
DeviceNet Slave Device

CAN-2057D

Application User's Manual

Warranty

Without contrived damage, all products manufactured by ICP DAS are warranted in one year from the date of delivery to customers.

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1 Introduction

1.1 Overview

DeviceNet is one kind of the network protocols based on the CAN bus and mainly used for the embedded network of the machine control, such as industrial machine control , aircraft engines monitoring, factory automation, medical equipments control, remote data acquisition, environmental monitoring, and packaging machines control, etc.

The CAN-2057D follows DeviceNet specification Volume I/II, Release 2.0. User can access the digital output status and set the configuration via DeviceNet EDS file. The CAN-2057D has 16 Digital output channels with Open Collector output type and can be used to develop powerful and cost effective digital control system. By owing to the DeviceNet masters of ICP DAS, you can quickly build a DeviceNet network to approach your requirements.



1.2 Hardware Specifications

Digital Output:

- Output Channels: 16 (Sink)
- Output Type: Open Collector.
- Max Load Current: 100 mA per channel.
- Load Voltage: +5 V_{DC} ~ +30 V_{DC}.
- Intra-module Isolation, Field to Logic: 3750 Vrms.
- ESD Protection: 4 kV Contact for each channel.

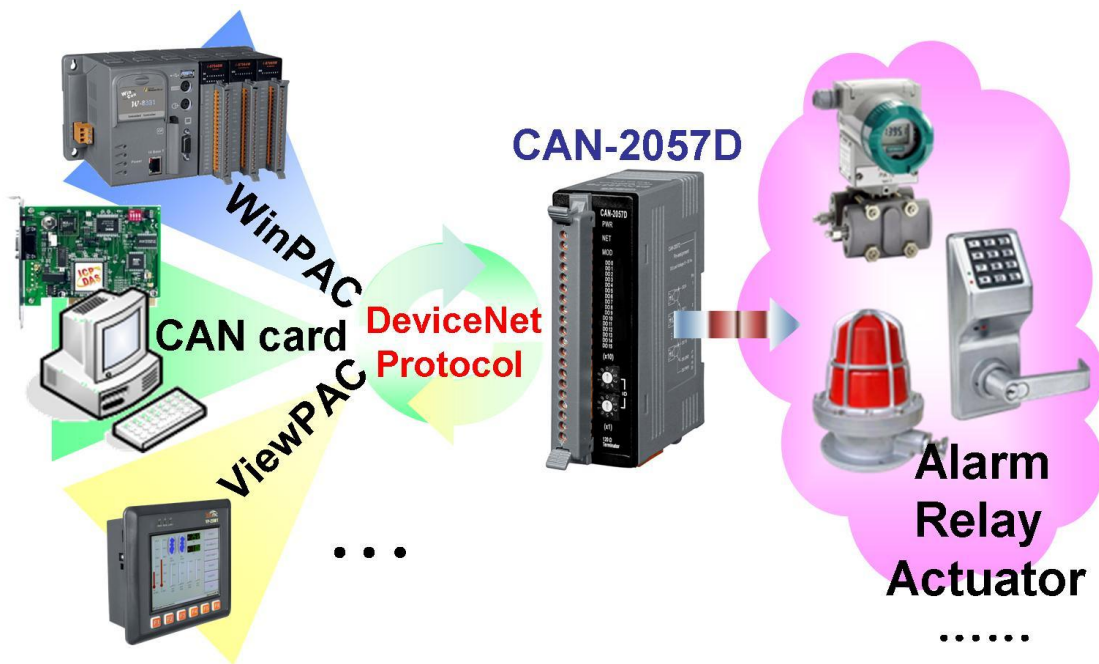
Others:

- DeviceNet Status: 3 LEDs for PWR / NET / MOD.
- Terminal Resister: 1 LED as terminator resister indicators
- DO LED: 16 LEDs as digital output indicators.
- Power Requirement: +10 ~ +30 V_{DC}, 1.0 W.
- Operating Temperature: -25 ~ 75 °C.
- Storage Temperature: -30 ~ 80 °C.
- Humidity: 10 to 90% RH, Non-condensing.
- Dimensions: 32.3 mm x 99 mm x 77.5 mm (W x L x H) [Detail](#).

