I-7017, I-7018, I-7019, M-7017, M-7018 and M-7019 Series User Manual

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year from the date of delivery to the original purchaser.

Warning

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Date: 2011/9/16

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1. Introduction

The I-7000 series is a family of network data acquisition and control modules, providing analog-to-digital, digital-to-analog, digital input/output, timer/counter and other functions. The modules can be remotely controlled using a set of commands, which we call the DCON protocol. Communication between the module and the host is in ASCII format via an RS-485 bi-directional serial bus standard. Baud Rates are software programmable and transmission speeds of up to 115.2K baud can be selected.

The functionality of the M-7000 series is the same as the I-7000 series, with the exception that the M-7000 series offers extended support for the Modbus RTU protocol.

Some I-7000 and all M-7000 modules feature a new design for the frame ground and INIT switch as shown in the figure (rear view). The frame ground provides enhanced static protection (ESD) abilities and ensures the module is more reliable. The INIT switch allows INIT mode to be accessed more easily. Refer to Sections A.1 and A.4 for more details.
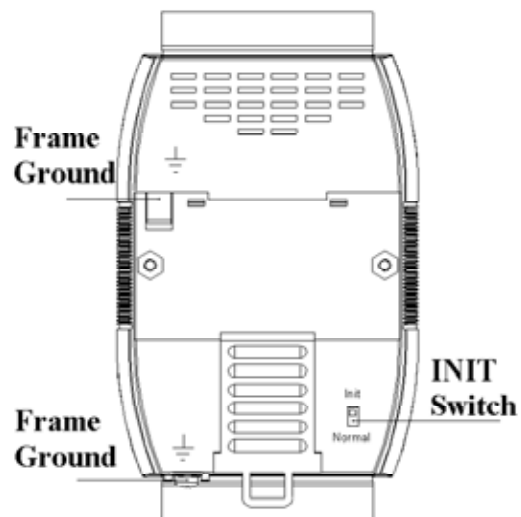
The common features of the I-7017, I-7018 and I-7019 are as follows:
1. 3000V DC inter-module isolation

2. 24-bit sigma-delta ADC to provide excellent accuracy
3. Software calibration

The I-7017 is an 8-channel voltage and current input module. The I-7018 is an 8-channel voltage, current and thermocouple input module. The I-7019 is an 8-channel voltage, current, and thermocouple input module, with the ability to connect various types of inputs to a single module.

The I-7017 has the following variations:
- I-7017F: added support for fast mode, 60 samples/second.
- I-7017C: used for current input only, with no external resistor required.
- I-7017FC: used for current input only, with no external resistor required.   Added support for fast mode, 60 samples/second.
- I-7017R: added high voltage overload protection, 240Vrms.
- I-7017RC: used for current input only, with no external resistor required.   Added high voltage overload protection, 240Vrms.
- I-7017R-A5: used for high voltage input
- I-7017Z: 10 channels, added high voltage overload protection, 240Vrms

The I-7018 has the following variations:
- I-7018P: added support for two additional thermocouple types, L and M
- I-7018BL: added thermocouple wire opening detection
- I-7018R: added thermocouple wire opening detection and high voltage overload protection, 240Vrms

- I-7018Z: 10 channels, added thermocouple wire opening detection and high voltage overload protection, 240Vrms

The I-7019 has the following variation:
- I-7019R: added high voltage overload protection, 240Vrms
- M-7019Z: 10 channels, added high voltage overload protection, 240Vrms

The I-7017R, I-7017RC, I-7017Z, I-7018R, I-7018Z, I-7019R and M-7019Z modules are designed for industrial plant environments and have special input circuits to provide 240Vrms continuous overload protection as shown in the figure.
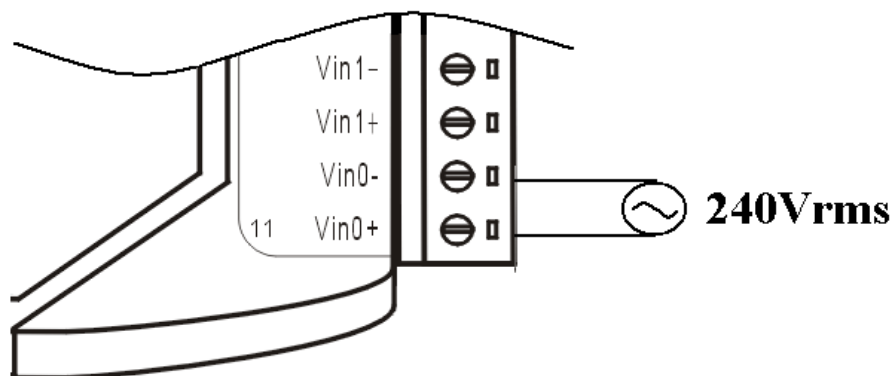
1.1 More Information

Refer to chapter 1 of the "I-7000 Bus Converter User's Manual" as shown below or visit the ICP DAS website http://www.icpdas.com for more information regarding the I-7000 series.

