CANopen Slave Device
CAN-2012C
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-2012C is a CANopen slave which follows the CiA 301 version 4.02 and CiA 401 version 2.1. This module provides 8 differential analog input channels or 16 single-ended analog input channels. Users can obtain those data or configure the CAN-2012C via the standard CANopen protocol. In order to be fully compatible with other CANopen devices, the CAN-2012C has passed the validation of the CiA CANopen Conformance Test tool. Therefore, it is very easy to integrate the CAN-2012C with the standard CANopen master by applying the EDS file. Combining with the CANopen masters of ICP DAS, you can quickly build a CANopen network to approach your requirements.



Figure 1-1 CAN-2012C

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1.2 Features

- Standard CANopen general purpose I/O slave device
- Supports NMT, PDO, SDO, EMCY, SYNC, guard and heartbeat protocols
- Provides 8 differential/16 single-ended analog input channels
- Transmission rate (bps): 10k, 20k, 50k, 125k, 250k, 500k, 800k, 1M
- The CANopen slave station number reaches a maximum of 99
- Each channel is exposed to 4KV ESD electrostatic protection
- EDS files provided to the CANopen host interface
- Verification through CANopen conformance testing

1.3 Hardware Specifications

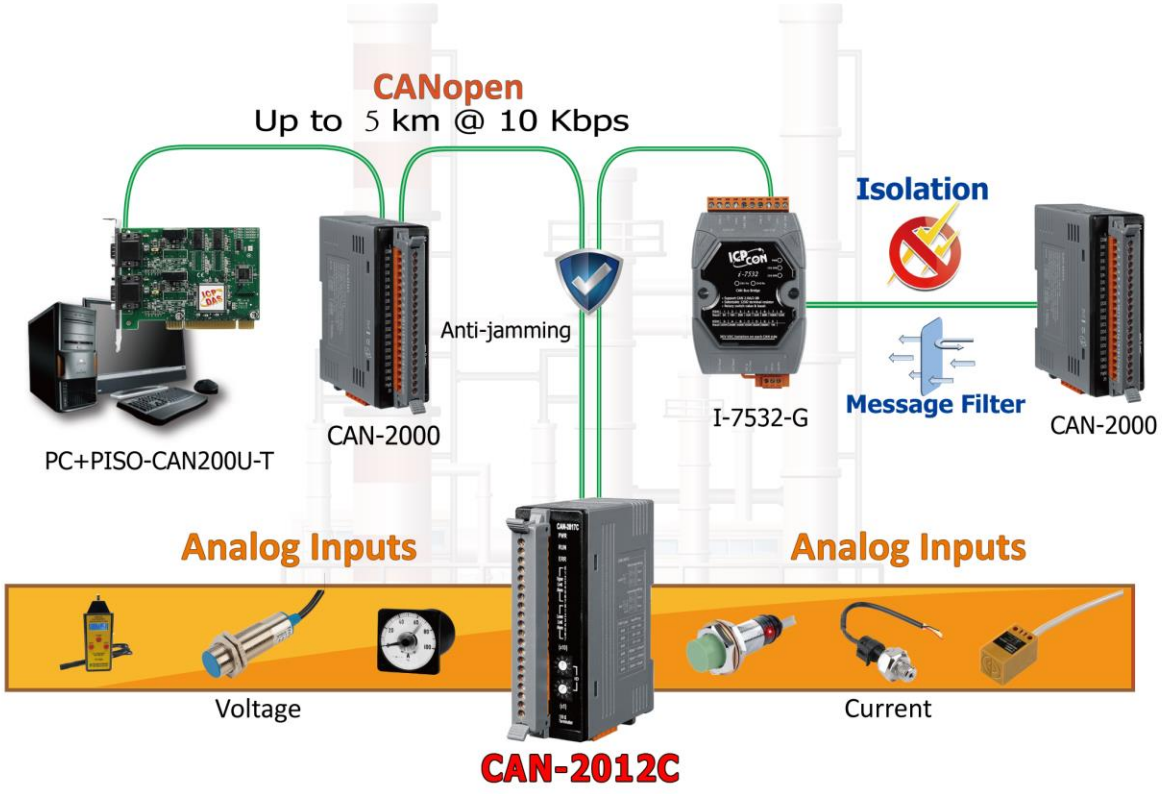
CANopen Interface	
Connector	5-pin screwed terminal block (CAN_GND, CAN_L, CAN_SHLD, CAN_H, CAN_V+)
Baud Rate (bps)	10 k, 20 k, 50 k, 125 k, 250 k, 500 k, 800 k, 1 M, selected by rotary switch
Terminator Resistor	DIP switch for the 120 Ω terminator resistor
Protocol	CANopen CiA 301 ver4.02, CiA 401 ver2.1
Node ID	1~99 selected by rotary switch
NMT	Slave
Error Control	Node Guarding protocol / Heartbeat Producer
SDOs	1 server, 0 client
PDOs	10 RxPDO, 10 TxPDO (TxPDO Supports dynamic PDO)
PDO Modes	Event-triggered, remotely-requested, synchronous (cyclic), synchronous (acyclic)
Emergency Message	Yes
EDS file	Yes
Analog Input	
Channels	8 (Differential) or 16(Single-ended)
Input Type	±10V, ±5V, ±2.5V, 0~10V, ±20mA, 0~20mA,4~20mA
Sampling Rate	4k Samples/Sec. (Total)
Zero Drift	+/-0.2 uV/°C
Span Drift	+/-5 ppm/ °C
Common Mode Rejection	84 dB Min.

