CANopen Slave Device
CAN-2060C
Application User's Manual

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1. Introduction

1.1 Overview

CANopen is one kind of the network protocols based on CAN bus and mainly used for embedded system, such as industrial machine control, vehicle control system, factory automation, medical equipments control, remote data acquisition, environment monitoring and package machines control.

The CAN-2060C is a CANopen slave which follows the CiA 301 version 4.02 and CiA 401 version 2.1.It is easy to access the digital I/O status and set the configuration by using standard CANopen protocol. CAN-2060C has passed the validation of the CiA CANopen Conformance Test tool. Therefore, the provided EDS file is standard for any other standard CANopen masters. CAN-2060C has 4-channel isolated sink/source input and 4-channel relay output. By owing to the CANopen masters of ICP DAS, you can quickly build a CANopen network to approach your requirements.



Figure 1-1 CAN-2060C

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1.2 Hardware Specifications

Relay Output

- Output channels: 4 (Source)
- Resistive Load : 5A/30 V_{DC} ，5A/250 V_{AC}
- Insulation Resistance: 1,000MΩs at 500 V_{DC}
- Output Type: Form A (SPST-NO)
- Intra-module isolation: 3750 Vrms
- Reaction Time:
  - Operate Time: 10ms max
  - Release Time: 5ms max
- ESD Protection 4 KV Contact for each channel

Digital Iutput

- Input channels: 4 (Sink/Source)
- DI On Level: +3.5 ~+30 V_{DC}
- DI Off Level: +1 V_{DC} Max.
- Input Impedance: 3kΩ ,0.3W
- Intra-module isolation: 3750 Vrms
- Response Time:
  - Rising edge to DI response: 75 us
  - Falling edge to DI response: 180 us
- ESD Protection 4 KV Contact for each channel

Others

- CANopen Status: 3 LEDs for PWR / RUN / ERR
- Terminal Resister: 1 LED as terminal resister indicator
- DI LED: 4 LEDs as digital input indicator
- DO LED: 4 LEDs as relay output indicator
- Power supply: Unregulated +10~+30 V_{DC}
- Power Consumption: 1.5W
- Operation Temperature: -25 ~ 75 ℃
- Storage Temperature: -35 ~ 80℃
- Humidity: 10~90% RH, Non-condensing
- Dimensions: 32.5mm × 110mm × 102 mm (W×L×H) Detail.

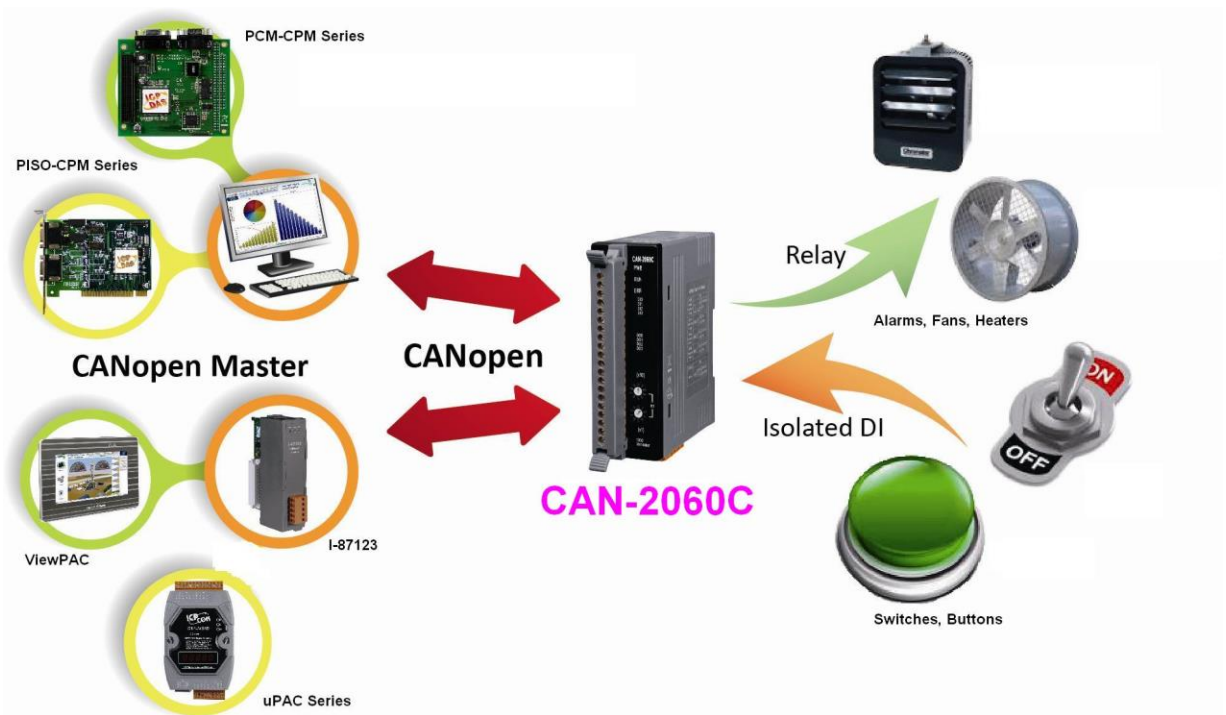
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1.3 Features