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1.1  The I-7000 Series Overview
1.2  Related Documentation for the I-7000 Series
1.3  Common Features of the I-7000 Series
1.4  The I-7000 Series System Network Configuration
1.5  I-7000 Dimensions
```

1.2 Terminal Assignment

I-7017C
I-7017FC
I-7017RC
M-7017C
M-7017RC

Top connector (pins 20–11): Iin4-, Iin4+, Iin3-, Iin3+, Iin2-, Iin2+, Iin1-, Iin1+, Iin0-, Iin0+

Bottom connector (pins 1–10): Iin5+, Iin5-, Iin6+, Iin6-, Iin7+, Iin7-, (Y)DATA+, (G)DATA-, (R)+Vs, (B)GND

Top terminals (20 to 11): Vin4-, Vin4+, Vin3-, Vin3+, Vin2-, Vin2+, Vin1-, Vin1+, Vin0-, Vin0+

I-7017R
I-7017R-A5
M-7017
M-7017R
M-7017R-A5

Bottom terminals (1 to 10): Vin5+, Vin5-, Vin6+, Vin6-, Vin7+, Vin7-, (Y)DATA+, (G)DATA-, (R)+Vs, (B)GND

Top terminal labels (pins 26 to 14):

26 AGND
Vin15+/Vin5-
Vin5+
Vin14+/Vin4-
Vin4+
Vin13+/Vin3-
Vin3+
Vin12+/Vin2-
Vin2+
Vin11+/Vin1-
Vin1+
Vin10+/Vin0-
14 Vin0+

I-7017Z
M-7017Z

Bottom terminal labels (pins 1 to 13):

Vin6+ 1
Vin6-/Vin16+
Vin7+
Vin7-/Vin17+
Vin8+
Vin8-/Vin18+
Vin9+
Vin9-/Vin19+
AGND
(Y)DATA+
(G)DATA-
(R)+Vs
(B)GND 13

Vin4 - Vin4 + Vin3 - Vin3 + Vin2 - Vin2 + Vin1 - Vin1 + Vin0 - Vin0 +

20

11

I-7018R
M-7018
M-7018R

1

Vin5 + Vin5 - Vin6 + Vin6 - Vin7 + Vin7 - (Y)DATA+ (G)DATA- (R)+Vs (B)GND

10

1	F.G.	F.G.	13
2	AGND	AGND	14
3	CH 0+	CH 5+	15
4	CH 0-	CH 5-	16
5	CH 1+	CH 6+	17
6	CH 1-	CH 6-	18
7	CH 2+	CH 7+	19
8	CH 2-	CH 7-	20
9	CH 3+	CH 8+	21
10	CH 3-	CH 8-	22
11	CH 4+	CH 9+	23
12	CH 4-	CH 9-	24

ICP DAS   DB-1820

CON1

CON2

CON1
(10-ch analog inputs)

I-7018Z
M-7018Z
M-7019Z

CON2

(Y)DATA+
(G)DATA-
(R)+Vs
(B)GND

CON2

(Y)DATA+
(G)DATA-
(R)+Vs
(B)GND

Top terminal block (pins 20–11):
Vin4 - | Vin4 + | Vin3 - | Vin3 + | Vin2 - | Vin2 + | Vin1 - | Vin1 + | Vin0 - | Vin0 +

I-7019R
M-7019R

Bottom terminal block (pins 1–10):
Vin5 + | Vin5 - | Vin6 + | Vin6 - | Vin7 + | Vin7 - | (Y)DATA+ | (G)DATA- | (R)+Vs | (B)GND

1.3 Specifications

	I-7017/M-7017	I-7017F/I-7017R M-7017R	I-7017C[*3]/I-7017FC/I-7017RC M-7017C[*3]/M-7017RC
Analog Input			
Input Channels	8 differential[*1]	8 differential[*1]	8 differential
Input Type	mV, V, mA[*2]	mV, V, mA[*2]	mA
Sampling Rate	10 samples/sec	10 samples/sec (normal) 60 samples/sec (fast)	10 samples/sec (normal) 60 samples/sec (fast)
Bandwidth	15.7Hz	15.7Hz (normal) 78.7Hz (fast)	15.7Hz (normal) 78.7Hz (fast)
Accuracy	±0.1%	±0.1% (normal) ±0.5% (fast)	±0.1% (normal) ±0.5% (fast)
Zero Drift	20μV/°C	20μV/°C	20μV/°C
Span Drift	25ppm/°C	25ppm/°C	25ppm/°C
CMR@50/60Hz	86dB min	86dB min	86dB min
NMR@50/60Hz	100dB min	100dB min	100dB min
Input Impedance	20MΩ	I-7017R/M-7017R 1MΩ I-7017F 20MΩ	125Ω
Voltage overload Protection	±35V	I-7017R/M-7017R ±240V I-7017F ±35V	I-7017RC/M-7017RC ±240V I-7017C/FC/M-7017C ±35V
Isolation	3000V DC	3000V DC	3000V DC
