
CCON Slave Device

CAN-2000 series

Application User's Manual

Warranty

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Revision

Version	Date	Author	Description
1.00	2013/08/09	Bao	First version

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1 Introduction

1.1 Overview

CCON protocol is one of the application layer protocol on the CAN bus. It was developed by the ICP DAS Co., LTD.

CCON protocol is a simple and effective protocol for industrial automation applications. Based on the CAN bus layer, it could provide many safe and robust communication mechanisms like arbitration, error detection, error correction and etc. It could help to establish the CAN networking application fast and easily. The CCON I/O modules could reply their own real-time I/O information to the controller at regular intervals automatically. In other word, the controller could acquire all remote modules in short time. It makes the communication more efficient when collecting a lot of remote I/O information.

CAN-2000 series module is easy to access the digital I/O status and set the configuration by using standard CCON protocol. By owing to the CCON masters of ICP DAS, you can quickly build a CCON network to approach your requirements.



Figure 1-1 Outside view of CAN-2000 series

1.2 Hardware Specifications

CAN-2053

Digital Input:

- Input Channels: 16 (Sink/Source).
- DI On Level: +3.5 ~ +30 VDC.
- DI Off Level: +1VDC Max.
- Input Impedance: 3 k Ω , 0.3 W.
- 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:

- CCON Status: 3 LEDs for PWR / RUN / ERR.
- Terminal Resistor: 1 LED as terminator resistor indicators
- DI LED: 16 LEDs as digital input indicators.
- Power Supply: Unregulated +10 ~ +30 VDC.
- Power Consumption: 1.5 W.
- Operating Temperature: -25 ~ 75 °C.
- Storage Temperature: -35 ~ 80 °C.
- Humidity: 10 to 90% RH, Non-condensing.
- Dimensions: 32.5 mm x 110 mm x 102 mm (W x L x H) Detail.

CAN-2054

Digital Output:

- Output Channels: 8 (Sink)
- DO Load Voltage: +5 ~ +30 VDC
- Output Max Load Current: 700 mA per channel.
- Output Type: Open-Collector.
- Intra-module Isolation: 3750 Vrms
- Reaction Time:
 - DO Message to rising edge: 55 us.
 - DO Message to falling edge: 170 us.
- ESD Protection: 4 kV Contact for each channel

Digital Input:

- Input Channels: 8 (Sink/Source).
- DI On Level: +3.5 ~ +30 VDC.
- DI Off Level: +1VDC Max.
- Input Impedance: 3 k Ω , 0.3 W.
- Intra-module Isolation: 3750 Vrms
- Response Time:
 - Rising edge to DI response: 75 us
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- ESD Protection: 4 kV Contact for each channel

Others:

- CCON Status: 3 LEDs for PWR / RUN / ERR.
- Terminal Resistor: 1 LED as terminator resistor indicators
- DI LED: 8 LEDs as digital input indicators.
- DO LED: 8 LEDs as digital output indicators.
- Power Supply: Unregulated +10 ~ +30 VDC.
- Power Consumption: 1.5 W.
- Operating Temperature: -25 ~ 75 °C.
- Storage Temperature: -35 ~ 80 °C.
- Humidity: 10 to 90% RH, Non-condensing.
- Dimensions: 32.5 mm x 110 mm x 102 mm (W x L x H) Detail.

CAN-2057

Digital Output:

- Output Channels: 16 (Sink)
- DO Load Voltage: +5 ~ +30 VDC
- Output Max Load Current: 700 mA per channel.
- Output Type: Open-Collector.
- Intra-module Isolation: 3750 Vrms
- Reaction Time:
 - DO Message to rising edge: 55 us.
 - DO Message to falling edge: 170 us.
- ESD Protection: 4 kV Contact for each channel

Others:

- CCON Status: 3 LEDs for PWR / RUN / ERR.
- Terminal Resister: 1 LED as terminator resister indicators
- DO LED: 8 LEDs as digital output indicators.
- Power Supply: Unregulated +10 ~ +30 VDC.
- Power Consumption: 1.5 W.
- Operating Temperature: -25 ~ 75 °C.
- Storage Temperature: -35 ~ 80 °C.
- Humidity: 10 to 90% RH, Non-condensing.
- Dimensions: 32.5 mm x 110 mm x 102 mm (W x L x H) Detail.

1.3 Features

- Standard CCON general I/O slave devices.
- CCON Version: v2.00.
- Support I/O pair-connection mechanism.
- CCON transfer rate: 10 kbps, 20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1000 kbps.
- Support maximum CCON slave devices Node-ID up to 99.
- Set Node-ID 0 for firmware update.
 - Firmware updates tools: I-7530 series, I-7540D series, I-7565 series, PISO-CM100 series, and PISO-CAN series.

