DeviceNet Slave Device

CAN-2018D

User's Manual

Warranty

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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 such as industrial machine control, factory automation, medical equipments control, remote data acquisition, environmental monitoring, and packaging machines control, etc.

The CAN-2018D follows DeviceNet specification Volume I/II, Release 2.0. You can obtain the analog input data and configure the module via standard DeviceNet protocol. To build a connection between DeviceNet master and the CAN-2018D is no more a tough project. The DeviceNet EDS file would help you to achieve this purpose quickly and easily. This module has 8 analog input channels for measuring the thermocouples or voltage values. It can be fit to various applications. By using the DeviceNet masters of ICP DAS, you can simply build a DeviceNet network for your requirements.



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1.2 Hardware Specifications

Analog Input:

- Input Channels: 8
- Input Type: +/- 15mV, +/- 50mV, +/- 100mV, +/- 500mV, +/- 1V, +/- 2.5V, -20mA ~ +20mA (Requires Optional External 125Ω Resistor) Thermocouple(J, K, T, E. R. S, B, N, C)
- Resolution: 16-bit
- Accuracy: +/-0.1% FSR
- Sampling Rate: 10 Samples/ sec (Total)
- Zero Drift: +/- 10μV/ °C
- Span Drift: +/- 25 ppm/ °C
- Common Mode Rejection: 86 dB
- Normal Mode Rejection: 100 dB
- Input Impedance: >400 kΩ
- Individual Channel Configuration: Yes
- Open Thermocouple Detection: Yes
- Over voltage Protection: 240 Vrms
- 4KV ESD Protection: Yes, Contact for each terminal.
- Intra-module Isolation, Field to Logic: 3000 V_{DC}

Others:

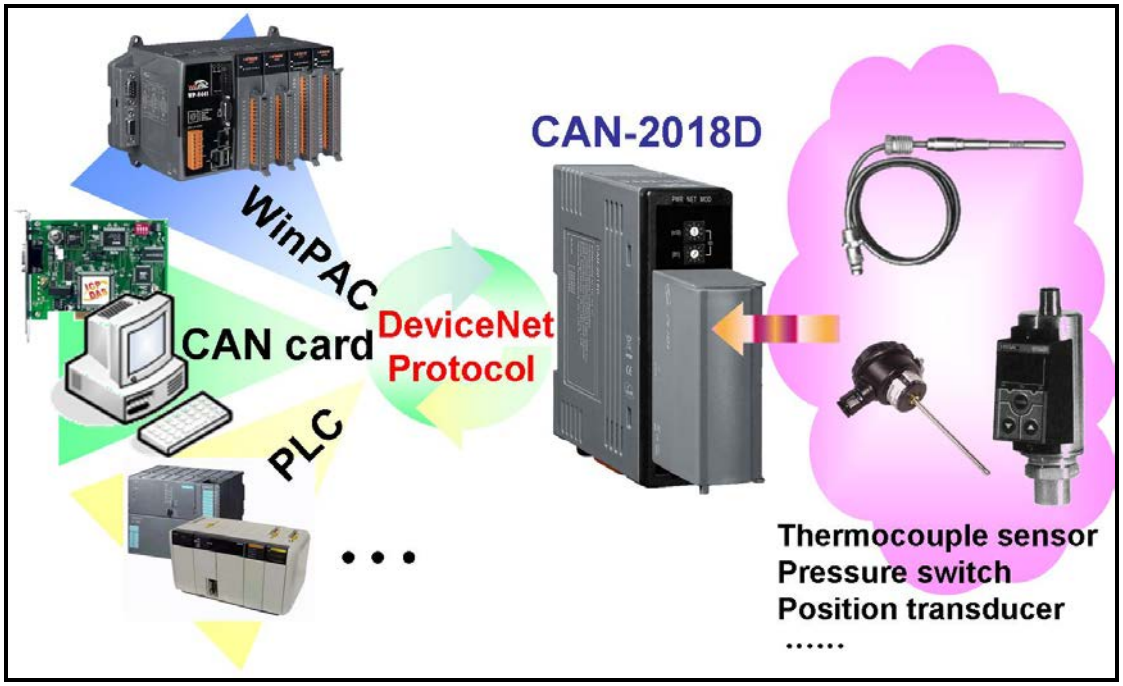
- Power LED: PWR (red)
- DeviceNet Status Led: NET/MOD, green/orange
- Power Supply: Unregulated +10 ~ +30 V_{DC}.
- Power Consumption: 1.5 W.
- Operating Temperature: -25 ~ 75 ℃.
- Storage Temperature: -30 ~ 80 ℃.
- Humidity: 10 to 90% RH, Non-condensing.
- Dimensions: 32.3 mm x 99 mm x 78 mm (W x L x H) Detail.

