

# GCAN-IO-8000

CANopen I/O coupler

User manual



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## Revision History:

<b>Version</b>	<b>Date</b>	<b>Reason</b>
V1.00	2015/10/16	Create
V2.01	2015/12/20	Fixed working parameters
V3.01	2017/11/22	Add parameters
V3.02	2018/01/22	Add protocol section
V3.03	2018/03/22	Fixed parameters
V3.25	2019/03/20	Modify the selection table
V4.00	2021/03/23	Product revision and upgrade

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# 1. Introduction

## 1.1 Overview

GCAN-8000 Modbus I/O Coupler can be used to connect CAN bus system and distributed bus terminal module, and these terminal modules can be expanded in a modular way. A complete node consists of a bus coupler, 1-32 arbitrary number of terminal modules and a terminal module. Adopt GCAN-IO-8000 bus coupler, through GC-bus expansion technology, can establish I/O connection extremely conveniently, can connect 32 input/output terminal modules at most.

The GCAN-IO-8000 CANopen bus coupler adopts the CAN bus protocol that conforms to the ISO 11898 standard. The GCAN-IO-8000 bus coupler not only supports all types of CANopen communication, but can also be easily applied to the manufacturer's specific CAN bus environment. In addition, the firmware can also be upgraded through the configuration interface.

GCAN-IO-8000 bus coupler can connect all bus terminal modules. As far as the user is concerned, there is no difference between the processing methods of analog input/output signals and the processing methods of other types of signals. The information in the process image area of the controller is displayed in byte array format. According to different models, the analog quantity bus terminal module register contains temperature range, gain value and linearization characteristic curve.

GCAN-8000 Bus Coupler supports automatic configuration, and you do not need to set parameters on the PC. When GCAN-8000 bus coupler uses Modbus RTU communication, communication parameters can be configured by RS232 interface.

## 1.2 Performance

- CANopen baud rate supports 1000k, 500k, 250k, 125k, 100k, 50k, 10k; PDO mode supports synchronization, loop, event-driven, and polling; The number of bus terminal modules is up to 32;
  - Sending PDO (CANopen) is determined by the number of extended input modules, and receiving PDO (CANopen) is determined by the number of extended output modules
  - Configuration mode is automatic configuration, expanded freely
- CAN bus interface is an open 4-pin terminal

- Supply power: 24V DC(-15%/+20%)
- Input current, 70mA+ (total GC-bus current), maximum2.5A
- Starting current: about 2.5 times continuous current
- Power contacts: maximum 24V DC/maximum10A
- Electrical isolation: 1500 Vrms (power contact/bus coupled power voltage)
- Working temperature: -40.00°C~85.00°C
- Dimensions: 100mm(L) \* 69mm(W) \* 48mm(H)

### **1.3 Typical application**

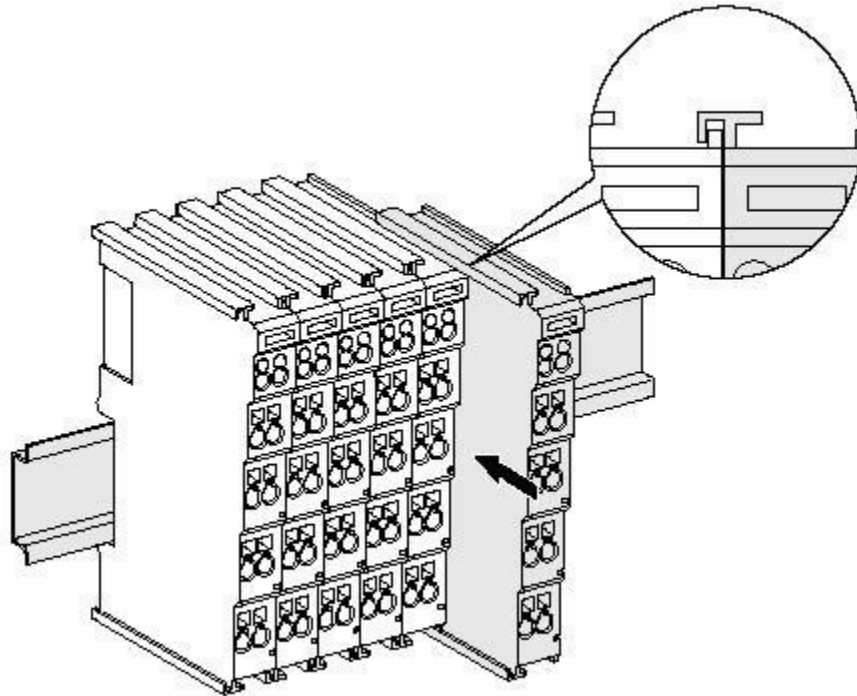
- Connect with the distributed bus terminal module to form a complete control node.
- Perform data acquisition and data transmission with CANopen protocol.

