The function block is executed when there is a transition in the Execute input pin's signal from low to high.	BOOL	True/False	-
NodeID	Node address	WORD	K1~K127	The value of the NodeID input pin is valid when there is a transition in the Execute input pin's signal from low to high.

Output pin				
Name	**Function**	**Data type**	**Time when there is a transition in an output pin's signal from low to high**	**Time when there is a transition in an output pin's signal from high to low**
Done	The execution of the function block is complete.	BOOL	• There is a transition in the Done output pin's signal from low to high when the execution of the function block is complete.	• There is a transition in the Done output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when the execution of the function block is complete, the Done output pin will be set to False in the next cycle.
Busy	The function block is being executed.	BOOL	• There is a transition in the Busy output pin's signal from low to high when there is a transition in the Execute input pin's signal from low to high.	• There is a transition in the Busy output pin's signal from high to low when there is a transition in the Done output pin's signal from low to high. • There is a transition in the Busy output pin's signal from high to low when there is a transition in the Error output pin's signal from low to high. • There is a transition in the Busy output pin's signal from high to low when there is a transition in the Aborted output pin's signal from low to high.
Aborted	The execution of the function block is interrupted by a command.	BOOL	• The execution of the function block is interrupted by a command.	• There is a transition in the Aborted output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when the execution of the function block is interrupted, the Aborted output pin will be set to False in the next cycle.
Error	An error occurs in the function block.	BOOL	• An error occurs when the function block is executed.	• There is a transition in the Error output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low.

Output pin				
Name	**Function**	**Data type**	**Output range**	**Update**
ErrorID	Error code	WORD	• 0B: A parameter is incorrect. 0C: The module does not support the function. • AH500 series CPU module error code	• When there is a transition in the Error output pin's signal from low to high, or a transition in the Done output pin's signal from low to high, the value of the ErrorID output pin is updated.
TotalNum	Total number of emergency messages	WORD	K0~K255	• When there is a transition in the Done output pin's signal from low to high, the value of the TotalNum output pin is updated.
RecordNum	Number of emergency messages recorded	WORD	K0~K5	• When there is a transition in the Done output pin's signal from low to high, the value of the RecordNum output pin is updated.
EMCY1	First emergency message	WORD[4]		• When there is a transition in the Done output pin's signal from low to high, the value of the EMCY1 output pin is updated.
EMCY2	Second emergency message	WORD[4]		• When there is a transition in the Done output pin's signal from low to high, the value of the EMCY2 output pin is updated.
EMCY3	Third emergency message	WORD[4]		• When there is a transition in the Done output pin's signal from low to high, the value of the EMCY3 output pin is updated.
EMCY4	Fourth emergency message	WORD[4]		• When there is a transition in the Done output pin's signal from low to high, the value of the EMCY4 output pin is updated.

15.5.5 Obtaining the States of the Slave Stations on a CANopen Network



1. Function block
   Users can obtain the states of the slave stations on a CANopen network from the AH10COPM-5A module in a slot on the main backplane used by means of the function block CANopen_Info.
2. Input pins/Output pins

Input pin				
Name	**Function**	**Data type**	**Setting value**	**Time when a value is valid**
SID	Slot number	WORD	K0~K11	The value of the SID input pin is valid when there is a transition in the Execute input pin's signal from low to high.
Execute	The function block is executed when there is a transition in the Execute input pin's signal from low to high.	BOOL	True/False	-

Output pin				
Name	**Function**	**Data type**	**Time when there is a transition in an output pin's signal from low to high**	**Time when there is a transition in an output pin's signal from high to low**
Done	The execution of the function block is complete.	BOOL	• There is a transition in the Done output pin's signal from low to high when the execution of the function block is complete.	• There is a transition in the Done output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when the execution of the function block is complete, the Done output pin will be set to False in the next cycle.
Busy	The function block is being executed.	BOOL	• There is a transition in the Busy output pin's signal from low to high when there is a transition in the Execute input pin's signal from low to high.	• There is a transition in the Busy output pin's signal from high to low when there is a transition in the Done output pin's signal from low to high. • There is a transition in the Busy output pin's signal from high to low when there is a transition in the Error output pin's signal from low to high. • There is a transition in the Busy output pin's signal from high to low when there is a transition in the Aborted output pin's signal from low to high.
Aborted	The execution of the function block is interrupted by a command.	BOOL	• The execution of the function block is interrupted by a command.	• There is a transition in the Aborted output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low. • If the Execute input pin is set to False when the execution of the function block is interrupted, the Aborted output pin will be set to False in the next cycle.
Error	An error occurs in the function block.	BOOL	• A parameter is incorrect.	• There is a transition in the Error output pin's signal from high to low when there is a transition in the Execute input pin's signal from high to low.