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1.3 Features

- DeviceNet general I/O slave device
- 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 LED indictors

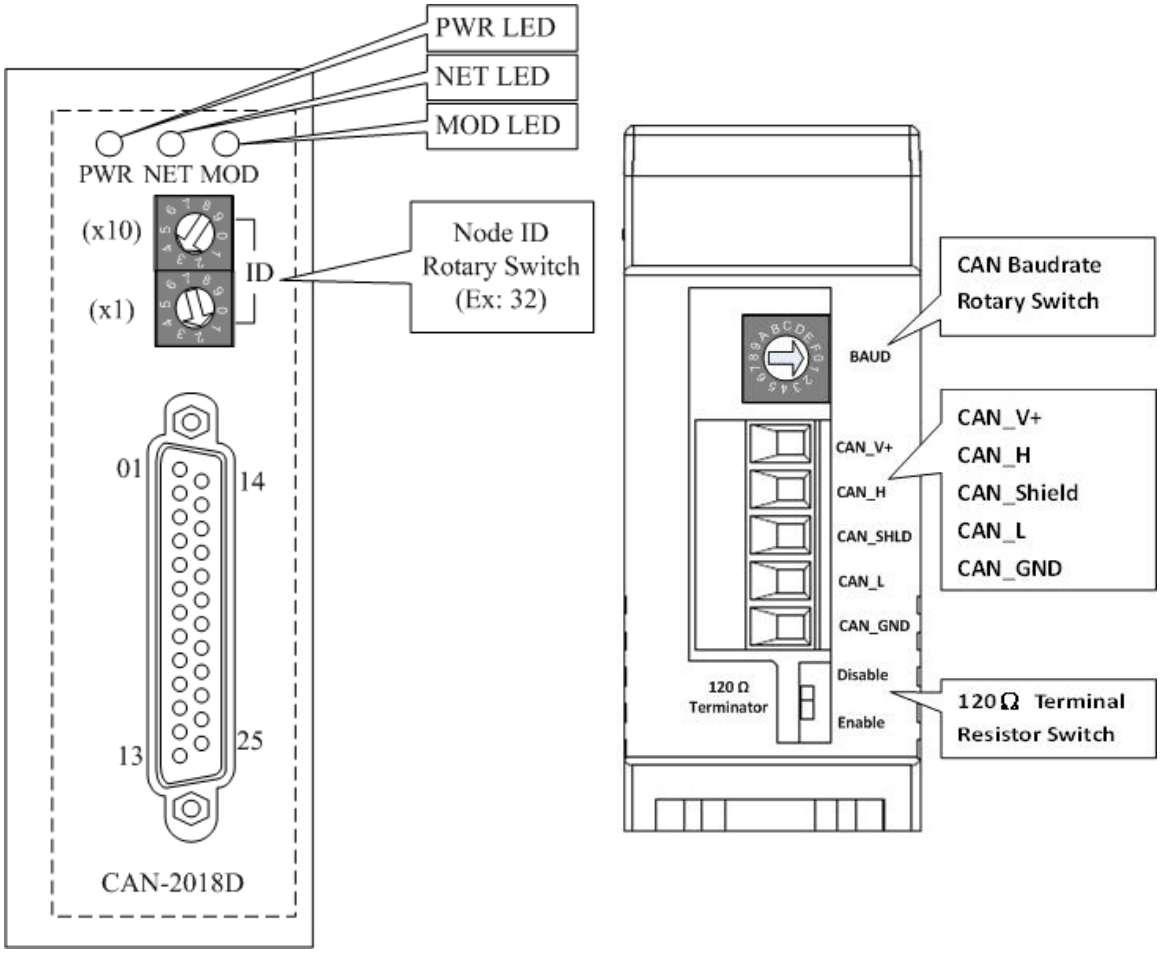
1.4 Application



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2 Hardware

2.1 Structure

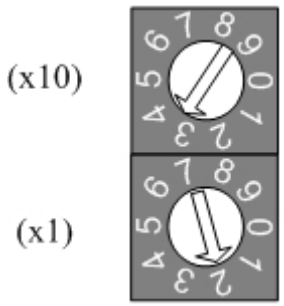


(Top View) **(Bottom View)**

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2.2 Node ID & Baud Rate Rotary Switch

The rotary switches of node ID configure the node ID of CAN-2018D module. These two switches are numbers in base ten. For example, the node ID value of the following picture is 32.



Node ID rotary switch

The rotary switch about the baud rate configuration handles the CAN baud rate of CAN-2018D 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

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2.3 LED Description

PWR LED

The CAN-2018D is powered by 10 ~ 30 V_{DC}. Under a normal connection, a good power supply and a correct voltage range 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