## 2. Installation and usage

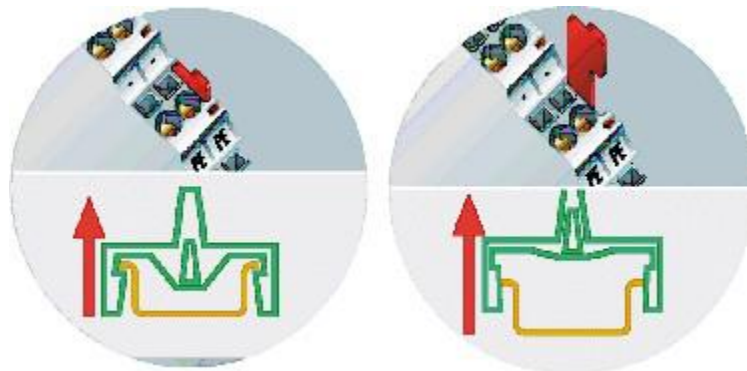
This chapter introduces the method installation and wiring, the meaning of the indicator and the interface.

### 2.1 Fixed module

The installation method of GCAN-8000CANopen bus coupler is shown in **Figure 2.1**



**Figure 2.1** GCAN-8000 module installation



**Figure 2.2** GCAN-8000 module self-locking mechanism

As shown **figure 2.1**, install the GCAN-8000CANopen bus coupler on the guide rail until the lock is stuck. The GCAN-8000 CANopen bus coupler has a self-locking mechanism that can effectively prevent equipment from falling. As shown **figure 2.2**, you can release the self-locking mechanism by pulling out the orange label

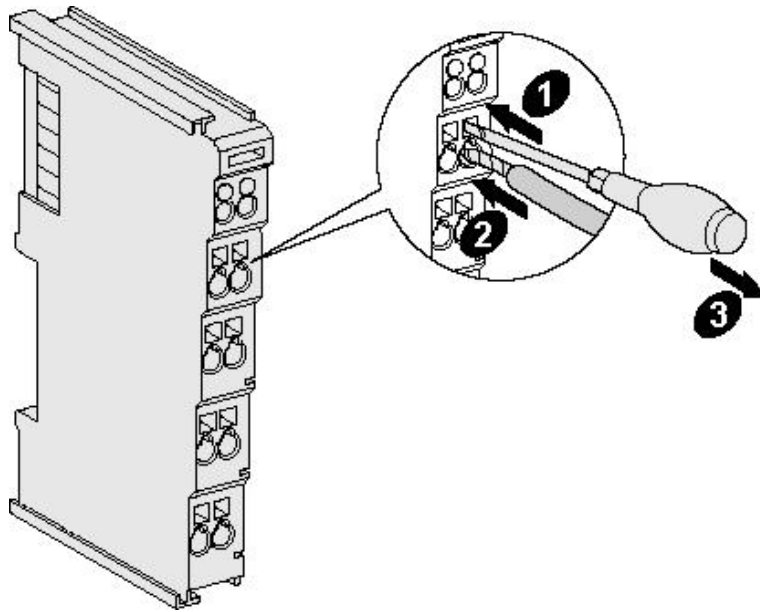
The GCAN-8000 CANopen bus coupler can connect up to 32 distributed

bus terminal modules. When inserting bus terminal module, be sure to insert it along the groove on the right side of the existing module sequentially until the lock is stuck. At the right end of the entire node, you need to install terminal module. The terminal will guarantee the data transmission and power supply of the GC-Bus.

When you assemble the nodes correctly, there is no obvious gap between the terminal modules. If the modules are not assembled correctly, the entire node will not operate normally.

## 2.2 Wiring method

The power wiring as shown in [figure 2.3](#). First, use a flat-blade screwdriver to insert into the square hole, hold the top edge of the metal sheet in the square hole, and press toward the hole. Then, insert the wire into the hole. After plugging in, pull out the screwdriver and the wire can be firmly locked in the hole.