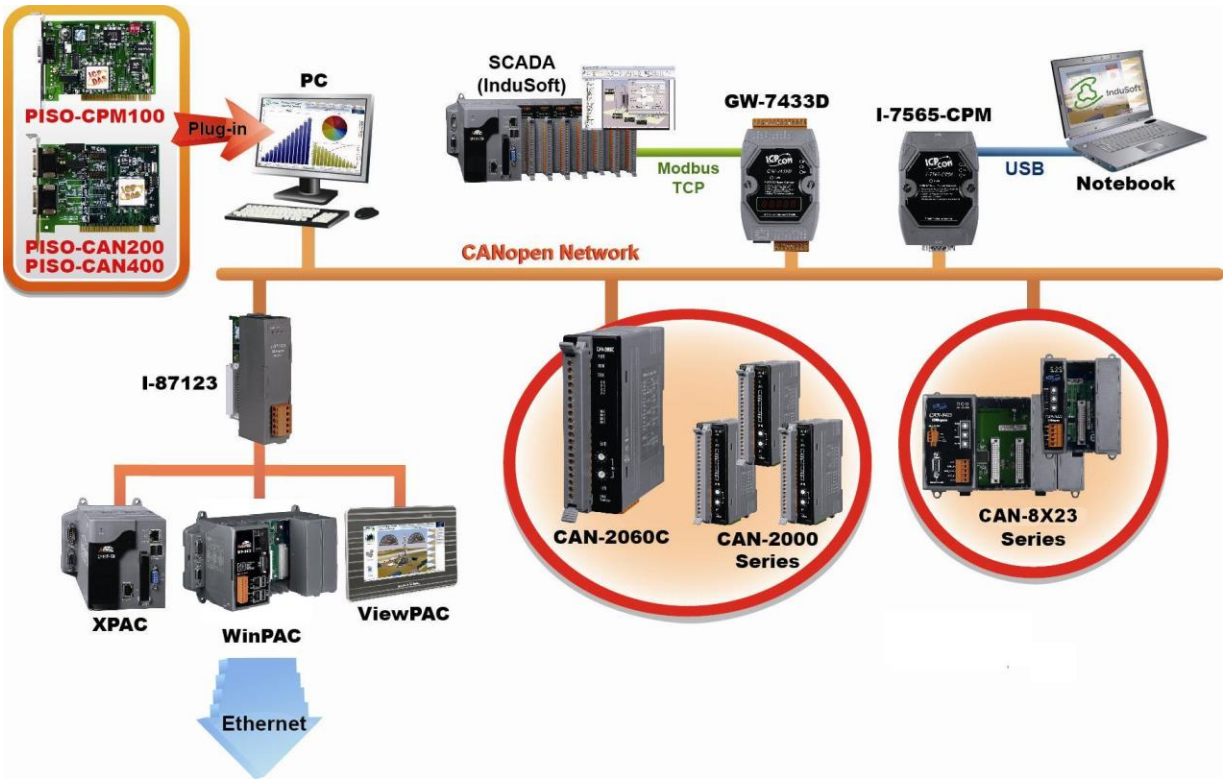
- Standard CANopen general I/O slave devices
- CANopen Version: CiA-301 ver4.02, CiA-401 ver2.1
- Support I/O pair-connection mechanism
- Provide normal/polarity 4 DI channels and 4 Relay channels
- CANopen transfer rate: 10k bps, 20k bps, 50k bps, 125k bps, 250k bps, 500k bps, 800k bps, 1000k bps
- Support maximum CANopen slave device Node-ID up to 99
- Set Node-ID 0 for firmware update
  - Firmware update tools:I-7530 series, I-7540D series, I-7565 series, PISO-CM100 series and PISO-CAN series
- Support NMT, PDO, SDO, EMCY, SYNC, Guarding and Heartbeat protocol
- Pass the validation of CANopen conformance test
- Provide EDS file for CANopen master interface