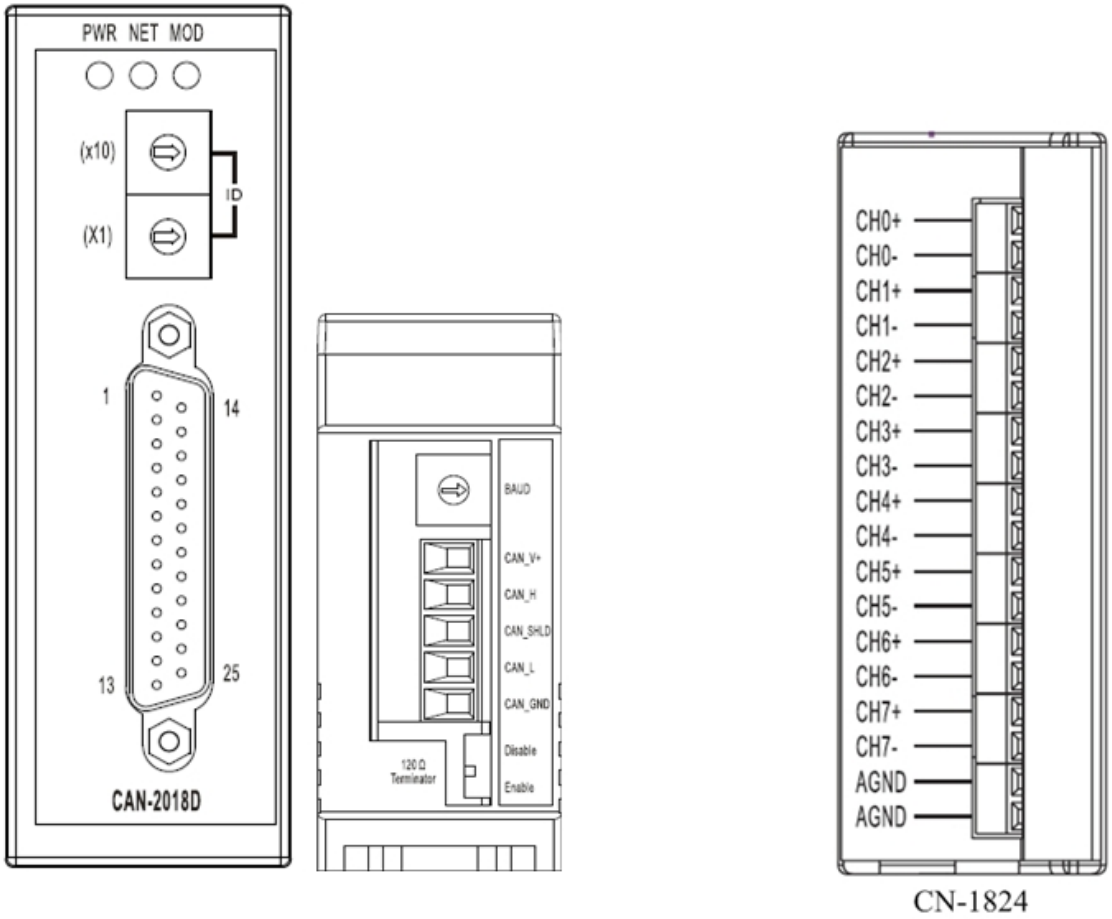
This LED provides the devices status. It indicates whether or not the device is operating properly.

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.

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2.4 PIN Assignment

CAN-2018D + CN-1824 (transformation connector)

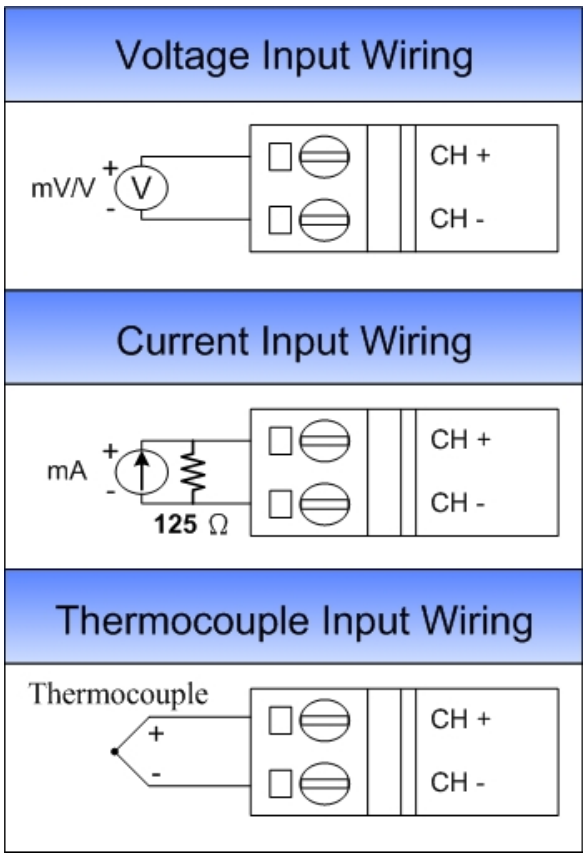


Pin Assignment Name	Terminal No.		Pin Assignment Name
+5V	01	14	DGND
CJC	02	15	CH0+
CH0-	03	16	CH1+
CH1-	04	17	CH2+
CH2-	05	18	CH3+
CH3-	06	19	CH4+
CH4-	07	20	CH5+
CH5-	08	21	CH6+
CH6-	09	22	CH7+
CH7-	10	23	N.C.
N.C.	11	24	N.C.
N.C.	12	25	AGND
AGND	13		
		Shield	F.G.

