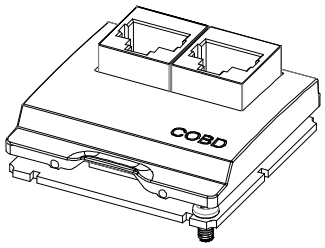
AP-COBD Manual

V0.2

2015/03

Context

1 AP-COBD expansion card Profile



1. The manual is only used as AP-COBD expansion card operation guide and entry reference, CANopen protocol content in the third chapter of this book to make a brief introduction. If readers want to know more about CANopen agreement, Please read CANopen related information articles or books.
2. AP-COBD expansion card is used in CANopen communication. To use the expansion card, you must plug in it before the Basic unit is powered on, otherwise, the expansion card won't work normally. The expansion card can be only plugged/unplugged when the power is off. When the expansion card is not in use, you shall install the standard cover of the expansion card, so as to protect it from dust, which may affect the connectivity of the connector. After the expansion card is plugged, the Basic unit will identify the expansion card automatically, and display the ID D8020=3(ID=0 when identification error occurs) in D8020 (for expansion card communication port).
3. Only AP300 AP Series models support CANopen, AP-360-B has two communication interfaces, only one communication interface expansion card inserted into the AP-COBD effective.

1.1 CANopen Feature

AP-COBD expansion cards can be used as a CANopen network master station also be used as a slave station.

1.1.1 Master station function

When it is used as the master station, the following features are available：

1. Support NMT(Network Management Object) service.
   Comply with CANopen standard protocol DS301 v4.02.
2. Support NMT status control.
   Can be used to control the status of slave station in CANopen network.
3. Support NMT error control.
   Support Heartbeat for monitoring whether the station is online.

4. Support PDO（RxPDO、TxPDO）service.

Each node has 8×RPDO and 8×TPDO in maximum. There may be a maximum of 16 nodes, and each PDO can have 8 bytes in maximum. 16×8 RxPDO can be supported in maximum, with the data volume that can reach 16×8×8=1024 bytes. 16×8 TxPDO can be supported in maximum, with the data volume that can reach 16×8×8=1024 bytes.

5. Support SDO service.

SDO can be used to read/write or configure the parameters of the slave station. Support standard SDO transmission mode. Support Auto SDO function, and it can write 20 data sets in each slave in maximum.

6. Support the service of reading the emergency message from the slave

The service of reading the emergency message from the slave can be used to read the error or alarm message of the slave

7. Support SYNC Object service

By SYNC message, it realizes the sync action among multiple devices.

1.1.2 Slave station function

As slave station, the following features are available：

1. Comply with CANopen standard protocol DS301 v4.02
2. Support NMT(Network Management Object) service

Support NMT error control，Support Heartbeat rather than Node Guarding.

3. Support PDO service

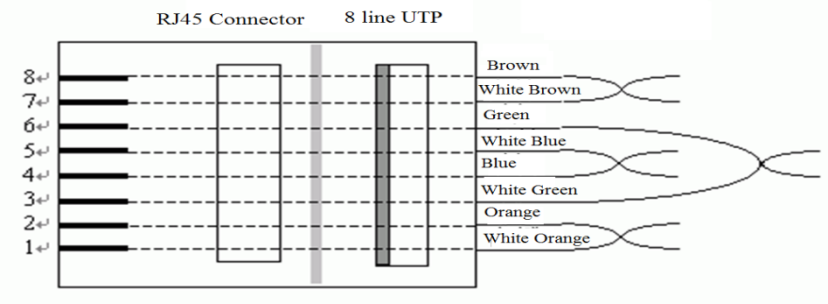
A maximum of 8×RxPDO and 8×TxPDO can be configured on each slave station. PDO message can be used to transmit the data that are input and output in real-time. PDO transmission type: Sync mode, async mode.

4. Support the service of emergency message

When emergency error or alarm occurs on the slave station, it could notify the master station via emergency message.

1.2 Specifications

1.2.1 CANopen connectors



The RJ45 connect comply with TIA/EIA 568B standard.

Item	specification
Connect cable	RJ45
Transmission	CAN
Electrical isolation	3.75 KV
Wiring	

Note: RJ45 communication lines need customers to buy their own

Pin	Signal	Description
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L Bus line(dominant low)
3,7	CAN_GND	CAN Ground
4,5,6,8	—	—

1.2.2 Communication Specifications

Item	Specification
Type	PDO、SDO、SYNC、Emergency、NMT
Transfer rate	10Kbps、20Kbps、50Kbps、125Kbps、250Kbps、500Kbps、800Kbps、1MKbps（Bit/sec）

1.2.3 Electrical Specifications

Item	Specification	Item	Specification
Voltage	VCC=5V	Current consumption	VCC ：160mA
	VDD=3.3V		VDD ：130mA

1.2.4 Environmental Specifications

Item	Specification
Operating temperature	0℃～55℃
Relative humidity	10%～95%
Storage Temperature	-25℃～75℃
Storage humidity	10%～95%
Standard	ISO11898 physical layer protocol

1.3 Input-output mapping

Mapping / Station	Output mapping	Input mapping
Master station	W0~W999	W1000~W1999
Slave station	D2000~D2999	D1000~D1999

2 CAN Introduction

CAN is an internationally standardized serial communication protocol. CAN protocol has the following features：

1. Sending message

All messages in CAN protocol are sent in fixed format, and all units can start sending message when the bus is idle. When more than two units start sending message simultaneously. the priority shall be subject to the ID. ID indicates the priority for accessing the bus message. When more than two units send message simultaneously. it will compare each bit of the ID for each message. The unit with the highest priority will continue to send message, while the other units will stop to receive message immediately

2. System flexibility

The units connected with the bus is without the information like "address". Therefore, when a new unit is added to the bus, it doesn't change the software/hardware and application layer for other units connected with the bus.

3. Communication rate

Use may set appropriate communication rate according to the entire network size.All units in the same network must set the uniform communication rate. Even if only one unit is set with communication rate different from others, it will output error signal to affect the communication of the entire network. The communication rate of different network can be different.

4. Error detection、notification、recovery

Error detection function：All units can detect error

Error notification function：The unit which detects error will notify other units immediately

Error recovery function：When the unit sending message detects error, the current sending action will be stopped, and the target unit will keep sending the

message until the action is successful

5. Connection

CAN bus can connect with the buses of multiple units simultaneously. The total number of connected units is unlimited technically. However, actually the number of connected units is restricted by the bus delay and electric load. Decreasing the communication rate may increase the number of connected units, and vice versa.◦

3 CANopen Introduction

3.1 CANopen Communication format

1. ID settings

Communication format is determined by the D8022. D8022's bit15 said master-slave: 0 based, one is from; bit7 ~ bit0 said node ID; bit10 ~ bit8 default is 0, the master node ID valid range of 1 to 127, the node ID valid range from 1 to 16, the main unrepeatable from the node ID.

Bit	Name	Description（Binary.）	
		Min	Max
bit7~bit0	Node ID	0000001	1111111
bit10~bit8	Preset value	000	000
bit14~bit11	Baud rate size	0000	0111
bit15	Master / Slave	0（Master）	1（Slave）

2. Baud rate size

D8022's bit14 ~ bit11 bit binary digital value corresponding to the size of the serial transmission rate◦

Baud rate（bps）	bit14~bit11（Binary）	Distance（M）
10 K	0000	5000
20 K	0001	2500
50 K	0010	1000
125 K	0011	500
250 K	0100	250
500 K	0101	100
800 K	0110	50

1 M	0111	25

Example: Main Select the communication speed from 500 Kbps.

The master node number is set to 4:

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binary	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0

The D8022=H2804；

From the node number is set to 11:

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binary	1	0	1	0	1	0	0	0	0	0	0	0	1	0	1	1

The D8022=HA80B；

Note: After the serial transmission rate change, the device should be powered off and on again, the communication speed to take effect. After the node ID changes, PLC Stop and then Run need only take effect

3.2 CANopen Communication Model

CANopen protocol defines three kinds of communication model represents the type of data exchange between devices. These three models are AP300 Series PLC

1. "Master - Slave " model

Used only for network management (NMT). Only a valid NMT master, the remaining devices are NMT slave. If the device has a CANopen NMT master functionality device, then it must also have the NMT slave functionality

2. "Client - server" model

Describe the communication relationship between the two devices. The client sends a request to the server, the server receives the request be handled in-house, will handle the response data were completed by CAN, after the client receives confirmation response. This model is used only for SDO communication

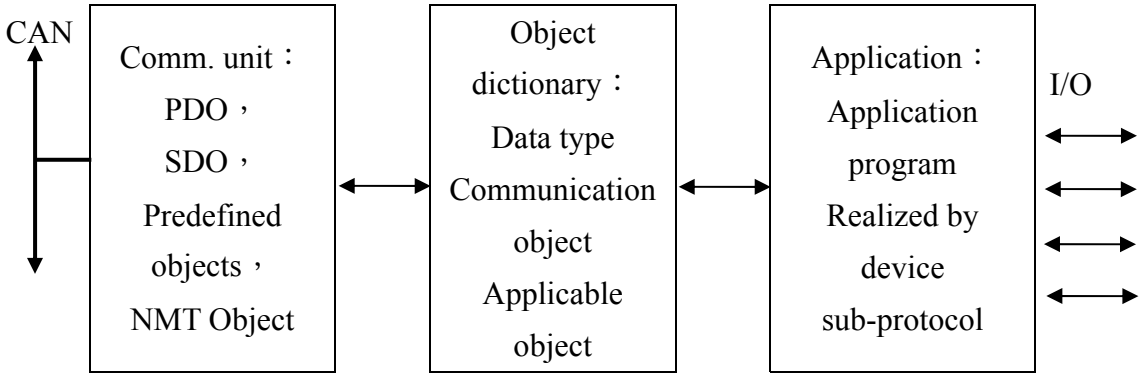
3. "Producer - consumer" model

Describe the relationship between a producer and communications with one or more consumers. Producer services, consumer services received or ignored. CANopen networks need CANopen master device to manage all CANopen slave devices, the master station by loading from the EDS file, you can operate the object dictionary stations, as well as from the

establishment of the PDO communication from the station. Master heartbeat packets by default monitor all slave status is currently located, as well as control of all operations from the station into a different state. Under - "producer-consumer" model can not require a master can also achieve communication between slaves, that is, "from the" Communication.