1.3 Features

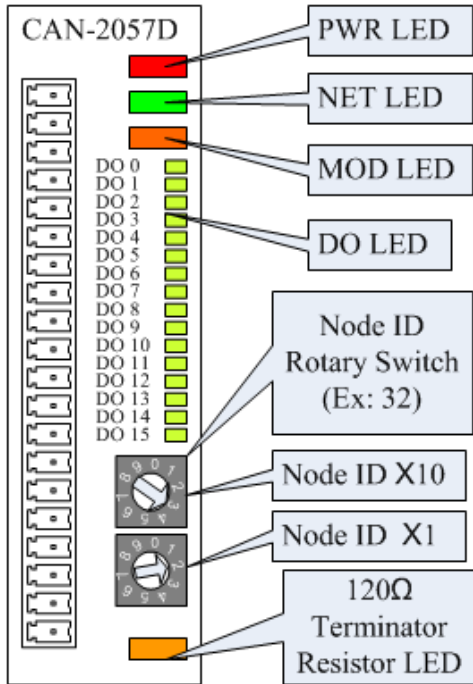
- DeviceNet general I/O slave devices.
- Comply with DeviceNet specification Volume I, Release 2.0 & Volume II, Release 2.0, Errata 5
- Group 2 Only Server (non UCMM-capable)
- Support Predefined Master/Slave Connection Set
- Connection supported:
 - 1 connection for Explicit Messaging
 - 1 connection for Polled I/O
 - 1 connection for Bit-Strobe I/O connection
- Support DeviceNet heartbeat and shutdown messages
- Provide EDS file for standard DeviceNet master interface.
- NET, MOD and PWR DeviceNet status LED indicators

1.4 Application

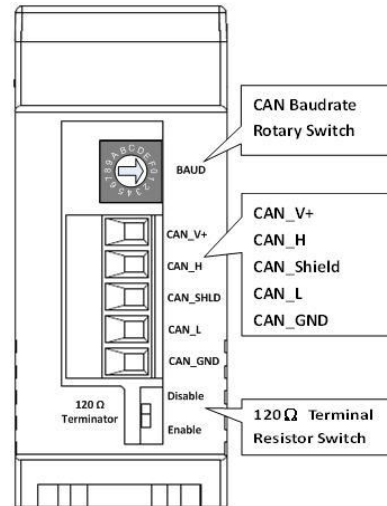


2 Hardware

2.1 Structure



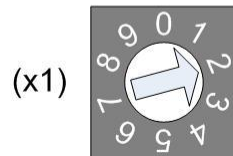
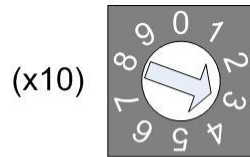
(Top View)



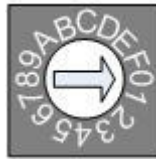
(Bottom View)

2.2 Node ID & Baud Rate Rotary Switch

The rotary switches of node ID configure the node ID of CAN-2057D 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.



The rotary switch for baud rate handles the CAN baud rate of CAN-2057D 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 (kbps) |
|---------------------|------------------|
| 0 | 125 |
| 1 | 250 |
| 2 | 500 |

2.3 LED Description

PWR LED

The CAN-2057D needs the power of 10 ~ 30 V_{DC}. Under a normal connection, a good power supply and a correct voltage selection, as the unit is turned on, the LED will light up in red.

NET LED

The NET LED indicates the current status of the DeviceNet communication link.

| condition | status | indicates |
|------------------|------------------------|--|
| Init Off | Off line | Device is not online |
| Off | Connection timeout | I/O connection timeout |
| Flashing | On line | Device is on line, but not communicating |
| Init solid | Link failed | (Critical) Device has detected an error that has rendered it incapable of communicating on the link; for example, detected a duplicate node address or network configuration error |
| Solid | On line, communicating | Device is online and communicating |

MOD LED

This LED provides the devices status. It indicates whether or not the device is operating properly.