1.4 Application

- Measuring Temperature
- Medical technology
- Utility vehicles



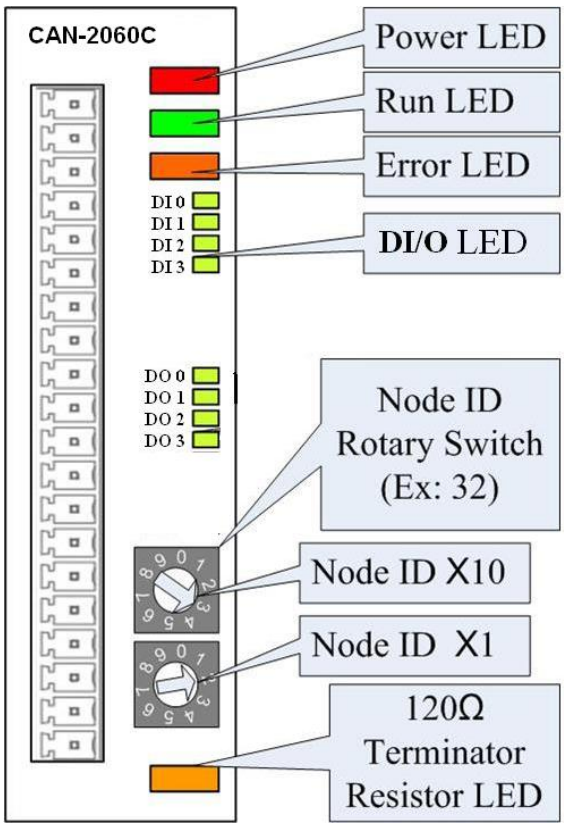
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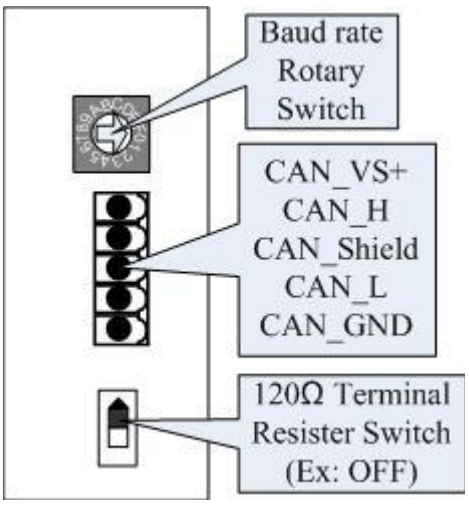
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2. Hardware

2.1 Structure



(Top View)

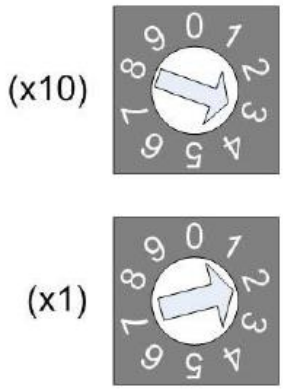


(Botton View)

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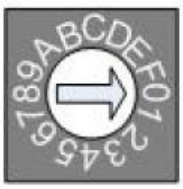
2.2 Node ID & Baud Rate Rotary Switch

The rotary switches for node ID configure the node ID of the CAN-2060C module. These two switches are for the tens digit and the units digit of node ID. The node ID value of this demo picture is 32.



Node ID rotary switch

The rotary switch for baud rate handles the CAN baud rate of the CAN-2060C module. The relationship between the rotary switch value and the practical baud rate is presented in the following table.