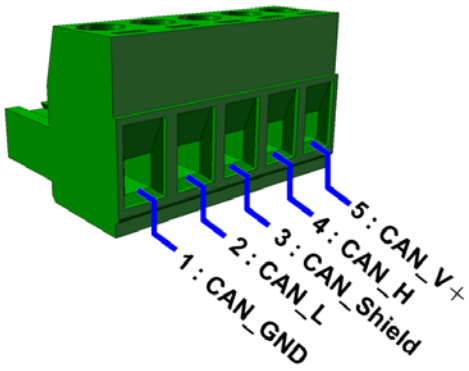
CAN-2018D 25-pin Female D-Sub Connector

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2.5 Wire Connection

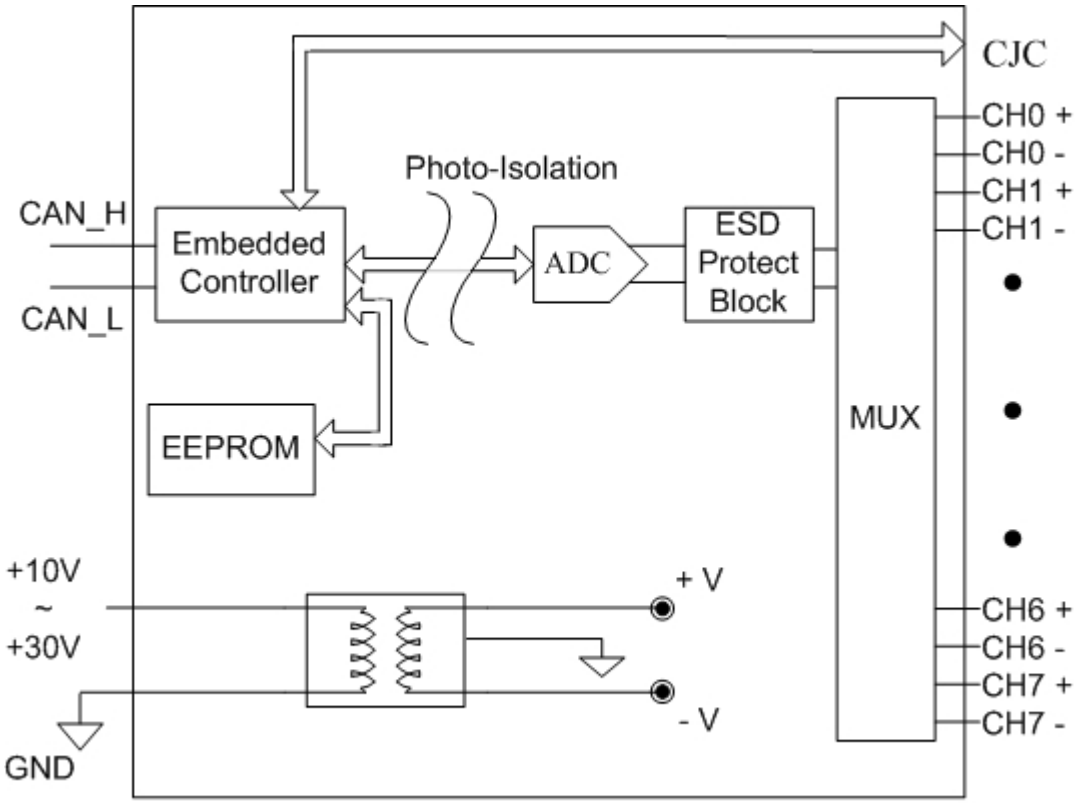


5-pin screw terminal block



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2.6 Internal I/O Structure



Internal I/O Structure

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3 DeviceNet Profile Area

This section describes the detailed functions for each object class that is implemented in the CAN-2018D 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-2018D
Production Revision	1.1

DeviceNet Physical Conformance Data

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

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3.2 Identity Object (Class ID: 0x01)

This object provides the identification 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	0x300
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-2018D
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.

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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	0x65	0x01	0x01
Bit Strobe Produced	0x04	0x64	0x03
Bit Strobe Consumed	0x65	0x01	0x01

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

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3.4 Assembly Object (Class ID: 0x04)

The Assembly Object binds attributes of multiple objects, which allows sending / receiving the data from / to each object 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. (The read temperature function is supported in firmware version 1.2 or later)

Class attribute (Instance ID=0)

Attribute ID	Attribute name	Data Type	Method	Value
0x01	Revision	UINT	Get	1
0x02	Max Instance	UINT	Get	0x04

Class service

Service Code	Service name	Support
0x0E	Get_Attribute_Single	Yes

Instance ID

Instance ID	OUTPUT	INPUT
0x64		Get values of all AI channels
0x65	Type codes of all AI channel	Get type codes of all AI channels (***Note**)
0x66	Offset values of all AI channels	Get offset values of all AI channels
0x67		Get single floating-point format value of all AI channels

***Note:** About the definition of the type codes, please refer to the appendix B for details.

Contents of Each Assembly Object Instance

Instance ID	Description	Type	Method	Default Value
0x64	Channel 0 ~ 7 AI values **(*Note1)**	UINT … UINT	Get	0x0000 … 0x0000

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0x65	Channel 0 ~ 7 AI type codes	USINT … USINT	Get/Set	0x0E … 0x0E
0x66	Channel 0 ~ 7 AI offset values	UINT … UINT	Get/Set	0x0000 … 0x0000
0x67	Channel 0 ~ 7 AI values **(*Note2)**	REAL … REAL	Get	0x00000000 … 0x00000000

***Note1:** The range of values for variables of type UINT are defined in appendix B.

***Note2 :** The range of values for variables of type REAL are defined in IEEE 754 for the basic single floating-point format.