Modbus RTU	M-7017	M-7017R	M-7017C/M-7017RC
Power			
Requirement	+10 to +30V DC	+10 to +30V DC	+10 to +30V DC
Consumption	1.3W	1.3W	1.3W
Temperature Range			
Operating	-25°C to +75°C	-25°C to +75°C	-25°C to +75°C
Storage	-30°C to +75°C	-30°C to +75°C	-30°C to +75°C

*1: For I-7017 and I-7017F, the number of input channels is 8 differential or 6 differential and 2 single-ended by jumper selection.
*2: requires optional external 125 ohm resistor.
*3: I-7017C and M-7017C does not support fast mode, 60 samples/sec sampling rate.

Note: A warm up period of 30 minutes is recommended in order to achieve the complete performance results described in the specifications.

	I-7017R-A5 M-7017R-A5	I-7017Z M-7017Z
Analog Input		
Input Channels	8 differential	10 differential/20 single-ended
Input Type	V	mV, V, mA (jumper selectable)
Sampling Rate	10 samples/sec (normal) 50 samples/sec (fast)	10 samples/sec (normal) 60 samples/sec (fast)
Bandwidth	15.7Hz (normal) 78.7Hz (fast)	15.7Hz (normal) 78.7Hz (fast)
Accuracy	±0.1% (normal) ±0.25% (fast)	±0.1% (normal) ±0.5% (fast)
Zero Drift	20μV/°C	20μV/°C
Span Drift	25ppm/°C	25ppm/°C
CMR@50/60Hz	86dB min	86dB min
NMR@50/60Hz	100dB min	100dB min
Input Impedance	290KΩ	Differential: 2MΩ Single-ended: 1MΩ
Current Impedance		125Ω, 1/4W
Voltage overload Protection	±200V	Differential: ±240V Single-ended: ±150V
Isolation	3000V DC	3000V DC
Individual Channel Configurable	No	Yes
Modbus RTU	M-7017R-A5	M-7017Z
Power		
Requirement	+10 to +30V DC	+10 to +30V DC
Consumption	1.7W	2.0W
Temperature Range		
Operating	-25°C to +75°C	-25°C to +75°C
Storage	-30°C to +75°C	-30°C to +75°C

Note: A warm up period of 30 minutes is recommended in order to achieve the complete performance results described in the specifications.

	I-7018 M-7018	I-7018P/I-7018Z M-7018Z	I-7018BL/I-7018R M-7018R
Analog Input			
Input Channels	8 differential[*1]	8 diff[*1] (10 for 7018Z)	8 differential[*1]
Input Type	mV, V, mA[*2]	mV, V, mA[*2]	mV, V, mA[*2]
Thermocouple Type	J, K, T, E, R, S, B, N, C	J, K, T, E, R, S, B, N, C, L, M	J, K, T, E, R, S, B, N, C
Sampling Rate	10 samples/sec	10 samples/sec	10 samples/sec
Bandwidth	15.7Hz	15.7Hz	15.7Hz
Accuracy	±0.1%	±0.1%	I-7018R/M-7018R 　±0.2% I-7018BL 　±0.1%
Zero Drift	0.5μV/°C	0.5μV/°C	10μV/°C
Span Drift	25ppm/°C	25ppm/°C	25ppm/°C
CMR@50/60Hz	150dB min	150dB min	86dB min
NMR@50/60Hz	100dB min	100dB min	100dB min
Input Impedance	20MΩ	20MΩ	I-7018R/M-7018R 　1MΩ I-7018BL 　20MΩ
Voltage overload Protection	±35V	I-7018Z/M-7018Z 　±240V I-7018P 　±35V	I-7018R/M-7018R 　±240V I-7018BL 　±35V
Isolation	3000V DC	3000V DC	3000V DC
Open Wire Detection	No	Yes for I-7018Z/ M-7018Z	Yes
Modbus RTU	M-7018	M-7018Z	M-7018R
Power			
Requirement	+10 to +30V DC	+10 to +30V DC	+10 to +30V DC
Consumption	1.0W	1.0W	1.0W
Temperature Range			
Operating	-25°C to +75°C	-25°C to +75°C	-25°C to +75°C