Baud rate rotary switch

Rotary Switch Value	Baud rate (k BPS)
0	10
1	20
2	50
3	125
4	250
5	500
6	800
7	1000

Baud rate and rotary switch

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2.3 LED Description

Power LED

The CAN-2060C needs a 10 V_{DC} ~30V_{DC} power supply. Under a normal connection, a good power supply and a correct voltage selection, as the unit it turned on, the LED will light up in red.

Run LED

The Run LED indicates the CANopen operation state. The description of the LED state is shown below. About the details, please refer to the section 2.3.1 of the CAN-2000C user manual.

LED Signal	State	Description
No Light	Non-power	Power Supply is not ready
Single Flash	Stopped	The device is in Stopped state
Blinking	Pre-operation	The device is in the pre-operation state
Continuing Light	Operation	The device is in the operational state

Error LED

The Error LED indicates the CANopen error state. The description of the LED state is shown below. About the details, please refer to the section 2.3.2 of the CAN-2000C user manual.

LED Signal	State	Description
No Light	Non error	Device is in working condition
Single Flash	Error Warning	At least one error of the CAN controller has occurred
Blinking	Guarding fail	Guard event happened
Continuing Light	Bus Off	The CAN controller is bus off

Terminal Resistor LED

When the switch of the 120Ω terminal resistor is turned on, the terminal resistor LED will be lightening.

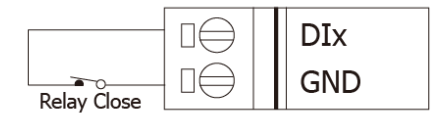
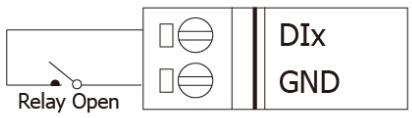
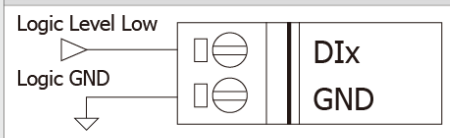
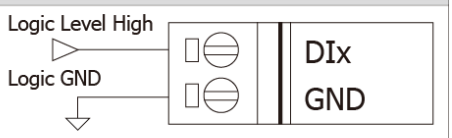
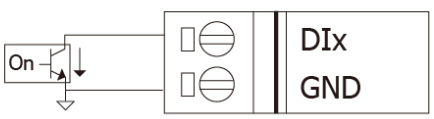
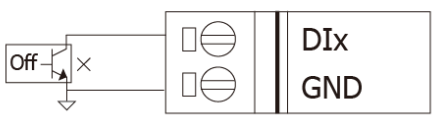
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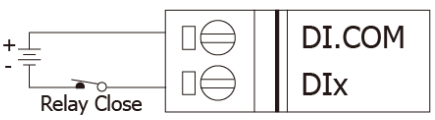
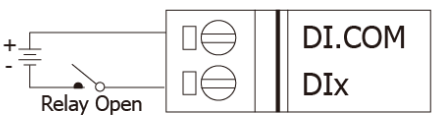
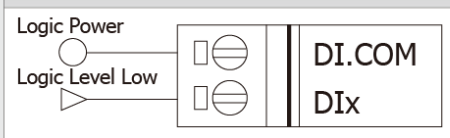
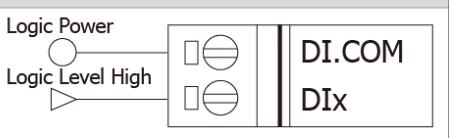
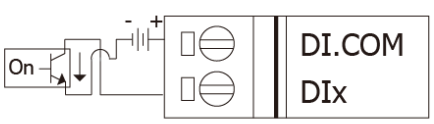
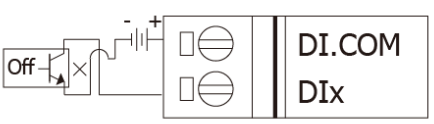
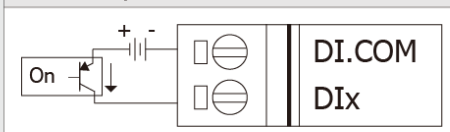
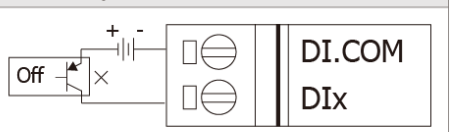
2.4 PIN Assignment