3.3 CANopen Device Mod

The basic model of the device includes a communication unit, the application process and object dictionary three part。



3.3.1 Object dictionary OD

OD object dictionary is the most central concept CANopen protocol. Each node has a CANopen object dictionary, the dictionary contains a description of the object of this equipment and its network behavior of all parameters (see Appendix II of this book). The so-called object dictionary is an ordered set of objects: each object using a 16-bit index addressing, the effective range is between 0x1000 ~ 0x9FFF. In order to allow access to the individual elements of the data structure, and defines an 8-bit sub-index. Eg: Index: 0x1000, sub-index: 0x00, indicating that the device type。

Index	Object
1000-1FFF	Communication profile field
2000-5FFF	Manufacturer-specific profile field
6000-9FFF	Standard device profile field

Device Status EDS is described under factory state, once the user design the network and the need to create applications that will produce specific network variables. In order to be able to addressing via CANopen network, the network must be assigned to a variable index and sub-index, AP series defines the index 0x2000 manufacturer-specific sub-agreements in the region, the sub-index 0x00 ~ 0x20, index 0x2001, subindex 0x00 ~ 0x20, the network variable transmission from PDO to the

application

3.3.2 Communication Unit

CANopen application layer describes the various types of communication objects, these communication objects are made of one or more CAN messages to achieve. Communication objects into network management NMT, service data objects SDO, process data object PDO, four types of predefined objects.

1. NMT network management

Network management objects, used to be responsible for starting the network and monitoring devices (heart rate, start packet). Network management, with a network allows only one master node and one or more slave nodes, and follow the master-slave model. Devices with network management host function is often called CANopen master device, usually with a SDO client functionality. On the other hand, has a network management functions from machine equipment commonly referred to as CANopen slave devices, and must have PDO function, so CANopen master device can be controlled from the station as well as read and write CANopen object dictionary slave devices. AP series PLC can be used as master or as a slave station, with NMT function as master station, as slave station no such function.

1. NMT services agreement

CANopen device automatically start and after the completion of the internal initialization pre-operational state, and then start the message packet (Boot-up), will this state change event notification NMT host. NMT master sends a CAN message, you can make the whole network into operation. In addition, NMT master can also force the device into the disabled state, in addition to network management and heartbeat, and the remaining communication services are disabled

2. Device Monitoring

Monitoring equipment (error control) services and agreements for state detection network devices and equipment are located online. CANopen system provides heartbeat packets for device monitoring. Heartbeat messages periodically sent a message to one or more devices, surveillance equipment between each other.

2. SDO Service Data Objects

Application object dictionary is part of the bridge and communications section. All data entry CANopen devices are managed by the object dictionary. Each object dictionary entry can be used to index or sub-index addressing. CANopen SDO defines the main parameters for the master node from the node configuration. SDO service confirmation is the biggest feature, generates a reply for each message, ensure the accuracy of data transmission.

In a CANopen system, so data exchange mode of communication is based on client / server architecture. Typically CANopen SDO from the node as a server, CANopen master node as a client. Client via the "Send SDO request" and "Auto SDO" in two ways, the object dictionary access information on the server, the server object dictionary of a single object for read / write. Each slave configuration automatically SDO biggest items for 20 pens, automatic SDO can only write parameters, the parameters can not be read. Auto SDO before running from the station by the desire to enter the running state of the slave write only once.

By AP as an example: SDO data exchange between at least two CAN messages can be achieved, and the two CAN CAN message identifier is not the same. CAN identifier for the node ID + 600H CAN messages containing information SDO client agreements identified, SDO server through the CAN identifier for the node ID + 580H of CAN packets response.

3. PDO process data objects

PDO using producer - consumer model to transmit real-time data, the producer responsible for sending data, such as data transmission is triggered by an event inside the device, the priority of all data sent by other devices on the bus monitor bus, PDO by corresponding CAN identifier (COB-ID) determine and identify words based on their right to determine whether the packet is processed (consumers). PDO is divided into RPDO (receive process data objects) and TPDO (sending process data objects), said in the agreement TPDO and RPDO are relative, usually a particular point of view to describe slave. For example: I / O device sends its input data in TPDO, TPDO to receive this information equipment, this TPDO is the device RPDO。

1. PDO's CAN identifier

CANopen protocol has been TPDO 1 ~ 4 and RPDO 1 ~ 4 predefined default word recognition, others PDO identifier assigned by the system developers based on the node ID. If you use the default CAN identifier, then all slaves may have RPDO and TPDO corresponding host communication, but the

machine can not listen to the other sent from the machine out of the TPDO. Therefore, if the producer - consumer model between non-program designed to exchange data directly from the machine, you need to re-set the COB-ID, so consistent CAN CAN identifier identifying word producers and consumers。

RPDO No	COB-ID（HEX）	TPDO No	COB-ID（HEX）
RPDO1	200 + Slave station No.	TPDO1	180 + Slave station No.
RPDO2	300 + Slave station No.	TPDO2	280 + Slave station No.
RPDO3	400 + Slave station No.	TPDO3	380 + Slave station No.
RPDO4	500 + Slave station No.	TPDO4	480 + Slave station No.

2. communication parameters

There are three main parameters contain, respectively, Transmission type, Inhibit time, and Event timer。

●Transmission type

1) Synchronous transmission, divided into non-periodic and periodic transmission. Non-periodic transmission is an object-specific event by the device specified in sub-agreements pre-trigger transmission. Transmission cycle is synchronized by receiving object (SYNC) to achieve, you can set 1-240 synchronization objects trigger.

2) Asynchronous transfer, which is an object-specific event trigger sub-agreements stipulated by the device to trigger (for example: regular transmission, data transmission and other changes)。

Transmission type		Description of transmission type	Remark
0	RPDO	The master station sends a sync message to the slave stations in each sync cycle. After RxPDO data changes, it will be sent to the master station. The data received by the slave station will take effect after the next sync message is received. When RxPDO data has no change, the master station won't send RxPDO data to the slave station.	Non-cyclic sync
	TPDO	The master station sends a sync message to the slave stations in each sync cycle. After RxPDO data changes, it will be sent to the master station immediately. Once it is received by the master station, it will take effect immediately. When RxPDO data has no change, the slave station won't send RxPDO data to the master station	
1	RPDO	The master station sends a sync message to the slave stations	Sync

Transmission type		Description of transmission type	Remark
		in each sync cycle. The master station sends RxPDO data every sync cycle, and the RxPDO data received by the slave station will take effect after the next sync message is received	cycle
	TPDO	The master station sends a sync message to the slave stations in each sync cycle. The slave station sends RxPDO data every time it receives a sync message. The RxPDO data will take effect immediately after it is received by the master station.	
2	RPDO	The master station sends a sync message to the slave stations in each sync cycle. The master station sends RxPDO data every 2 sync cycles, and the RxPDO data received by the slave station will take effect after the next sync message is received.	Sync cycle
	TPDO	The master station sends a sync message to the slave stations in each sync cycle. The slave station sends RxPDO data every time it receives two sync messages. The RxPDO data will take effect immediately after it is received by the master station	
3 ~ 240	RPDO	Follow the transmission type 1 and transmission type 2	Sync cycle
	TPDO	Follow the transmission type 1 and transmission type 2	
254	RPDO	After RxPDO data changes, it will be sent to the slave station. Once it is received by the slave station, it will take effect immediately. When RxPDO data has no change, the master station won't send RxPDO data to the slave station	Asynchronous
	TPDO	When the event time and time is 0 ban after TPDO data changes, TPDO data transmission to the master station, the main station received the information immediately; TPDO data did not change when the slave does not send data to the master station TPDO. Time and time when the event is not prohibited for 0:00, an event from the station every time data (TPDO data transmission after the first ban is not allowed to transfer TPDO information within the time), and the TPDO changes to master data transmission once TPDO, TPDO data transfer immediately to the main station, the main station received the information immediately.	
255	RPDO	Same as the transmission type 254	Asynchronous
	TPDO	Same as the transmission type 254	

●Inhibit Time

Inhibit time functions as PDO send screening program, in the PDO changes in the input data for the first time without waiting for data to be sent directly to the PDO, PDO input after sending PDO will not immediately trigger when data changes happen again. Inhibit Time defines the time between two PDO sent with the same CAN identifier must be at least interval is to prevent TPDO sent too frequently occupied a large number of bus bandwidth, thus affecting the bus communication, that is, when after sending PDO interval of a prohibited time before sending the next one PDO. When this parameter is set to invalid 0. For example: AP300 PLC register data changes once every 500ms data set Inhibit time is 600ms, the PDO input data without waiting for the first time sent directly change interval 600ms before sending the next PDO。

●Event Timer

Event time in the non-synchronous transmission type is valid, the overflow is considered a trigger event, the timer overflow trigger a TPDO sending, then the timer is reset periodically send PDO. When this parameter is set to invalid 0. Events or sub-protocol defined by the manufacturer occur before the end of the event time, then immediately send TPDO, and restart the event timer. For example: AP300 PLC register data changes once every 500ms information, event timer set time is 300ms, 300ms is timing when to trigger a TPDO, the timer is cleared to re-timing, when the 500ms data register values change once, triggering an event, timing again reset again when the time 300ms trigger a TPDO, conduct loop.