Storage	-30°C to +75°C	-30°C to +75°C	-30°C to +75°C

*1: For I-7018, I-7018P and I-7018BL, the number of input channels is 8 differential or 6 differential and 2 single-ended by jumper selection.
*2: requires optional external 125 ohm resistor
*3: I-7018Z and M-7018Z are individual channel configurable.

Note: A warm up period of 30 minutes is recommended in order to achieve the complete performance results described in the specifications.

	I-7019R/M-7019R	M-7019Z
Analog Input		
Input Channels	8 differential	10 differential
Input Type	mV, V, mA (jumper selectable)	
Thermocouple Type	J, K, T, E, R, S, B, N, C, L, M, L$_{DIN43710}$	
Sampling Rate	8 samples/sec	10 samples/sec
Bandwidth	5.24Hz	
Accuracy	±0.1%	
Zero Drift	10µV/°C for +/-10 V and +/-5 V types 0.5µV/°C for other types	
Span Drift	25ppm/°C	
CMR@50/60Hz	86dB min	
Input Impedance	2MΩ	
Current Impedance	125Ω, 1/4W	
Voltage overload Protection	±240V	
Isolation	3000V DC	
Open Wire Detection	Yes	
Individual Channel Configurable	Yes	
Modbus RTU	M-7019R	M-7019Z
Power		
Requirement	+10 to +30V DC	
Consumption	1.2W	1.8W
Temperature Range		
Operating	-25°C to +75°C	
Storage	-30°C to +75°C	

Note: A warm up period of 30 minutes is recommended in order to achieve the complete performance results described in the specifications.

1.4 Block Diagrams

1.4.1 Block diagram for the I-7017, I-7017F, and M-7017
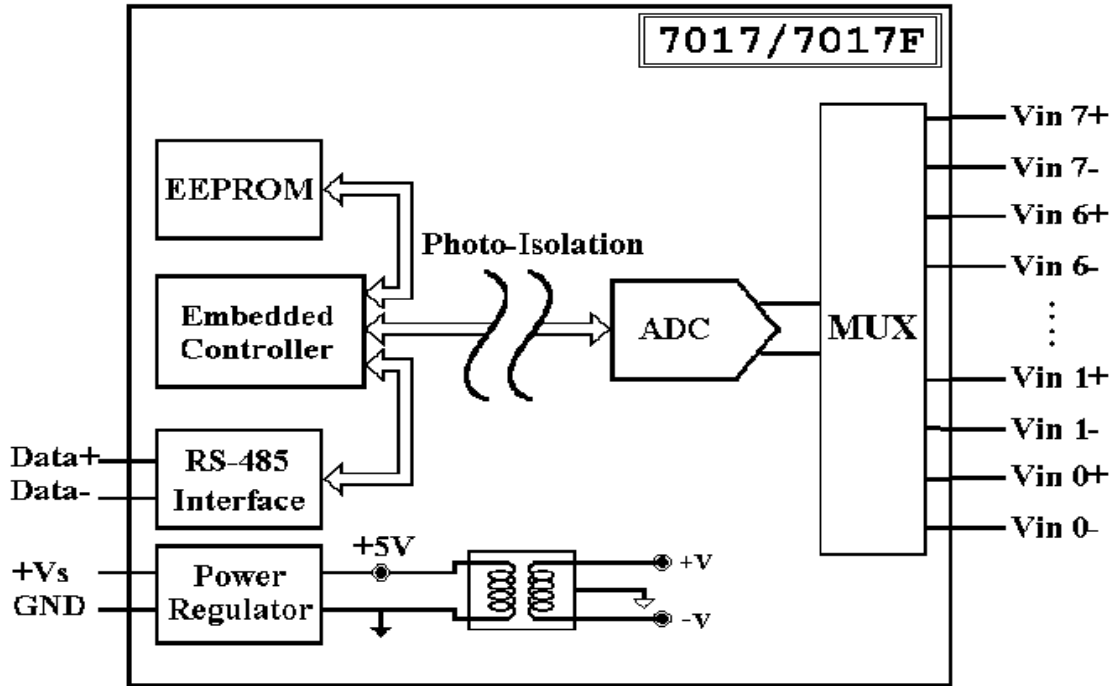
1.4.2 Block diagram for the I-7017C, I-7017FC and M-7017C
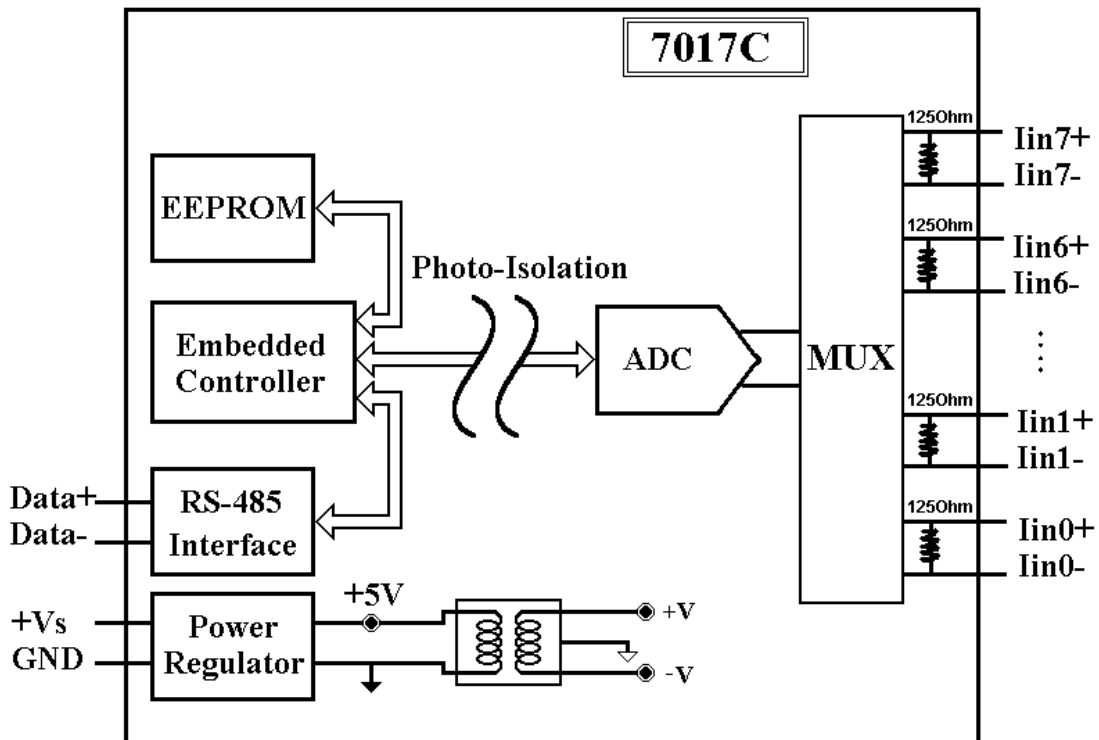
1.4.3 Block diagram for the I-7017R and M-7017R
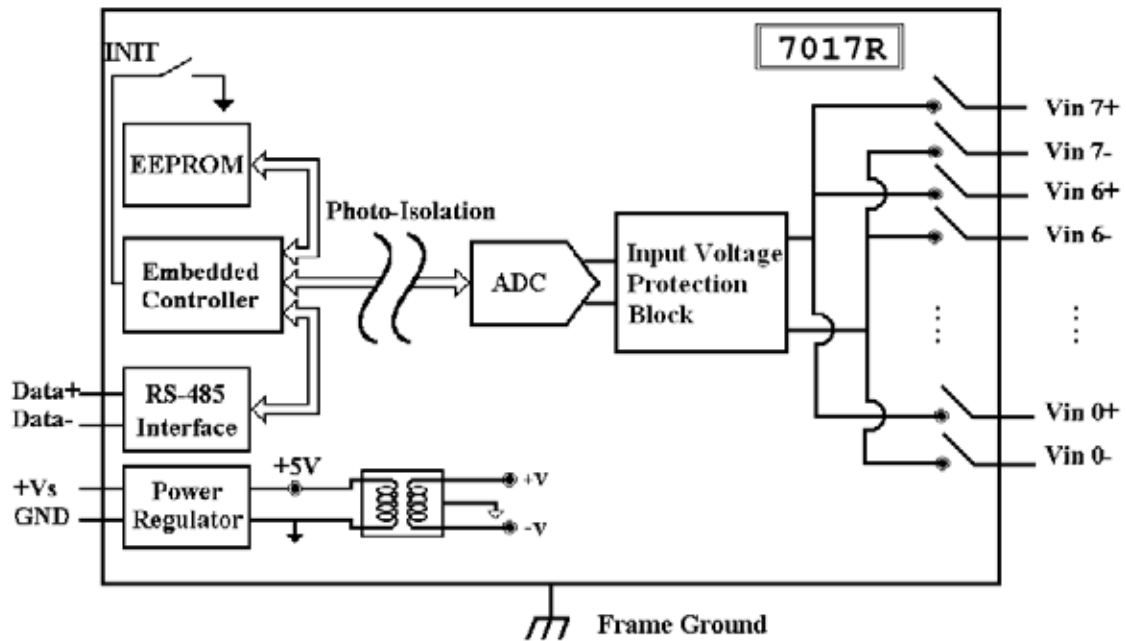
1.4.4 Block diagram for the I-7017R-A5 and M-7017R-A5
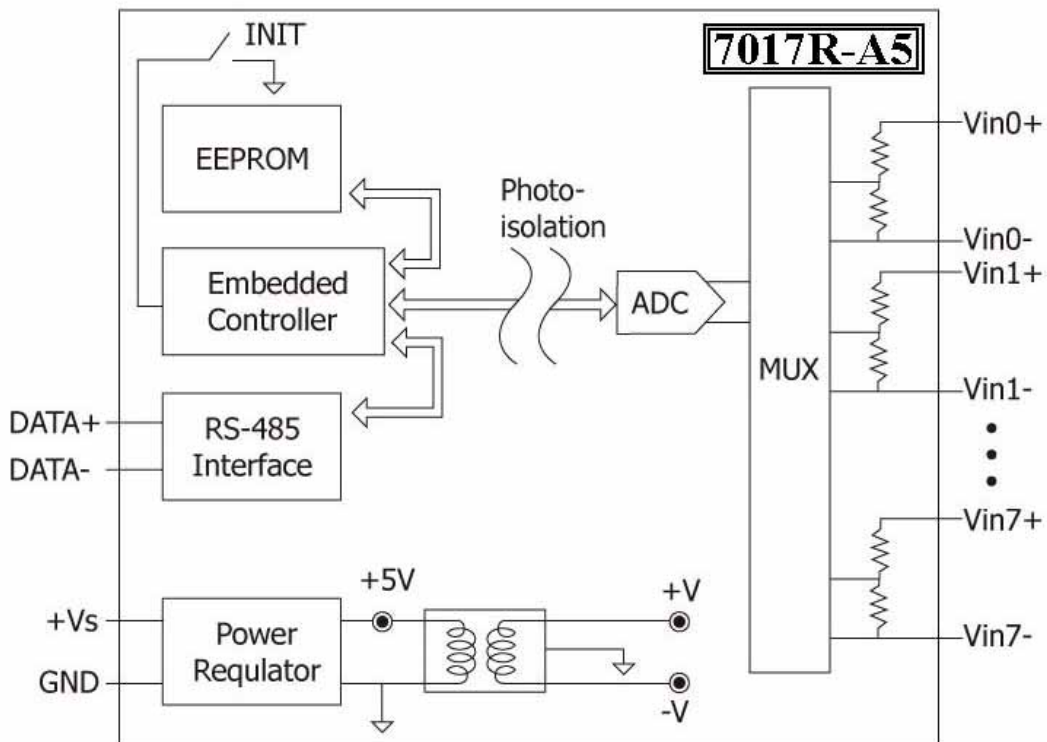
1.4.5 Block diagram for the I-7017Z and M-7017Z
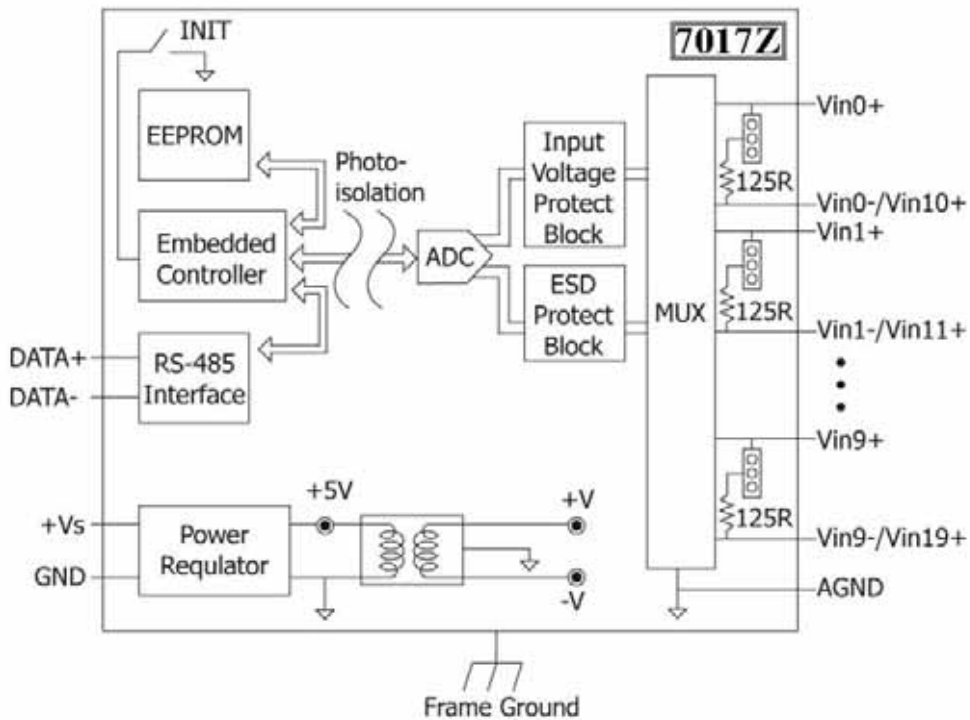
1.4.6 Block diagram for the I-7018, I-7018P and M-7018
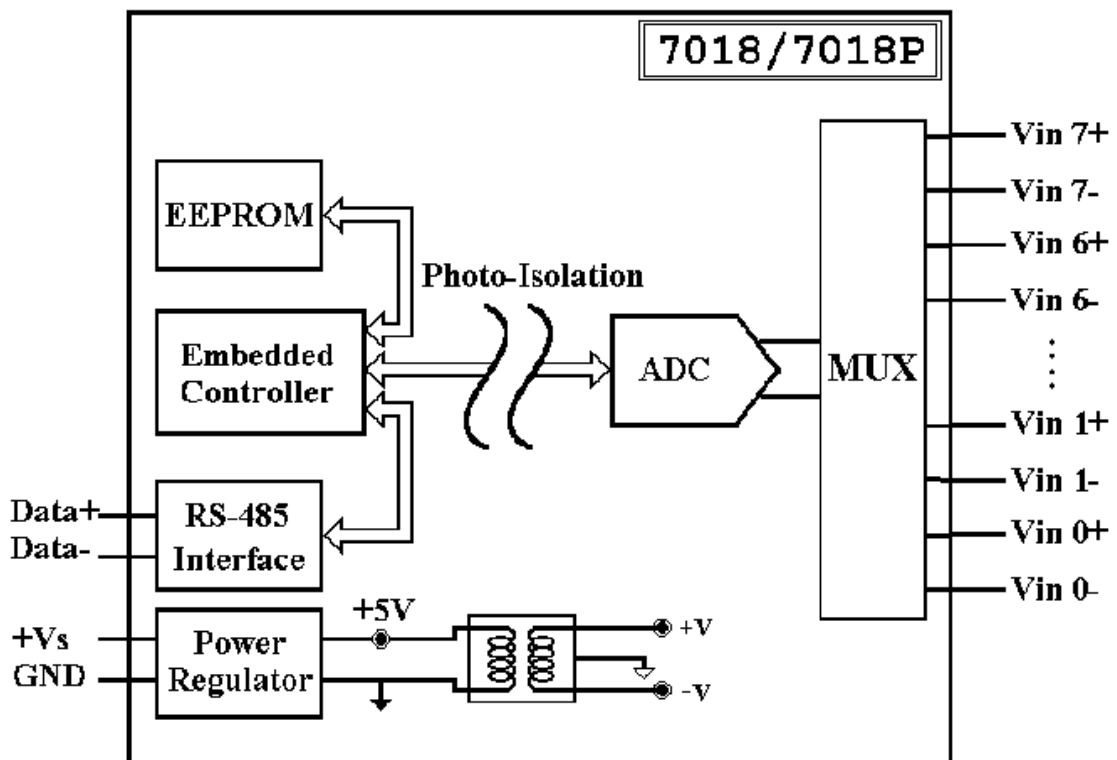
1.4.7 Block diagram for the I-7018BL
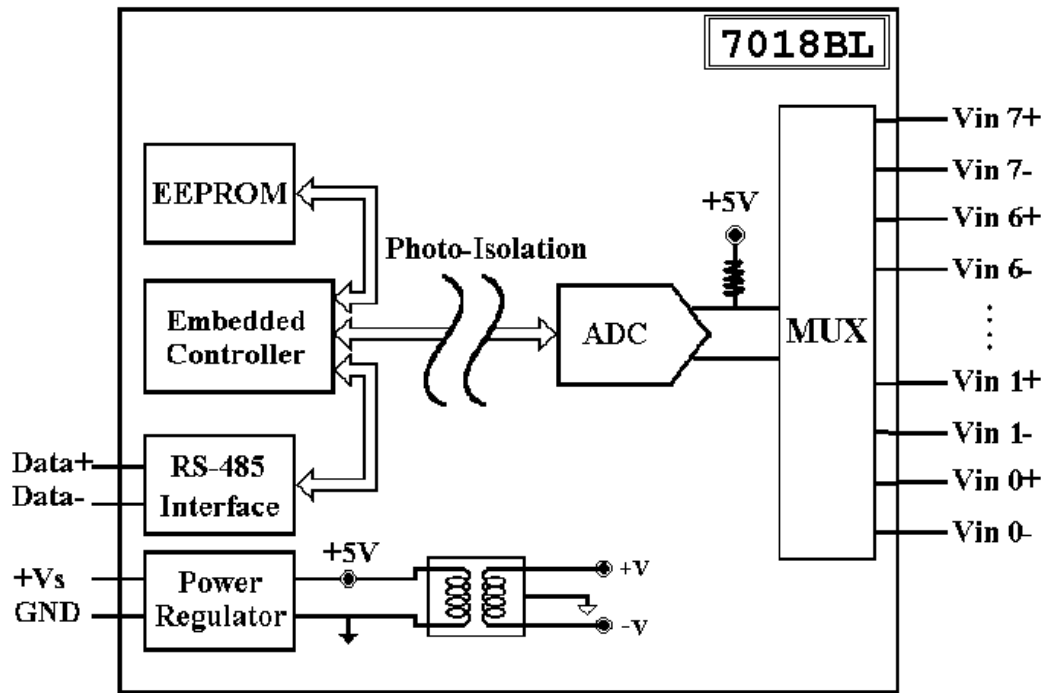
1.4.8 Block diagram for the I-7018R and M-7018R
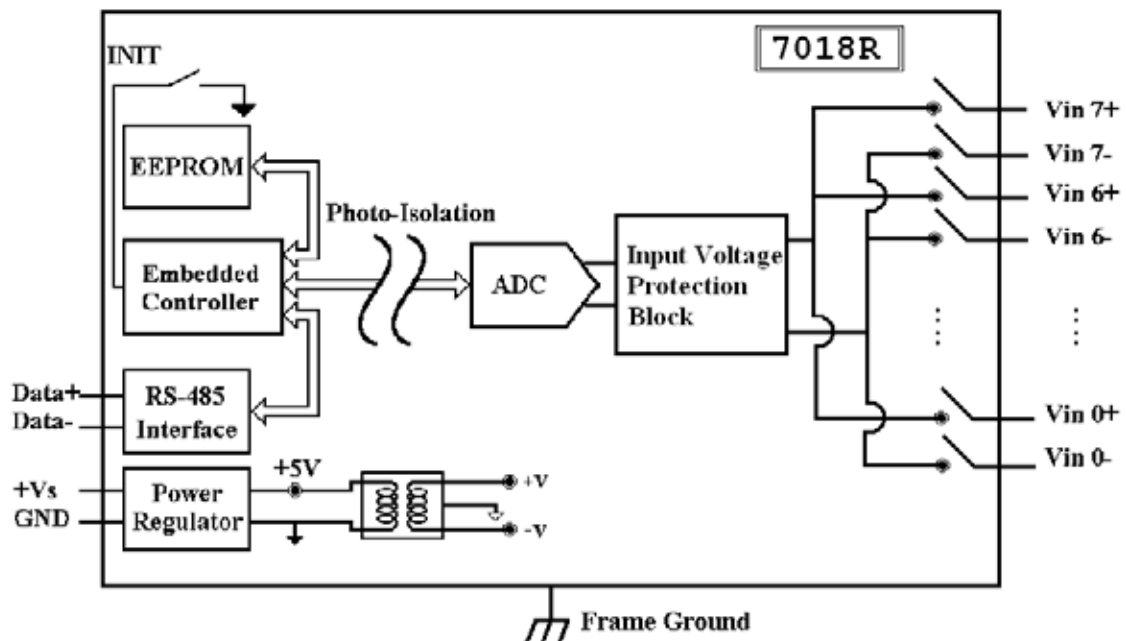
1.4.9 Block diagram for the I-7018Z and M-7018Z
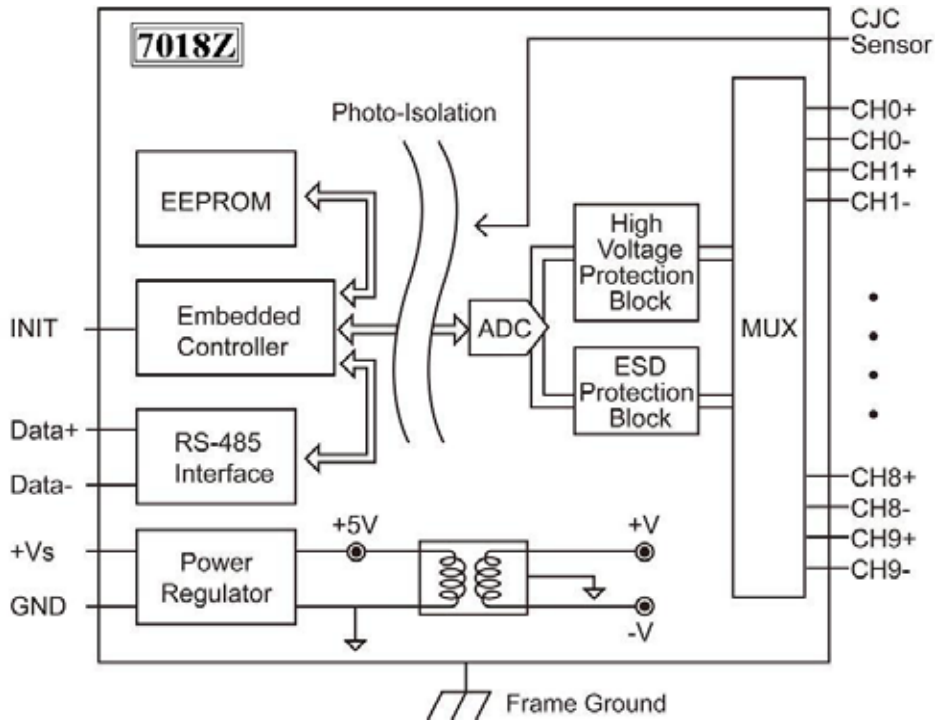
1.4.10 Block diagram for the I-7019R and M-7019R
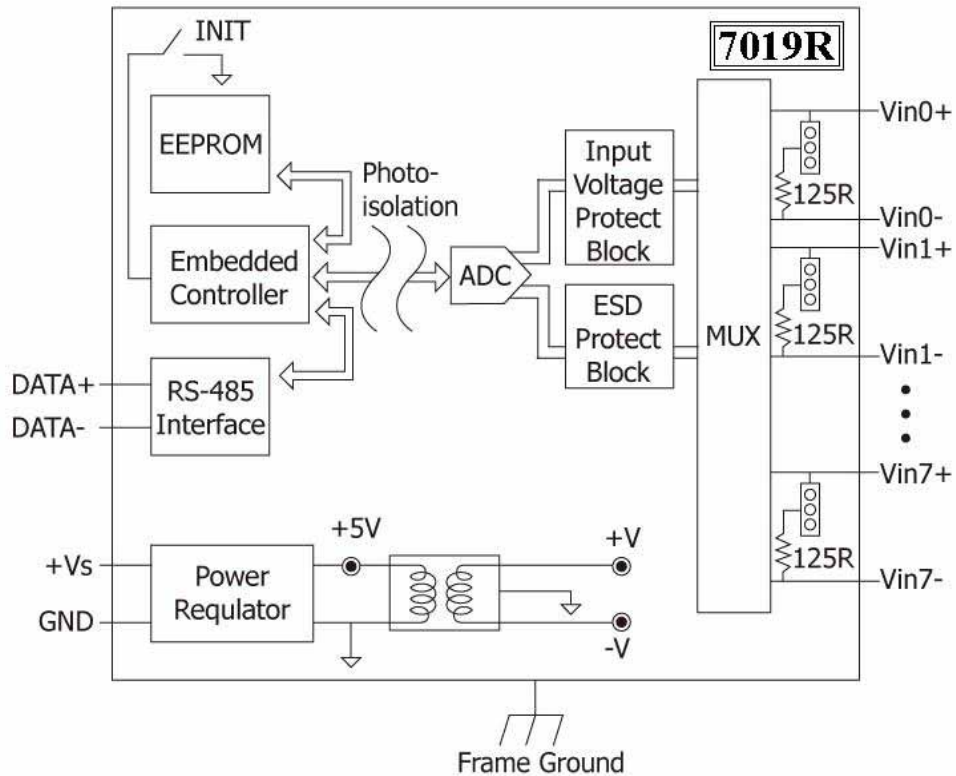
1.4.11 Block diagram for the M-7019Z
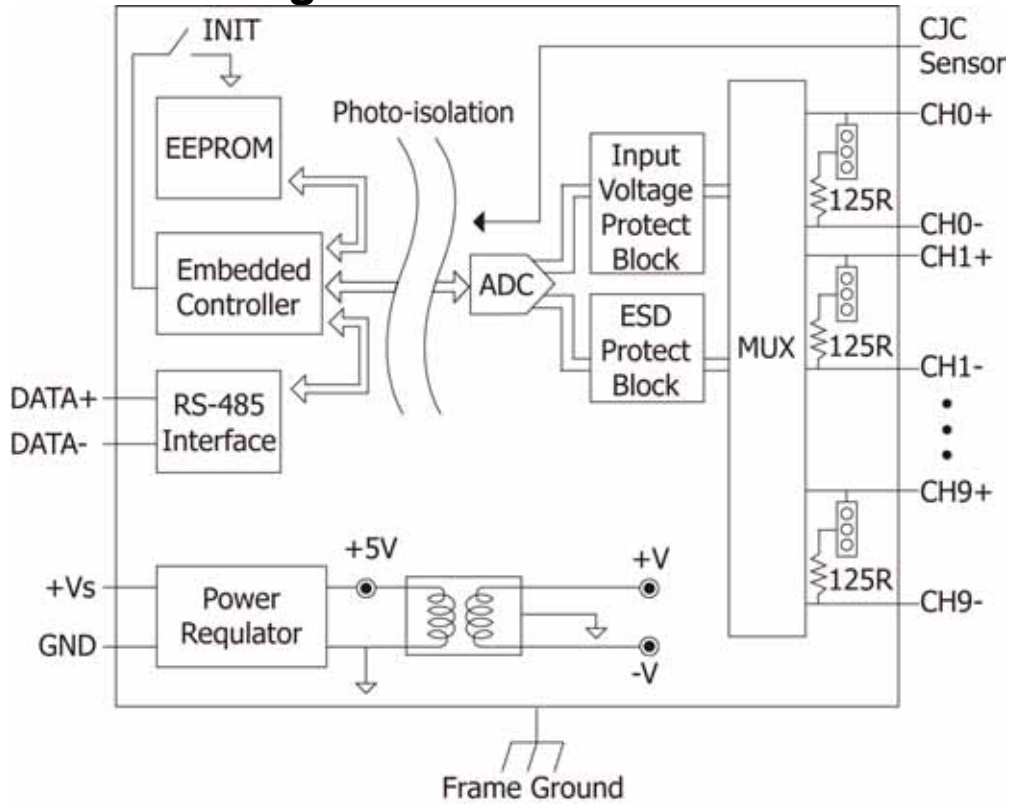
1.5 Dimensions

1.5.1 Modules without Frame Ground

The dimensions of the I-7017, I-7017F, I-7018, I-7018P and I-7018BL are as shown below.

Back View

Side View

Top View

Front View
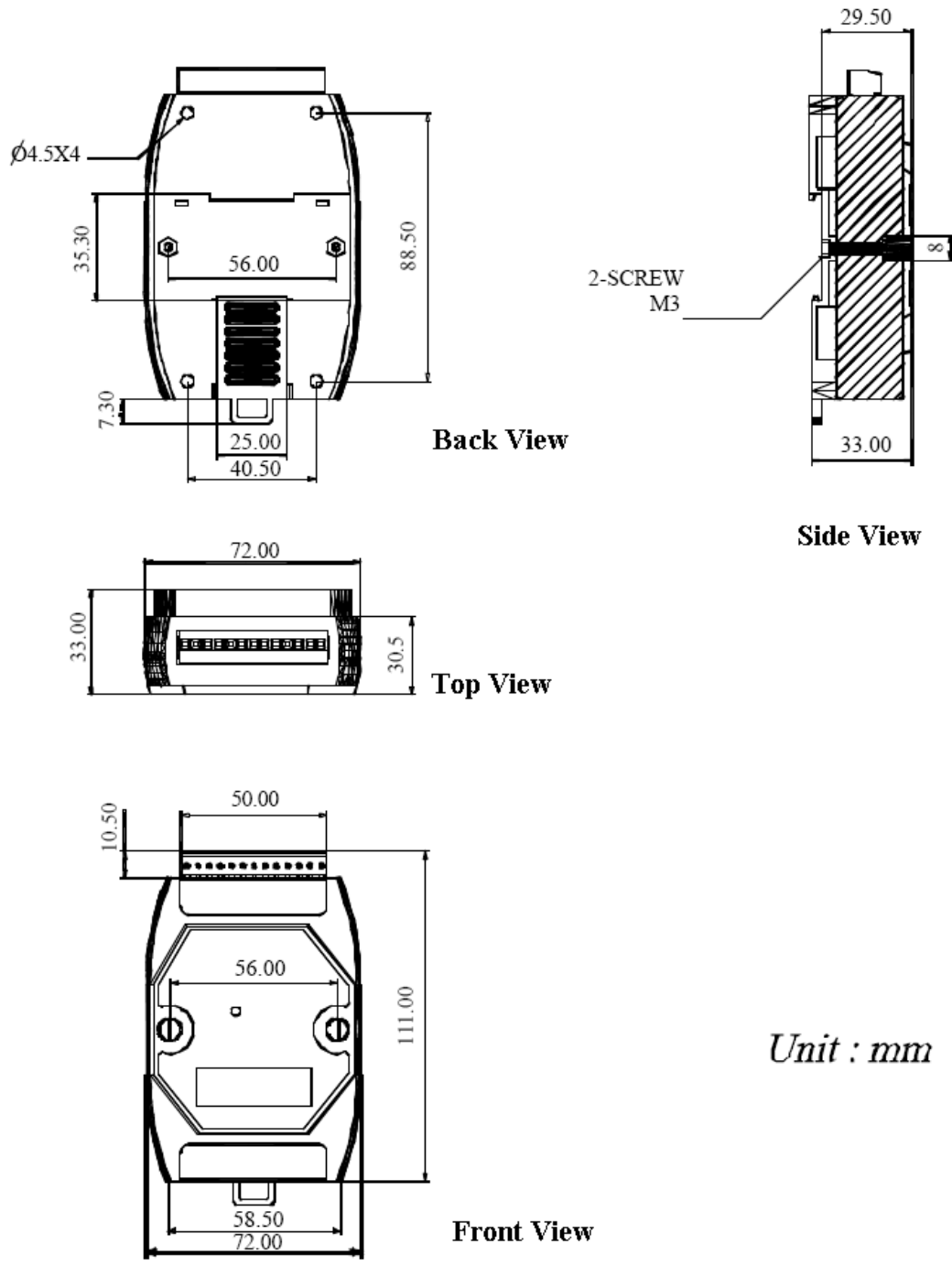
Unit : mm

1.5.2 Modules with Frame Ground

The dimensions of the M-7017, I-7017C, I-7017FC, M-7017C, I-7017R, M-7017R, I-7017RC, M-7017RC, I-7017R-A5, M-7017R-A5, I-7017Z, M-7017Z, M-7018, I-7018R, M-7018R, I-7018Z, M-7018Z, I-7019R, M-7019R and M-7019Z are as shown below.

Back View

Side View