**Figure 2.3** GCAN-8000 module installation

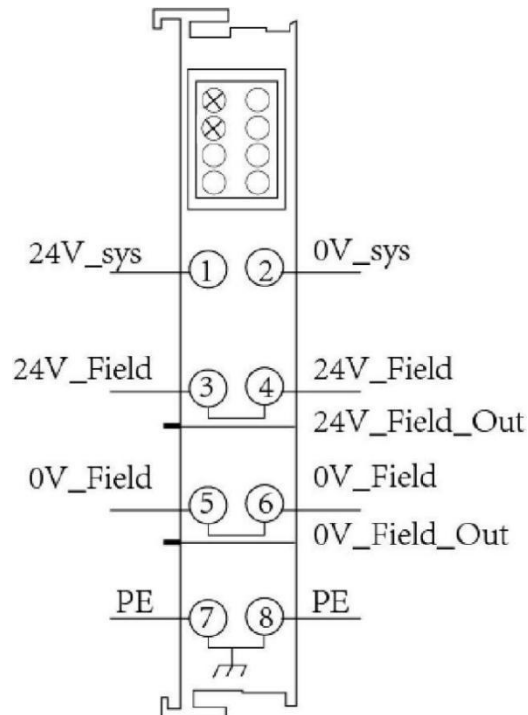


Figure 2.4 GCAN-8000 module, wiring terminal block

The wiring terminal block of the GCAN-8000CANopen bus coupler is shown in Figure 2.4, including 8 terminals. The number corresponding to each terminal and its meaning are shown in Table 2.1.

Note: connecting between terminal 3 and terminal 4, terminal 5 and terminal 6, terminal 7 and terminal 8 inside the module.

Terminal	Number	Definition
24V	1	Input 24V power
0V	2	GND power
+	3	IO positive power
+	4	IO positive power
-	5	IO negative power
-	6	IO negative power
PE	7	shield
PE	8	shield

Table 2.1 GCAN-8000 module, wiring terminal definition

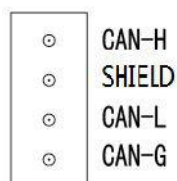


Figure 2.5 CAN bus terminal block of GCAN-IO-8000 module

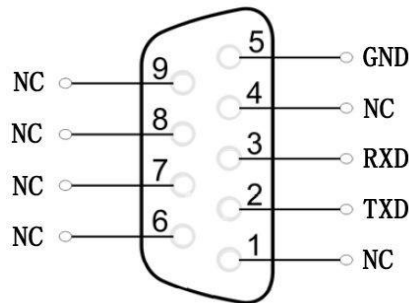


The CAN bus terminal block of GSCAN-IO-8000 CANopen bus coupler is shown in [Figure 2.5](#).

The CAN bus terminal block of GSCAN-IO-8000 contains 4 terminals, and the corresponding serial number of each terminal and its meaning are shown in [Table 2.2](#)

Terminal	Serial number	Meaning
CAN-H	1	CAN bus-high
SHIELD	2	Shield
CAN-L	3	CAN bus-low
CAN-G	4	CAN bus-GND

**Table 2.2** CAN bus terminal definition of GSCAN-IO-8000 module



**Figure 2.6** GSCAN-IO-8000 module RS-232 interface definition

The RS-232 interface definition of GSCAN-IO-8000 CANopen bus coupler is shown in [Figure 2.6](#). The RS-232 interface of GSCAN-IO-8000 only defines 3 signal lines, RXD, TXD and GND.

### 2.3 System status indicator

GSCAN-8000CANopen bus coupler has two sets of status indicators, contains 6 circular status indicators in the left area and 2 power indicators in the right area. The specific indicating function of the indicator is shown in [table 2.3](#).

Indicator	Color	Status
PWR	green	Power
SYS	green	System
RUN	green	Run
ERR	green	Error
IO RUN	green	GC-Bus run
IO ERR	green	GC-Bus error
NO.1 on the right	green	Power

NO.3 on the right	green	GC-Bus power
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**Table 2.3** GCAN-8000 module, indicators

<b>Indicator</b>	<b>Status</b>	<b>Meaning</b>
PWR	bright	Power supply normally
	not bright	Power supply abnormally
SYS	Blinking	Working status
	not bright	Initialization error
RUN	Blinking	Run normal
	not bright	stop
ERR	bright	System error
	not bright	System normal
IO RUN	Blinking	GC-Bus run normally
	not bright	GC-Bus stop
IO ERR	bright	GC-Bus error
	not bright	GC-Bus normal
<b>Terminal module</b>		
NO.1 on the right	bright	Power supply normally
	not bright	Power supply abnormally
NO.3 on the right	bright	Internal power supply normally
	not bright	Internal Power supply abnormally