1.4 Application

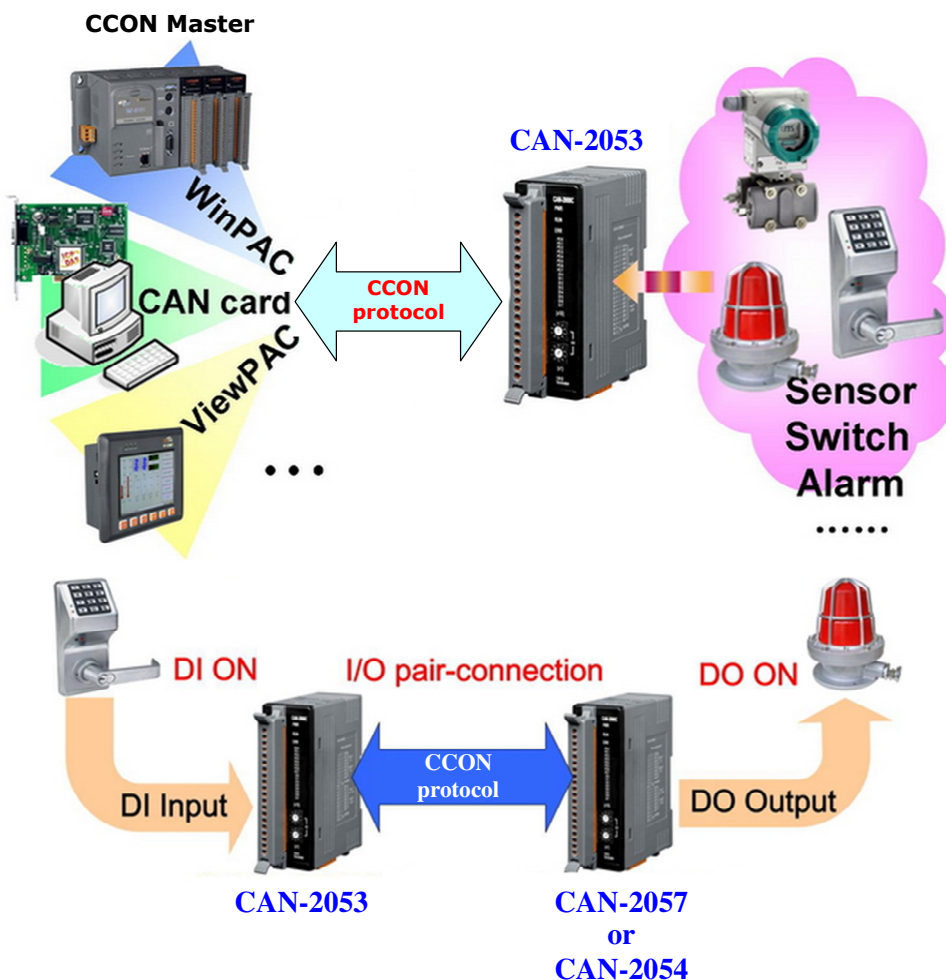


Figure 1-2 Application Structure of CAN-2053

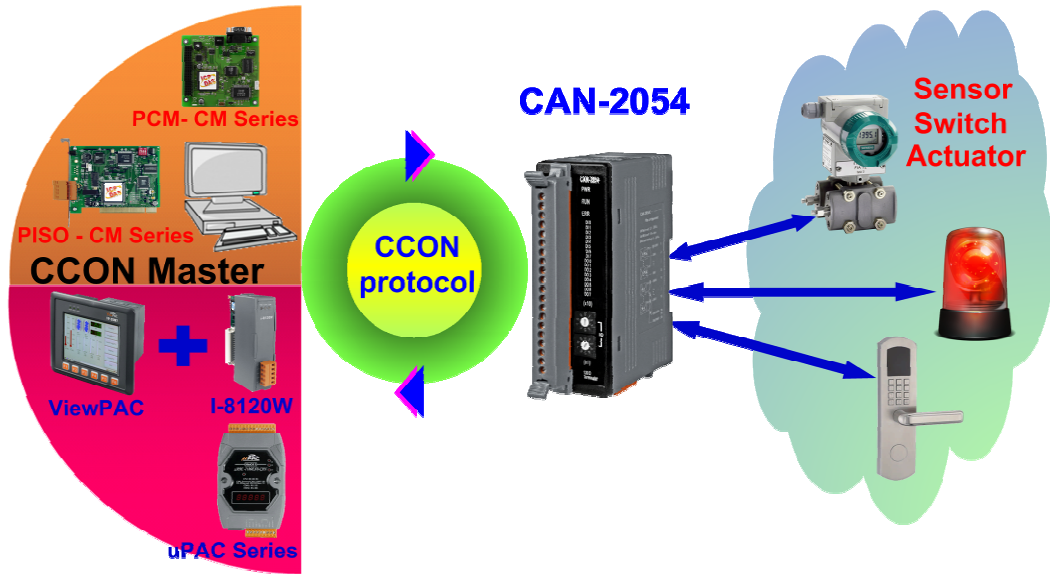


Figure 1-3 Application Structure of CAN-2054

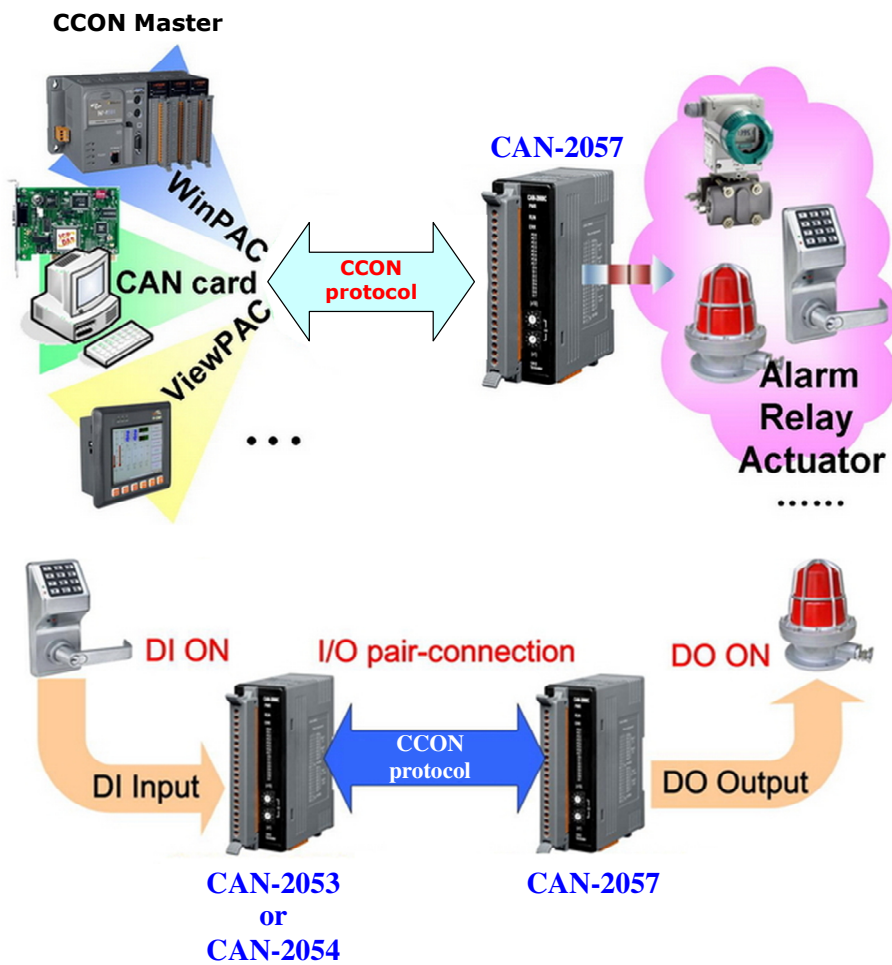


Figure 1-4 Application Structure of CAN-2057

2 Hardware

2.1 Structure

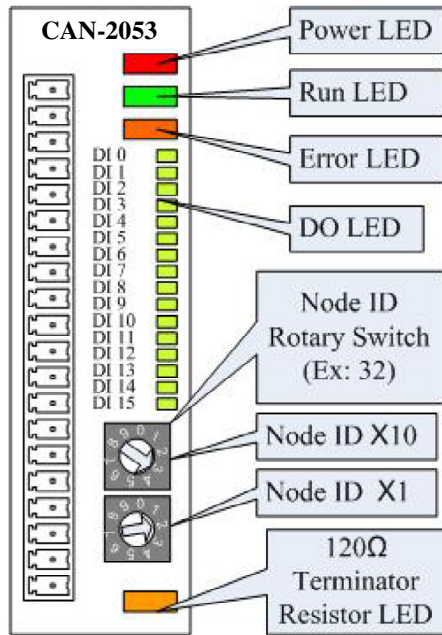


Figure 2-1 Top View of CAN-2053

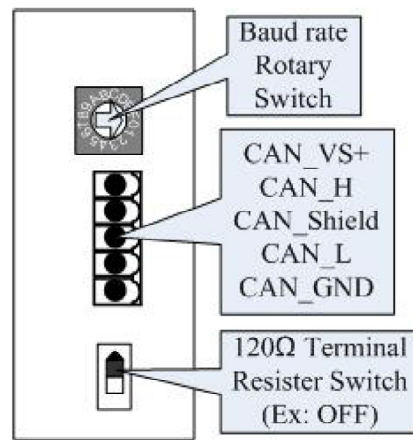


Figure 2-2 Bottom View of CAN-2053

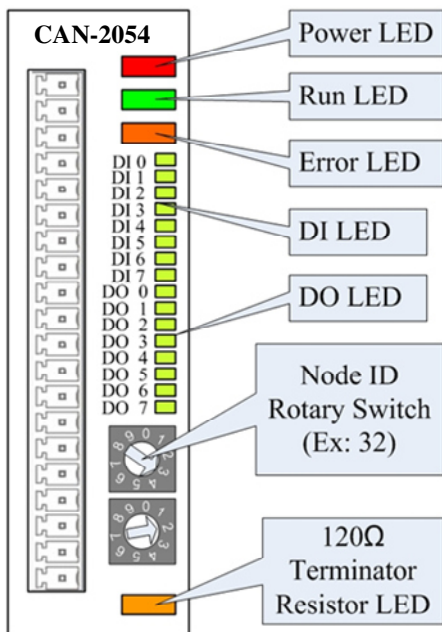


Figure 2-3 Top View of CAN-2054

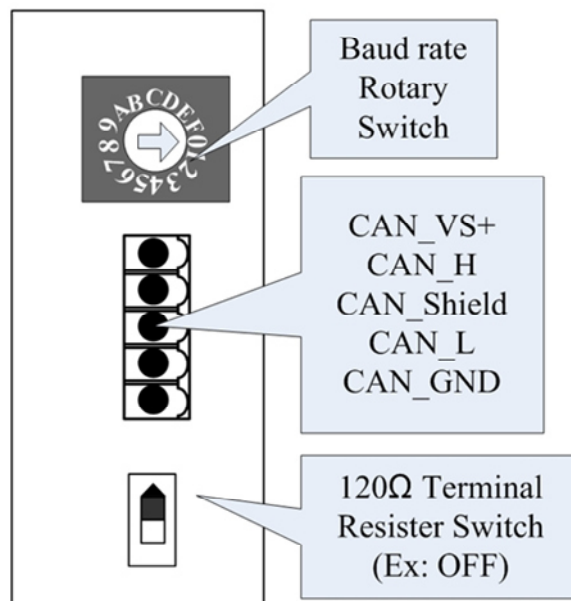


Figure 2-4 Bottom View of CAN-2054

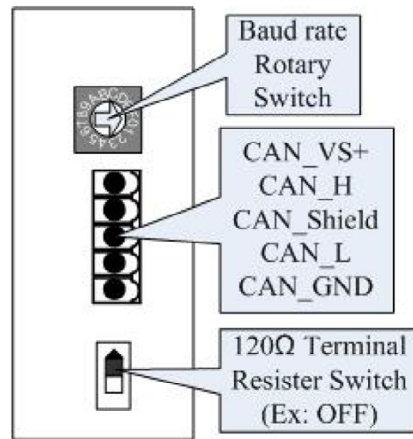
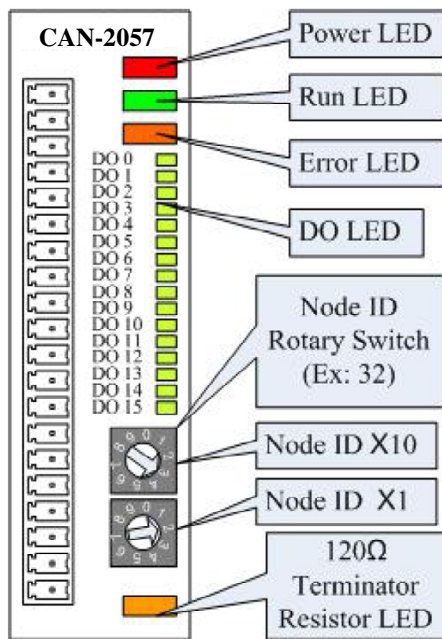


Figure 2-5 Top View of CAN-2057

Figure 2-6 Bottom View of CAN-2057

2.2 Node ID & Baud Rate Rotary Switch

The rotary switches of node ID configure the node ID of CAN-2000 series module. These two switches are for the tens digit and the units digit of the node ID. The node ID value of this demo picture is 32.

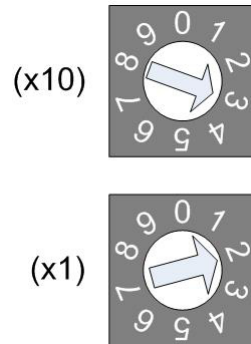


Figure 2-7 Node ID rotary switch

The rotary switch of baud rate handles the CAN baud rate of CAN-2000 series module. The value of baud rate switch from 0 ~ 7 are normal CCON mode, and 8 ~ F are I/O pair-connection mode. About the I/O pair-connection mode please refer to section 3.5. The relationship between the rotary switch value and the practical baud rate is presented in the following table.

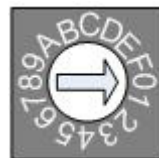


Figure 2-8 Baud rate rotary switch

Table 2-1 Rotary switch value

Rotary Switch Value	Rotary Switch Value of I/O Pair-connection	Baud Rate (k bps)
0	8	10
1	9	20
2	A	50
3	B	125
4	C	250
5	D	500
6	E	800
7	F	1000

2.3 LED Description

Power LED

CAN-2000 series module allows 10 VDC ~ 30 VDC for working voltage. The power consumption is 1.5 W. Under the connection of a proper power connection, as the unit is turned on, the LED will light up in red.

Run LED

The Run LED indicates the CCON operation state. The description of LED state is shown below.

Table 2-2 Run LED status

LED Signal	State	Description
No Light	Non-operation	Power Supply is not ready
Single Flash	Host heartbeat don't exist	Slave module doesn't receive the host heartbeat of master