| condition | status | indicates |
|------------------|--------------------|--|
| Off | Normal | |
| Solid | Critical fault | Device has unrecoverable fault. |
| Flashing | Non_critical fault | Device has recoverable fault to recover. If users want to fix the problem, reconfiguring device's MAC ID or resetting device may work. |

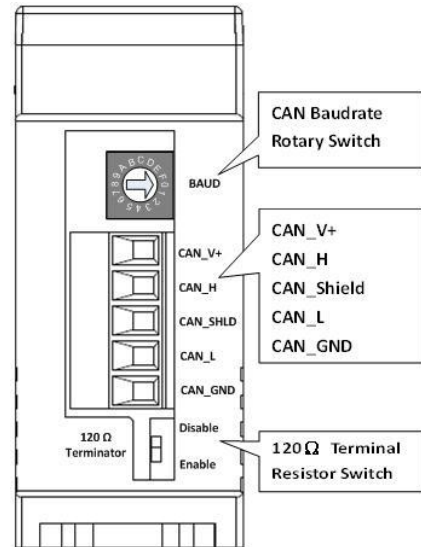
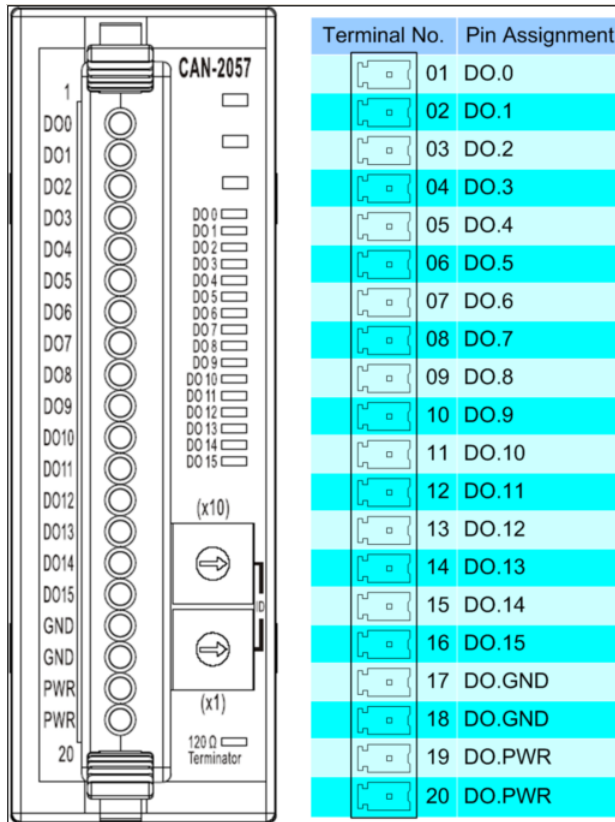
Terminal Resistor LED

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

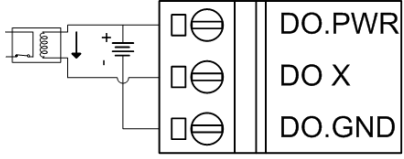
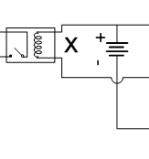
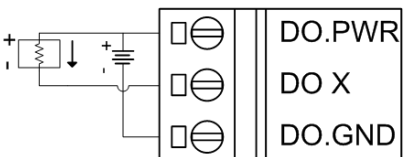
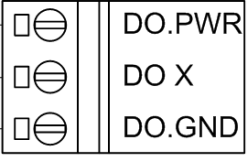
DO LED

If the DO LED turns on, it means that the corresponding DO channel sends an ON voltage-level digital signal.

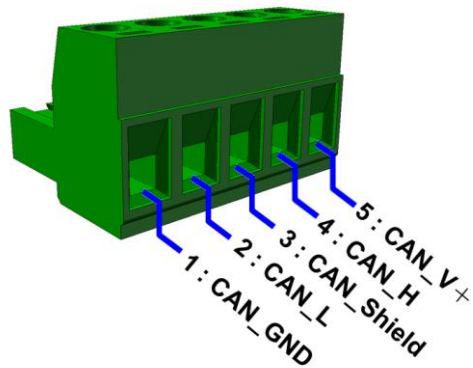
2.4 PIN Assignment



2.5 Wire Connection

| Output Type | ON State LED ON Readback as 1 | OFF State LED OFF Readback as 0 |
|-------------|--|---|
| Drive Relay | Relay On  | Relay Off  |
| | Resistance Load  | Resistance Load  |

5-pin screw terminal block



3 DeviceNet Profile Area

This section documents the detailed functions for each object class that is implemented in the CAN-2057D DeviceNet network.