**Table 2.4** GCAN-8000 module, indicators status

## 3. Communication connection

### 3.1 Serial connection

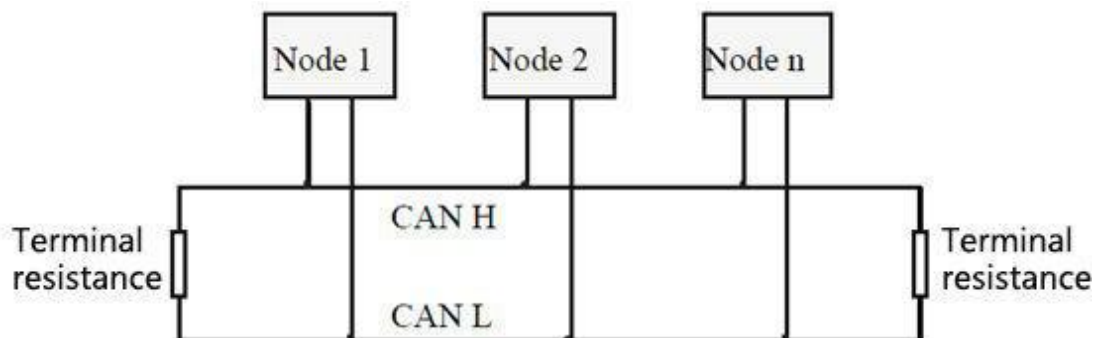
GCAN-IO-8000 CANopen bus coupler uses standard serial port level (RS232:  $\pm 3\sim 15V$ ), so this module can be directly connected to equipment with RS232 interface.

The RS232 interface baud rate of the GCAN-IO-8000 CANopen bus coupler cannot be modified and is fixed at 19200bps.

### 3.2 CAN connection

GCAN-IO-8000 connect to CAN-Bus as described in [figure 3.1](#), CAN-H connect CAN-H, CAN-L connect CAN L to make communication.

GCAN-IO-8000, must be installed two 120 ohms terminal resistance at the farthest end of CAN-Bus network; if the node number is more than 2, intermediate nodes needn't to install 120 ohms terminal resistance. For branch connections, the length should not exceed 3 meters.



**Figure 3.1** CAN-Bus network structure

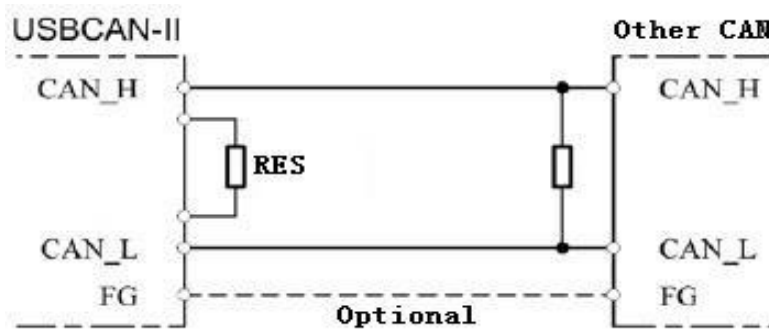
Please note: CAN-bus cable can use ordinary twisted pair and shielded twisted pair. The theoretical maximum communication distance mainly depends on the bus baud rate. The relationship between the maximum bus length and the baud rate is shown in Table 3.1. If the communication distance exceeds 1km, the cross-sectional area of the line should be greater than  $\Phi 1.0\text{mm}^2$ . The specific specifications should be determined according to the distance. The general rule is to increase the distance as the distance increases

Baud rate	Distance
1 Mbit/s	40m
500 kbit/s	110m
250 kbit/s	240m
125 kbit/s	500m
50 kbit/s	1.3km
20 kbit/s	3.3km
10 kbit/s	6.6km
5 kbit/s	13km

**Table 3.1** the relationship between CAN-Bus length and baud rate.

### 3.3 CAN-Bus terminal resistance

In order to enhance the reliability of CAN communication and eliminate the interference of CAN bus terminal signal reflection, the two farthest endpoints of the CAN bus network usually need to add terminal matching resistors, as shown in **Figure 3.2**. The value of the terminal matching resistance is determined by the characteristic impedance of the transmission cable. For example, the characteristic impedance of the twisted pair is 120Ω, and the two end points on the bus should also be integrated with 120Ω terminal resistance. If other nodes on the network use different transceivers, the terminal resistance must be calculated separately.



**Figure 3.2** GCAN-IO-8000 connect with other nodes

Please note: 2 GCAN-IO-8000 hasn't integrated 120Ω terminal resistance. If the number of nodes is more than 2, the middle node does not need to install 120Ω terminal resistance. When you need to use it, connect the both sides of the resistance to CAN\_H and CAN\_L

### 3.4 CAN baud rate and node number setting

You can modify the CAN bus communication baud rate of the GCAN-IO-

8000 module through the RS232 interface. The specific process is as follows: First, establish a serial port connection with a baud rate of 19200bps, configure the data bit and stop bit as none, 8, 1, and send a "help" command or "?" command through the RS232 interface, and then the RS232 interface will return to the configuration information. Please note that when sending the command, please add a carriage return at the end or select "Send New Line" in the software. Do not select "Hexadecimal Display" or "Hexadecimal Transmission" for display and transmission. You can send "setbaud=500000" to modify the baud rate of the GCAN-IO-8000 module to 500kbps. At the same time, you can send "getbaud" to get the CAN baud rate of this machine, and the unit of the reply value is bps.