Parameter description of Assembly Object Instance

Instance ID	Data Range	Parameter Description
0x64	Refer to Appendix B for the corresponding input values	Channel 0~7 input values **(*Note1)**
0x65	Refer to Appendix B for the type code definition	Channel 0~7 AI type codes
0x66	0x0000 ~ 0xFFFF	Channel 0~7 AI offset value 0x0000 ~ 0x7FFF => 0 ~ +32767 0xFFFF ~ 0x8000 => -1 ~ -32768
0x67	Refer to Appendix B for the corresponding input values	Channel 0~7 input values **(*Note2)**

***Note1:** The range of values for variables are defined in appendix B.

***Note2 :** The range of values for variables are defined in IEEE 754 for the basic single floating-point format

Instance attribute (Instance ID=0x64~0x68)

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

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0x10	Set_Attribute_Single	Yes

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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 the DeviceNet protocol. A DeviceNet device accesses application data by invoking read and write functions. These functions need to be provided by an Application Object. The DeviceNet protocol provides Get_Attribute_Single and Set_Attribute_Single to read and write the single AO channel configuration of the CAN-2018D module. (The read temperature function is supported in firmware version 1.2 or later)

Class attribute (Instance ID=0)

Attribute ID	Attribute name	Data Type	Method	Value
0x01	Revision	UINT	Get	1
0x02	Max Instance	UINT	Get	0x08

Class service

Service Code	Service name	Support
0x0E	Get_Attribute_Single	Yes

Instance ID

Instance ID	Description
0x01	For accessing channel 0 AI configuration
0x02	For accessing channel 1 AI configuration
0x03	For accessing channel 2 AI configuration
0x04	For accessing channel 3 AI configuration
0x05	For accessing channel 4 AI configuration
0x06	For accessing channel 5 AI configuration
0x07	For accessing channel 6 AI configuration
0x08	For accessing channel 7 AI configuration

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Instance attribute (Instance ID=0x01~0x08)

Attribute ID	Description	Method	Data Type	Default Value
0x01	AI value	Get	UINT	0x0000
0x02	AI type code	Get/Set	USINT	0x0E
0x03	AI offset value	Get/Set	UINT	0x0000
0x04	AI value	Get	REAL	0x00000000

Parameter description of Application Object1 attributes

Attribute ID	Data Range	Parameter Description
0x01	Refer to Appendix B for the corresponding input values	Channel**x** AI value (***Note1**)
0x02	Refer to Appendix B for the corresponding output values	Channel**x** AI type code
0x03	0x0000 ~ 0xFFFF	Channel**x** AI offset value 0x0000 ~ 0x7FFF => 0 ~ +32767 0xFFFF ~ 0x8000 => -1 ~ -32768
0x04	Refer to Appendix B for the corresponding input values	Channel**x** AI value (***Note2**)

Note: Channel**x** is channel number of module, which is selected by Instance ID

***Note1:** The range of values for variables are defined in appendix B.

***Note2 :** The range of values for variables are defined in IEEE 754 for the basic single floating-point format

Instance service

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

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3.6 Application Object2 (Class ID: 0x65)

Application Object2 not only defines parameters for saving configurations into EEPROM or loading factory default setting but also defines CJC parameters.

Class attribute (Instance ID=0)

Attribute ID	Attribute name	Data Type	Method	Value
0x01	Revision	UINT	Get	1
0x02	Max Instance	UINT	Get	0x03

Class service

Service Code	Service name	Support
0x0E	Get_Attribute_Single	Yes

Instance attribute (Instance ID=1)

Attribute ID	Description	Method	Data Type	Default Value
0x01	Save all configurations into EEPROM or using factory default configuration setting	Set	USINT	-
0x02	Set CJC (cold junction compensation) Offset value or Get CJC (offset) temperature value	Set/Get	UINT	0x0000
0x03	Enable/Disable CJC	Set/Get	USINT	0x01

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Parameter description of Application Object2 attributes

Attribute ID	Data Range	Parameter Description
0x01	0x01: Use default configuration 0x02: Save all configurations to EEPROM	0x01: After restarting the device, all configurations will become default setting. 0x02: Save all channels configuration into EEPROM
0x02	Refer to Appendix B for the CJC (cold junction compensation) temperature values	CJC Enable => Get CJC temperature value CJC Disable => Get CJC offset value
0x03	0x00 or 0x01	0x00: Disable CJC 0x01: Enable CJC

Instance service

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

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4 Application

Application Object (Class ID:0x64, 0x65) lists all the parameters of the module. Each Instance ID is corresponding to the different channel. By using “Set/Get Attribute Single” service, you can read/write the parameters of each channel.

Example1:

Enable/Disable CJC.

(Class ID: **0x65**, Instance ID: **0x01**, Attribute ID **0x03**).

If the node ID of the CAN-2018D is 1, and the master (ID: 0x0A) has completed “Explicit” connection with the device. By setting the value of Attribute ID 0x03 to 0x01, you can set the CJC status to enable mode.