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Resolution	16-bit
Over voltage protection	70 Vrms
Individual channel configuration	Yes
Hardware	
ESD Protection	Contact 4 kV class A
LED	
CANopen Status	3 LEDs to PWR, RUN and ERR
I/O LED	16 LEDs as Analog Input,,and 1 LED as terminal resister indicator
Power	
Power Supply	Unregulated +10 ~ +30 VDC
Power Consumption	0.5 W
Mechanism	
Installation	DIN-Rail
Dimensions	33 mm x 99 mm x 78 mm (W x L x H)
Environment	
Operating Temp.	-25 ~ 75 ℃
Storage Temp.	-30 ~ 80 ℃
Humidity	10 ~ 90% RH, non-condensing

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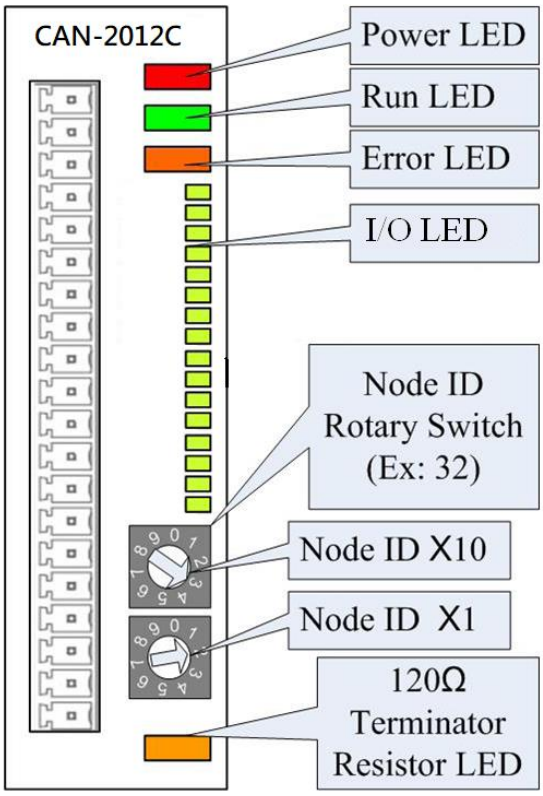
1.4 Application



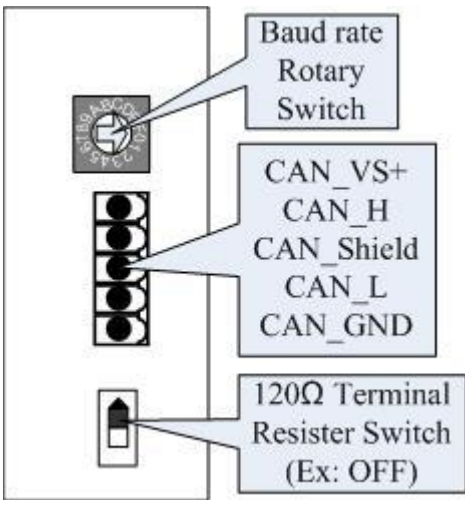
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2. Hardware