Top View

Unit : mm

Front View
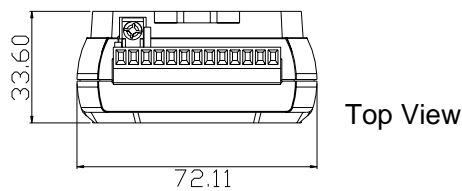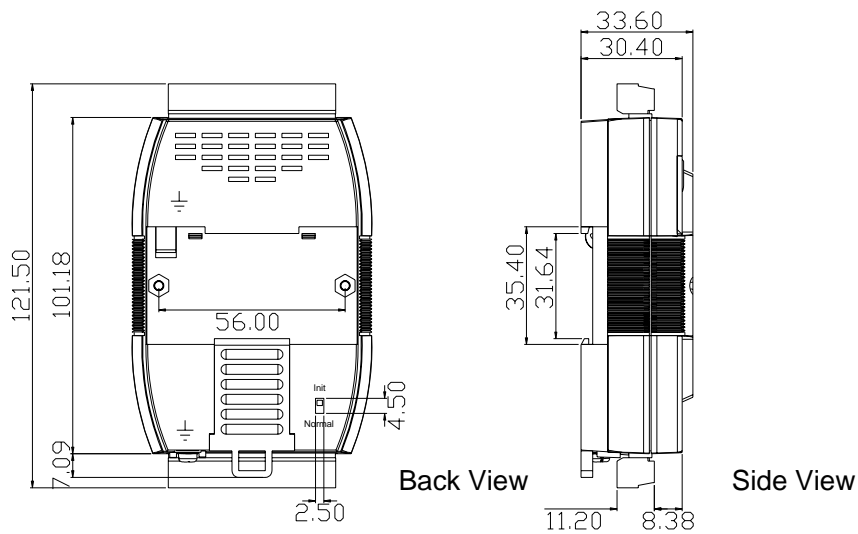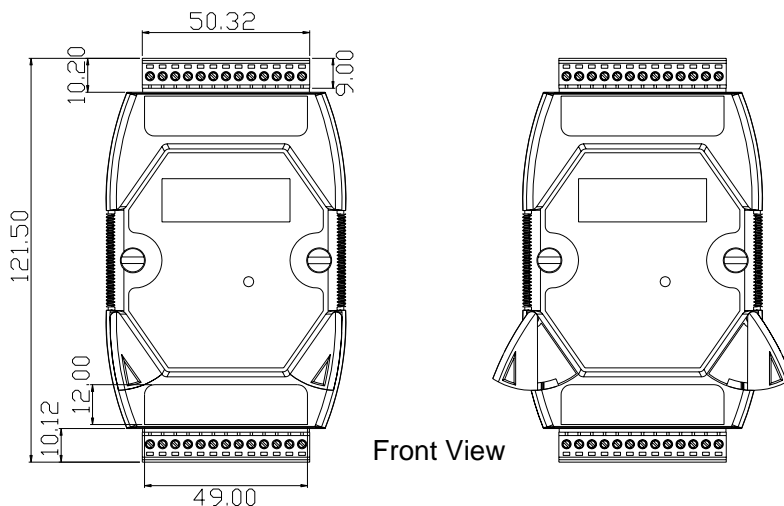
1.6 Wiring Diagrams

1.6.1 Wiring diagram for the I-7017, I-7017F, I-7017R, M-7017 and M-7017R

For I-7017R, M-7017, M-7017R and channels 0 to 5 of I-7017 and I-7017F
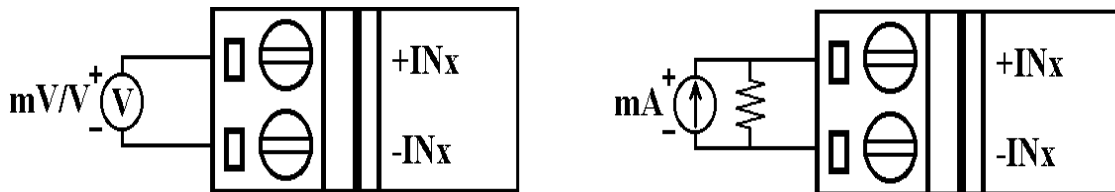
For channels 6 and 7 of I-7017 and I-7017F, single-ended mode, INIT mode available (factory default)
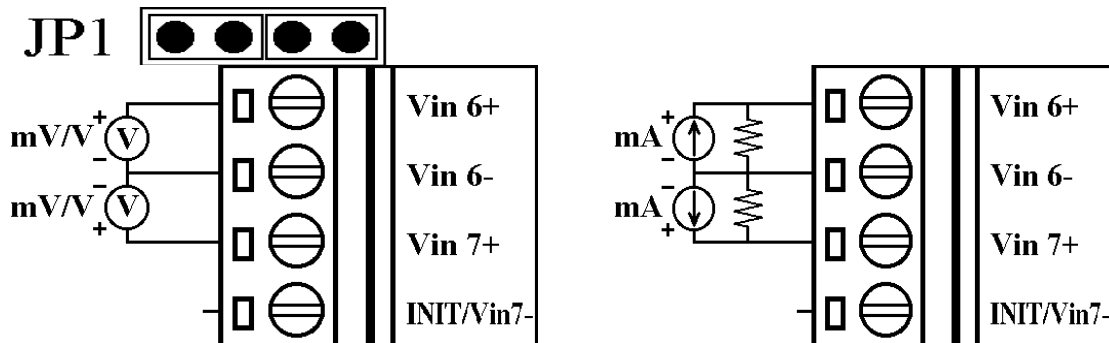
For channels 6 and 7 of I-7017 and I-7017F, differential mode, INIT mode not available
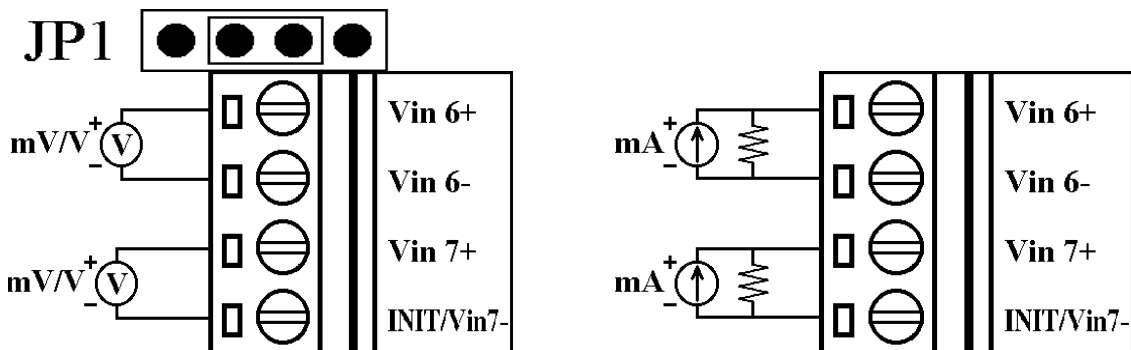
Note: When connecting to a current source, an optional external 125-ohm resistor is required.

1.6.2 Wiring diagram for the I-7017C, I-7017FC, I-7017RC, M-7017C and M-7017RC
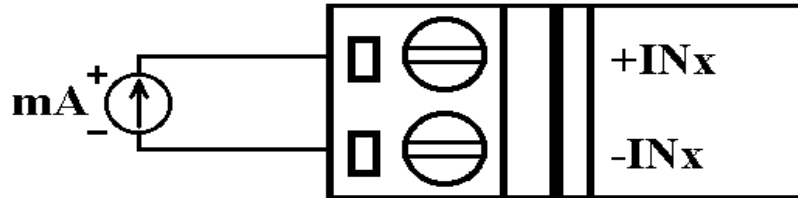
1.6.3 Wiring diagram for the I-7017R-A5 and M-7017R-A5
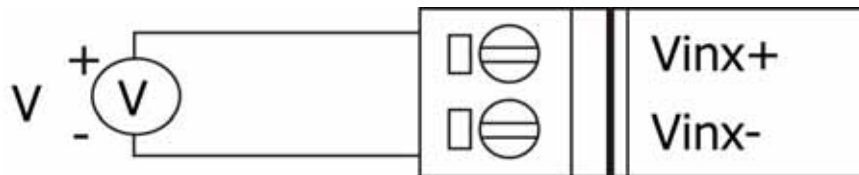
1.6.4 Wiring diagram for the I-7017Z and M-7017Z

Voltage Input		
	Differential Mode	Single-ended Mode
Current Input		

1.6.5 Wiring diagram for the I-7018, I-7018P, I-7018BL, I-7018R, I-7018Z, M-7018, M-7018R and M-7018Z

For I-7018R, I-7018Z, M-7018, M-7018R, M-7018Z and channels 0 to 5 of I-7018, I-7018P and I-7018BL
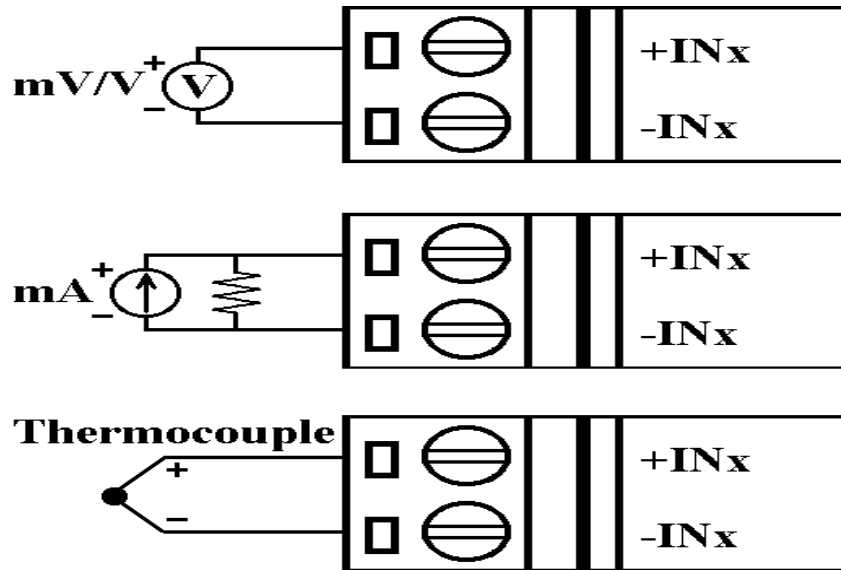
For channels 6 and 7 of I-7018, I-7018P and I-7018BL

Single-ended mode, INIT mode available (factory default)

Differential mode, INIT mode not available
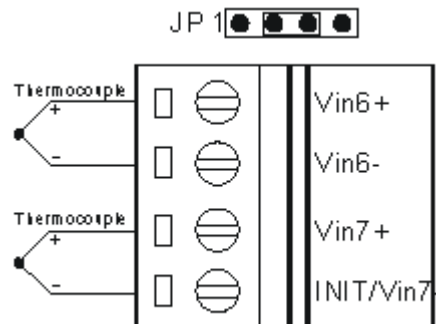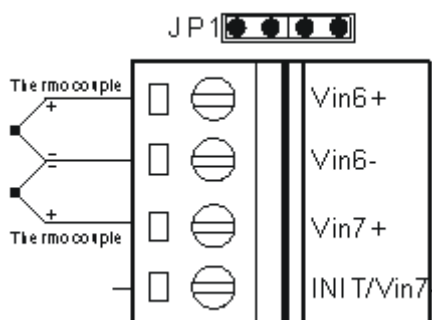
For voltage and current inputs of channels 6 and 7 of I-7018, I-7018P and I-7018BL, the wiring is the same as channels 6 and 7 of I-7017 as shown in Section 1.6.1.

Note: When connecting to a current source, an optional external 125-ohm resistor is required.

1.6.6 Wiring diagram for the I-7019R, M-7019R and M-7019Z
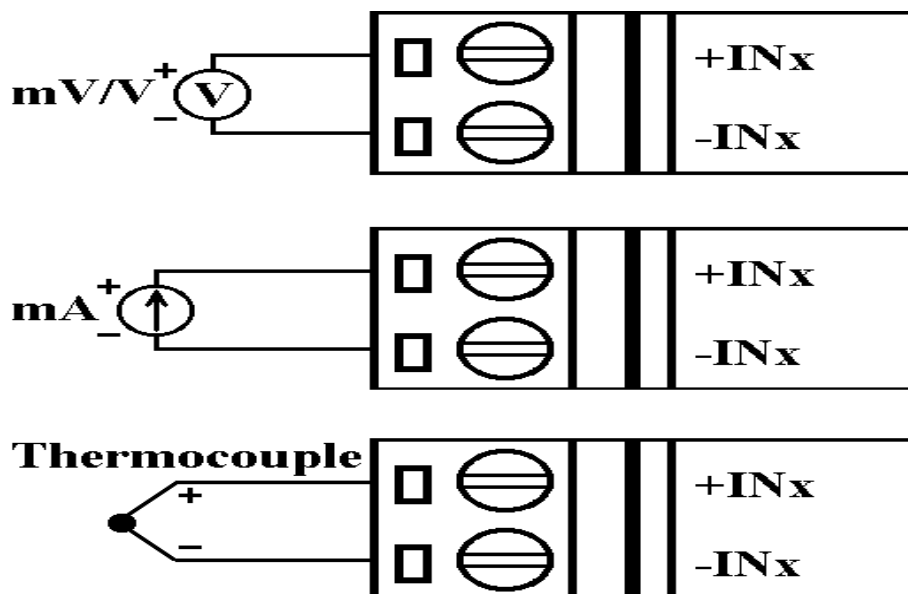
Note: When a channel is connected to a current source, the corresponding jumper should be shorted, see Section 1.7.2 for details.

1.7 Jumper Settings

Note: To access the jumpers, the cover must be opened.

1.7.1 I-7017, I-7017F, I-7018, I-7018P and I-7018BL Jumper Settings

For the I-7017, I-7017F, I-7018, I-7018P and I-7018BL modules, the INIT* terminal is shared with the Vin7- terminal. The functionality of the terminal is set using the JP1 jumper. The position of the JP1 jumper is shown in the figure below.
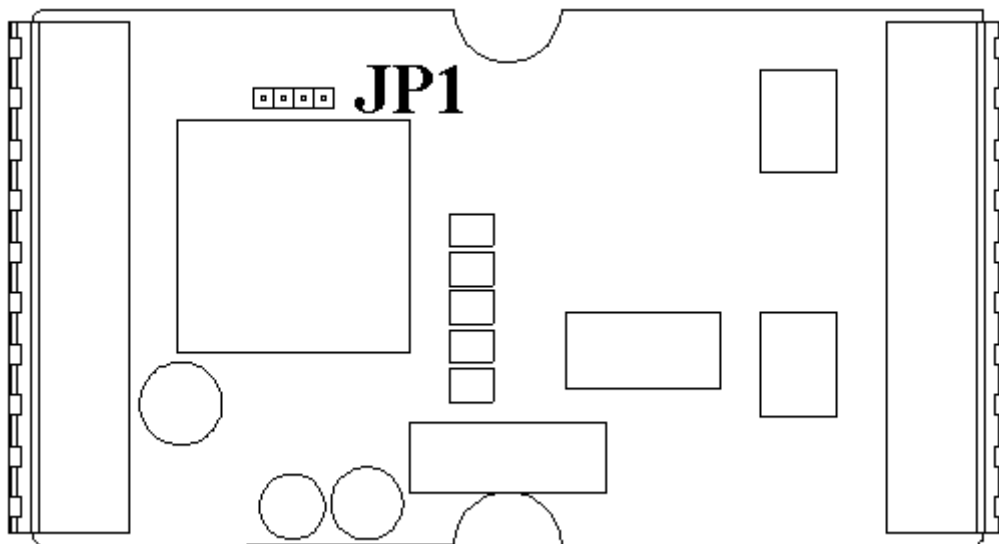
The settings for the JP1 jumper are as follows.

JP1 ●●●●	**Terminal INIT*/Vin7- is set to INIT*. Channels 6 and 7 are in single-ended mode and INIT mode is available. (factory default)**
JP1 ●●●●	**Terminal INIT*/Vin7- is set to Vin7-. Channels 6 and 7 are in differential mode and INIT mode is not available.**

1.7.2 I-7019R and M-7019R Jumper Settings