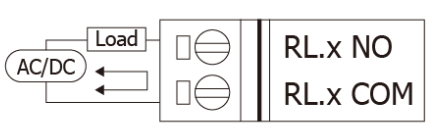
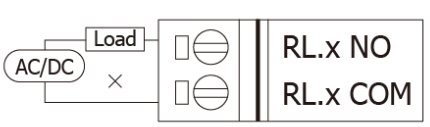
Terminal No.	Pin Assignment
01	DI.COM
02	DI0
03	DI1
04	DI2
05	DI3
06	GND
07	
08	NO0
09	COM0
10	NO1
11	COM1
12	NO2
13	COM2
14	NO3
15	COM3
16	
17	
18	
19	
20	

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2.5 Wire Connection

Input Type Dry Contact	ON State LED ON	OFF State LED OFF
Relay Contact	Relay ON	Relay Off
		
TTL/CMOS Logic	Voltage < 1V	Voltage > 3.5V
		
Open Collector	Open Collector On	Open Collector Off
		

Input Type Dry Contact	ON State LED ON	OFF State LED OFF
Relay Contact	Relay ON	Relay Off
		
TTL/CMOS Logic	Voltage > 3.5V	Voltage < 1V
		
NPN Output	Open Collector On	Open Collector Off
		
PNP Output	Open Collector On	Open Collector Off
		

Output Type	ON State LED ON	OFF State LED OFF
Relay	Relay ON	Relay Off
		

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3. Application

3.1 Object Dictionary

General Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1000h	0h	device type	UNSIGNED 32	RO	---
1001h	0h	error register	UNSIGNED 8	RO	---
1003h	0h	largest sub-index supported for “predefine error field”	UNSIGNED 8	RO	0h
	1h	actual error (the newest one)	UNSIGNED 32	RO	---
	…	…	…	…	---
	5h	actual error (the oldest one)	UNSIGNED 32	RO	---
1005h	0h	COB-ID of Sync message	UNSIGNED 32	RW	80h
1008h	0h	manufacturer device name	VISIBLE_STRING	RO	CAN-2060C
1009h	0h	manufacturer hardware version	VISIBLE_STRING	RO	1.00
100Ah	0h	manufacturer software version	VISIBLE_STRING	RO	1.00-20130407
100Ch	0h	guard time	UNSIGNED 16	RW	0
100Dh	0h	life time factor	UNSIGNED 8	RW	0
1010h	0h	largest subindex supported	UNSIGNED 8	RO	1
1010h	1h	save all parameters	UNSIGNED 32	RW	0
1011h	0h	largest subindex supported	UNSIGNED 8	RO	1
1011h	1h	restore all default parameters	UNSIGNED 32	RW	0
1014h	0h	COB-ID of EMCY	UNSIGNED 32	RW	80h+Node-ID
1015h	0h	Inhibit time of EMCY	UNSIGNED 16	RW	0
1017h	0h	Heartbeat time	UNSIGNED 16	RW	0
1018h	0h	largest sub-index supported for “identity object”	UNSIGNED 8	RO	4
	1h	vender ID	UNSIGNED 32	RO	0x0000013C
	2h	Produce Code	UNSIGNED 32	RO	0x00002060
	3h	Revision_number	UNSIGNED 32	RO	0x00030001
	4h	Serial_number	UNSIGNED 32	RO	0x6cd3683c

Table 3-1

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SDO Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1200h	0h	largest sub-index supported for “server SDO parameter”	UNSIGNED 8	RO	2
	1h	COB-ID form client to server (RxSDO)	UNSIGNED 32	RO	600h+Node-ID
	2h	COB-ID form server to client (TxSDO)	UNSIGNED 32	RO	580h+Node-ID

Table 3-2

RxPDO Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1400h	0h	Number of entries	UNSIGNED 8	RO	2
	1h	COB-ID used by RxPDO	UNSIGNED 32	RW	200h+Node-ID
	2h	Transmission type	UNSIGNED 8	RW	FFh

Table 3-3

RxPDO Mapping Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1600h	0h	Number of entries	UNSIGNED 8	RW	0
	1h	Write Output channels	UNSIGNED 32	RW	6200 0108h