Continuing Light	Operational	Device is in Operational state

Error LED

The Error LED indicates the CCON or CAN Bus error state. The description of LED state is shown below.

Table 2-3 Error LED status

LED Signal	State	Description
No Light	No error	Device is working well.
Single Flash	Node ID conflict	There is same node ID of modules on same CAN bus.
Double Flash	Bus shedding	Module can't transmit the CAN message to CAN bus.
Continuing Light	Bus Off	The bus off state happened.

Terminal Resistor LED

When user enables the 120Ω terminator resistor, the LED will turn on.

DO LED

If the DO LED turns on, it means that the corresponding DO channel is active. By the way, the DO channel polarity is opposite, when user input value 1 to No.1 DO channel, No.1 DO channel will output low level.

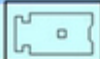
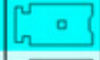
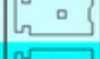
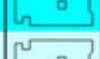
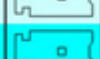
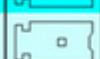
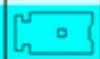
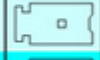
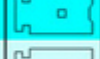
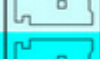
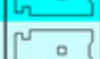
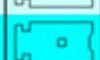
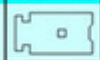
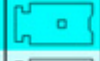
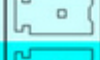
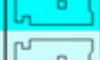
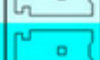
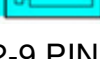


Terminal No.	Pin Assignment
	01 DI.COM
	02 DI.0
	03 DI.1
	04 DI.2
	05 DI.3
	06 DI.COM
	07 DI.4
	08 DI.5
	09 DI.6
	10 DI.7
	11 DI.COM
	12 DI.8
	13 DI.9
	14 DI.10
	15 DI.11
	16 DI.COM
	17 DI.12
	18 DI.13
	19 DI.14
	20 DI.15

Figure 2-9 PIN Assignment of CAN-2053





















Terminal No.	Pin Assignment
 01	DI.COM
 02	DI0
 03	DI1
 04	DI2
 05	DI3
 06	DI4
 07	DI5
 08	DI6
 09	DI7
 10	DO0
 11	DO1
 12	DO2
 13	DO3
 14	DO4
 15	DO5
 16	DO6
 17	DO7
 18	DO.GND
 19	DO.GND
 20	DO.PWR

Figure 2-10 PIN Assignment of CAN-2054

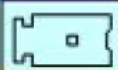

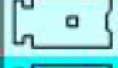

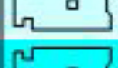


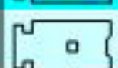
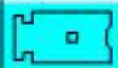