IDENTIFIER BITS											RTR	Data Length	8-byte Data (byte) (HEX)							
		Destination MAC ID																		
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	6	0A	10	65	01	03	01	--	--

Master → **Slave (CAN-2018D)**

IDENTIFIER BITS											RTR	Data Length	8-byte Data (byte) (HEX)							
		Source MAC ID																		
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	--	--	--	--	--	--

Slave (CAN-2018D) → **Master**

Set the value 0x01 to the Application Object2 with Instance ID 0x01 and Attribute ID 0x03. After sending the “Set Attribute Single”, the slave device will response 0x90 to mean that the setting is OK. Then the CJC status will become to “Enable” mode. Setting the value 0x00 to this attribute will disable the CJC status.

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

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Example2:

Get channel0 AI data

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

If the node ID of the CAN-2018D 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 of the AI data.

IDENTIFIER BITS											RTR	Data Length	8-byte Data (byte) (HEX)							
		Destination MAC ID																		
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-2018D)**

IDENTIFIER BITS											RTR	Data Length	8-byte Data (byte) (HEX)							
		Source MAC ID																		
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	FF	7F	--	--	--	--

Slave (CAN-2018D) → **Master**

Get the value of Application Object1 with Instance ID 0x01 and Attribute ID 0x01. After sending the “Get Attribute Single”, the slave device responds the AI data. The value 0x7FFF means that the channel0’s input data is 0x7FFF. About the meaning of the AI value, refer to the appendix B for the AI data and type code definition.

Attribute 0x02 of Application Object1 is used for AI type code. Please refer to the appendix B for the AI data and type code definition. The Attribute 0x03 of Application Object1 can use to shift the AI data. The value 0x0000 ~ 0x7FFF means the AI value plus 0 ~ 32767. The value 0xFFFF ~ 0x8000 means the AI data plus -1 ~ -32768.

Attribute 0x02 of Application Object2 is used for CJC offset value. When enable the CJC, users can get the CJC value from this parameter. When disable the CJC, users can set/get the CJC offset value. Please refer to the appendix B for the range definition. The Attribute 0x03 of Application Object2 is used to enable/disable the CJC.

After modifying the value of the parameters, set attribute 0x01 of Application Object2 to “2” to save all channels’ configuration into the module’s EEPROM. Users also can set this attribute to “1” to be factory setting after rebooting.

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Example3:

Get channel0 temperature value with K type thermocouple.

(Class ID: **0x64**, Instance ID: **0x01**, Attribute ID **0x04**).

If the node ID of the CAN-2018D is 1, and the master (ID: 0x0A) has completed “Explicit” connection with the device. By getting the value of the object with attribute ID 0x04, you can get the channel 0 of the temperature value.

IDENTIFIER BITS											RTR	Data Length	8-byte Data (byte) (HEX)							
		Destination MAC ID																		
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	04	--	--	--

Master → **Slave (CAN-2018D)**

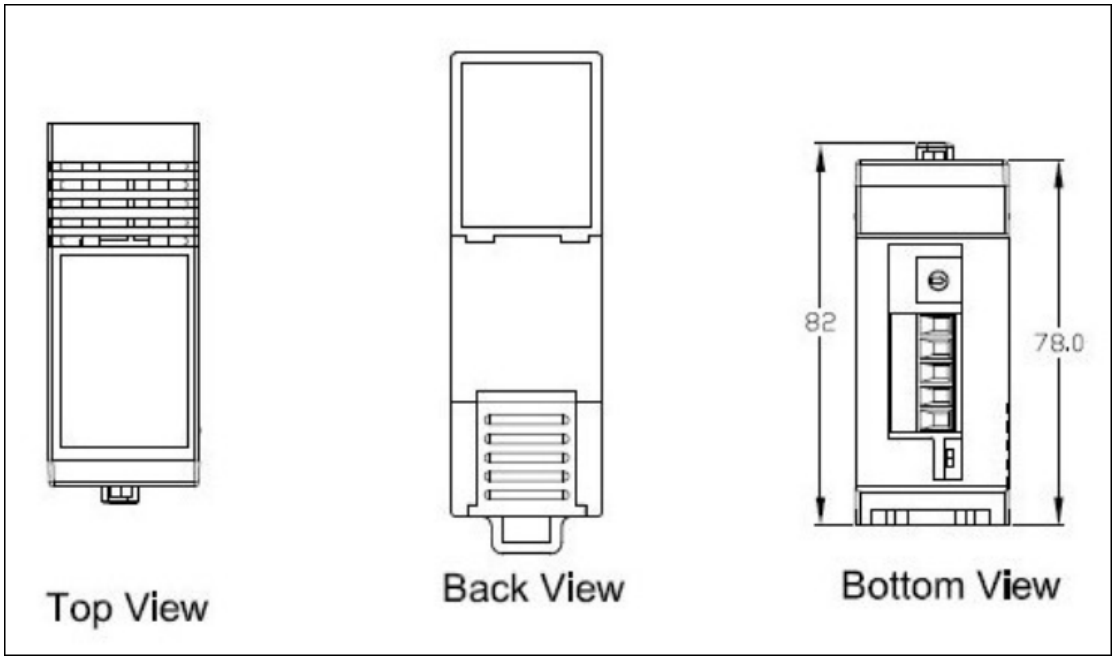
IDENTIFIER BITS											RTR	Data Length	8-byte Data (byte) (HEX)							
		Source MAC ID																		
10	9	8	7	6	5	4	3	2	1	0			0	1	2	3	4	5	6	7
1	0	0	0	0	0	0	1	0	1	1	0	6	0A	8E	00	80	AB	44	--	--