2.1 Structure



(Top View)

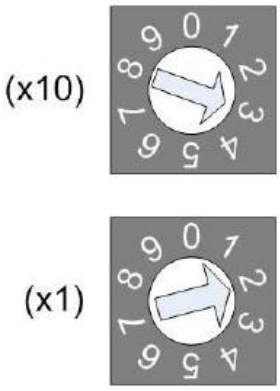


(Botton View)

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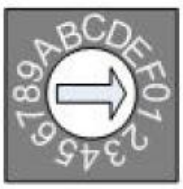
2.2 Node ID & Baud Rate Rotary Switch

The rotary switches for node ID configure the node ID of the CAN-2012C 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-2012C 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-2012C needs a 10V~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.

Upper/lower limit alarm indicator

First, the analog input interrupt full enable function (SDO:6423) must be enabled. If the analog input quantity is above/lower limit, larger/less than the channel of integer (6424h / 6425h) value, the indicator light will continue light / flash.

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2.4 PIN Assignment

-	Differential	Single-ended
Terminal No.	**Pin Assignment**	**Pin Assignment**
1	V0-	Vin0
2	V0+	Vin1
3	V1-	Vin2
4	V1+	Vin3
5	V2-	Vin4
6	V2+	Vin5
7	V3-	Vin6
8	V3+	Vin7
9	V4-	Vin8
10	V4+	Vin9
11	V5-	Vin10
12	V5+	Vin11
13	V6-	Vin12
14	V6+	Vin13
15	V7-	Vin14
16	V7+	Vin15
17	AGND	AGND
18	AGND	AGND
19	AGND	AGND
20	AGND	AGND

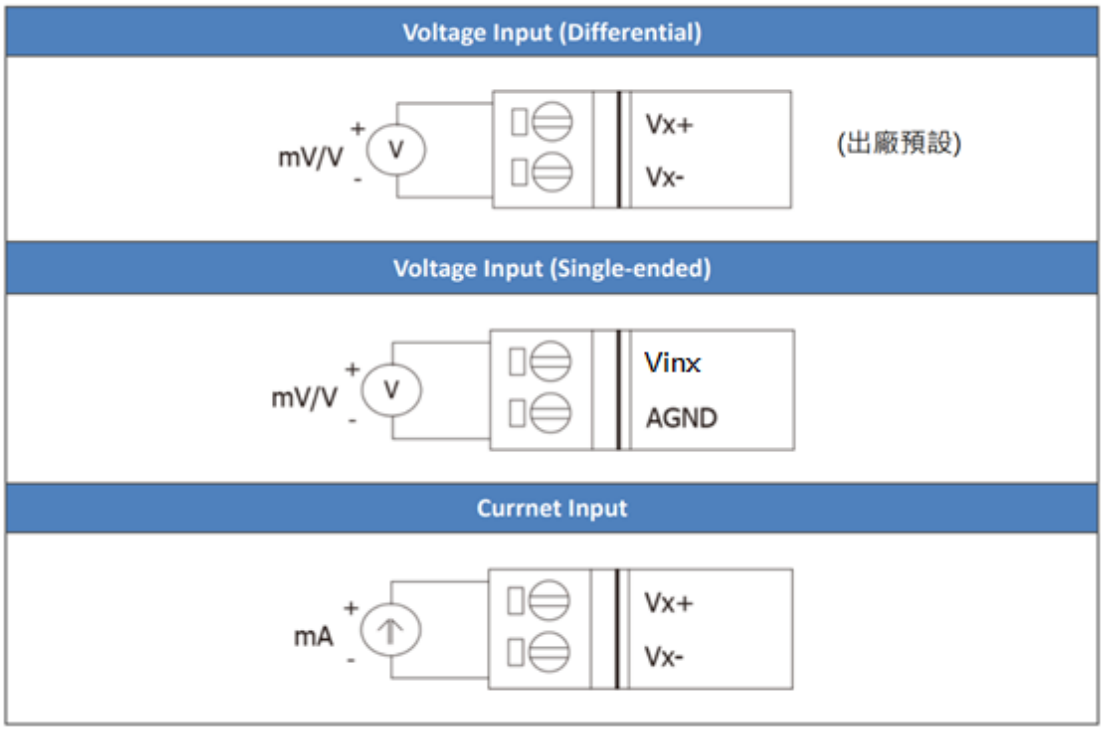


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2.5 Wire Connection

The default input type of CAN-2012C is Differential Input. If you need to change the input type, please refer to the module analog input type.