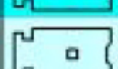



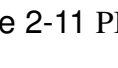

Terminal No.	Pin Assignment
 01	DO.0
 02	DO.1
 03	DO.2
 04	DO.3
 05	DO.4
 06	DO.5
 07	DO.6
 08	DO.7
 09	DO.8
 10	DO.9
 11	DO.10
 12	DO.11
 13	DO.12
 14	DO.13
 15	DO.14
 16	DO.15
 17	DO.GND
 18	DO.GND
 19	DO.PWR
 20	DO.PWR

Figure 2-11 PIN Assignment of CAN-2057

2.4 Wire Connection

Input Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Relay Contact	Relay On	Relay Off
TTL/CMOS Logic	Voltage > 3.5 V	Voltage < 1 V
NPN Output	Open Collector On	Open Collector Off
PNP Output	Open Collector On	Open Collector Off

Figure 2-12 Wire connection of CAN-2053

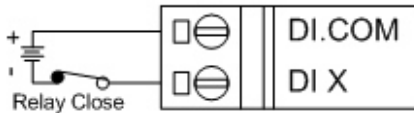
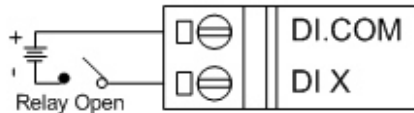
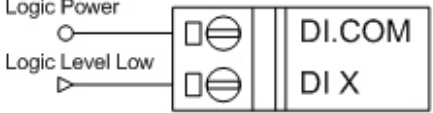
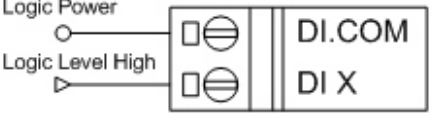
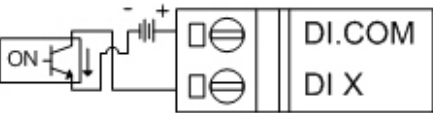
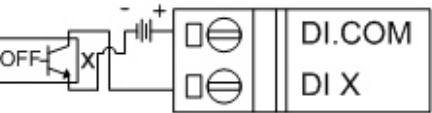
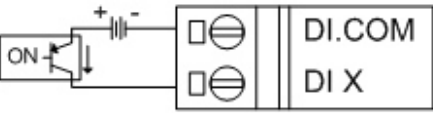
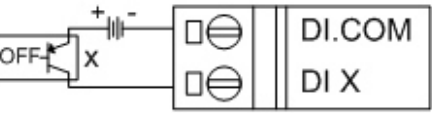
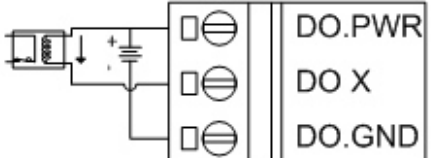
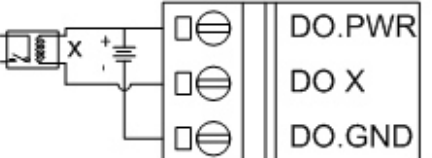
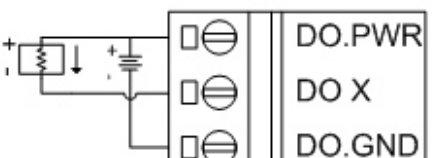
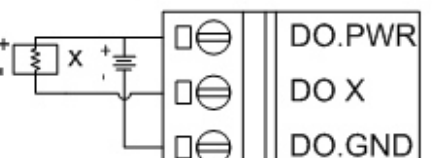
Input Type	ON State LED ON Readback as 0	OFF State LED OFF Readback as 1
Relay Contact	Relay On 	Relay Off 
	Voltage > 3.5 V	Voltage < 1 V
TTL/CMOS Logic	Logic Power Logic Level Low 	Logic Power Logic Level High 
NPN Output	Open Collector On 	Open Collector Off 
	Open Collector On	Open Collector Off
PNP Output	Open Collector On 	Open Collector Off 
	Open Collector On	Open Collector Off
Output Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Drive Relay	Relay On 	Relay Off 
Resistance Load		

Figure 2-13 Wire connection of CAN-2054

Module Name	CAN-2057	
Output Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
Drive Relay	Relay Off	Relay On
Resistance Load	Relay Off	Relay On

Figure 2-14 Wire connection of CAN-2057

3 CCON Protocol

CCON protocol is one of the application layer protocol on the CAN bus. Each CCON CAN package includes 29-bit identifier, 1-bit RTR (remote transmission request), 4-bit DLC (data length code) and 8-bytes data frame.

3.1 CAN Identifier

The CAN identifier of CCON includes below items which are Ack, function code, node id and advanced flag. The identifier format can refer to table 3-1, and description of each item can refer to table 3-2.

Table 3-1 CAN Identifier format

Item	Reserved	Ack	Function code	Node id	Advanced flag
size	4-bit (MSB)	1-bit	8-bit	8-bit	8-bit (LSB)

Table 3-2 Identifier description

Item	Description	
Reserved	Reserved for future use.	
Ack	The value 1 represents a response package. The value 0 represents a command package.	
Function code	This field indicates the function of the command or response message. Refer to CH 3.2 for detail.	
Node id	ID ranges from 00h to FFh (from 0 to 255).	
Advanced flag	bit7~bit6	This value indicates how many packages in the single command or response message. 0: one package. 1: two package. 2: three package. 3: four package.
	bit5~bit4	The value indicates the index number of the package. 0: No.1 package. 1: No.2 package. 2: No.3 package. 3: No.4 package.
	bit3~bit0	The value indicates the I/O type in the data field. 0: Setting command or all I/O type. 1: DO data. 2: DI data. 3: AO data. 4: AI data. 5: PWM data. 6: Counter data. 7~15: Reserved.

3.2 Function Codes

Function codes include common command, setting command and query command. User can use those commands to control or monitor the I/O status of modules.

Table 3-3 CAN-2053 function codes List

Function codes	Description	Module version	Support
00h~06h	Reserved.	---	---
07h	ID conflict checking.	V1.00	O
08h	Reset remote module.	V1.00	X
09h	Restore default value and reset module.	V1.00	X
10h	Set or query I/O data.	V1.00	O
11h~1Eh	Reserved.	---	---
1Fh	Host heartbeat.	V1.00	O
20h	Set the timeout value of host heartbeat.	V1.00	O
21h	Set the time to automatic response I/O status.	V1.00	O
22h~2Fh	Reserved.	---	---
30h	Set AI range.	V1.00	X
31h	Set the threshold value of AI Hi-Alarm.	V1.00	X
32h	Set the threshold value of AI Low-Alarm.	V1.00	X
33h~3Fh	Reserved.	---	---
40h	Set AO range.	V1.00	X
41h	Set the threshold value of AO Hi-Alarm.	V1.00	X
42h	Set the threshold value of AO Low-Alarm.	V1.00	X
43h~4Fh	Reserved.	---	---
50h	Set the DI whether latch and the time of latch.	V1.00	X
51h~5F	Reserved.	---	---
60h	Set power on value of DO.	V1.00	X
61h	Set safe value of DO.	V1.00	X
62h~6Fh	Reserved.	---	---
70h~7Fh	Reserved for PWM.	V1.00	X
80h~8Fh	Reserved for RTD.	V1.00	X
90h~EFh	Reserved.	---	---
F0h	Query the name of module.	V1.00	O
F1h	Query the version of module.	V1.00	O
F2h	Query the protocol version of module.	V1.00	O