The I-7019R and M-7019R modules can accept current inputs from –20mA to 20mA. No external resistor required but the corresponding jumper must be shorted. The following figure shows the jumper positions.
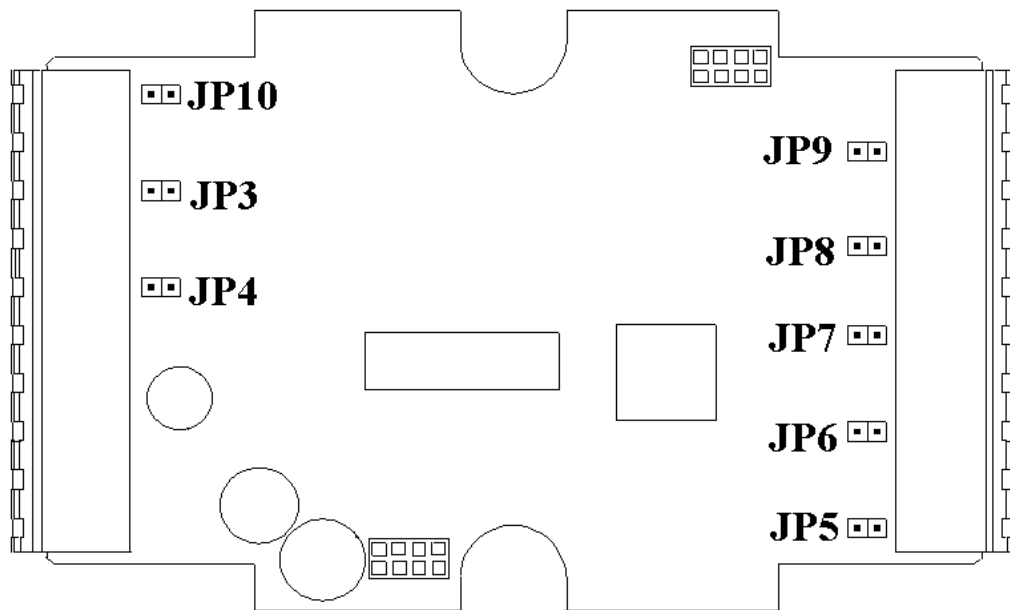
The corresponding jumpers and channels are as follows.

Channel	0	1	2	3	4	5	6	7
Jumper	JP5	JP6	JP7	JP8	JP9	JP10	JP3	JP4

When a channel is connected to a current input, the corresponding jumper should be shorted. For example, to connect a current input to channel 3, short the JP8 jumper.

For I-7019R and M-7019R PCB version 4.4 and later, the jumpers for current input are shown in the following figure.
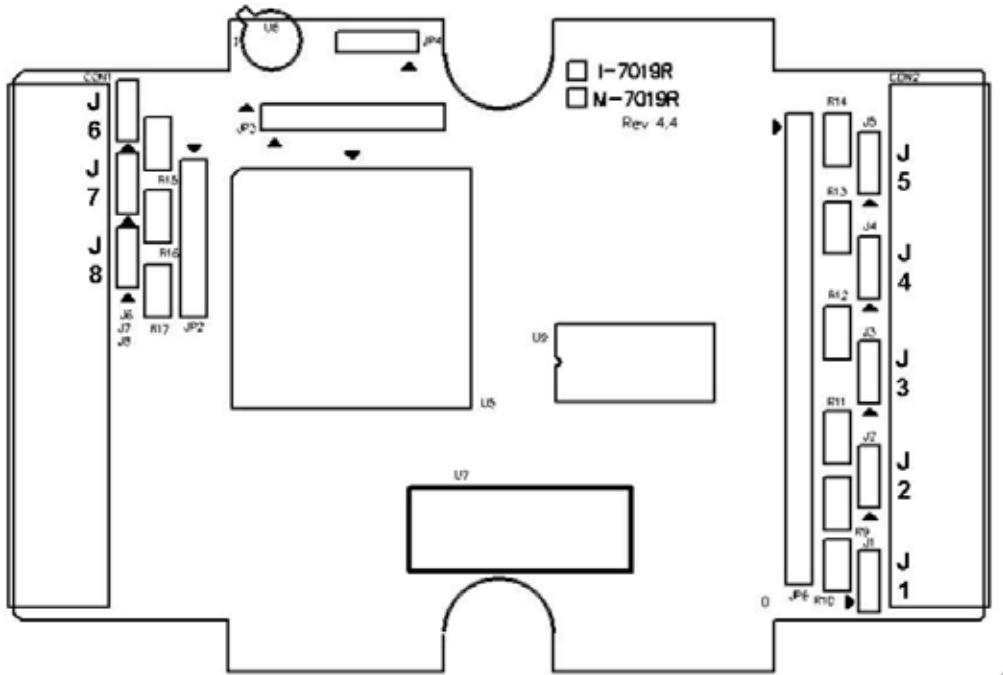
The corresponding jumpers and channels are as follows.

Channel	0	1	2	3	4	5	6	7
Jumper	J1	J2	J3	J4	J5	J6	J7	J8

The jumper position for voltage and current inputs are:

Voltage Input		Current Input	
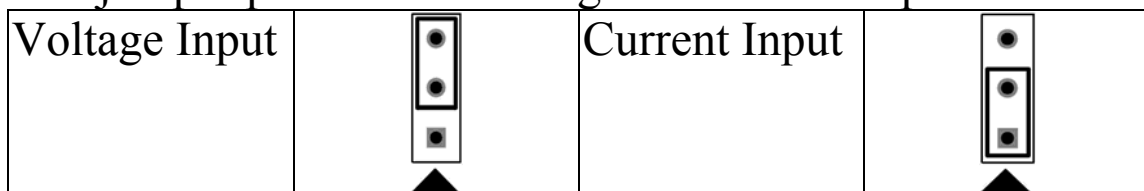
1.7.3 M-7019Z Jumper Settings
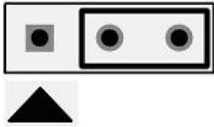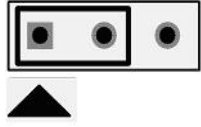
The M-7019Z can accept current inputs from –20mA to 20mA. No external resistor required but the corresponding jumper must be shorted. The following figure shows the jumper positions.
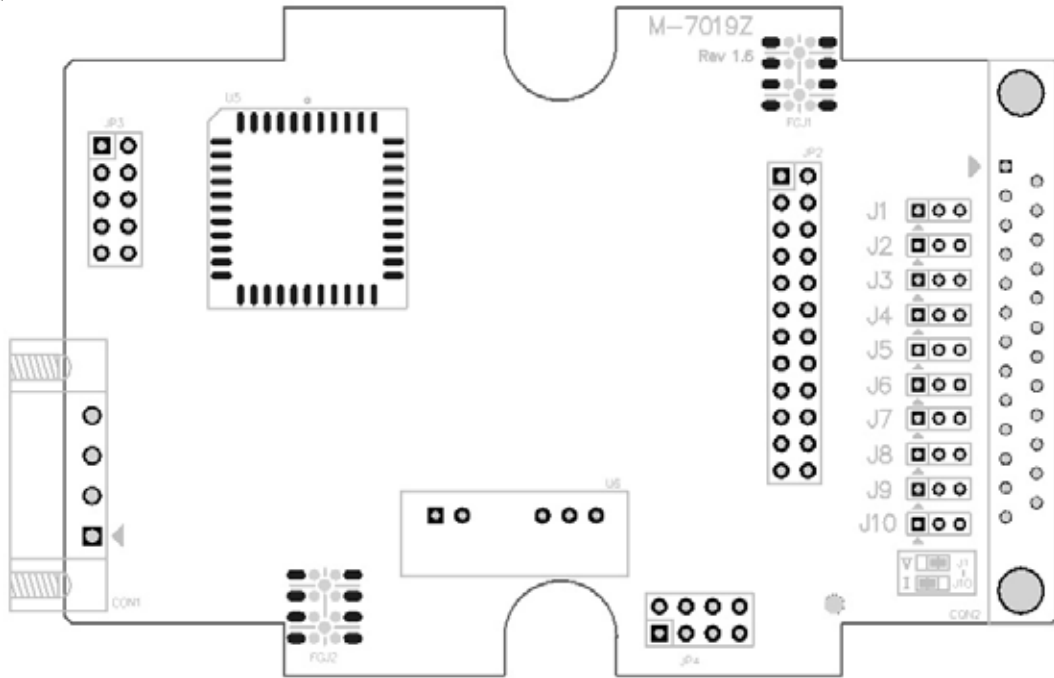
The corresponding jumpers and channels are as follows.

Channel	0	1	2	3	4	5	6	7	8	9
Jumper	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10

The jumper position for voltage and current inputs are:

Voltage Input		Current Input	

1.8 Quick Start

To install the module, follow the steps below:
1. Connect the analog input. See Section 1.2 for the terminal assignment and Section 1.6 for the wiring diagram.
2. Connect the module to the RS-485 network using the DATA+ and DATA- terminals. See Section 1.2 for the terminal assignment. If the host is only equipped with an RS-232 interface, then an RS-232 to RS-485 converter will be required. Refer to the "**I-7000 Bus Converter User's Manual**" for more information.
3. Connect the module to the power supply using the +Vs and GND terminals. See Section 1.2 for the terminal assignment. Note that the voltage supplied should be in the range of +10 to +30V DC.
4. For I-7000 modules, configure the module by sending the %AANNTTCCFF command. See Section 2.1 for details. To configure the I-7017Z, I-7018Z and I-7019 series, the $AA7CiRrr command must also be sent. See Section 2.14 for details. For M-7000 modules using the Modbus RTU protocol, configure the module using the following functions.
   □ Sub-function 04h of Function 46h, see Section 3.3.2
   □ Sub-function 06h of Function 46h, see Section 3.3.4
   □ Sub-function 08h of Function 46h, see Section 3.3.6
   The default settings for the module can be found in Section 1.9.