Note: x = channel code



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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	0x00040191
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-2012
1009h	0h	manufacturer hardware version	VISIBLE_STRING	RO	1.1
100Ah	0h	manufacturer software version	VISIBLE_STRING	RO	1.00-20240731
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	0x00002012
	3h	Revision_number	UNSIGNED 32	RO	0x00030001
	4h	Serial_number	UNSIGNED 32	RO	0x6cd3683c

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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

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
1401h	0h	Number of entries	UNSIGNED 8	RO	2
	1h	COB-ID used by RxPDO	UNSIGNED 32	RW	300h+Node-ID
	2h	Transmission type	UNSIGNED 8	RW	FFh
1402h	0h	Number of entries”	UNSIGNED 8	RO	2
	1h	COB-ID used by RxPDO	UNSIGNED 32	RW	400h+Node-ID
	2h	Transmission type	UNSIGNED 8	RW	FFh
1403h	0h	Number of entries	UNSIGNED 8	RO	2
	1h	COB-ID used by RxPDO	UNSIGNED 32	RW	500h+Node-ID
	2h	Transmission type	UNSIGNED 8	RW	FFh
1404h	0h	Number of entries	UNSIGNED 8	RO	2
	1h	COB-ID used by RxPDO	UNSIGNED 32	RW	C0000000h
	2h	Transmission type	UNSIGNED 8	RW	---
…	…	…	…	…	…
1409h	0h	Number of entries	UNSIGNED 8	RO	2
	1h	COB-ID used by RxPDO	UNSIGNED 32	RW	C0000000h
	2h	Transmission type	UNSIGNED 8	RW	---

RxPDO Mapping Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1600h	0h	Number of entries	UNSIGNED 8	RW	0
1601h	0h	Number of entries	UNSIGNED 8	RW	0
1602h	0h	Number of entries	UNSIGNED 8	RW	0
…	…	…	…	…	…
1609h	0h	Number of entries	UNSIGNED 8	RW	0

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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
1801h	0h	Number of entries	UNSIGNED 8	RO	5
	1h	COB-ID used by TxPDO	UNSIGNED 32	RW	280h+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
1802h	0h	Number of entries	UNSIGNED 8	RO	5
	1h	COB-ID used by TxPDO	UNSIGNED 32	RW	380h+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
1803h	0h	Number of entries	UNSIGNED 8	RO	5
	1h	COB-ID used by TxPDO	UNSIGNED 32	RW	480h+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
1804h	0h	Number of entries	UNSIGNED 8	RO	5
	1h	COB-ID used by TxPDO	UNSIGNED 32	RW	80000000h
	2h	Transmission type	UNSIGNED 8	RW	FFh
	3h	Inhibit time	UNSIGNED 16	RW	0
	4h	Reversed	---	---	---
	5h	Event timer	UNSIGNED 16	RW	0
1805h	0h	Number of entries	UNSIGNED 8	RO	5
	1h	COB-ID used by TxPDO	UNSIGNED 32	RW	80000000h
	2h	Transmission type	UNSIGNED 8	RW	FFh
	3h	Inhibit time	UNSIGNED 16	RW	0
	4h	Reversed	---	---	---
	5h	Event timer	UNSIGNED 16	RW	0
…	…	…	…	…	…

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1809h	0h	Number of entries	UNSIGNED 8	RO	5
	1h	COB-ID used by TxPDO	UNSIGNED 32	RW	80000000h
	2h	Transmission type	UNSIGNED 8	RW	FFh
	3h	Inhibit time	UNSIGNED 16	RW	0
	4h	Reversed	…	…	…
	5h	Event timer	UNSIGNED 16	RW	0