3.1 DeviceNet Statement of Compliance

General Device Data

| Device Information | Description |
|--|--|
| Version Description of DeviceNet Specification | Volume I, Release 2.0 & Volume II, Release 2.0 |
| Vendor Name | ICP DAS |
| Device Profile Name | CAN-2057D |
| Production Revision | 1.1 |

DeviceNet Physical Conformance Data

| Item | Description |
|--|-----------------------------|
| LED Support | Yes |
| MAC ID Setting | Switch (0 ~ 63) |
| Default MAC ID | 1 |
| Communication Baud Rate Setting | Switch (125, 250, 500 kbps) |
| Default Baud Rate | 125 kbps |
| Predefined Master/Slave Connection Set | Group 2 Only Server |

3.2 Identity Object (Class ID: 0x01)

This object provides the identification of and general information about the device.

Class Attribute (Instance ID=0)

| Attribute ID | Attribute name | Data Type | Method | Value |
|--------------|----------------|-----------|--------|-------|
| 0x01 | Revision | UINT | Get | 0001 |
| 0x02 | Max Instance | UINT | Get | 1 |

Class Service

| Service Code | Service name | Support |
|--------------|----------------------|---------|
| 0x0E | Get_Attribute_Single | Yes |

Instance Attribute (Instance ID=1)

| Attribute ID | Description | Method | DeviceNet Data Type | Value |
|--------------|----------------------------------|---------|-----------------------|------------|
| 1 | Vendor | Get | UINT | 803 |
| 2 | Product type | Get | UINT | 0x00 |
| 3 | Product code | Get | UINT | 0x200 |
| 4 | Major. Minor of firmware version | Get | Struct of USINT USINT | 1.1 |
| 5 | Status | Get | WORD | - |
| 6 | Serial number | Get | UDINT | 1 |
| 7 | Product name | Get | Short_String | CAN-2057D |
| 10 | Heartbeat Interval | Get/Set | USINT | 0(default) |

Instance Service

| Service Code | Service name | Support |
|--------------|----------------------|---------|
| 0x0E | Get_Attribute_Single | Yes |
| 0x10 | Set_Attribute_Single | Yes |
| 0x05 | Reset | Yes |

Note: Use the Instance Service 0x05 will reboot the device.

3.3 Connection Object (Class ID:0x05)

This section presents the externally visible characteristics of the Connection Objects associated with the Predefined Master/Slave Connection Set within slave devices.

The default IO connection path is as follow.

| Connection Path | Class ID | Instance ID | Attribute ID |
|---------------------|----------|-------------|--------------|
| Poll Produced | 0x04 | 0x64 | 0x03 |
| Poll Consumed | 0x04 | 0x64 | 0x03 |
| Bit Strobe Produced | 0x04 | 0x64 | 0x03 |
| Bit Strobe Consumed | 0x04 | 0x64 | 0x03 |

| Connection Instance ID | Description |
|------------------------|--|
| 1 | References the Explicit Messaging Connection into the Server |
| 2 | References the Poll I/O Connection |
| 3 | References the Bit–Strobe I/O Connection |

3.4 Assembly Object (Class ID: 0x04)

The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection. Assembly objects can be used to bind input data or output data. The terms of "input" and "output" are defined from the network's point of view. An input will produce data on the network and an output will consume data from the network.