F3h	Query the I/O type of module.	V1.00	O
F4h~FFh	Reserved.	---	---

Table 3-4 CAN-2054 function codes List

Function codes	Description	Module version	Support
00h~06h	Reserved.	---	---
07h	ID conflict checking.	V1.01	O
08h	Reset remote module.	V1.01	X
09h	Restore default value and reset module.	V1.01	X
10h	Set or query I/O data.	V1.01	O
11h~1Eh	Reserved.	---	---
1Fh	Host heartbeat.	V1.01	O
20h	Set the timeout value of host heartbeat.	V1.01	O
21h	Set the time to automatic response I/O status.	V1.01	O
22h~2Fh	Reserved.	---	---
30h	Set AI range.	V1.01	X
31h	Set the threshold value of AI Hi-Alarm.	V1.01	X
32h	Set the threshold value of AI Low-Alarm.	V1.01	X
33h~3Fh	Reserved.	---	---
40h	Set AO range.	V1.01	X
41h	Set the threshold value of AO Hi-Alarm.	V1.01	X
42h	Set the threshold value of AO Low-Alarm.	V1.01	X
43h~4Fh	Reserved.	---	---
50h	Set the DI whether latch and the time of latch.	V1.01	X
51h~5Fh	Reserved.	---	---
60h	Set power on value of DO.	V1.01	O
61h	Set safe value of DO.	V1.01	O
62h~6Fh	Reserved.	---	---
70h~7Fh	Reserved for PWM.	V1.01	X
80h~8Fh	Reserved for RTD.	V1.01	X
90h~EFh	Reserved.	---	---
F0h	Query the name of module.	V1.01	O
F1h	Query the version of module.	V1.01	O
F2h	Query the protocol version of module.	V1.01	O
F3h	Query the I/O type of module.	V1.01	O
F4h~FFh	Reserved.	---	---

Table 3-5 CAN-2057 function codes List

Function codes	Description	Module version	Support
00h~06h	Reserved.	---	---
07h	ID conflict checking.	V1.00	O
08h	Reset remote module.	V1.00	X
09h	Restore default value and reset module.	V1.00	X
10h	Set or query I/O data.	V1.00	O
11h~1Eh	Reserved.	---	---
1Fh	Host heartbeat.	V1.00	O
20h	Set the timeout value of host heartbeat.	V1.00	O
21h	Set the time to automatic response I/O status.	V1.00	O
22h~2Fh	Reserved.	---	---
30h	Set AI range.	V1.00	X
31h	Set the threshold value of AI Hi-Alarm.	V1.00	X
32h	Set the threshold value of AI Low-Alarm.	V1.00	X
33h~3Fh	Reserved.	---	---
40h	Set AO range.	V1.00	X
41h	Set the threshold value of AO Hi-Alarm.	V1.00	X
42h	Set the threshold value of AO Low-Alarm.	V1.00	X
43h~4Fh	Reserved.	---	---
50h	Set the DI whether latch and the time of latch.	V1.00	X
51h~5Fh	Reserved.	---	---
60h	Set power on value of DO.	V1.00	O
61h	Set safe value of DO.	V1.00	O
62h~6Fh	Reserved.	---	---
70h~7Fh	Reserved for PWM.	V1.00	X
80h~8Fh	Reserved for RTD.	V1.00	X
90h~EFh	Reserved.	---	---
F0h	Query the name of module.	V1.00	O
F1h	Query the version of module.	V1.00	O
F2h	Query the protocol version of module.	V1.00	O
F3h	Query the I/O type of module.	V1.00	O
F4h~FFh	Reserved.	---	---

3.3 Arrangement of I/O data

The 8-bytes data of each package is arranged based on two rules.

Rule one, if a module includes multifarious I/O types, such as DO, DI, AO, AI, PWM and counter, the first data is DO data, the second data is DI data, the third data is AO data, the fourth data is AI data, the fifth data is PWM data, and the sixth data is counter data. The arrangement can refer to figure 3-1.

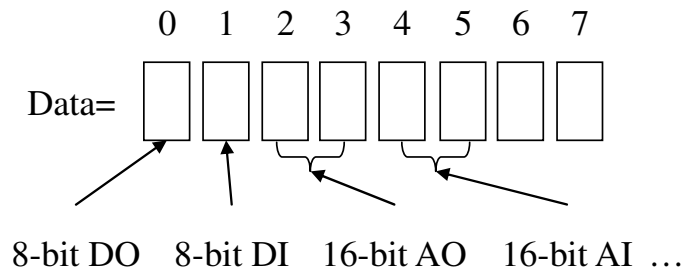


Figure 3-1 Arrangement of rule one

Rule two, if a module only includes few I/O types, and no includes other I/O types, such as only includes DI, AI and counter, the data of few I/O types will be placed to front position. The arrangement can refer to figure 3-2.

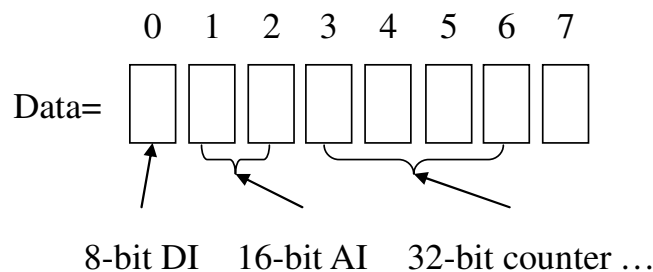


Figure 3-2 Arrangement of rule two

About the arrangement of each byte, here for example of DI/DO data is like figure 3-3.

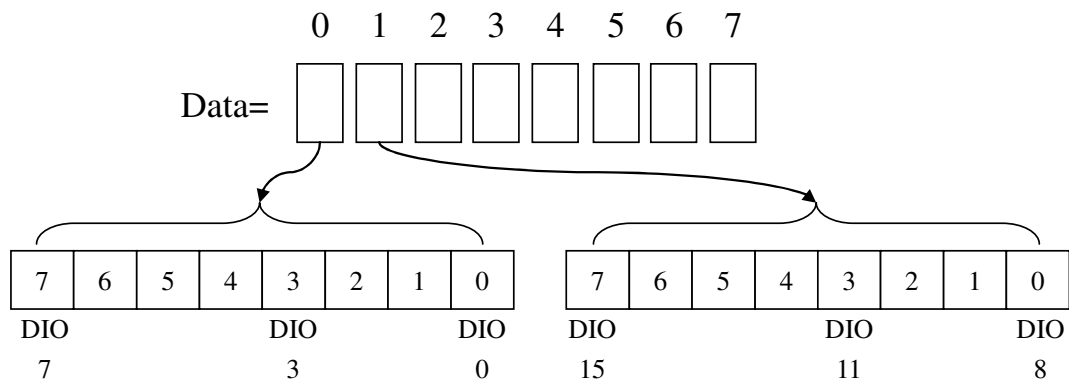


Figure 3-3 Arrangement of each DI/DO data

3.4 Application example

ID conflict checking mechanism

When a new module need be add to the CAN bus, ID conflict checking mechanism can detect whether exists the same node id. The users need not to take care of the ID conflict checking message. This mechanism will detect and complete among the CCON I/O modules.

At the booted beginning of the two seconds, the module will send out ID conflict checking command (Ack=0) per second. The module receives the ID conflict message which the Ack bit is 1 on CAN bus during the two seconds, the module could not boot successfully. It means that at least one the same node id module on the CAN bus. CAN-2000 series module will flash error LED per second. Conversely the CAN-2000 series module has not received any ID conflict message which the Ack bit is 1 during the booted beginning of the two seconds, it will boot successfully.

After the CAN-2000 series module has booted successfully and the ID is owned by this module, any ID conflict checking command would make the module to reply the same message with the Ack bit is 1. If the CAN-2000 series module receives ID conflict checking command (Ack=1) in the booted condition, its DO will output safe value and flash error LED per second.