5. For I-7000 modules, in order to read data from the input channels, send either the #AA or #AAN command to the module. See Sections 2.3 and 2.4 for details. For M-7000 modules using the Modbus RTU

protocol, use Function 04h to read the data from the input channels. See Section 3.2 for details.

6. If the host is a PC with a Windows operating system installed, the DCON Utility can be used to allow easy configuration and reading of data. The DCON Utility can be downloaded from the ICP DAS website (http://www.icpdas.com). The documentation for the DCON Utility can be found in the ''**Getting Started For I-7000 Series Modules**'' manual.

Refer to the ''**I-7000 Bus Converter User's Manual**'' and ''**Getting Started For I-7000 Series Modules**'' manuals for more details. The ''**Getting Started For I-7000 Series Modules**'' manual can be downloaded from the ICP DAS website (http://www.icpdas.com).

1.9 Default Settings

Default settings for the I-7017, I-7018 and I-7019 series modules are:

- Module address: 01
- Analog input type:
  Type 08, -10V to 10V, for the I-7017 and I-7019 series
  Type 1B, -150V to +150V for the I-7017R-A5
  Type 0D, -20mA to +20mA for the I-7017C, I-7017FC and I-7017RC
  Type 05, -2.5V to 2.5V, for the I-7018 series
- Baud Rate: 9600 bps
- Checksum disabled
- Engineering unit format
- Filter set at 60Hz rejection (Not used by the I-7019R, firmware version B2.6 and earlier)
- Fast mode for I-7017F and I-7017FC
- JP1 set to single-ended mode for the I-7017, I-7017F, I-7018, I-7018P and I-7018BL.

Default settings for the M-7017, M-7018 and M-7019 series modules are:

▫ Protocol: Modbus RTU
▫ Module address: 01
▫ Analog input type:

Type 08, -10V to 10V, for the M-7017 and M-7019 series

Type 1B, -150V to 150V, for the M-7017R-A5

Type 0D, -20mA to +20mA for the M-7017C and M-7017RC

Type 05, -2.5V to 2.5V, for the M-7018 series

▫ Baud Rate: 9600 bps
▫ Filter set at 60Hz rejection (Not used by the M-7019R, firmware version B2.6 and earlier)

1.10 Calibration

Warning: *It is not recommended that calibration be performed until the process is fully understood.*

The calibration procedure is as follows:
1. Warm up the module for 30 minutes.
2. Set the type code to the type you want to calibrate. Refer to Sections 2.1 and 2.14 for details.
3. Enable calibration. Refer to Section 2.30 for details.
4. Apply the zero calibration voltage/current.
5. Send the zero calibration command. Refer to Sections 2.6 and 2.7 for details.
6. Apply the span calibration voltage/current.
7. Send the span calibration command. Refer to Sections 2.5 and 2.8 for details.
8. Repeat steps 3 to 7 three times.

Notes:
1. For the I-7017 and I-7018 series, connect the calibration voltage/current to channel 0.
2. When calibrating type 06 for the I-7018 series and type 0D for the I-7017 series, a resistor of 125 ohms, 0.1% should be connected, not required for I-7017C, I-7017FC, I-7017RC, and I-7017Z. Refer to Section 1.6 for details.