Class attribute (Instance ID=0)

| Attribute ID | Attribute name | Data Type | Method | Value |
|--------------|----------------|-----------|--------|-------|
| 0x01 | Revision | UINT | Get | 1 |
| 0x02 | Max Instance | UINT | Get | 0x01 |

Class service

| Service Code | Service name | Support |
|--------------|----------------------|---------|
| 0x0E | Get_Attribute_Single | Yes |

Instance ID

| Instance ID | OUTPUT | INPUT |
|-------------|--------------|--------------|
| 0x64 | Set DO value | Get DO value |

Contents of Each Assembly Object Instance

| Instance ID | Description | Type | Method | Default Value |
|-------------|-------------------------|------|---------|---------------|
| 0x64 | Channel 0 ~ 15 DO value | UINT | Get/Set | 0x0000 |

Parameter description of Assembly Object Instance

| Instance ID | Data Range | Parameter Description |
|-------------|-----------------|--|
| 0x64 | 0x0000 ~ 0xFFFF | Bit 0 => channel 0 DO value Bit 1 => channel 1 DO value ... Bit 15 => channel 15 DO value |

Note: x is channel number of module

Instance attribute (Instance ID=0x64)

| Attribute ID | Description | Method | DeviceNet Data Type | Value |
|--------------|-------------|---------|---------------------|--------------------------|
| 0x03 | Data | Get/Set | OUTPUT/ INPUT | Dependent on instance ID |

Instance service

| Service Code | Service name | Support |
|--------------|----------------------|---------|
| 0x0E | Get_Attribute_Single | Yes |
| 0x10 | Set_Attribute_Single | Yes |

3.5 Application Object1 (Class ID: 0x64)

Application objects are the interfaces between an application and the DeviceNet Layer. The attributes of application Objects contain the data for the application, which are accessed and exchanged via DeviceNet. DeviceNet accesses application data by invoking read and write functions. These functions need to be provided by an Application Object. DeviceNet provides Get_Attribute_Single and Set_Attribute_Single to read and write CAN-2057D module.

Application Object1 defines digital output channels configuration.

Class attribute (Instance ID=0)

| Attribute ID | Attribute name | Data Type | Method | Value |
|--------------|----------------|-----------|--------|-------|
| 0x01 | Revision | UINT | Get | 1 |
| 0x02 | Max Instance | UINT | Get | 0x05 |

Class service

| Service Code | Service name | Support |
|--------------|----------------------|---------|
| 0x0E | Get_Attribute_Single | Yes |

Instance attribute (Instance ID=0x01)

| Attribute ID | Description | Method | Data Type | Default Value |
|--------------|----------------------------------|---------|-----------|---------------|
| 0x01 | DO value | Get/Set | UINT | 0x0000 |
| 0x02 | DO power on value | Get/Set | UINT | 0x0000 |
| 0x03 | DO safe value mask | Get/Set | UINT | 0x0000 |
| 0x04 | DO safe value | Get/Set | UINT | 0x0000 |
| 0x05 | Save all Configuration to EEPROM | Set | USINT | - |

Parameter description of Application Object1 attributes

| Attribute ID | Data Range | Parameter Description |
|--------------|---|---|
| 0x01 | 0x0000 ~ 0xFFFF | Bit 0 => channel 0 DO value Bit 1 => channel 1 DO value ... Bit 15 => channel 15 DO value |
| 0x02 | 0x0000 ~ 0xFFFF | Bit 0 => channel 0 DO power on value Bit 1 => channel 1 DO power on value ... Bit 15 => channel 15 DO power on value |
| 0x03 | 0x0000 ~ 0xFFFF | Bit 0 => channel 0 DO safe value mask Bit 1 => channel 1 DO safe value mask ... Bit 15 => channel 15 DO safe value mask Bit value=1 => apply safe value setting Bit value=0 => apply DO output value |
| 0x04 | 0x0000 ~ 0xFFFF | Bit 0 => channel 0 DO safe value Bit 1 => channel 1 DO safe value ... Bit 15 => channel 15 DO safe value |
| 0x05 | 0x01: Use default configuration 0x02: Save all Configuration to EEPROM | 0x01: After restarting the device, configuration will become factory setting. 0x02: Save all channels configuration into EEPROM |

Instance service

| Service Code | Service name | Support |
|--------------|----------------------|---------|
| 0x0E | Get_Attribute_Single | Yes |
| 0x10 | Set_Attribute_Single | Yes |

4 Application

Application Object1 (Class ID:0x64) lists all the parameters of the module. Each Instance ID is corresponding to the different channels. By using “Set/Get Attribute Single” service, user can read/write the parameters of each channel.