3. PDO mapping parameter

The mapping parameter includes an object list in OD. These objects will be mapped to the corresponding PDO, which include the data length(unit: bit). The PDO message content is pre-defined. If PDO supports variable PDO mapping, the PDO can be configured by SDO。

4. Pre-Defined Message

The pre-defined message or special functional object is the specific functions of CANopen device, which are prodived to facilitate the CANopen master station for the management of slave station. COB-ID for the special function is pre-defined in CANopen protocol.

1. Synchronization (SYNC)

The newspaper major pieces of cultural relics throughout the network to achieve synchronous transmission, the CANopen device to trigger the input data can be collected through SYNC, equally applicable TPDO synchronous transmission. TPDO synchronous data output according to their COB-ID for transmission, using data synchronization RPDO next sync signal processing previously received, whereby the output data synchronization. Synchronization object COB-ID and synchronization cycle can be set, according to the set value synchronization messages sent.

2. Emergency Object

In CANOpen, the error status information to be sent by standardized mechanism, when the device error occurs, standardized mechanism will send an emergency message to inform other devices of its error state networks.

3.3.3 Pre-defined Connection Set of CANopen

Reboot CANopen network configuration and the time required may be relatively long, in order to simplify the configuration work, CANopen defines the "Predefined Connection Set." So all must be well defined CAN CANopen device identifier, and then according to the level of priority to assign identifiers to all devices, thus shortening the time to restart and configure the CANopen network.

CANopen pre-defines the broadcasting objects of the master/slave connection sets			
Object	Functional code（bit10~bit7）	COB-ID	Index of communication parameter in OD
NMT-Module-control	0000	000H	–
SYNC	0001	080H	1005H、1006H、1007H
Time stamp	0010	100H	1012H、1013H

CANopen pre-defines the broadcasting objects of the master/slave connection sets			
Object	Functional code（bit10~bit7）	COB-ID	Index of communication parameter in OD
Emergency	0001	081H~0FFH	1014H、1015H
PDO1（Sending）	0011	181H~1FFH	1800H
PDO1（Receiving）	0100	201H~27FH	1400H
PDO2（Sending）	0101	281H~2FFH	1801H
PDO2（Receiving）	0110	301H~37FH	1401H

PDO3（Sending）	0111	381H~3FFH	1802H
PDO3（Receiving）	1000	401H~47FH	1402H
PDO4（Sending）	1001	481H~4FFH	1803H
PDO4（Receiving）	1010	501H~57FH	1403H
SDO（Sending ／server）	1011	581H~5FFH	1200H
SDO（Receiving ／client）	1100	601H~67FH	1200H
NMT NMT-Error -control	1110	701H~77FH	1016H、1017H

3.3.4 AP Error Monitoring

1. Error Code Register D8071

Monitoring PLC registers D8071, its value indicates an error code。

Station	Error Code	Meaning	Description	Approach
Master station	7101	Communication speed error	Non-support of CANopen Communication speed	Select correct Communication speed
	7102	Node ID error	From the node ID = 0 or ID> 16	Node set in the range from 1 to 16
	7103	Connection Error	Network cable is bad or unplug	Check the cable & Plug firmly
	7104	Auto SDO error	Configuring SDO over 20	The number of set less than 20
Slave station	7105	Heartbeat error	Master dropped no heartbeat	Check the Master station

2. Error website register D8072

Monitoring PLC registers D8072, its value indicates an error website。

Node	D8072 Meaning
Main Node	Indicates that the Main node is monitoring whether the line from the node. D8072 in bit0 ~ bit15 bit corresponding node number from 1 to 16. If the node number is dropped from slave station 1, the main node D8072 monitor this position in a bit0
Slave Node	Indicates that from the master node to monitor or whether the rest of the line from the node. D8072 in bit0 ~ bit15 bit corresponding to the node number from 1 to 16. From the node to monitor the main node number> 16, from the node itself reported errors. If the main node number 20, number 10 from the slave node, the main node D8072 monitor this from the position of a bit9

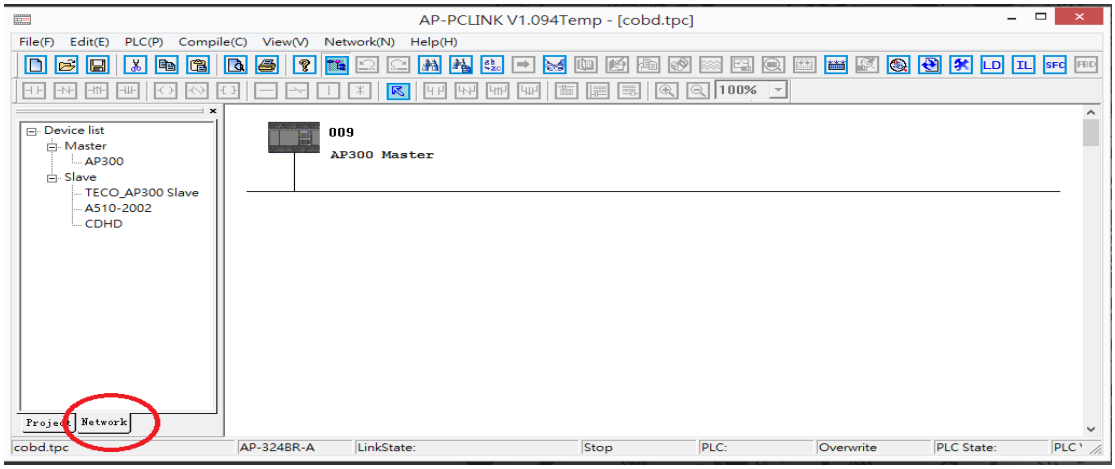
4 Use AP-PCLINK software configuration network

4.1 CANopen Network structure

Because CANopen is an application layer protocol based on CAN bus, so its network set up for a typical bus structure, the master and slave are mounted on the bus. Usually in a CANopen network, only one master device and several slave devices. CANopen network in the wiring, should be selected with the mask twisted to improve bus interference. DIP switch AP-COBD expansion cards only role as a terminal resistor. Terminal resistor selection, a short distance from time to consider. AP-COBD inclusive general bus expansion card DIP switch must be set ON, indicates that the internal connection between CAN_L and CAN_H 120 ohm resistor. Can improve the ability of the network topology nodes to eliminate signal reflections in Communication. If you ignore this resistance, noise immunity and reliability make the communication greatly reduced, or even can not communicate。

1. New CANopen network

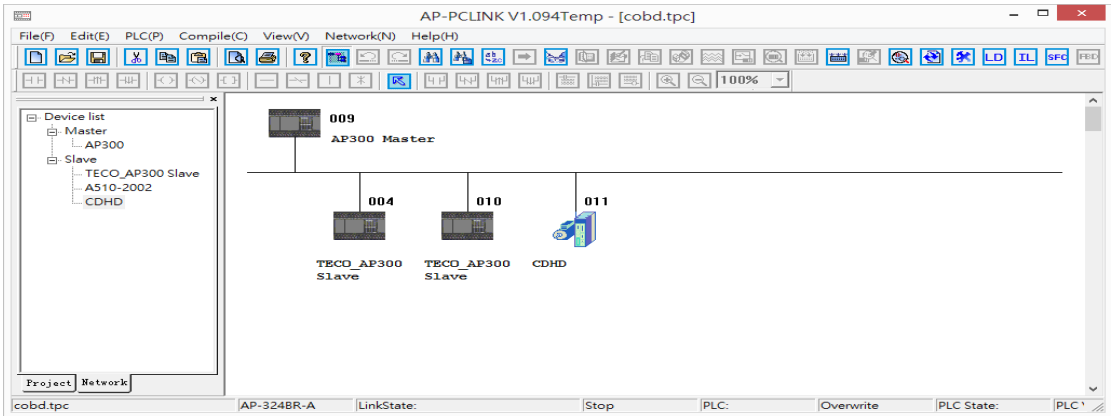
Start the AP-PCLINK software, the new AP300 engineering, software default interface is "project", click "Network" to Network interface, the master node number is preset to 9.