Output pin				
Name	**Function**	**Data type**	**Output range**	**Update**
ErrorID	Error code	WORD	• 0B: A parameter is incorrect. 0C: The module does not support the function. • AH500 series CPU module error	• When there is a transition in the Error output pin's signal from low to high, or a transition in the Done output pin's signal from low to high, the value of the ErrorID output pin is updated.
Nodes_0	States of station address 0~station address 15	WORD	Every bit indicates the state of a station. 0: Normal 1: Abnormal	• When there is a transition in the Done output pin's signal from low to high, the value of the Nodes_0 output pin is updated.
Nodes_1	States of station address 16~station address 31	WORD	Every bit indicates the state of a station. 0: Normal 1: Abnormal	• When there is a transition in the Done output pin's signal from low to high, the value of the Nodes_1 output pin is updated.
Nodes_2	States of station address 32~station address 47	WORD	Every bit indicates the state of a station. 0: Normal 1: Abnormal	• When there is a transition in the Done output pin's signal from low to high, the value of the Nodes_2 output pin is updated.
Nodes_3	States of station address 48~station address 63	WORD	Every bit indicates the state of a station. 0: Normal 1: Abnormal	• When there is a transition in the Done output pin's signal from low to high, the value of the Nodes_3 output pin is updated.
Nodes_4	States of station address 64~station address 79	WORD	Every bit indicates the state of a station. 0: Normal 1: Abnormal	• When there is a transition in the Done output pin's signal from low to high, the value of the Nodes_4 output pin is updated.
Nodes_5	States of station address 80~station address 95	WORD	Every bit indicates the state of a station. 0: Normal 1: Abnormal	• When there is a transition in the Done output pin's signal from low to high, the value of the Nodes_5 output pin is updated.
Nodes_6	States of station address 96~station address 111	WORD	Every bit indicates the state of a station. 0: Normal 1: Abnormal	• When there is a transition in the Done output pin's signal from low to high, the value of the Nodes_6 output pin is updated.

Output pin				
Name	**Function**	**Data type**	**Output range**	**Update**
Nodes_7	States of station address 112~station address 127	WORD	Every bit indicates the state of a station. 0: Normal 1: Abnormal	• When there is a transition in the Done output pin's signal from low to high, the value of the Nodes_7 output pin is updated.

If a node on the node list in a master station is normal, the bit corresponding to the node will be OFF. If a node on the node list in a master station is abnormal (a node is not initialized successfully, or is offline abnormally), the bit corresponding to the bit will be ON.

15.6 Error Diagnostics and Troubleshooting

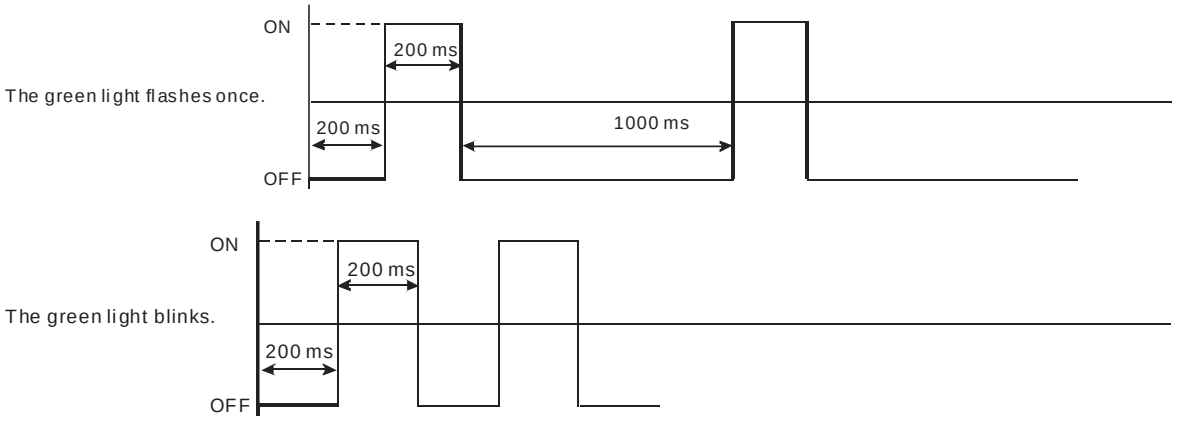
15.6.1 LED Indicators and Troubleshooting