About the flow chart of ID conflict checking mechanism can refer to figure 3-4 and figure 3-5.

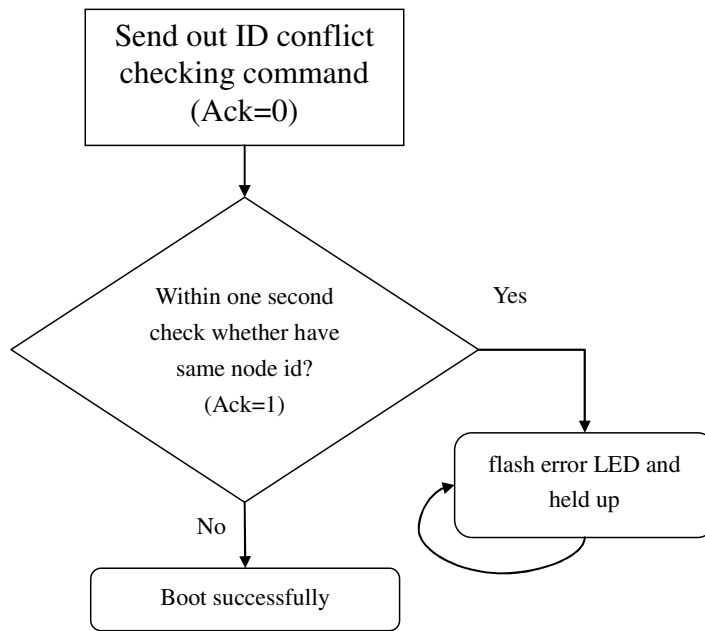


Figure 3-4 CAN-2000 series module in booting process

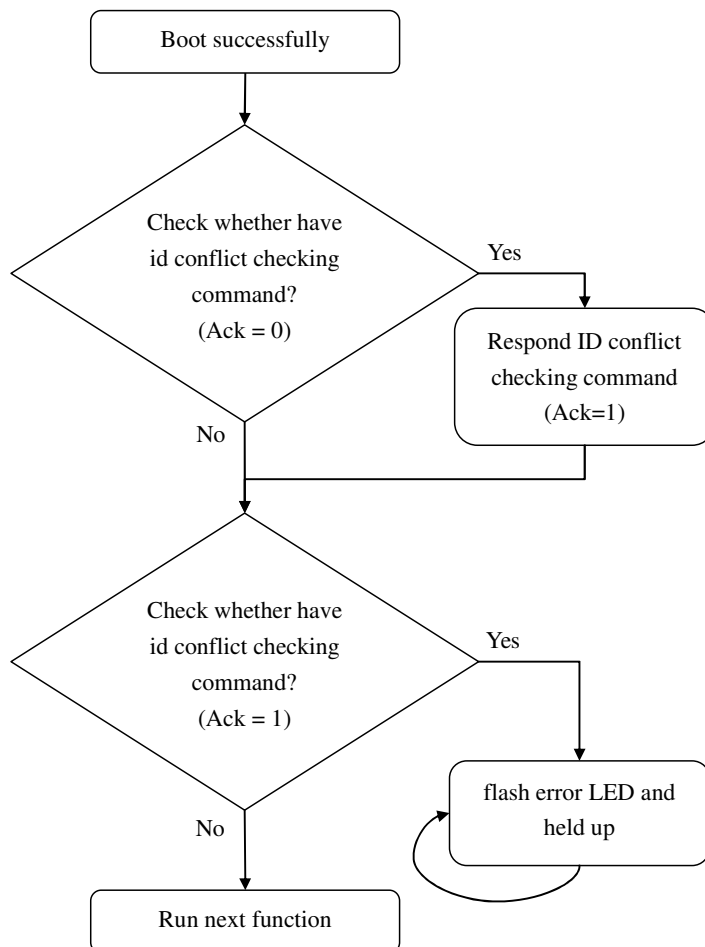


Figure 3-5 CAN-2000 series module boots successfully

For example, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	07h	0Ah	00h	0	8	Random value or serial number of module							

Master or Slave module



Slave module (CAN-2054)

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	07h	0Ah	00h	0	8	Random value or serial number of module							

Master or Slave module



Slave module (CAN-2054)

Set DO data and query DI/DO data from the I/O module

The users can set DI/DO data to I/O module or query DI/DO data from I/O module. Like CAN-2054, users can set 8-bit digital output (DO), and query 8-bit digital input (DI) of CAN-2054. Or the users can query 8-bit DI and 8-bit DO at the same time. In default, CAN-2000 series module will automatically send out its I/O data, Like CAN-2054, CAN-2054 will automatically send out 8-DI/8-DO data every one second. About the time setting of CAN-2000 series module automatically send out can refer to 「**Set and query the time to automatically respond I/O status**」.

By the way, the module will regularly check host heartbeat whether it exists or not, if host heartbeat doesn't exist, its DO will output safe value and be locked until host heartbeat exist again. About the host heartbeat setting refer to 「**Host heartbeat format**」 and 「**Set and query the waiting time of host heartbeat timeout**」.

For example of *DO setting command*, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	10h	0Ah	01h	0	1	55h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	10h	0Ah	01h	0	1	55h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

For example of *DO querying command*, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	10h	0Ah	01h	1	1	-	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	10h	0Ah	01h	0	1	55	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

For example of *DI querying command*, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	10h	0Ah	02h	1	1	-	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	10h	0Ah	02h	0	1	AAh	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

For example of DO/DI querying command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	10h	0Ah	00h	1	2	-	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	10h	0Ah	00h	0	2	55	AA	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

Host heartbeat format

Host heartbeat is the existence information of the master. If master exists, the master will continuously send the heartbeat message to slave. So slave can detect this message to know whether the master exists or not.

The fixed node id of master is FEh, and only one byte data 00h in host heartbeat format. For example, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	1Fh	FEh	00h	0	1	00h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

Set and query the timeout value of host heartbeat

Users can set the waiting time of host heartbeat. In default, the timeout value is 100ms. If the module doesn't receive host heartbeat message within the time, the module will transfer to the safe mode and its DO will output safe value. About the host heartbeat message format can refer to 「**Host heartbeat format**」.

The timeout value ranges between 10 ms to 4294967295 ms which are 0000000Ah and FFFFFFFFh. So if user wants to set 1000 ms, the data can be set 000003E8h.

By the way, when user set the time to module, module will save the time to EEPROM and take action immediately.

For example of *setting command*, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	20h	0Ah	00h	0	4	E8h	03h	00h	00h	-	-	-	-

Master



Slave module
(CAN-2054)

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	20h	0Ah	00h	0	4	E8h	03h	00h	00h	-	-	-	-

Master



Slave module
(CAN-2054)

For example of querying command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	20h	0Ah	00h	1	4	-	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	20h	0Ah	00h	0	4	E8h	03h	00h	00h	-	-	-	

Master



**Slave module
(CAN-2054)**

Set and query the time to respond I/O status automatically

The CCON module supports to reply its I/O information in regular time. Users can set the regular time to CAN-2000 series, CAN-2000 series will respond all I/O status in regular time. Like CAN-2054, CAN-2054 will respond DI, DO or all I/O status in regular time. The setting command would be separated into DI, DO, and all I/O type by different advanced flag. The advanced flag of all I/O is 00h, DO is 01h and DI is 02h. At the same time, CAN-2054 will only respond all I/O status or DI, DO status respectively. So, user can set the 0ms to stop the automatic response.

The range of time is from 10ms to 4294967295ms which are 0000000Ah to FFFFFFFFh. So if user wants to set 1000ms, the data can be set 000003E8h.