Example1:

Set DO output value.

(Class ID: 0x64, Instance ID: 0x01, Attribute ID 0x01).

If the node ID of the CAN-2057D is 1, and the master (ID: 0x0A) has completed “Explicit” connection with the device. By setting the value of Attribute ID 0x01 to 0x00F0, you can set the DO4, DO5, DO6, and DO7 to turn ON and others to turn OFF.

| IDENTIFIER BITS | | | | | | | | | | | RTR | Data Length | 8-byte Data (byte) | | | | | | | |
|--------------------|---|---|---|---|---|---|---|---|---|---|-----|-------------|--------------------|----|----|----|----|----|----|----|
| Destination MAC ID | | | | | | | | | | | | | (HEX) | | | | | | | |
| 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 7 | 0A | 10 | 64 | 01 | 01 | 00 | F0 | -- |

Master



**Slave
(CAN-2057D)**

| IDENTIFIER BITS | | | | | | | | | | | RTR | Data Length | 8-byte Data (byte) | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|---|-----|-------------|--------------------|----|----|----|----|----|----|----|
| Source MAC ID | | | | | | | | | | | | | (HEX) | | | | | | | |
| 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 2 | 0A | 90 | -- | -- | -- | -- | -- | -- |

Master



**Slave
(CAN-2057D)**

Set the value 0x00F0 to the Application Object1 with Instance ID 0x01 and Attribute ID 0x01. After sending the “Set Attribute Single”, the slave device will response 0x90 to mean that the setting is OK. Then the DO4, DO5, DO6, and DO7 will be turned ON and others are turned OFF.

Via changing the Attribute ID of the Application Object, user can set other parameters of this device.

Example2:

Get DO data (Class ID: 0x64, Instance ID: 0x01, Attribute ID 0x01).

If the node ID of the CAN-2057D is 1, and the master (id: 0x0A) has completed “Explicit” connection with the device. By getting the value of the object with attribute ID 0x01, you can get the channel 0 ~ 15 of the DO data.

| IDENTIFIER BITS | | | | | | | | | | | RTR | Data Length | 8-byte Data (byte) | | | | | | | |
|--------------------|---|---|---|---|---|---|---|---|---|---|-----|-------------|--------------------|----|----|----|----|----|----|----|
| Destination MAC ID | | | | | | | | | | | | | (HEX) | | | | | | | |
| 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 5 | 0A | 0E | 64 | 01 | 01 | -- | -- | -- |

Master → **Slave (CAN-2057D)**

| IDENTIFIER BITS | | | | | | | | | | | RTR | Data Length | 8-byte Data (byte) | | | | | | | |
|-----------------|---|---|---|---|---|---|---|---|---|---|-----|-------------|--------------------|----|----|----|----|----|----|----|
| Source MAC ID | | | | | | | | | | | | | (HEX) | | | | | | | |
| 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 4 | 0A | 8E | 00 | 0F | -- | -- | -- | -- |

Master ← **Slave (CAN-2057D)**

Get the value of Application Object1 with Instance ID 0x01 and Attribute ID 0x01. After sending the “Get Attribute Single”, the slave device response the DO data (0x000F) at byte 2 and byte 3. The value 0x000F means that the status of DO3, DO2, DO1 and DO0 are turned on and others are turned off.

Via changing the Attribute ID of the Application Object1, user can get other parameters of this device.

The attribute 0x02 of Application Object1 can control the DO power on value of each channel. After setting this attribute, the DO channels will output DO power on value when booting up.

Attribute 0x03 and 0x04 of Application Object1 are used for safe value configuration when “Explicit Message Timeout” error occurs. When setting the channel selection value of the Attribute ID 0x03 to “1”, the safe value of Channel 0 will be active. If the value is set to 0x4, it means that the safe value of the channel 2 is active. Afterwards, you can configure the output safe value of this channel by setting the value of Attribute ID 0x04. When setting the Attribute ID 0x03 to “0x1” and Attribute ID 0x04 to “0x1”, the channel 0 will turn ON while the error occurs.

Appendix A: Dimension