TxPDO Mapping Communication Entries

Idx	Sidx	Description	Type	Attr	Default
1A00h	0h	Number of entries	UNSIGNED 8	RO	4
	1h	Read Analog input 0	UNSIGNED 16	RW	6401 0110h
	2h	Read Analog input 1	UNSIGNED 16	RW	6401 0210h
	3h	Read Analog input 2	UNSIGNED 16	RW	6401 0310h
	4h	Read Analog input 3	UNSIGNED 16	RW	6401 0410h
1A01h	0h	Number of entries	UNSIGNED 8	RO	4
	1h	Read Analog input 4	UNSIGNED 16	RW	6401 0510h
	2h	Read Analog input 5	UNSIGNED 16	RW	6401 0610h
	3h	Read Analog input 6	UNSIGNED 16	RW	6401 0710h
	4h	Read Analog input 7	UNSIGNED 16	RW	6401 0810h
1A02h	0h	Number of entries	UNSIGNED 8	RO	4
	1h	Read Analog input 8	UNSIGNED 16	RW	6401 0910h
	2h	Read Analog input 9	UNSIGNED 16	RW	6401 0A10h
	3h	Read Analog input 10	UNSIGNED 16	RW	6401 0B10h
	4h	Read Analog input 11	UNSIGNED 16	RW	6401 0C10h
1A03h	0h	Number of entries	UNSIGNED 8	RO	4
	1h	Read Analog input 12	UNSIGNED 16	RW	6401 0D10h
	2h	Read Analog input 13	UNSIGNED 16	RW	6401 0E10h
	3h	Read Analog input 14	UNSIGNED 16	RW	6401 0F10h
	4h	Read Analog input 15	UNSIGNED 16	RW	6401 1010h
1A05h	0h	Number of entries	UNSIGNED 8	RO	0
…	..	…	…	…	…
1A09h	0h	Number of entries	UNSIGNED 8	RO	0

Analog Input/Output range Entry

Idx	Sidx	Description	Type	Attr	Default
2004h	0h	Number of entries	UNSIGNED 8	RO	16
	1h	Input range of AI channel 0	UNSIGNED 8	RW	1
	2h	Input range of AI channel 1	UNSIGNED 8	RW	1
	3h	Input range of AI channel 2	UNSIGNED 8	RW	1
…	…	…	…	…	…

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	Eh	Input range of AI channel 13	UNSIGNED 8	RW	1
	Fh	Input range of AI channel 14	UNSIGNED 8	RW	1
	10h	Input range of AI channel 15	UNSIGNED 8	RW	1

Enable Channel

Idx	Sidx	Description	Type	Attr	Default
2044h	0h	Number of entries	UNSIGNED 8	RO	16
	1h	Enable AI channel 0	UNSIGNED 8	RW	1(Enable)
	2h	Enable AI channel 1	UNSIGNED 8	RW	1(Enable)
	3h	Enable AI channel 2	UNSIGNED 8	RW	1(Enable)
…	…	…	…	…	…
	Eh	Enable AI channel 13	UNSIGNED 8	RW	1(Enable)
	Fh	Enable AI channel 14	UNSIGNED 8	RW	1(Enable)
	10h	Enable AI channel 15	UNSIGNED 8	RW	1(Enable)

Analog Input type

Idx	Sidx	Description	Type	Attr	Default
2101h	0h	Number of entries	UNSIGNED 8	RO	1
	1h	0:Differential Input 1:Single-ended Input	UNSIGNED 8	RW	--

Digital Input Device Entries

Idx	Sidx	Description	Type	Attr	Default
6000h	0h	Number of entries	UNSIGNED 8	RO	0

Digital Output Device Entries

Idx	Sidx	Description	Type	Attr	Default
6200h	0h	Number of entries	UNSIGNED 8	RO	0

Analog Input DeviceEntries

Idx	Sidx	Description	Type	Attr	Default
6401h	0h	Number of entries	UNSIGNED 8	RO	16
	1h	Read Analog Input channel 0	UNSIGNED 16	RO	-
	2h	Read Analog Input channel 1	UNSIGNED 16	RO	-
	3h	Read Analog Input channel 2	UNSIGNED 16	RO	-
…	…	…	…	…	…
	Eh	Read Analog Input channel 13	UNSIGNED 16	RO	-
	Fh	Read Analog Input channel 14	UNSIGNED 16	RO	-
	10h	Read Analog Input channel 15	UNSIGNED 16	RO	-