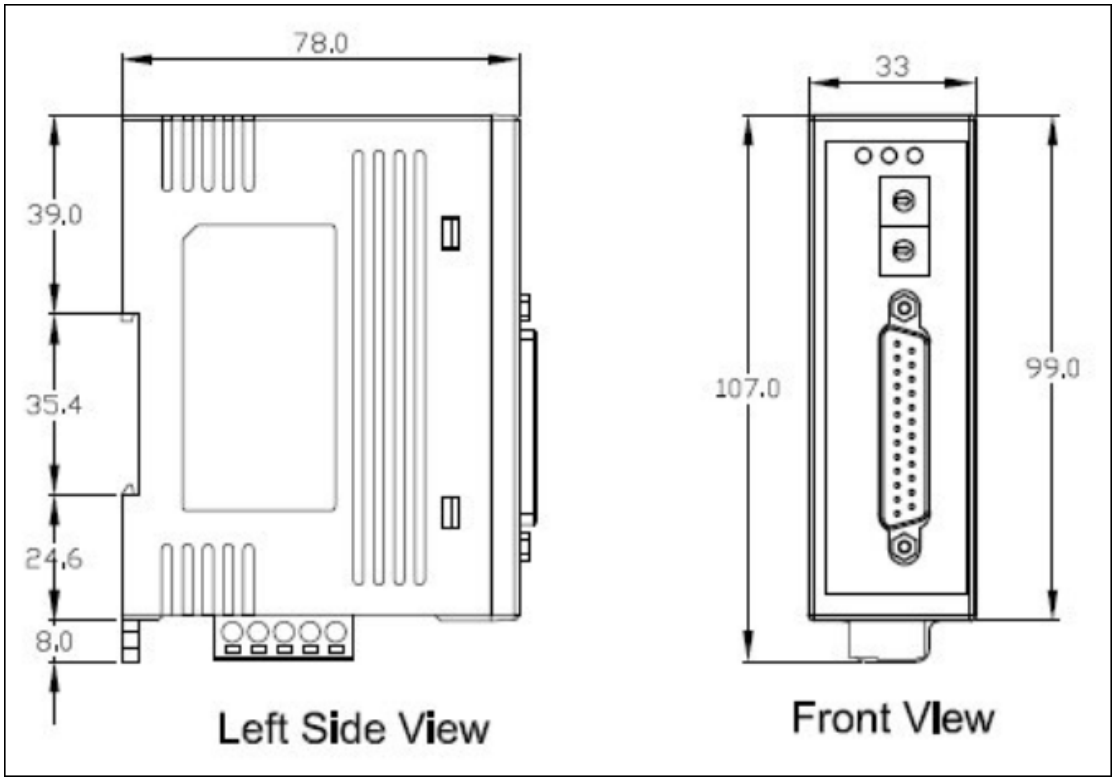
Master ← **Slave (CAN-2018D)**

Get the value of Application Object1 with Instance ID 0x01 and Attribute ID 0x04. After sending the “Get Attribute Single”, the slave device responds the temperature data. The value 0x44AB8000 is in IEEE 754 for the basic single floating-point format, means that the channel0’s data is 1372.0 ℃. About the range of the value, refer to the appendix B for the AI data and type code definition. (The read temperature function is supported in firmware version 1.2 or later)

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Appendix A: Dimension





Unit: mm

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Appendix B: Type Code Definition

Type Code Definition for CAN-2018D

Type Code	Input Range	Data Format	Max Value	Min Value
0x00	-15 to +15 mV	Engineer Unit	+15	-15
		2's Complement HEX	0x7FFF	0x8000
0x01	-50 to +50 mV	Engineer Unit	+50	-50
		2's Complement HEX	0x7FFF	0x8000
0x02	-100 to +100 mV	Engineer Unit	+100	-100
		2's Complement HEX	0x7FFF	0x8000
0x03	-500 to +500 mV	Engineer Unit	+500	-500
		2's Complement HEX	0x7FFF	0x8000
0x04	-1 to +1 V	Engineer Unit	+1	-1
		2's Complement HEX	0x7FFF	0x8000
0x05	-2.5 to +2.5 V	Engineer Unit	+2.5	-2.5
		2's Complement HEX	0x7FFF	0x8000
0x06	-20 to +20 mA (with 125Ω resistor)	Engineer Unit	+20	-20
		2's Complement HEX	0x7FFF	0x8000
0x0E	J Type (℃)	Engineer Unit	+1200	-210
		2's Complement HEX	0x7FFF	0xE99A
0x0F	K Type (℃)	Engineer Unit	+1372	-270
		2's Complement HEX	0x7FFF	0xE6D0
0x10	T Type (℃)	Engineer Unit	+400	-270
		2's Complement HEX	0x7FFF	0xA99A
0x11	E Type (℃)	Engineer Unit	+1000	-270
		2's Complement HEX	0x7FFF	0xDD71
0x12	R Type (℃)	Engineer Unit	+1765	-50
		2's Complement HEX	0x7FFF	0xFC60
0x13	S Type (℃)	Engineer Unit	+1765	-50
		2's Complement HEX	0x7FFF	0xFC60
0x14	B Type (℃)	Engineer Unit	+1820	0
		2's Complement HEX	0x7FFF	0x0000
0x15	N Type (℃)	Engineer Unit	+1300	-270
		2's Complement HEX	0x7FFF	0xE56B
0x16	C Type (℃)	Engineer Unit	+2320	0
		2's Complement HEX	0x7FFF	0x0000