By the way, when user set the time to module, module will save the time to EEPROM and take action immediately.

For example of setting command of all I/O, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	21h	0Ah	00h	0	4	E8h	03h	00h	00h	-	-	-	-

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	21h	0Ah	00h	0	4	E8h	03h	00h	00h	-	-	-	-

Master



**Slave module
(CAN-2054)**

For example of querying command all I/O, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	21h	0Ah	00h	1	4	-	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	21h	0Ah	00h	0	4	E8h	03h	00h	00h	-	-	-	

Master



**Slave module
(CAN-2054)**

Set and query power on value

The power on value means that the CCON module's DO/AO output value when it has been powered on and has not received any output command. In default, the power on value is 00h. By the way, when user set the value to module, module will save the value to EEPROM and take action in the next booting up.

For example of setting command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	60h	0Ah	01h	0	1	07h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	60h	0Ah	01h	0	1	07h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

For example of querying command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	60h	0Ah	01h	1	1	-	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	60h	0Ah	01h	0	1	07h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

Set and query safe value

Users can set the DO safe value of the CAN-2000 series, when the CAN-2000 series held up or host heartbeat doesn't exist on CAN bus, CAN-2000 series will output the DO value. In default, the safe value is 00h. By the way, when users set the value to module, module will save the value to EEPROM and take action immediately.

For example of setting command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	61h	0Ah	01h	0	1	E0h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	61h	0Ah	01h	0	1	E0h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

For example of querying command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. Code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	61h	0Ah	01h	1	1	-	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	61h	0Ah	01h	0	1	E0h	-	-	-	-	-	-	

Master



**Slave module
(CAN-2054)**

Query module name

Users can query module name from module. The data format is ASCII, so if module name is "CAN2054", the data are 43h, 41h, 4Eh, 32h, 30h, 35h and 34h.

For example of command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	F0h	0Ah	00h	1	7	-	-	-	-	-	-	-	-

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	F0h	0Ah	00h	0	7	43h	41h	4Eh	32h	30h	35h	34h	-

Master



**Slave module
(CAN-2054)**

Query module version

Users can query module version from module. The data byte 0 to data byte 3 is the ASCII version information. And the data byte 4 to data byte 7 is the hexadecimal date information. So if version is 12.34, date is 2013/07/25, the 8 bytes data are 31h, 32h, 33h, 34h, 14h, 0Dh, 07h, 19h.

For example of command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	F1h	0Ah	00h	1	8	-	-	-	-	-	-	-	-

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	F1h	0Ah	00h	0	8	31h	32h	33h	34h	14h	0Dh	07h	19h

Master



**Slave module
(CAN-2054)**

Query protocol version

Users can query the protocol version which the module supports. The data byte 0 to data byte 3 is the ASCII version information. And the data byte 4 to data byte 7 is the hexadecimal date information. So if version is 12.34, date is 2013/07/25, the 8 bytes data are 31h, 32h, 33h, 34h, 14h, 0Dh, 07h, 19h.

For example of command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	F1h	0Ah	00h	1	8	-	-	-	-	-	-	-	-

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	F1h	0Ah	00h	0	8	31h	32h	33h	34h	14h	0Dh	07h	19h

Master



**Slave module
(CAN-2054)**

Query I/O type of module

User can query I/O type of module from module. The data length of data format is 6. The data byte 0 to data byte 5 is the I/O channel count which corresponding I/O types are the DO, DI, AO, AI, PWM and counter. For example, CAN-2054 includes 8-DO and 8-DI. The data content of data 0 to data 5 are 8, 8, 0, 0, 0 and 0.

For example of command, if the node id of CAN-2054 is 10, the command is as below:

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	F3h	0Ah	00h	1	6	-	-	-	-	-	-	-	-

Master



**Slave module
(CAN-2054)**

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	F3h	0Ah	00h	0	6	08h	08h	00h	00h	00h	00h	-	-

Master



**Slave module
(CAN-2054)**

3.5 I/O Pair-connection

I/O pair-connection can send the DI value from a DI slave to a paired DO slave through the CAN bus. It is useful for users who need to detect a DI signal and output a DO alarm in time.

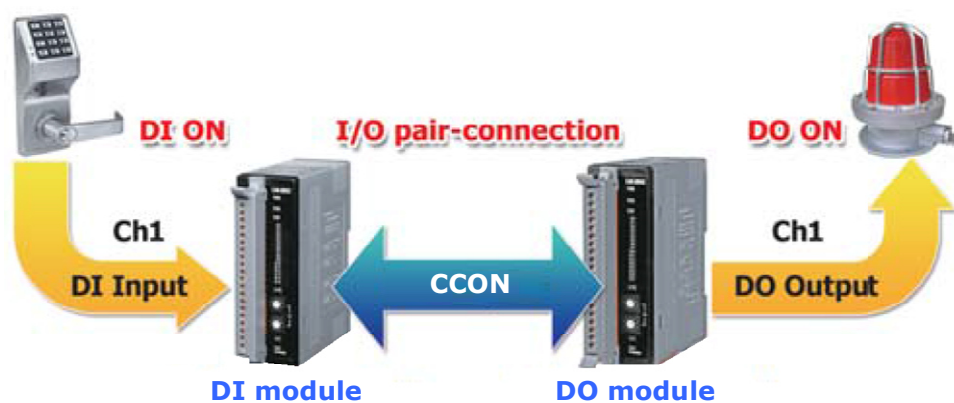


Figure 3-6 I/O pair-connection application

The CAN-2000 series module provides the I/O pair-connection function. Before using this function, you need to prepare one DI module and one DO module (such as CAN-2054 and CAN-2054, CAN-2054 and CAN-2057, or CAN-2053 and CAN-2057). When applying this function, like CAN-2054 and CAN-2054, the DI channels of one CAN-2054 and the DO channels of another CAN-2054 are mapping with each other. That is to say that when the DI channels of one CAN-2054 get the ON signal, the corresponding DO channels of another CAN-2054 will be turned on.

When you completed the connection of these two CAN-2054s by CAN bus, you need to set the baud rate rotary switch of these two modules to 0x8 ~ 0xF and configure the node ID of them by the special rule. Set the node ID to be odd for one module that includes DI channels, and set the node ID of another module that includes DO channels to be the value which is equal to the node ID increased one of the former. Therefore, they are the couple as the following figure 3-7.

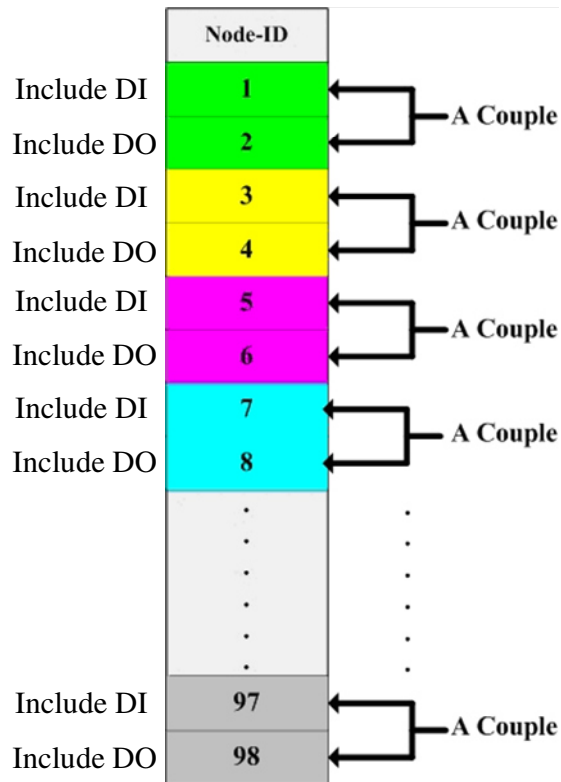


Figure 3-7 Couple rule

For example, user uses two CAN-2054s to do I/O pair-connection. The connection structure is as follows.