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Analog Output DeviceEntries

Idx	Sidx	Description	Type	Attr	Default
6411h	0h	Number of entries	UNSIGNED 8	RO	0

When the AI interrupt full trigger function (SDO: 6423h) is enabled and the AI input value reaches the condition configuration of the AI interrupt trigger selection (SDO: 6421h), CAN-2012C will start to feedback TxPDO. Users can set the upper limit, lower limit and variation of each AI channel through SDO: 6424h, 6425h, 6426h.

Analog Input Global Interrupt Enable

Idx	Sidx	Description	Type	Attr	Default
6423h	0h	Analog Input Interrupt Enable	Boolean	RW	0(Disable)

Analog Input Interrupt Trigger Selection

Idx	Sidx	Description	Type	Attr	Default
6421h	0h	Number of entries	UNSIGNED 8	RO	16
	1h	AI upper limit of channel 0	UNSIGNED 8	RW	0
	2h	AI upper limit of channel 1	UNSIGNED 8	RW	0
	3h	AI upper limit of channel 2	UNSIGNED 8	RW	0
…	…	…	…	…	…
	Eh	AI upper limit of channel 13	UNSIGNED 8	RW	0
	Fh	AI upper limit of channel 14	UNSIGNED 8	RW	0
	10h	AI upper limit of channel 15	UNSIGNED 8	RW	0

Bit no	**Analog Interrupt Trigger Selection**
0	The AI input value exceeds upper limit
1	The AI input value is less than lower limit
2	The change of the AI value is more than the delta
3 to 7	Reversed

Assume that you set the Bit 0 field in the interrupt trigger selection to 1. When the analog input value exceeds the upper limit, CAN-2012C will actively feedback the analog input value, and the 16 upper limit indicators on the CAN-2012C panel will be Light up individually.

In addition, if the AI upper or lower limit causes CAN-2012C to send too many TxPDO messages in a short period of time, you can modify the TxPDO inhibition time (Inhibit Time).

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This will change the minimum period between subsequent CAN messages, allowing you to set a larger Inhibit Time. You will find that there will be a longer time period between two TxPDO messages.

Analog Input Interrupt Upper Limit Integer

Idx	Sidx	Description	Type	Attr	Default
6424h	0h	Number of entries	UNSIGNED 8	RO	2
	1h	AI upper limit of channel 0	INTEGER 32	RW	---
	2h	AI upper limit of channel 1	INTEGER 32	RW	---
…	…	…	…	…	…
	Eh	AI upper limit of channel 13	INTEGER 32	RW	---
	Fh	AI upper limit of channel 14	INTEGER 32	RW	---
	10h	AI upper limit of channel 15	INTEGER 32	RW	---

Note: Please refer to "Appendix" for AI upper limit range

Analog Input Interrupt Lower Limit Interger

Idx	Sidx	Description	Type	Attr	Default
6425h	0h	Number of entries	UNSIGNED 8	RO	2
	1h	AI lower limit of channel 0	INTEGER 32	RW	---
	2h	AI lower limit of channel 1	INTEGER 32	RW	---
…	…	…	…	…	…
	Eh	AI lower limit of channel 13	INTEGER 32	RW	---
	Fh	AI lower limit of channel 14	INTEGER 32	RW	---
	10h	AI lower limit of channel 15	INTEGER 32	RW	---

Note: Please refer to "Appendix" for AI lower limit range

Analog Input Interrupt Delta Unsigned

Idx	Sidx	Description	Type	Attr	Default
6426h	0h	Number of entries	UNSIGNED 8	RO	2
	1h	AI delta value of channel 0	UNSIGNED 32	RW	---
	2h	AI delta value of channel 1	UNSIGNED 32	RW	---
…	…	…	…	…	…
	Eh	AI delta value of channel 13	UNSIGNED 32	RW	---
	Fh	AI delta value of channel 14	UNSIGNED 32	RW	---
	10h	AI delta value of channel 15	UNSIGNED 32	RW	

Note: These values are used to define the acceptable AI change ranges for each AI channels and may have different range for the physical value because of the settings of the type code. Please refer to the appendix or the type code definition.