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Note:

Getting the 0x7FFF value (UINT formate) or 0x7FFFFFFF value (REAL format) in all of the thermocouple type codes, it means that the thermocouple wires are broken.(The read temperature function is supported in firmware version 1.2 or later)

CJC (cold junction compensation) Definition for CAN-2018D

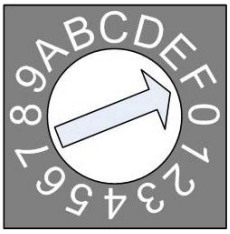
Input Range	Data Format	Max Value	Min Value
-30 to +100 (℃)	Engineer Unit	+100	-30
	2's Complement HEX	0x03E8	0xFED4

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Appendix C: Firmware Update

Step 1: Set Module to “Bootloader” mode

Set Module to “Bootloader” mode (set baud rate to 0xF). Then power on the module. After power on, the module’s led (PWR, NET, MOD) will be flashed at the same time. It means that the module have entered into “Bootloader” mode.



Baud Rate Rotary Switch

Step 2: Get Module firmware

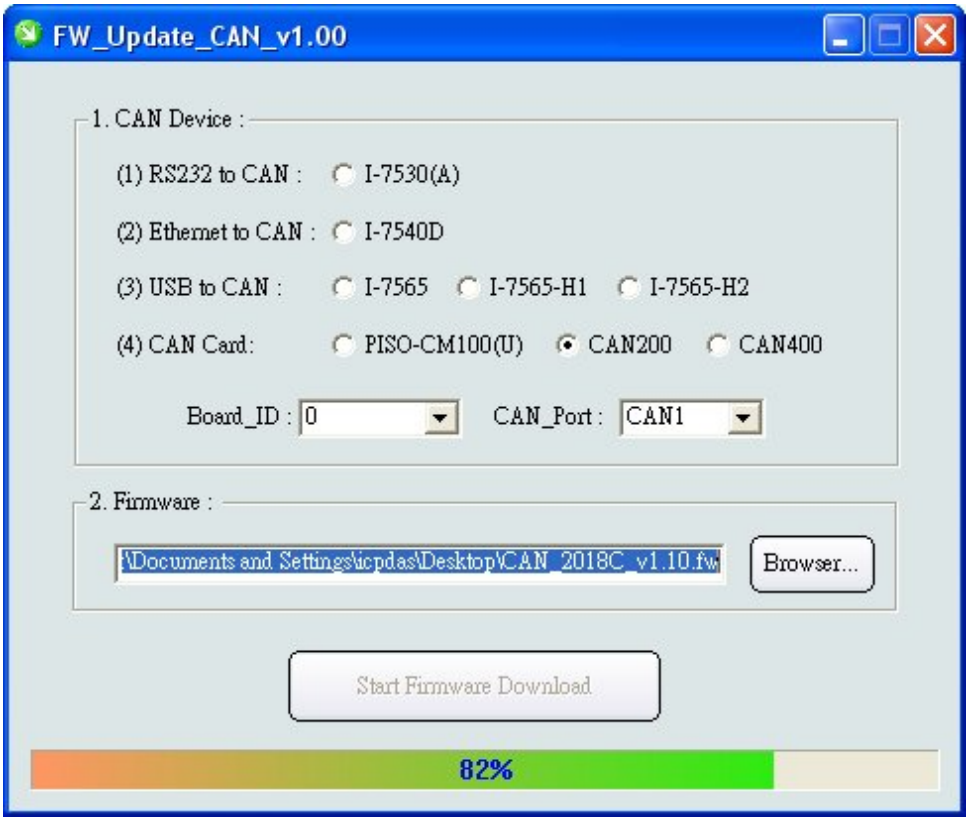
Module firmware can be downloaded from following link:
https://www.icpdas.com/en/download/show.php?num=1922&model=CAN-2018D/S

Step 3: Run FW_Update_CAN Utility

FW_Update_CAN Utility can be downloaded from following link:
https://www.icpdas.com/en/download/show.php?num=1914&model=CAN-2018D/S

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Run FW_Update_CAN Utility



[1] CAN Device:

The below ICP DAS CAN products are supported by FW_Update_CAN utility for firmware update.

(1) RS232 to CAN **:** I-7530

(2) Ethernet to CAN **:** I-7540D

(3) USB to CAN **:** I-7565, I-7565-H1, I-7565-H2

(4) CAN Card **:** PISO-CM100(U), PISO-/PCM-/PEX-CAN200 / CAN400

Before firmware update, users need to set the below parameters.

(1) Select CAN hardware interface

(2) set Dev_Port or Board_ID

(3) set CAN_Port" number

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[2] Download Firmware:

(1) Click “**Browser**…” button to choose firmware file.

(2) Click “**Start Firmware Update**” button to start firmware update and it will show the total percentage of firmware update in progress bar. After the firmware update finished, it will show the “Firmware Update Success !!” message.



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