2. The basic network structure

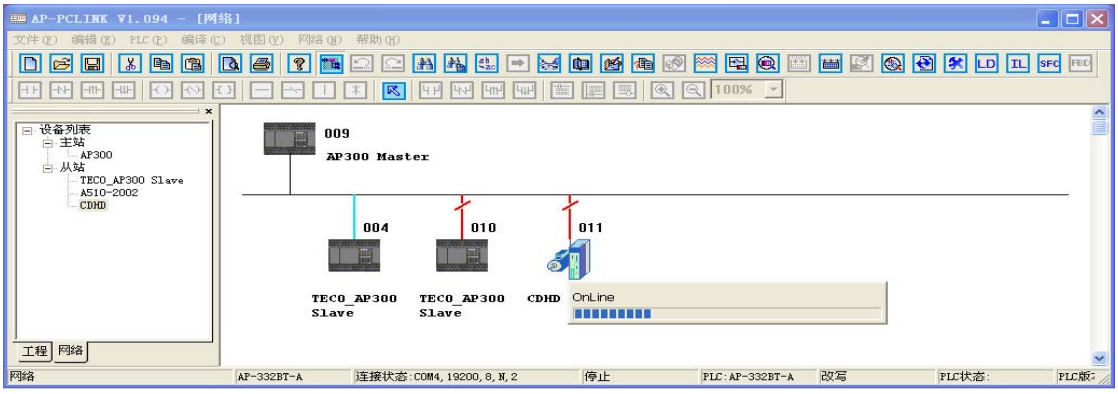
Left side of the "Network" interface is optional equipment list, double-click the device name can be added to the device bus. If no list of equipment required equipment, you can through the menu "Network" >> "EDS Operations" (referring to the specific operation of the album section 4.2.3) to add a new device. The following figure shows the basic structure of CANopen network, the network has a CANopen master, responsible for managing the networks all

slaves, each device has a separate node ID. Can master → properties by right-clicking, double-click or right-click → Properties, modify the node ID from the station。

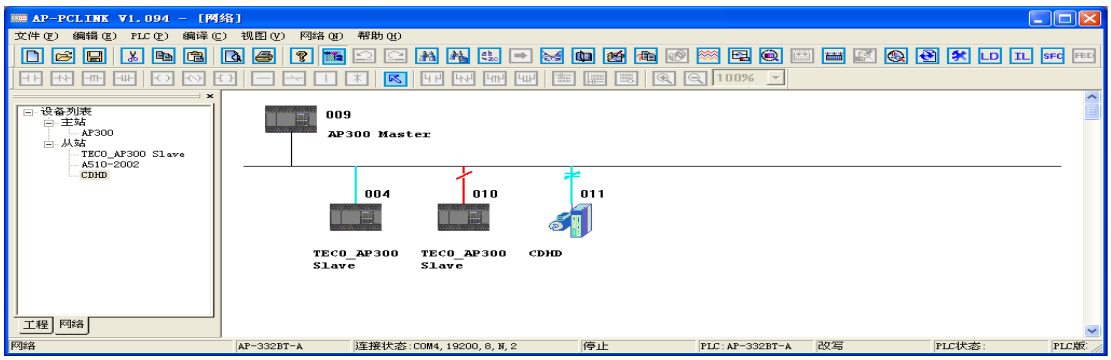


3. Network Online

AP-COBD expansion card into the RJ45 cable to achieve CANopen network communications. Select Menu "Network" >> "online"。



A progress bar will appear online upon completion of the following three conditions:
Node 4: Indicates Slave 4 successful communication with the master station.
Node 10: 10 and interrupt slave master communication.
Node 11: 11, said the success of the slave master communication, but the upper and lower computer do not match.

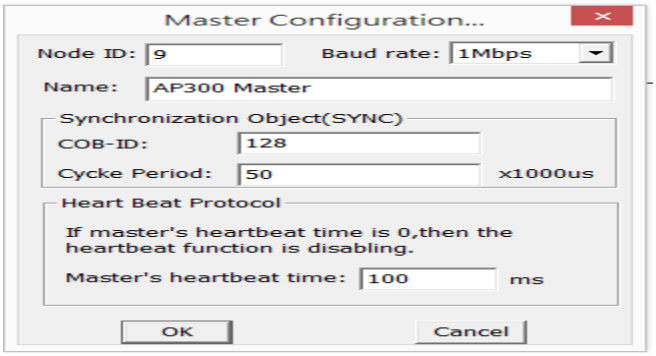


4.2 CANopen Network configuration

4.2.1 Station Configuration

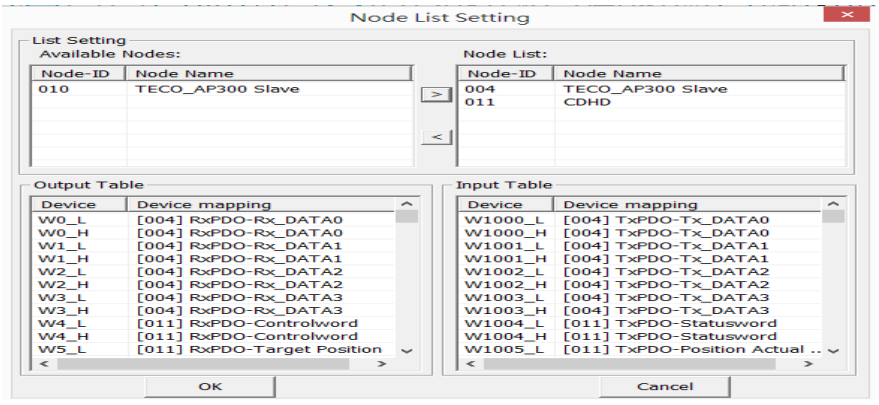
1. Master Station Configuration

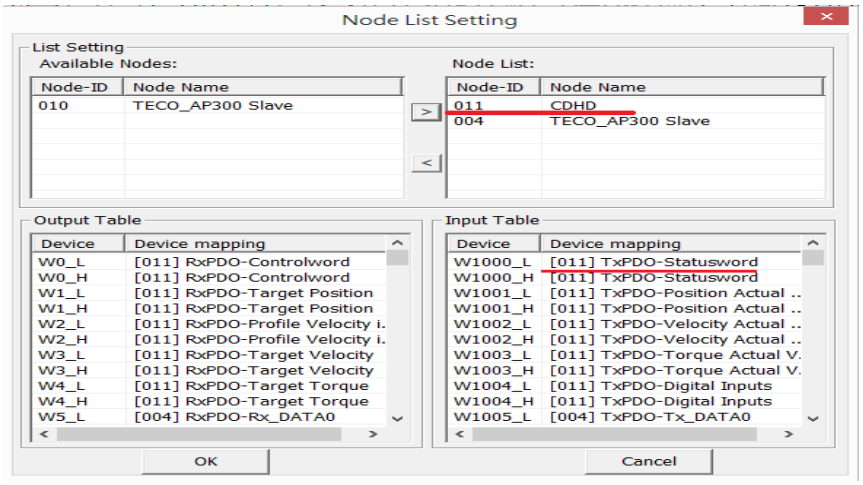
1. Right-click the master PLC icon → Properties → Master Configuration。



2. Configuration node list

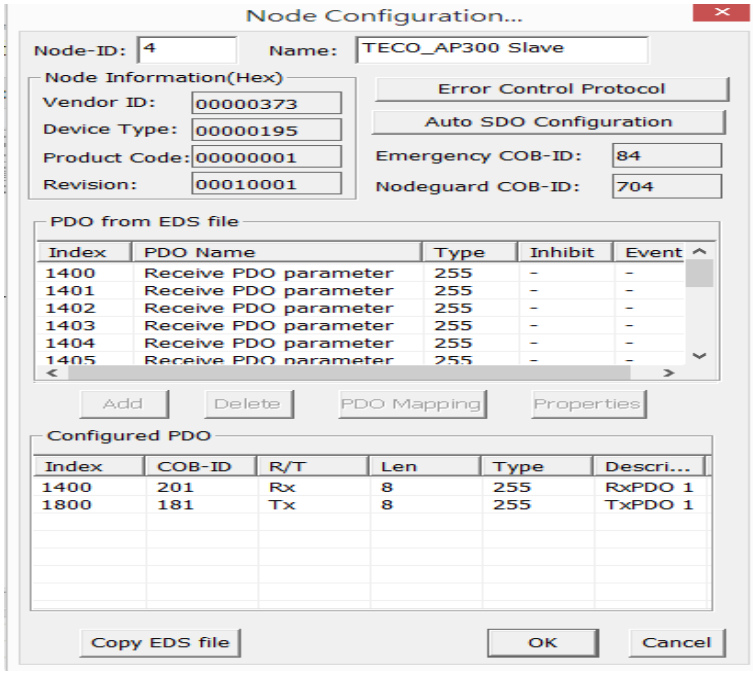
Example: Double-click the icon master PLC, configure the list of available nodes 4 and 11 is selected, click the button ">" to add the node list. If the slave does not fit into the list, its configuration is invalid and a different order corresponding to different configurations.