Set baud	Corresponding baud rate (kbps)
setbaud=1000000	1000
setbaud=500000	500
setbaud=250000	250
setbaud=125000	125
setbaud=100000	100
setbaud=50000	50
setbaud=10000	10

**Table 3.2**

The method of setting and obtaining the CANopen node ID is similar to the baud rate. You can modify the CAN bus node number of the GCAN-IO-8000 module through the RS232 interface. You can send "setid=3" to modify the CANopen node ID of the GCAN-IO-8000 module to 3. At the same time, you can send "getid" to get the CANopen node ID of the machine. The node number can be set arbitrarily within 1-127

## 4. Communication example

GCAN-IO-8000 implements the CANopen communication protocol and is a CANopen slave device. The GCAN-IO-8000 module uses PDO (Process Data Object) to collect or output digital signals.

When equipped with GC-3804 or GC-1008 module, GCAN-IO-8000 will send out TPDO data. Typical frame IDs are 0x181, 0x281 and so on. When equipped with GC-2008 module, GCAN-IO-8000 will receive RPDO data, typical frame IDs are 0x203, 0x303, etc.

This chapter will use Guangcheng Technology's USBCAN-II Pro module and ECANTools software to receive and send CAN bus data. The CANopen master function attached to the software can help debug CANopen slaves, which is very convenient and practical.

Use Guangcheng Technology's USBCAN bus analyzer to simulate CAN bus communication equipment and perform communication tests on GCAN-IO-8000 modules. The USBCAN bus analyzer is an intuitive CAN bus debugging and analysis tool. The device can be used to monitor and simulate CAN data transmission and reception through a computer. It is an indispensable tool for engineers engaged in the CAN bus industry. You are welcome to buy through the contact information on the last page of this manual.

### 4.1 NMT command

The GCAN-IO-8000 module meets the standard CANopen Cia301 protocol and is a standard CANopen slave device. After GCAN-IO-8000 is started, the master will send a frame command to the master station, the frame ID is 0x700+Node ID, and the frame data is 0x7F.

For example: Set the Node ID of GCAN-IO-8000 to 1 through the DIP switch, then USBCAN-II Pro as the master device can receive a start command, the frame ID is 0x701, and the frame data is 0x7F. As shown in Figure 4.1, this data can be received using ECANTools software.

FrameID (HEX)	DLC	Frame data (HEX)							
701	1	7F	--	--	--	--	--	--	--

Table 4.1

序号	帧间隔时间us	名称	帧ID	帧类型	帧格式	DLC	数据	帧数量
00000001	007.495.863	接收	701	DATA	STANDARD	1	7F	1

Figure 4.1

The GCAN-IO-8000 module receives the operation command issued by the master station, the frame ID is 0x000, and the DLC is 2. The first byte of the frame data is the command symbol, and the second byte is the node number (00 means all nodes).

For example: the Node ID of GCAN-IO-8000 is 1, and the command GCAN-IO-8000 is to enter the operating state (01), the NMT command frame ID is 0x000, and the frame data is 0x01, 0x01. This command can also be issued by CANopenMaster plug-in of ECANTools software. For detailed instructions of NMT, please refer to Appendix B.4. CANopen communication.

FrameID (HEX)	DLC	Frame data (HEX)							
		Command symbol	Node address						
000	2	01	01	--	--	--	--	--	--