AH10COPM-5A has two LED indicators—a RUN LED indicator and an ERROR LED indicator. The LED indicators indicate the current states of the module.

- RUN LED indicator

LED indicator	Description	Solution
The light is OFF.	AH10COPM-5A is disconnected.	Check whether the AH500 system used is powered.
The green light flashes once.	AH10COPM-5A stops running.	AH10COPM-5A is downloading a network configuration, and waits to complete the downloading of the network configuration.
The green light blinks.	AH10COPM-5A is ready to operate.	If the green light is blinking when the AH500 series CPU module is running, users have to 1. check whether the bus cable on the CANopen network created is connected correctly. 2. check whether the serial communication speed of the master station selected is the same as the serial communication speeds of the other slave stations. 3. check whether the slave stations configured are connected to the network created. 4. check whether slave stations are offline.
The green light is ON.	AH10COPM-5A is operational.	No solution is required.

Difference between the green light which flashes once and the green light which blinks:

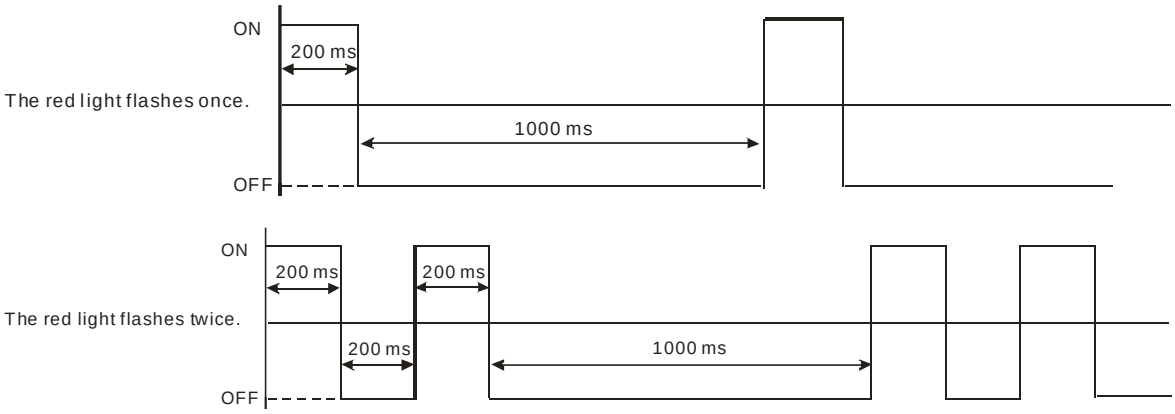


- ERROR LED indicator

LED indicator	Description	Solution
The light is OFF.	AH10COPM-5A is normal.	No action is needed.
The red light flashes once.	Bus fault	1. Check whether the CANopen bus cable used is a standard cable. 2. Check whether the both ends of the CANopen bus used are connected to terminal resistors. 3. Check whether the noise around the CANopen bus cable used is strong.
The red light flashes twice.	Master station: The control of the errors in a slave station is not sent after a set period of time. Slave station: AH10COPM-5A does not send a heartbeat message after a set period of time.	1. Check whether the CANopen bus cable used is a standard cable. 2. Check whether the both ends of the CANopen bus used are connected to terminal resistors.
The red light is ON.	The bus used is off.	1. Check whether the bus cable on the CANopen network created is connected correctly. 2. Check whether the serial communucation speed of AH10COPM-5A is the same as the serial communication speeds of other slave stations.

15

Difference between the red light which flashes once and the red light which flashes twice:



15.6.2 Error Codes

Users can monitor the error codes in the system log in ISPSoft, or the error code in the module error code register in the AH500 series CPU module used.

- AH10COPM-5A functions as a master station.