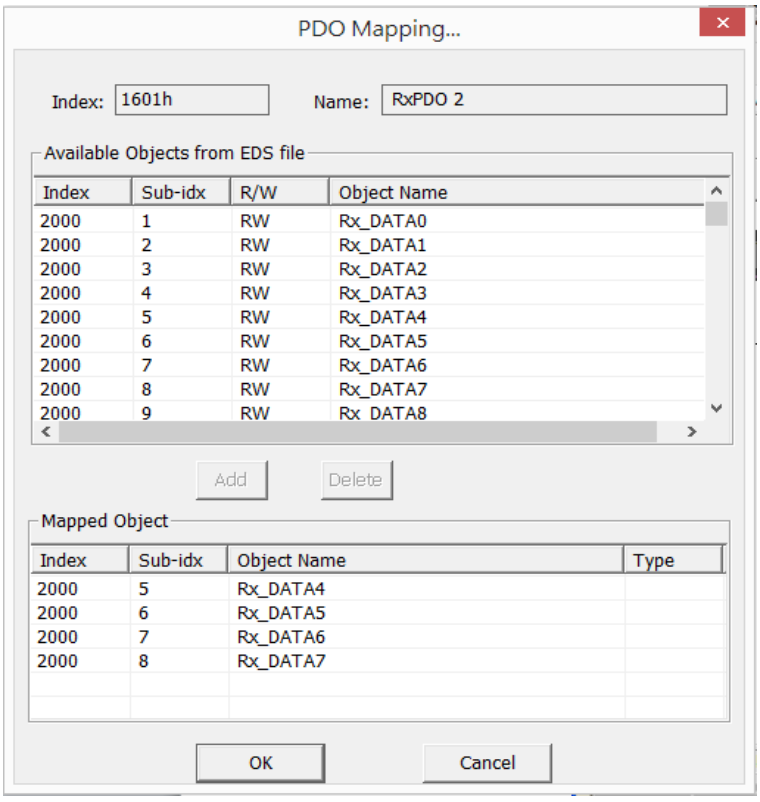




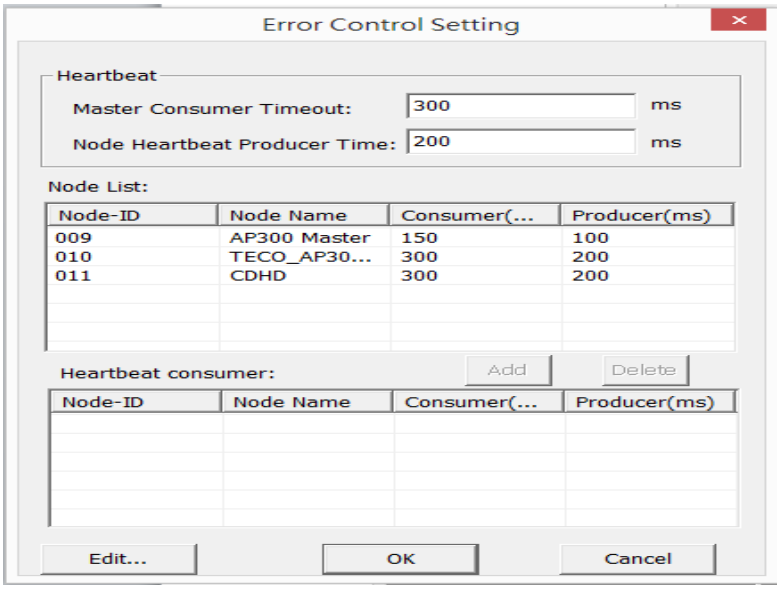
2. Slave configuration

1. Right-click or double-click the configuration icon → slave node configuration slave node icon → Properties →





2. Error Control Protocol

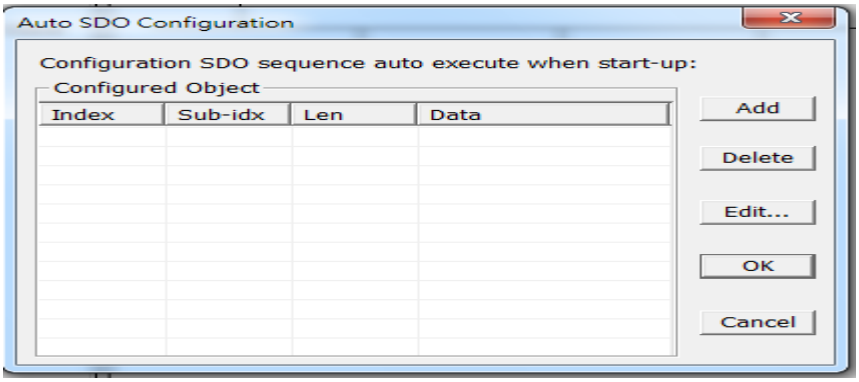


Parameter name		Description	Remark
Heartbeat	Slave station Heartbeat generation time	The slave sends the heartbeat message to the master based on the cycle of "slave heartbeat generation time".	The master monitoring timeout period shall be larger than the slave heartbeat generation time
	Master monitoring timeout period	If the master fails to receive the heartbeat message from the slave within the "master monitoring timeout period", the master will consider the slave is disconnected.	
	Master station Heartbeat generation time	The master sends the heartbeat message to the master based on the cycle of "slave heartbeat generation time"	
Heartbeat monitoring		By configuring the "error control protocol" node, it can monitor whether the node configured in the field of "Heartbeat Monitoring" is disconnected	The field of "Heartbeat Monitoring" can be only configured with one node.

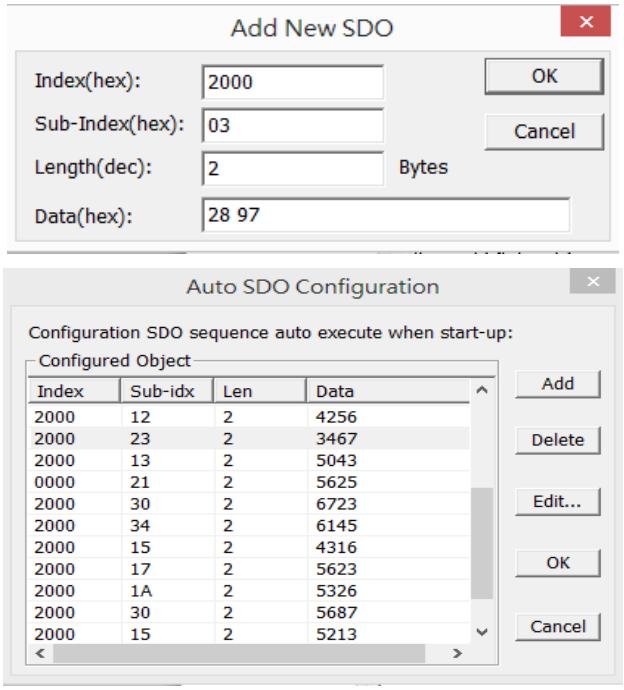
3. SDO Configuration

●Auto SDO configuration

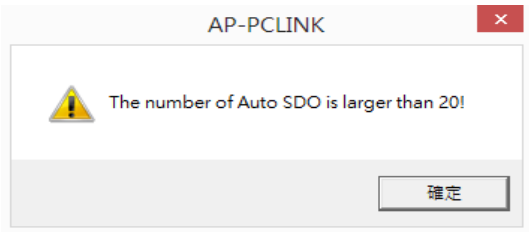
Click "Auto SDO Configuration" option in the interface of "Node Configuration". Click "Add" to select the auto SDO. Click "Edit" to modify the selected auto SDO.



Example: SDO automatically configure up to 20, continue to add, prompt box appears。

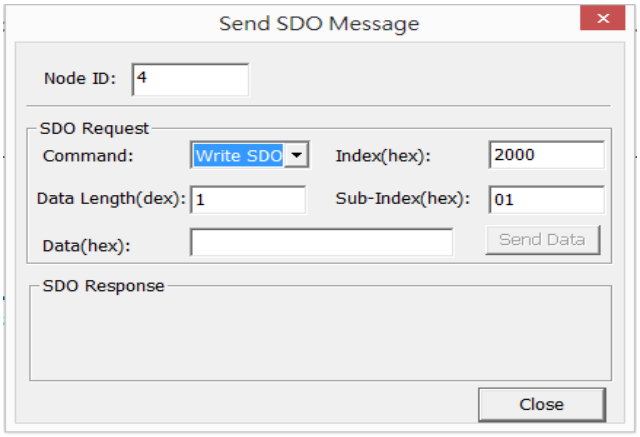


Click "Add" button to pop up the dialog. “index(hex)” and “sub-index(hex)” are for the parameter to be accessed . “Length(dec)” is determined by the data type of the parameter to be accessed. The data length of word-type parameter is 2. “Data (hex)” is the data to be written into the parameter(The data type is of hexadecimal system). The low word is in the front, while the high word is at the end. The words are separated by blank space. When the data type is dual-word, the data of low word is in the front, while the data of high word is at the end.



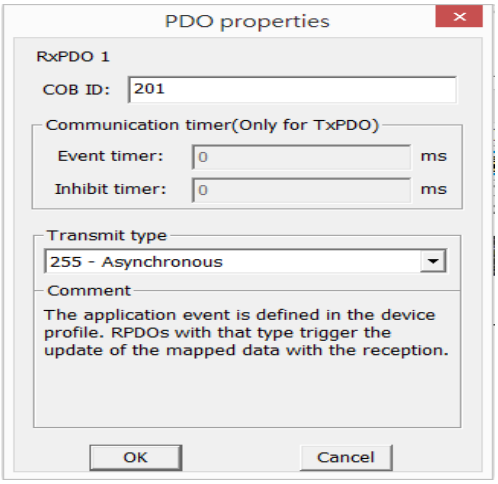
●Manual SDO

Menu bar "Network(N)" → "Send SDO Request(S)." If the information does not meet the written data type, will be reported SDO error code (see Appendix I)。