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3.2 Store and Restore Object

The user can write the value 65766173h to object with index 1010h and subindex 1 to save the application setting, or write the value 64616F6Ch to the object with index 1011h and subindex 1 and reboot the module 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 below:

Index	Subindex	Description	Factory Default
2004h	1~10h	Analog Input type code for channel 0 ~ 1 5	1h
2100h	1	Set Module to Operation Mode when powering on	0
2101h	1	Analog input type	0
6421h	1~10h	AI interrupt trigger selections for channel 0~15	0
6423h	0	AI global interrupt enable	0
6424h	1~10h	AI interrupt upper limit for channel 0~15	--
6425h	1~10h	AI interrupt lower limit for channel 0~15	--
6426h	1~10h	AI interrupt delta values for channel 0~15	0x3E8
1400h	1~2	RxPDO1 parameter	--
...	...	...	...
1409h	1~2	RxPDO10 parameter	--
1600h	0~8	RxPDO1 mapping information	--
...	...	...	…
1609h	0~8	RxPDO10 mapping information	--
1800h	1~5	TxPDO1 parameter	--
...	...	...	...
1809h	1~5	TxPDO10 parameter	--
1A00h	0~8	TxPDO1 mapping information	--
...	...	...	…
1A09h	0~8	TxPDO10 mapping information	--

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3.3 Application Object

Type code of CAN-2012C module (0x2004)

The user can read the object with index 6401h and subindex 0x01~0x10 to get the AI value of the channel 0~15, and the range for each AI type code are listed in Appendix.

If the user wants to change the AI input range, write the type code to the object with index 2004h and subindex 0x01~0x10. For example, if the node ID of CAN-2012C is 1, the following command would be used:

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	04	20	01	02	00	00	00

SDO client → **SDO server (CAN-2012C)**

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	0	1	1	0	0	0	0	0	0	1	0	8	60	04	20	01	00	00	00	00

SDO client ← **SDO server (CAN-2012C)**

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Analogue Input module (0x6401)

Writing object with index 2004h and subindex 1 with 2h means to change the type code of the AI channel 0 with 2h.

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	01	64	01	00	00	00	00

SDO client → **SDO server (CAN-2012C)**

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	0	1	1	0	0	0	0	0	0	1	0	8	4B	01	64	01	FF	3F	00	00

SDO client ← **SDO server (CAN-2012C)**

Reading object with index 6401h and subindex 1 means to get the value of the AI channel 0. According to the type code 2h set before, the replied value of the AI channel 0 is 3FFFh.(+2.5V)

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Analog Input Type(0x2101)

Write 0x01 to the object of main index 0x2101 sub-index 1 to set the module to single-ended mode, and write 0 to differential mode (default).
For example: Assume that the node ID of CAN-2012C is 1, and the instructions are as follows:

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	01	21	01	01	00	00	00

SDO client → **SDO server (CAN-2012C)**

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	0	1	1	0	0	0	0	0	0	1	0	8	60	01	21	01	--	--	--	--

SDO client ← **SDO server (CAN-2012C)**

If you then use the CANopen command to save parameters, the module will directly enter single-ended mode after powering on.

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	23	10	10	01	73	61	76	65

SDO client → **SDO server (CAN-2012C)**

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	0	1	1	0	0	0	0	0	0	1	0	8	60	10	10	01	--	--	--	--

SDO client ← **SDO server (CAN-2012C)**

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Set Module to Operation Mode when powering on (0x2100)

This object 0x2100 with subindex 1 defines if the module will enter operation mode automatically when powering on.

For example, if the node id of CAN-2012C 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	21	01	01	00	00	00

SDO client → **SDO server (CAN-2012C)**

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	0	1	1	0	0	0	0	0	0	1	0	8	60	00	21	01	--	--	--	--

SDO client ← **SDO server (CAN-2012C)**

Write object index 0x2100 with subindex 1 to 0x01 then store the setting as below. Module will enter operation mode when powering on.