Code	Description	Solution
16#A0E0	AH10COPM-5A receives an emergency message from a slave station.	Use the function block CANopen_EMCY to read relevant information.
16#A0E1	The length of a PDO that a slave station sends is not the same as the length of the PDO set in the node list.	Set the length of the PDO in the slave station again, and then download the setting to AH10COPM-5A.

Code	Description	Solution
16#A0E2	AH10COPM-5A does not receive a PDO from a slave station.	Make sure that the PDOs in the slave station are set correctly.
16#A0E3	An automatic SDO is not downloaded successfully.	Make sure that the automatic SDO is et correctly.
16#A0E4	A PDO parameter is not set successfully.	Make sure that the setting of the PDO parameter is legal.
16#A0E5	A key parameter is set incorrectly.	Make sure that the slave stations connected are the same as the slave stations set.
16#A0E6	The actual network configuration is not the same as the network configuration set.	Make sure that the power supplied to the slave stations connected is normal and the network created is connected correctly.
16#A0E7	The control of the errors in a slave station is not sent after a set period of time.	
16#A0E8	The master station address is the same as a slave station address.	Set the master station address or the slave station address again, and make sure the new station address is not the same as a slave station address.
16#A0F1	No slave station is added to the node list in CANopen builder.	Add slave stations to the node list, and download the configuration to AH10COPM-5A.
16#A0F3	An error occurs in AH10COPM-5A.	Download parameters again. If the error still occurs, please replace AH10COPM-5A.
16#A0F4	The bus used is off.	Please check whether the bus cable on the CANopen network created is connected correctly, make sure that the serial transmission speeds of all the nodes on the network are the same, and power AH10COPM-5A again.
16#A0F5	The node address of AH10COPM-5A is set incorrectly.	The node address of AH10COPM-5A must be in the range of 1 to 127.
16#A0F6	Internal error: An error occurs in the manufacturing process in the factory.	Power AH10COPM-5A again. If the error still occurs, please replace AH10COPM-5A.
16#A0F7	Internal error: GPIO error	
16#A0F8	Internal error: Internal memory error	
16#A0F9	Low voltage	Make sure that the power supplied to AH10COPM-5A is normal.
16#A0FA	An error occurs in the firmware of AH10COPM-5A.	Power AH10COPM-5A again.
16#A0FB	The transmission registers in AH10COPM-5A are full.	Please make sure that the bus cable on the CANopen network created is connected correctly, and power AH10COPM-5A again.
16#A0FC	The reception registers in AH10COPM-5A are full.	Please make sure that the bus cable on the CANopen network created is connected correctly, and power AH10COPM-5A again.

- AH10COPM-5A functions as a slave station.

Code	Description	Solution
16#A0B0	AH10COPM-5A does not send a heartbeat message after a set period of time.	Check whether the bus cable on the CANopen network created is connected correctly.
16#A0B1	The length of a PDO that a slave station sends is not the same as the length of the PDO set in the node list.	Set the length of the PDO in the slave station again, and then download the setting to AH10COPM-5A.
16#A0B2	The master station selected does not send a node guarding message after a set period of time.	Check whether the bus cable on the CANopen network created is connected correctly.
16#A0F4	The bus used is off.	Please check whether the bus cable on the CANopen network created is connected correctly, make sure that the serial transmission speeds of all the nodes on the network are the same, and power AH10COPM-5A again.
16#A0F5	The node address of AH10COPM-5A is set incorrectly.	The node address of AH10COPM-5A must be in the range of 1 to 127.
16#A0F6	Internal error: An error occurs in the manufacturing process in the factory.	Power AH10COPM-5A again. If the error still occurs, please replace AH10COPM-5A.
16#A0F7	Internal error: GPIO error	
16#A0F8	Hardware error	
16#A0F9	Low voltage	Make sure that the power supplied to AH10COPM-5A is normal.
16#A0FA	An error occurs in the firmware of AH10COPM-5A.	Power AH10COPM-5A again.
16#A0FB	The transmission registers in AH10COPM-5A are full.	Please make sure that the bus cable on the CANopen network created is connected correctly, and power AH10COPM-5A again.
16#A0FC	The reception registers in AH10COPM-5A are full.	Please make sure that the bus cable on the CANopen network created is connected correctly, and power AH10COPM-5A again.