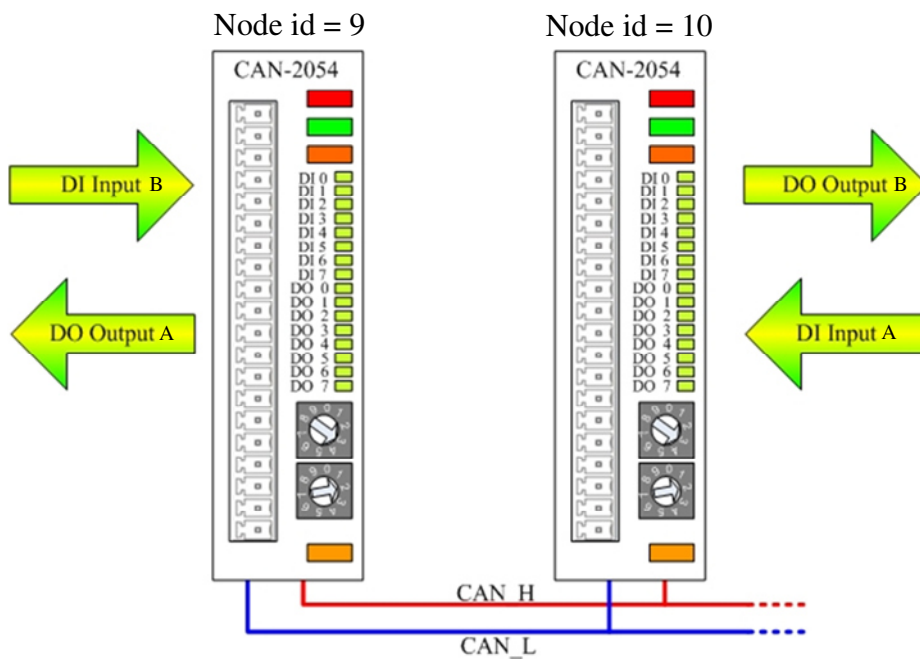


Figure 3-8 CAN-2054 couple with CAN-2054

The node IDs of these two CAN-2054s are 9 and 10 respectively. Both of these two module's baud rate switch are selected to "D", 500 kbps CCON baud rate with I/O pair-connection mode, and these two modules will be in the operational state automatically. When the DI channel of one CAN-2054 receives a DI ON-signal, another CAN-2054 will output the ON-signal at the corresponding DO channel.

Pairing types

CCON can support two pairing types: one DI module to multiple DO modules or multiple DI modules to one DO module, such as figure 3-9. But the I/O type of multiple modules can't be identified on CAN bus, because these modules have same node id. For this case, if user wants to use these pairing types, user himself must know I/O type of these multiple modules.

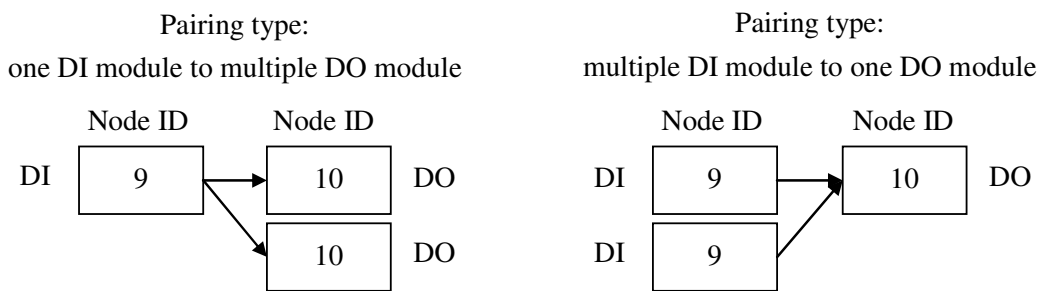


Figure 3-9 Pairing type

Things of cancel check

In I/O pair-connection mode, slave module of CAN-2000 series will cancel two things that are:

- Check ID conflict
- Check host heartbeat

For above-mentioned case of pairing types, slave module of CAN-2000 series will cancel respond checking ID conflict status (ack=1) that can let multiple same ID modules on the same CAN bus. And I/O pair-connection often is used to communicate between slave modules, so slave modules will cancel checking host heartbeat. If host heartbeat exists on CAN bus, slave module will not be affected.

When slave modules in I/O pair-connection, master can still set or query the command to slave modules.

For example of command

In I/O pair-connection mode, when DI slave module detect the change of DI status, it will send two messages to CAN bus, the first message will set the pairing DO slave module to output the DO and the second message will send the DI status to master regardless of master whether exist. When DO slave module receives the DO setting command, it will set the DO and respond the DO status.

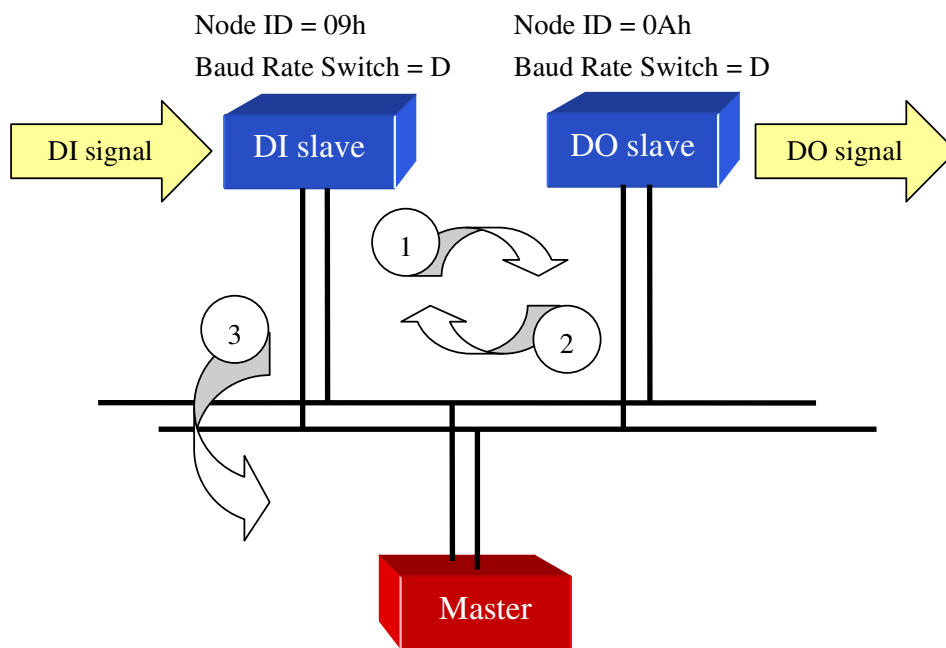


Figure 3-10 Pair-connection applied structure

For example of command, if the node id of CAN-2054 is 10, the command is as below:

①

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	0	10h	0Ah	01h	0	8	55h	00h	00h	00h	00h	00h	00h	00h

②

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	10h	0Ah	01h	0	1	55h	-	-	-	-	-	-	-

③

29-bit Identifier					RTR	DLC	8-bytes Data (byte)							
Reserved	Ack	Func. code	Node id	Adv. flag			0	1	2	3	4	5	6	7
00h	1	10h	09h	02h	0	1	55h	-	-	-	-	-	-	-