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	23	10	10	01	73	61	76	65

SDO client → **SDO server (CAN-2012C)**

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	0	1	1	0	0	0	0	0	0	1	0	8	60	10	10	01	--	--	--	--

SDO client ← **SDO server (CAN-2012C)**

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3.4 Default PDO Mapping

RxPDO mapping list:

ID	Len	D0	D1	D2	D3	D4	D5	D6	D7
200h+x	0	Reserved							
300h+x	0	Reserved							
400h+x	0	Reserved							
500h+x	0	Reserved							

TxPDO mapping list:

ID	Len	D0	D1	D2	D3	D4	D5	D6	D7
180h+x	4	AI_C0_L	AI_C0_H	AI_C1_L	AI_C1_H	AI_C2_L	AI_C2_H	AI_C3_L	AI_C3_H
280h+x	0	AI_C4_L	AI_C4_H	AI_C5_L	AI_C5_H	AI_C6_L	AI_C6_H	AI_C7_L	AI_C7_H
380h+x	0	AI_C8_L	AI_C8_H	AI_C9_L	AI_C9_H	AI_C10_L	AI_C10_H	AI_C11_L	AI_C11_H
480h+x	0	AI_C12_L	AI_C12_H	AI_C13_L	AI_C13_H	AI_C14_L	AI_C14_H	AI_C15_L	AI_C15_H

Note: x is Node-ID of the module

Note: AI is Analogue Input

Note: C0, C1, C2 and C3 is channel 0, channel 1, channel 2 and channel 3.

Note: The 'L' indicates low byte and 'H' indicates high byte.

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3.5 EMCY Communication

The data format of the emergency object data follows the structure below.

Byte	0	1	2	3	4	5	6	7
Content	Emergency Error code		Error register	Manufacturer specific Error Field				

Each bit on the error register is defined as follows.

Bit	Meaning
0	Generic error
1	Current
2	Voltage
3	Temperature
4	Communication error (Overrun, error state)
5	Device profile specific
6	Reserved (Always 0)
7	Manufacturer specific

The Emergency error codes and the error register are specified in the following table.

Emergency Error Code		Error Register	Manufacture Specific Error Field			Description
High Byte	Low Byte	Byte2	Byte3	Byte 4~7		
00	00	00	00	00 00 00 00		Error Reset or No Error
10	00	81	01	00 00 00 00		CAN controller Error Occur
50	00	81	02	00 00 00 00		EEPROM Access Error
81	01	11	04	00 00 00 00		Soft Rx Buffer Overrun
81	01	11	05	00 00 00 00		Soft Tx Buffer Overrun
81	01	11	06	00 00 00 00		CAN controller Overrun
81	30	11	07	00 00 00 00		Lift Guarding Fail
81	40	11	08	00 00 00 00		Recover From Bus Off
82	10	11	09	00 00 00 00		PDO Data Length Error
FF	00	80	0A	00 00 00 00		Request To Reset Node or Communication
FF	00	2E	0B	00 00 Upper limit alarm	00 00 Lower limit alarm	Upper/Lower limit alarm for Each channel
FF	00	00	0B	00 00 00 00		Disable upper/lower limit alarm

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Appendix: Type Code Definition

Analog Input Type code Definition for CAN-2012C

Type Code	Input Type	Data Format	Max Value	Min Value
01 (Default)	-10 to +10V	Engineer Unit	+10.000	-10.000
		2's complement HEX	7FFF	8000
02	-5 to +5V	Engineer Unit	+5.0000	-5.0000
		2's complement HEX	7FFF	8000
03	-2.5 to +2.5V	Engineer Unit	+2.5000	-2.5000
		2's complement HEX	7FFF	8000
04	0 to +10 V	Engineer Unit	+10.000	+0.000
		2's complement HEX	7FFF	0
05	-20 to +20 mA	Engineer Unit	+20.000	-20.000
		2's complement HEX	7FFF	8000
06	0 to +20 mA	Engineer Unit	+20.000	+0.000
		2's complement HEX	7FFF	0
07	4 to +20 mA	Engineer Unit	+20.000	+4.000
		2's complement HEX	7FFF	0

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