Table 4.2

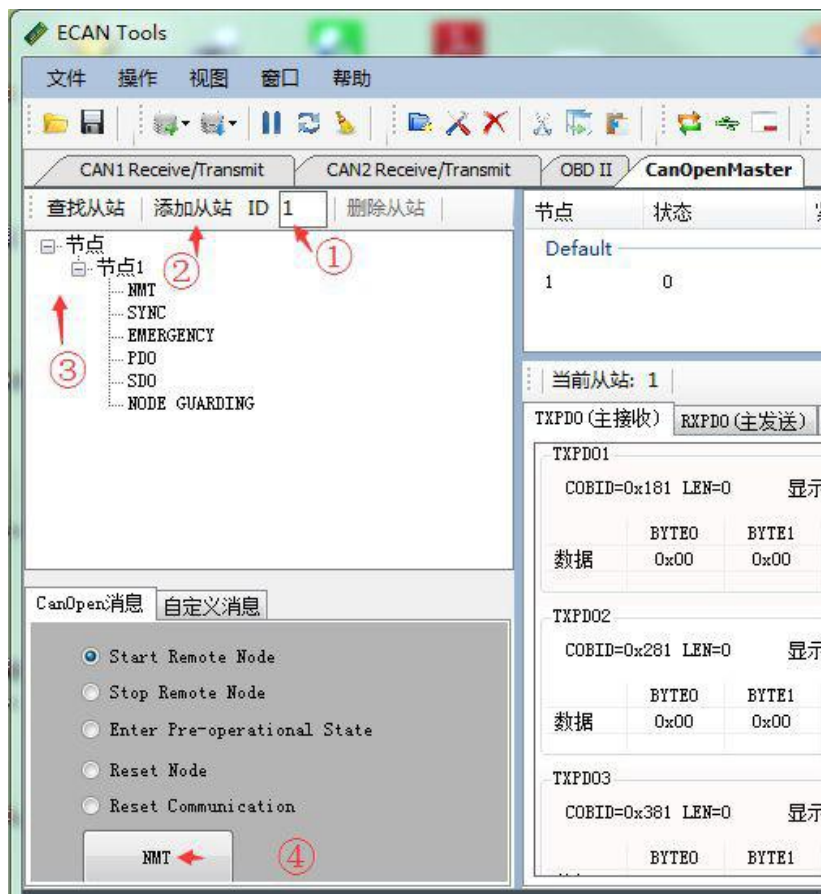


Figure 4.2 NMT command sending interface

Use the ECANTools software to command GCAN-IO-8000 to enter the operating state:

- ① Fill the slave node number into the text box behind the ID
- ② click the Add Slave button
- ③ open the + sign on the left side of the node, and click " NMT"
- ④ Select "Start Remote Node" (default), and click the "NMT" button below. As shown in Figure 4.3, the NMT command can be viewed in the ECANTools monitoring interface after sending.

After receiving the NMT command, GCAN-IO-8000 will start broadcasting PDO data and send out a heartbeat command with a frame ID of 0x701 and frame data of 0x05, indicating that GCAN-IO-8000 has entered the operating state.



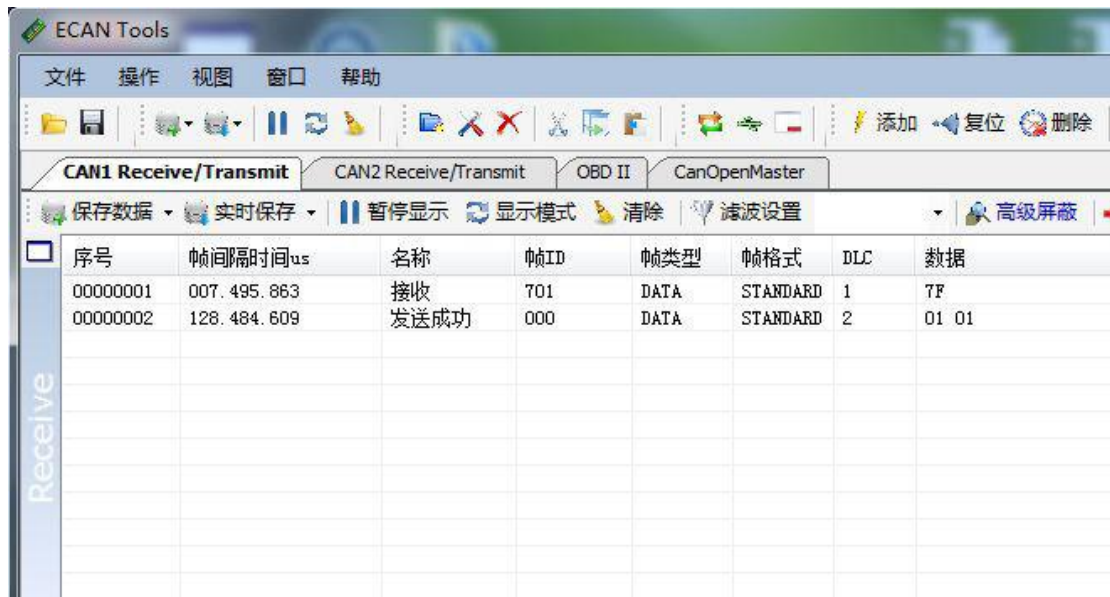


Figure 4.3 NMT command monitoring interface

## 4.2 Equipped with GC-1008module

The state of the digital input is represented by one byte, channel 8 is high and channel 1 is low.

Eg: GCAN-8000 module node number is set to 1. The channel 8 and channel 4 status are 1 and the other status are 0, and the DI status data displayed on one end of the Modbus is 88. The following table lists two common DI states and their corresponding state data.

DI State								
Channel Number	8	7	6	5	4	3	2	1
State	1	0	0	0	1	0	0	0
Modbus data	88							

DI State								
Channel Number	8	7	6	5	4	3	2	1
State	0	1	0	1	1	0	1	0
Modbus data	5A							

Table 4.3

### 4.3 Equipped with GC-2008module

The state of the digital output is represented by one byte, channel 8 is high and channel 1 is low.