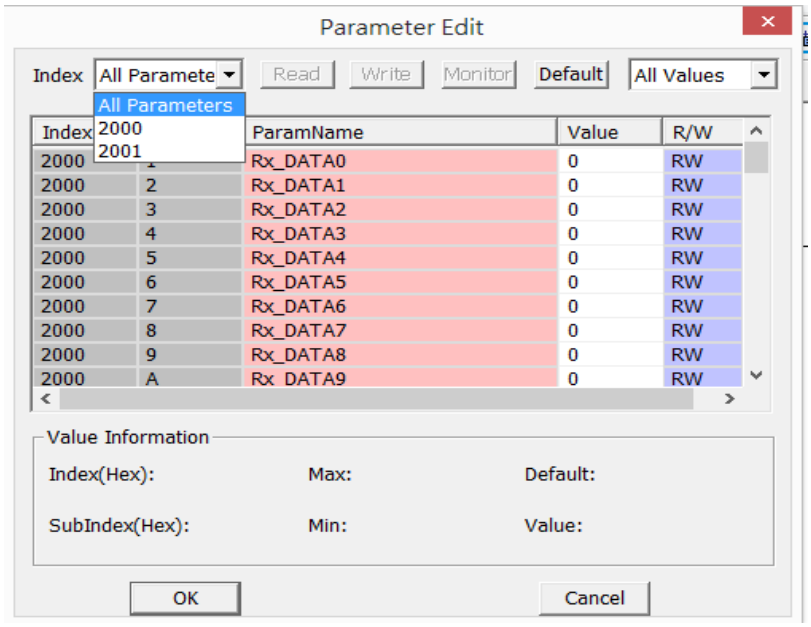
4. PDO Properties

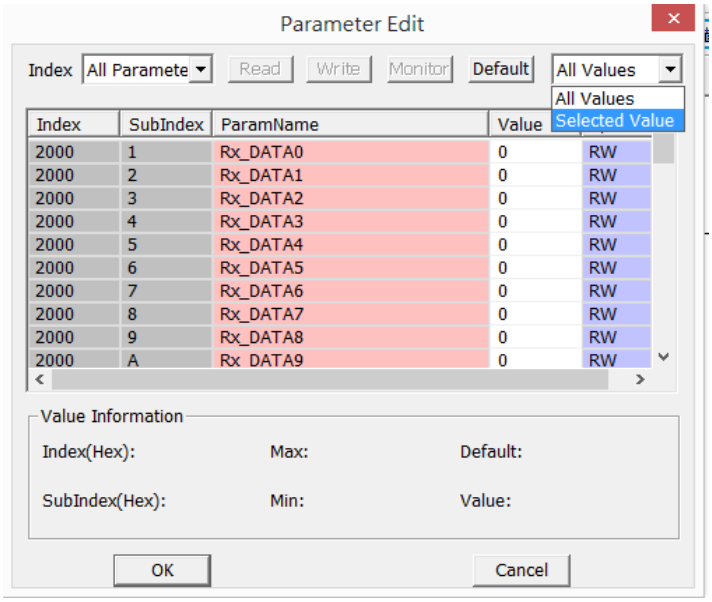
PLC slave station which PDO and PDO mapping preset configuration already exists. The number can be changed according to the needs of PDO, mapping, transmission type, event time, disable time. PDO number and mapped in the "EDS file provided PDO" selection and "EDS file supplied parameters". PDO mapping parameter length can not be more than 8 bytes.



3. Parameter editing

Right-click the node and select "parameter editing." The parameters can be easily performed via the "edit parameters" is written, read, the monitoring operation. The left side of the drop-down list to select all indexes or 2000 and 2001 index, the right of the drop-down list to select all values or a single value.

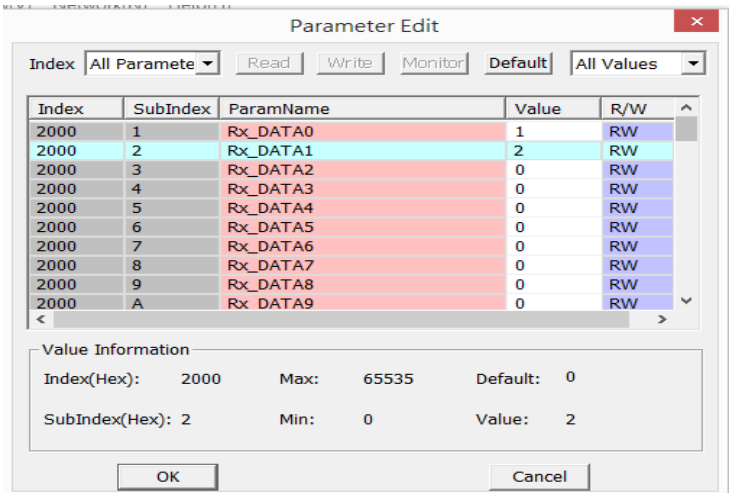




Example: Parameter editor

1 reads the sub-index value index 2000 01.

2 Write Index 2000 is consistent sub-index 01 is 1, then its value is read, the read-out value and write values.

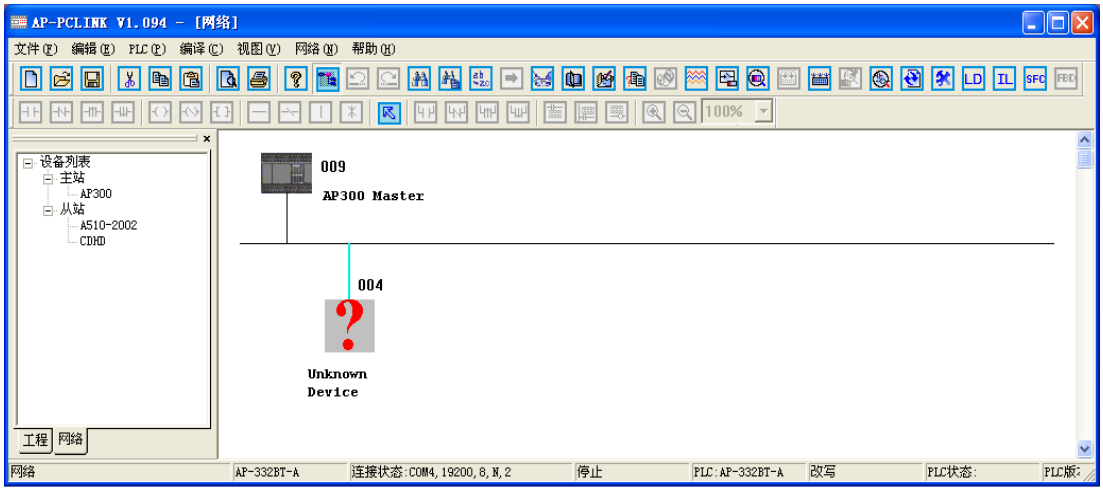


4.2.2 Download

Select the menu "Network" → "Download" to download the configuration data to the master, if not download the configuration is invalid. At this point if the PLC is running, you are prompted to stop running before you can download. After the download is complete, you will be prompted whether to re-run the PLC, click "OK" to continue running PLC program, click on "Cancel" is not running PLC program。

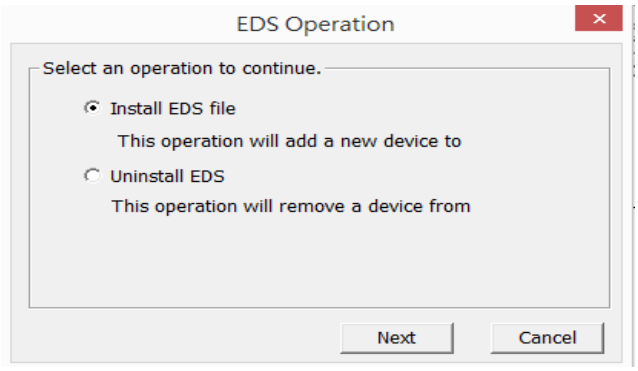
4.2.3 EDS operation

“Network "on the left is the default interface for the selected device, if customers use AP-PCLINK line appears under the figure case, it indicates that AP-PCLINK not provide customer equipment used, customers need to manually add devices.

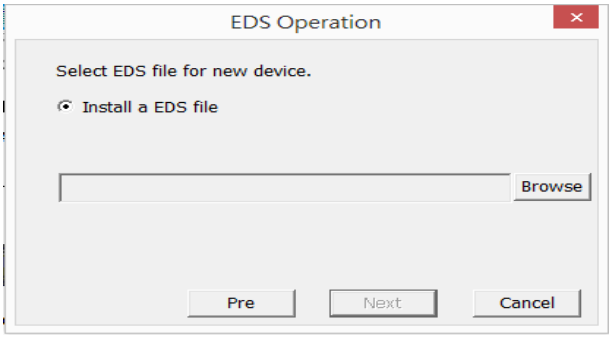


Follow these steps:

1 Select Menu "Network" >> "EDS Operations"。



2. Click "Next"。



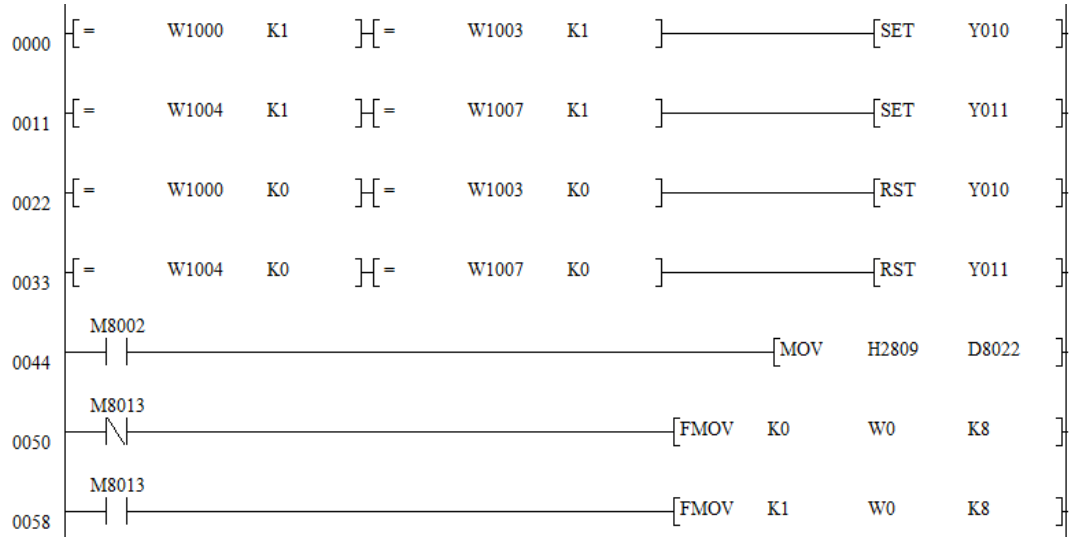
3. Click the "Browse" icon to add EDS files and customer equipment required. After the operation is complete, you can re-line。