Table 3-4

TxPDO Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1800h	0h	Number of entries	UNSIGNED 8	RO	5
	1h	COB-ID used by TxPDO	UNSIGNED 32	RW	180h+Node-ID
	2h	Transmission type	UNSIGNED 8	RW	FFh
	3h	Inhibit time	UNSIGNED 16	RW	0
	4h	Reversed	---	---	---
	5h	Event timer	UNSIGNED 16	RW	0

Table 3-5

TxPDO Mapping Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1A00h	0h	Number of entries	UNSIGNED 8	RO	0
	1h	DI channel 0 ~ 3	UNSIGNED 32	RW	6000 0108h

Table 3-6

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Digital Input Function

Idx	Sidx	Description	Type	Attr	Default
6000h	0h	Number of entries	UNSIGNED 8	RO	1
	1h	DI value of ch0 ~ ch3	UNSIGNED 8	RO	0
6002h	0h	Number of entries	UNSIGNED 8	RO	1
	1h	Change polarity DI ch0 ~ ch3	UNSIGNED 8	RW	0
2030h	0h	Number of entries	UNSIGNED 8	RO	1
	1h	DI Scan Filter times	UNSIGNED 8	RW	2

Table 3-7

Note: Object 0x2030h is used for DI noise. If there is any DI noise in your application, you can set the value larger to avoid the unexpected noise.

Digital Output Function

Idx	Sidx	Description	Type	Attr	Default
6200h	0h	Number of Output 8-Bit	UNSIGNED 8	RO	1
	1h	DO value of ch0 ~ ch3	UNSIGNED 8	RW	0
6202h	0h	Number of Output 8-Bit	UNSIGNED 8	RO	1
	1h	Change polarity DO ch0 ~ ch3	UNSIGNED 8	RW	0
6206h	0h	Number of Output 8-Bit	UNSIGNED 8	RO	2
	1h	Error mode DO ch0 ~ ch3	UNSIGNED 8	RW	0x0F
6207h	0h	Number of Output 8-Bit	UNSIGNED 8	RO	2
	1h	Error value DO ch0 ~ ch3	UNSIGNED 8	RW	0

Table 3-8

Power on Value Function

Idx	Sidx	Description	Type	Attr	Default
2010h	0h	Number of Output 8-Bit	UNSIGNED 8	RO	1
	1h	Set DO power on value of ch0 ~ ch3	UNSIGNED 8	RW	0

Table 3-9

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3.2 Store and Restore Object

User can write the value 0x65766173 to the object index 0x1010 to save configuration setting, or write the value 0x64616F6C to object index 0x1011 to load the factory default. The following table lists the relative objects which will be stored or restored after writing these two objects. The factory default for these objects is also shown.

Store and Restore functions

Index	Subindex	Function
1010h	1	Store application and communication setting.
1011h	1	Restore application and communication setting.

Communication Setting:
Please refer to above table 3-3, 3-4, 3-5 and 3-6.

Application Setting:

Index	Subindex	Description	Factory Default
2010h	1	Set digital output power on value for channel 0 ~ 3	0x00
6002h	1	Change polarity digital input for channel 0 ~ 3	0x00
6202h	1	Change polarity digital output for channel 0 ~ 3	0x00
6206h	1	Error mode digital output for channel 0 ~ 3	0x0F
6207h	1	Error value digital output for channel 0 ~ 3	0x00

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3.3 Application Object

Digital Input module (0x6000)

User can use the object index 0x6000 with subindex 1 to read a group of 8-bit information.

For example, if the node id of CAN-2060C is 1, the commands are as below:

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	40	00	60	01	00	00	00	00

SDO client → **SDO server (CAN-2060C)**

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	4F	00	60	01	0F	--	--	--

SDO client ← **SDO server (CAN-2060C)**

Read the object index 0x6000 with subindex 1, and the digital value 0x0F will be responded by CAN-2060C module. The DI channels of DI3, DI2, DI1 and DI0 are turn on and others are turn off.

Change Input polarity (0x6002)

User can configure the object index 0x6002 with subindex 1 to set the polarity of DI channels.

The object 0x6002 with subindex 1 defines the polarity of a group of 8 input lines. Input polarity can be inverted individually.