Eg: GCAN-8000 module node number is set to 1. Set the status of channel 8 and channel 4 to 1, and set the other status to 0. The data of the Modbus DO status to be sent is 88 (15 function code).

DO State								
Channel Number	8	7	6	5	4	3	2	1
State	1	0	0	0	1	0	0	0
Modbus data	88							

DO State								
Channel Number	8	7	6	5	4	3	2	1
State	0	1	0	1	1	0	1	0
Modbus data	5A							

Table 4.4

### 4.4 Equipped with GC-3804module

The temperature status of each channel is represented by two bytes, eight bytes for four channels.

Among them, the two bytes representing the temperature state, the first byte is low, and the data of byte to be converted to decimal and multiplied by 0.1. The second byte is high, the data of byte need to be converted to decimal and multiplied by 25.6.

Finally add the two values, which is the final temperature value, and the unit is degrees Celsius.

Eg: The temperature of the four channels is 25.6 degrees, 25.5 degrees, 20 degrees, and 30 degrees respectively. The analog input data is 0x00, 0x01, 0xFF, 0x00, 0xC8, 0x00, 0x2C, 0x01.

GC-3804 temperature and CAN data		
Modbus data	Low byte C8	High byte 00
coefficient	200 (0xC8) x0.1	0 (0x00) x25.6
temperature	20°C	

GC-3804 temperature and CAN data		
Modbus data	Low byte 2C	High byte 01
coefficient	44 (0x2C) x0.1	1 (0x01) x25.6
temperature	30°C	

Table 4.5

## 4.5 Equipped with multiple modules

If the GCAN-IO-8000 is equipped with multiple sets of GC-1008 modules at the same time, then we will number them according to their distance from the GCAN-IO-8000, from the nearest to the farthest, and the nearest one is number 1. The TPDO data sent by the GCAN-IO-8000 coupler will be sent according to the following table. For example, when the GCAN-IO-8000 node number is 3 and 9 GC-1008 modules are installed at the same time, you will receive two sets of data with frame IDs of 0x183 and 0x283. Among them, the eight data bytes with frame ID 0x183 correspond to GC-1008 modules No. 1-8 in turn; one data byte with frame ID 0x283 corresponds to No. 9 GC-1008 modules.

Frame ID	Frame data							
0x180+Node ID	1	2	3	4	5	6	7	8
0x280+Node ID	9	10	11	12	13	14	15	16
0x380+Node ID	17	18	19	20	21	22	23	24
0x480+Node ID	25	26	27	28	29	30	31	32

Table 4.6 Correspondence between multiple sets of GC-1008 modules and CAN data

If GCAN-IO-8000 is equipped with multiple sets of GC-2008 modules at the same time, then we will number them according to their distance from GCAN-IO-8000, from the nearest to the farthest, and the nearest one is number 1. The RPDO data received by the GCAN-IO-8000 coupler needs to be sent

according to the following table. For example, when the GCAN-IO-8000 node number is 3 and 9 GC-2008 modules are installed at the same time, you need to send two sets of data with frame IDs of 0x203 and 0x303 to control all 9 modules. Among them, the eight data bytes with frame ID 0x203 correspond to GC-2008 modules 1-8 in sequence; one data byte with frame ID 0x303 corresponds to GC-2008 module 9.

Frame ID	Frame data							
0x200+Node ID	1	2	3	4	5	6	7	8
0x300+Node ID	9	10	11	12	13	14	15	16
0x400+Node ID	17	18	19	20	21	22	23	24
0x500+Node ID	25	26	27	28	29	30	31	32

**Table 4.7** Correspondence between multiple groups of GC-2008 modules and CAN data

If the GCAN-IO-8000 is equipped with multiple sets of GC-3804 modules at the same time, then we number them according to their distance from the GCAN-IO-8000, from the nearest to the farthest, and the nearest one is number 1. The TPDO data sent by the GCAN-IO-8000 coupler will be sent according to the following table. For example, when the GCAN-IO-8000 node number is 3 and 4 GC-3804 modules are installed at the same time, you will receive four sets of data such as frame ID 0x183. Among them, the eight data bytes with frame ID 0x183 correspond to the 4 channels of No. 1 GC-3804 module in turn; the eight data bytes with frame ID 0x283 correspond to the 4 channels of No. 2 GC-3804 module in turn.

Frame ID	Frame data
0x180+Node ID	No.1GC-3804 4 channels
0x280+Node ID	No.2GC-3804 4 channels
0x380+Node ID	No.3GC-3804 4 channels
0x480+Node ID	No.4GC-3804 4 channels

**Table 4.8** Correspondence between multiple groups of GC-3804 modules and CAN data

If GCAN-IO-8000 is equipped with GC-1008 module and GC-3804 module at the same time, then we will number them according to their distance from GCAN-IO-8000, from the nearest to the farthest, and the nearest one is number 1. The TPDO data sent by the GCAN-IO-8000 coupler will be sent according to the following table.