4.2.4 Programming example

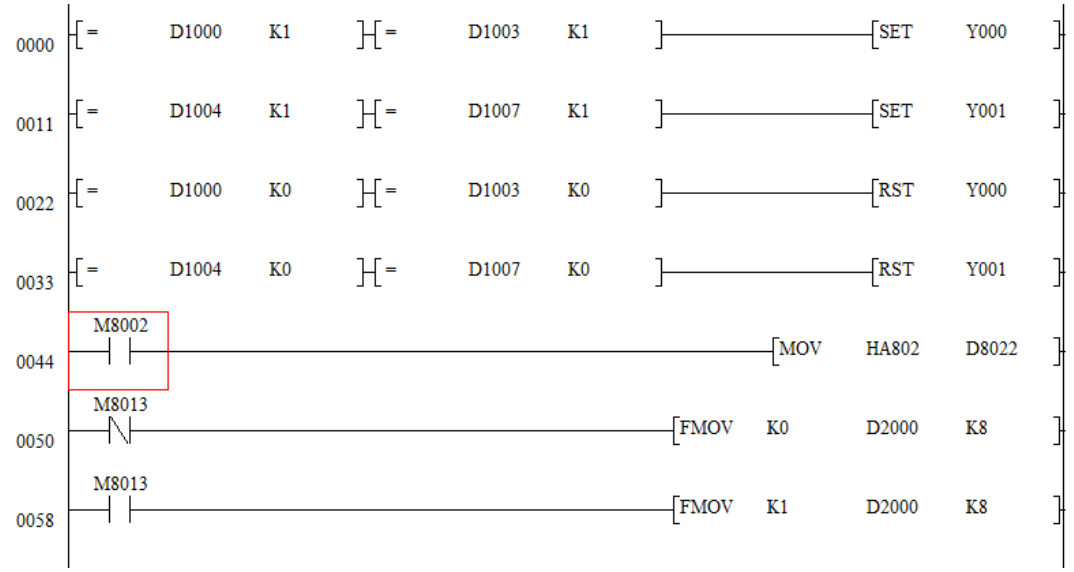
Using COBD cards communicate between nodes in CANopen to achieve the function that can control each other.

Example: Main node assign to 9, slave nodes assin to 2 and 11. Baud rate is 500 Kbps. Data registers change value every 0.5s. In error control protocol, setting node 2 monitor main node and node 11 monitor node 2. Cycke period is 50×1000us. Master's heartbeat time is 100ms. Slave's heartbeat time is 200ms. Master monitoring timeout period is 300ms. When Communication is normally, main nodes (Y10, Y11) and slave nodes (Y0,Y1) act ON and OFF according to every 0.5s.

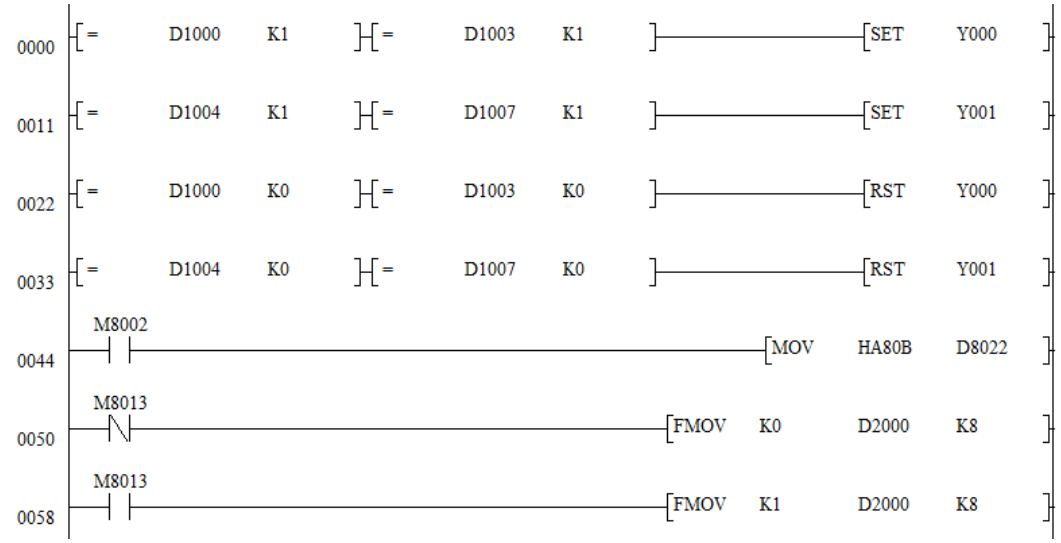
Ladder for main node:



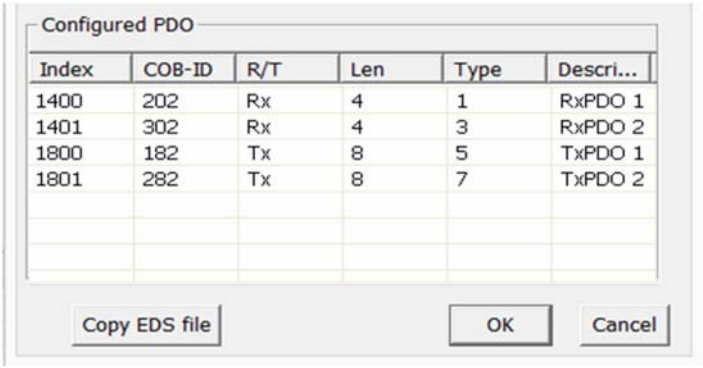
Ladder for slave node11:



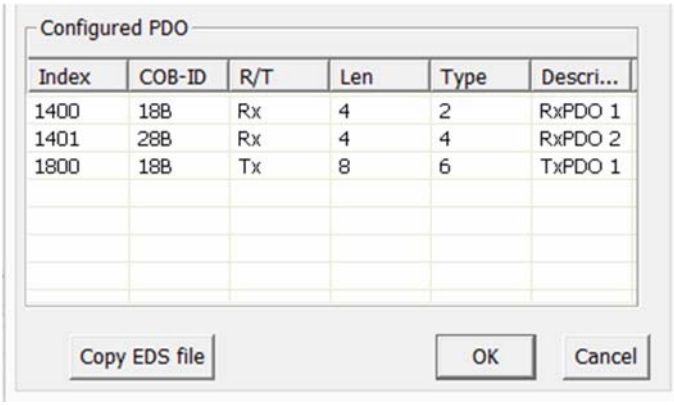
Ladder for slave node2:



Configuration at node 2:



Configuration at node 11:



After node configuration add to list, click recipe→download. Configuration complete.

Appendix I: SDO abort code

Abort code	Description of functional code
05 03 00 00	The trigger bit doesn't change alternatively
05 04 00 00	SDO protocol timeout
05 04 00 01	Illegal or unknown Client/Server command word
05 04 00 02	Invalid block size(For Block Transfer mode only)
05 04 00 03	Invalid serial number(For Block Transfer mode only)
05 03 00 04	CRC mode(For Block Transfer mode only)
05 03 00 05	Memory overflow
06 01 00 00	Object doesn't support access
06 01 00 01	Attempt to read the write-only object
06 01 00 02	Attempt to write the read-only object
06 02 00 00	The object in OD doesn't exist
06 04 00 41	The object can't be mirrored to the PDO
06 04 00 42	The number and length of the mirroring object exceed the PDO length
06 04 00 43	General parameters are incompatible
06 04 00 47	General devices are internally incompatible
06 06 00 00	Failed to access the object due to the hardware error
06 06 00 10	Data type or service parameter length is mismatching.
06 06 00 12	Data type is mismatching, or the service parameter is too long.
06 06 00 13	Data type is mismatching, or the service parameter is too short.
06 09 00 11	Sub index doesn't exist
06 09 00 30	Exceed the range of parameter value(When writing access)
06 09 00 31	The written parameter value is too large
06 09 00 32	The written parameter value is too small
06 09 00 36	The maximum value is smaller than the minimum value
08 00 00 00	General error
08 00 00 20	The data can't be transmitted to or save on the application
08 00 00 21	The data can't be transmitted to or save on the application due to the local control
08 00 00 22	The data can't be transmitted to or save on the application due to the current status of the device
08 00 00 23	Error occurs to the dynamic OD, or the OD doesn't exist.