1 = input inverted

0 = input not inverted

For example, if the node id of CAN-2060C is 1, the commands are as below:

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	2F	02	60	01	0F	00	00	00

SDO client → **SDO server (CAN-2060C)**

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11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	60	02	60	01	--	--	--	--

SDO client ← **SDO server (CAN-2060C)**

Write object index 0x6002 with subindex 1 to 0x0F means that set the Ch0~ Ch3 of DI channels to normal, and set the Ch4 ~ Ch7 to be inverted.

Digital Output module (0x6200)

User can set a group of 8 output lines as a byte of information and sent it into the object index 0x6200 with subindex 1 of CAN-2060C. For example, if the node id of CAN-2060C is 1, the commands are as below:

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	2F	00	62	01	0F	00	00	00

SDO client → **SDO server (CAN-2060C)**

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	60	00	62	01	--	--	--	--

SDO client ← **SDO server (CAN-2060C)**

Write the 0x0F of digital output value into the object index 0x6200 with subindex 1, and its response success by CAN-2060C.

Change Output polarity (0x6202)

The object 0x6002 with subindex 1 defines the polarity of a group of 8 output lines. Output polarity can be inverted individually.

1 = input inverted

0 = input not inverted

For example, if the node id of CAN-2060C is 1, the commands are as below:

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11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	2F	02	62	01	F0	00	00	00

SDO client ⟶ **SDO server (CAN-2060C)**

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	60	02	62	01	--	--	--	--

SDO client ⟵ **SDO server (CAN-2060C)**

Write object index 0x6202 with subindex 1 to 0xF0 means that set the Ch0~ Ch3 of DO channels to normal, and set the Ch4 ~ Ch7 to be inverted.

Error Mode and Error Value(0x6206, 0x6207)

The object 0x6206 and 0x6207 are used to control the safe value when error happens. When some error event of this module happens such as node guarding failure, the module will check the value of the object 0x6206. If some bits of this value are set to 1, the corresponding DO channels will be into error mode output. The error mode output values are concerned to the object 0x6207.

For example, if the subindex 01 in the object with 0x6206 and 0x6207 are 0x31 and 0xF8 respectively, when some error event occurs, only the DO5, DO4, DO0 will be changed to error mode output because the bit 5, bit 4, and bit 0 of the value 0x31 is 1. The others channels keeps the status as the error event is not happened. The bit 5, bit 4, and bit 0 of the value 0xF8 are 1, 1 and 0, therefore the error mode output value of DO5, DO4 and DO0 are active, active, and inactive respectively.

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	2F	02	62	01	31	00	00	00

SDO client ⟶ **SDO server (CAN-2060C)**

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11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	60	02	62	01	--	--	--	--

SDO client ← **SDO server (CAN-2060C)**

Write object index 0x6206 and subindex 1 to 0x31 means set the error mode to 0x31 for enabling the error mode output of DO 0, DO 4 and DO5.

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	2F	07	62	01	F8	00	00	00

SDO client → **SDO server (CAN-2060C)**

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	60	07	62	01	--	--	--	--

SDO client ← **SDO server (CAN-2060C)**

Write object index 0x6207 and subindex 1 to 0xF8 means set the error value to 0xF8 for activating the error mode output value of DO 3 ~ DO 7. If the error event in this module, the module will output the safe value 0x30 (0x31 & 0xF8 = 0x30) corresponding the object 0x6206 and 0x6207.

Set Power On Value (0x2010)

This object 0x2010 with subindex 1 defines the power on value of a group of 8 output lines. Power on value can be set individually.

For example, if the node id of CAN-2060C is 1, the commands are as below:

11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	2F	10	20	01	0F	00	00	00

SDO client → **SDO server (CAN-2060C)**

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11-bit COB-ID (bit)											RTR	Data Length	8-byte Data (byte)							
Func Code				Node ID																
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	1	0	0	0	0	0	0	0	0	1	0	8	60	10	20	01	--	--	--	--

SDO client ← **SDO server (CAN-2060C)**

Write object index 0x2010 with subindex 1 to 0x0F means that set the Ch0 ~ Ch3 of DO channels to 1 when the CAN-2060C power on.

3.4 Default PDO Mapping

RxPDO mapping list:

ID	Len	D0
200h+x	1	DO0 ~ DO3

Note: x is node id of CAN-2060C module

TxPDO mapping list:

ID	Len	D0
180h+x	1	DI0 ~ DI3

Note: x is node id of CAN-2060C module

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