For example, when the GCAN-IO-8000 module node number is 3 and it is equipped with 3 GC-1008 modules and 1 GC-3804 module at the same time,

you will receive two sets of data with frame IDs of 0x183 and 0x283. The data correspondence is shown in the table below.

Frame ID	Frame data							
0x180+ Node ID	No.1 GC-1008	No.2 GC-1008	No.3 GC-3804 byte1	No.3 GC-3804 byte2	No.3 GC-3804 byte3	No.3 GC-3804 byte4	No.3 GC-3804 byte5	No.3 GC-3804 byte6
0x280+ Node ID	No.3 GC-3804 byte7	No.3 GC-3804 byte8	No.4 GC-1008	00	00	00	00	100

**Table 4.9** Correspondence between multiple groups of GC-1008 and GC-3804 and CAN data

## 5. Module selection table

GCAN-IO-8000 series products consist of a programmable main control module, several GC series IO modules and a terminal resistance module. GC series IO modules currently include five categories: digital input, digital output, analog input, analog output, and communication extension. The specific selection table is shown in **Table 5.1**.

I/O	Type	Characteristic	Signal	Channel
PLC Control module	GCAN-PLC-400	CPU:168M	-	-
	GCAN-PLC-510	CPU:400M	-	-
	GCAN-PLC-511	CPU:400M (2CAN)	-	-
Digital input	GC-1008	Digital input (PNP)	24V DC	8-channel
	GC-1018	Digital input (NPN)	24V DC	8-channel
	GC-1502	Counter (200kHz max)	-	2-channel
Digital output	GC-2008	Digital output (PNP)	24V DC	8-channel
	GC-2018	Digital output (NPN)	24V DC	8-channel
	GC-2204	relay output	-	4-channel
	GC-2302	PWM (20Hz~200kHz)	-	2-channel
Analog input	GC-3604	Voltage input, 16 bits	-5~+5V	4-channel
	GC-3624	Voltage input, 16 bits	10V~+10V	4-channel
	GC-3644	Current input, 16 bits	0-20mA	4-channel
	GC-3654	Current input, 16 bits	4-20mA	4-channel
	GC-3664	Voltage input, 16 bits	0~+5V	4-channel
	GC-3674	Voltage input, 16 bits	0~+10V	4-channel
	GC-3804	2-wire PT100, 16 bits	Thermal resistance	4-channel
	GC-3822	3-wire PT100, 16 bits	Thermal resistance	2-channel

	GC-3844/3854/3864	K type / S type / T type thermocouple	Thermocouple	4-channel
Analog output	GC-4602	Voltage output, 16 bits	-5V~+5V	2-channel
	GC-4622	Voltage output, 16 bits	-10V~+10V	2-channel
	GC-4642	Current output, 16 bits	0-20mA	2-channel
	GC-4652	Current output, 16 bits	4-20mA	2-channel
	GC-4662	Voltage output, 16 bits	0~5V	2-channel
	GC-4672	Voltage output, 16 bits	0~10V	2-channel
	GC-4674	Voltage output, 12 bits	0~10V	4-channel
Special module	GC-6101	RS232/RS485 extension	-	-
	GC-6201	GPRS extension	-	-
	GC-6221	4G extension	-	-
	GC-6501	WiFi extension	-	-

**Table 5.1** Selection table

## 6. Technical specifications

<b>PLC Parameters</b>	
CANopen baud rate	1000k, 500k, 250k, 125k, 100k, 50k, 10k
PDO mode	Synchronous, circular, event-driven, polling
Bus terminal module quantity	Up to 32 modules
The biggest byte number of profibus	256bytes input and 256bytes output
Digital I/O signal	256 input/output
Analog I/O signal	128 input/64 output
Configuration mode	automatic configuration
Bus interface	RJ45
Power	24V DC (-15%/+20%)
Input current	70mA+ (total GC-bus current) /maximum2.5A
Starting current	About 2.5 times continuous current
GC-bus current supply	500mA
Fuse capacity	≤10A
Power supply	Maximum 24V DC/maximum 10A
Electrical isolation	1000 Vrms (power contact/bus coupled power voltage)
<b>Environmental testing</b>	
Working temperature	-40℃~+85℃
Working humidness	95%RH, without condensation
EMC test	EN 55024:2011-09 EN 55022:2011-12
Anti-vibration / impact resistance performance	EN 60068-2-6/EN 60068-2-27/29
Anti-electromagnetic interference/radiation performance	EN 61000-6-2 /EN 61000-6-4
IP grade	IP 20
<b>Basic information</b>	
Dimension	100mm *69mm *44mm
Weight	100g



## Sales and service



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