Appendix 2 Object dictionary

Communication objects in the object dictionary is as follows：

Index	Sub index	Object name	Access privilege	Default value
H1000	H00	Device type	R	0x00000195
H1001	H00	Error register	R	0
H1003	H00	The number of errors in error memory	RW	5
	H01	Memory error domain	R	0
	H02	Memory error domain	R	0
	H03	Memory error domain	R	0
	H04	Memory error domain	R	0
	H05	Memory error domain	R	0
H1005	H00	COB-ID for SYNC	RW	0x80
H1006	H00	Communication loop cycle	RW	0x0
H1008	H00	Manufacturer Device Name	R	TECO_AP300 Slave
H1014	H00	The COB-ID of emergency	R	Node ID + 0x80
H1015	H00	The Disable time of emergency messages	RW	0
H1016	H00	Number of valid sub indexes	R	1
	H01	Consumer's heartbeat time	RW	0
H1017	H00	Producer's heartbeat time	RW	0
H1018	H00	Number of valid sub indexes	R	3
	H01	Manufacturer code	R	0x00000373
	H02	Product code	R	0x00000001
	H03	Version number	R	0x00010001
H1200	H00	Number of valid sub indexes	R	2
	H01	The COB-ID send from Master to slave station.	R	Node ID + 0x600
	H02	The COB-ID send from Slave to Master station	R	Node ID + 0x580
H1400		Communication Parameter of RPDO1		
	H00	Number of valid sub indexes	R	2
	H01	COB-ID of RPDO1	RW	Node ID + 0x200
	H02	Transmission model	RW	255
H1401		Communication Parameter of RPDO2		
	H00	Number of valid sub indexes	R	2
	H01	COB-ID of RPDO2	RW	Node ID + 0x80000300
	H02	Transmission model	RW	255

Index	Sub index	Object name	Access privilege	Default value
H1402		Communication Parameter of RPDO3		
	H00	Number of valid sub indexes	R	2
	H01	COB-ID of RPDO3	RW	Node ID + 0x 80000400
	H02	Transmission model	RW	255
H1403		Communication Parameter of RPDO4		
	H00	Number of valid sub indexes	R	2
	H01	COB-ID of RPDO4	RW	Node ID + 0x 80000500
	H02	Transmission model	RW	255
H1404		Communication Parameter of RPDO5		
	H00	Number of valid sub indexes	R	2
	H01	COB-ID of RPDO5	RW	0x80000FFF
	H02	Transmission model	RW	255
H1405		Communication Parameter of RPDO6		
	H00	Number of valid sub indexes	R	2
	H01	COB-ID of RPDO6	RW	0x80000FFF
	H02	Transmission model	RW	255
H1406		Communication Parameter of RPDO7		
	H00	Number of valid sub indexes	R	2
	H01	COB-ID of RPDO7	RW	0x80000FFF
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	
H1407		Communication Parameter of RPDO8		
	H00	Number of valid sub indexes	R	2
	H01	COB-ID of RPDO8	RW	0x80000FFF
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	
H1600		Mapping parameter of RPDO1		
	H00	Number of valid sub indexes	R	4
	H01	The first mirroring target	RW	0x20000110
	H02	The second mirroring target		0x20000210
	H03	The third mirroring target	RW	0x20000310
	H04	The fourth mirroring target	RW	0x20000410

Index	Sub index	Object name	Access privilege	Default value
H1601		Mapping parameter of RPDO2		
	H00	Number of valid sub indexes	R	4
	H01	The first mirroring target	RW	0x20000510
	H02	The second mirroring target		0x20000610
	H03	The third mirroring target	RW	0x20000710
	H04	The fourth mirroring target	RW	0x20000810
H1602		Mapping parameter of RPDO3		
	H00	Number of valid sub indexes	R	4
	H01	The first mirroring target	RW	0x20000910
	H02	The second mirroring target		0x20000A10
	H03	The third mirroring target	RW	0x20000B10
	H04	The fourth mirroring target	RW	0x20000C10
H1603		Mapping parameter of RPDO4		
	H00	Number of valid sub indexes	R	4
	H01	The first mirroring target	RW	0x20000D10
	H02	The second mirroring target		0x20000E10
	H03	The third mirroring target	RW	0x20000F10
	H04	The fourth mirroring target	RW	0x20001010
H1604		Mapping parameter of RPDO5		
	H00	Number of valid sub indexes	R	4
	H01	The first mirroring target	RW	0x20001110
	H02	The second mirroring target		0x20001210
	H03	The third mirroring target	RW	0x20001310
	H04	The fourth mirroring target	RW	0x20001410
H1605		Mapping parameter of RPDO6		
	H00	Number of valid sub indexes	R	4
	H01	The first mirroring target	RW	0x20001510
	H02	The second mirroring target		0x20001610
	H03	The third mirroring target	RW	0x20001710
	H04	The fourth mirroring target	RW	0x20001810
H1606		Mapping parameter of RPDO7		
	H00	Number of valid sub indexes	R	4

Index	Sub index	Object name	Access privilege	Default value
	H01	The first mirroring target	RW	0x20001910
	H02	The second mirroring target		0x20001A10
	H03	The third mirroring target	RW	0x20001B10
	H04	The fourth mirroring target	RW	0x20001C10
H1607		Mapping parameter of RPDO8		
	H00	Number of valid sub indexes	R	4
	H01	The first mirroring target	RW	0x20001D10
	H02	The second mirroring target		0x20001E10
	H03	The third mirroring target	RW	0x20001F10
	H04	The fourth mirroring target	RW	0x20002010
H1800		Communication Parameter of TPDO1		
	H00	Number of valid sub indexes	R	5
	H01	COB-ID of TPDO1	RW	Node ID+ 0x180
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	50
	H05	Event timer	RW	0
H1801		Communication Parameter of TPDO2		
	H00	Number of valid sub indexes	R	5
	H01	COB-ID of TPDO2	RW	Node ID+ 0x80000280
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	50
	H05	Event timer	RW	0
H1802		Communication Parameter of TPDO3		
	H00	Number of valid sub indexes	R	5
	H01	COB-ID of TPDO3	RW	Node ID+ 0x80000380
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	50
	H05	Event timer	RW	0
H1803		Communication Parameter of TPDO4		
	H00	Number of valid sub indexes	R	5
	H01	COB-ID of TPDO4	RW	Node ID+

Index	Sub index	Object name	Access privilege	Default value
				0x80000480
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	50
	H05	Event timer	RW	0
H1804		Communication Parameter of TPDO5		
	H00	Number of valid sub indexes	R	5
	H01	COB-ID of TPDO5	RW	0x800007FF
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	50
	H05	Event timer	RW	0
H1805		Communication Parameter of TPDO6		
	H00	Number of valid sub indexes	R	5
	H01	COB-ID of TPDO6	RW	0x800007FF
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	50
	H05	Event timer	RW	0
H1806		Communication Parameter of TPDO7		
	H00	Number of valid sub indexes	R	5
	H01	COB-ID of TPDO7	RW	0x800007FF
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	50
	H05	Event timer	RW	0
H1807		Communication Parameter of TPDO78		
	H00	Number of valid sub indexes	R	5
	H01	COB-ID of TPDO8	RW	0x800007FF
	H02	Transmission model	RW	255
	H03	Inhibit time	RW	50
	H05	Event timer	RW	0
H1A00		Mapping parameter of TPDO1		
	H00	Number of valid sub indexes	RW	4
	H01	The first mirroring target	RW	0x20010110
	H02	The second mirroring target	RW	0x20010210

Index	Sub index	Object name	Access privilege	Default value
	H03	The third mirroring target	RW	0x20010310
	H04	The fourth mirroring target	RW	0x20010410
H1A01		Mapping parameter of TPDO2		
	H00	Number of valid sub indexes	RW	4
	H01	The first mirroring target	RW	0x20010510
	H02	The second mirroring target	RW	0x20010610
	H03	The third mirroring target	RW	0x20010710
	H04	The fourth mirroring target	RW	0x20010810
H1A02		Mapping parameter of TPDO3		
	H00	Number of valid sub indexes	RW	4
	H01	The first mirroring target	RW	0x20010910
	H02	The second mirroring target	RW	0x20010A10
	H03	The third mirroring target	RW	0x20010B10
	H04	The fourth mirroring target	RW	0x20010C10
H1A03		Mapping parameter of TPDO4		
	H00	Number of valid sub indexes	RW	4
	H01	The first mirroring target	RW	0x20010D10
	H02	The second mirroring target	RW	0x20010E10
	H03	The third mirroring target	RW	0x20010F10
	H04	The fourth mirroring target	RW	0x20011010
H1A04		Mapping parameter of TPDO5		
	H00	Number of valid sub indexes	RW	4
	H01	The first mirroring target	RW	0x20011110
	H02	The second mirroring target	RW	0x20011210
	H03	The third mirroring target	RW	0x20011310
	H04	The fourth mirroring target	RW	0x20011410
H1A05		Mapping parameter of TPDO6		
	H00	Number of valid sub indexes	RW	4
	H01	The first mirroring target	RW	0x20011510
	H02	The second mirroring target	RW	0x20011610
	H03	The third mirroring target	RW	0x20011710
	H04	The fourth mirroring target	RW	0x20011810

Index	Sub index	Object name	Access privilege	Default value
H1A06		Mapping parameter of TPDO7		
	H00	Number of valid sub indexes	RW	4
	H01	The first mirroring target	RW	0x20011910
	H02	The second mirroring target	RW	0x20011A10
	H03	The third mirroring target	RW	0x20011B10
	H04	The fourth mirroring target	RW	0x20011C10
H1A07		Mapping parameter of TPDO8		
	H00	Number of valid sub indexes	RW	4
	H01	The first mirroring target	RW	0x20011D10
	H02	The second mirroring target	RW	0x20011E10
	H03	The third mirroring target	RW	0x20011F10
	H04	The fourth mirroring target	RW	0x20012010

Note: R means read-only, RW means read and write.