3. When calibrating type 0D for the I-7017Z, the jumper of channel 0 should be set to the current input position.
4. For the I-7019 series, each channel should be calibrated separately. When calibrating type 06, the jumper of the corresponding channel should be short. Refer to Section 1.7.2 for details.
5. Calibration voltages and currents are shown below.

6. The M-7000 series modules must be switched to the DCON protocol mode before calibrating. Refer to Section 3.3.4 for details of the switching protocol.

Calibration voltages/current used by the I-7017 and M-7017 series:

Type Code	08	09	0A	0B	0C	0D
Zero Input	0V	0V	0V	0mV	0mV	0mA
Span Input	+10V	+5V	+1V	+500mV	+150mV	+20mA

Calibration voltages/current used by the I-7017R-A5 and M-7017R-A5:

Type Code	1B	1C
Zero Input	0V	0V
Span Input	+150V	+50V

Calibration voltages/current used by the I-7018 and M-7018 series:

Type Code	00	01	02	03	04	05	06
Zero Input	0mV	0mV	0mV	0mV	0V	0V	0mA
Span Input	+15mV	+50mV	+100mV	+500mV	+1V	+2.5V	+20mA

Calibration voltages/current used by the I-7019 and M-7019 series:

Type Code	00	01	02	03	04	05
Zero Input	0mV	0mV	0mV	0mV	0V	0V
Span Input	+15mV	+50mV	+100mV	+500mV	+1V	+2.5V
Type Code	06	08	09	0C[*1]	10[*2]	
Zero Input	0mA	0V	0V	0mV	0mV	
Span Input	+20mA	+10V	+5V	+150mV	+35mV	
*1: for firmware version B2.7 and later. *2: for firmware version B2.6 and earlier.						

1.11 Configuration Tables

Baud Rate Setting (CC)

Code	03	04	05	06	07	08	09	0A
Baud Rate	1200	2400	4800	9600	19200	38400	57600	115200

Note: The data bits are fixed at one start bit, eight data bits, no parity and one stop bit for both the I-7000 and M-7000 series.

Analog Input Type Setting (TT)

Type Code	Analog Input Type	Range
00	+/-15mV	-15mV ~ 15mV
01	+/-50mV	-50mV ~ 50mV
02	+/-100mV	-100mV ~ 100mV
03	+/-500mV	-500mV ~ 500mV
04	+/-1V	-1V ~ 1V
05	+/-2.5V	-2.5V ~ 2.5V
06	+/-20mA	-20mA ~ 20mA
07	+4 to +20mA	4mA ~ 20mA
08	+/-10V	-10V ~ 10V
09	+/-5V	-5V ~ 5V
0A	+/-1V	-1V ~ 1V
0B	+/-500mV	-500mV ~ 500mV
0C	+/-150mV	-150mV ~ 150mV
0D	+/-20mA	-20mA ~ 20mA
0E	Type J Thermocouple	-210°C ~ 760°C
0F	Type K Thermocouple	-270°C ~ 1372°C
10	Type T Thermocouple	-270°C ~ 400°C
11	Type E Thermocouple	-270°C ~ 1000°C
12	Type R Thermocouple	0°C ~ 1768°C
13	Type S Thermocouple	0°C ~ 1768°C
14	Type B Thermocouple	0°C ~ 1820°C
15	Type N Thermocouple	-270°C ~ 1300°C
16	Type C Thermocouple	0°C ~ 2320°C
17	Type L Thermocouple	-200°C ~ 800°C
18	Type M Thermocouple	-200°C ~ 100°C
19	Type L DIN43710 Thermocouple	-200°C ~ 900°C
1A	0 to +20mA	0 ~ 20mA

Type Code	Analog Input Type	Range
1B	+/-150V	-150V ~ 150V
1C	+/-50V	-50V ~ 50V

Note:
1. Types 00, 01, 02, 03, 04, 05, 06, 0E, 0F, 10, 11, 12, 13, 14, 15 and 16 are only used in I-7018, M-7018, I-7019 and M-7019 series modules.
2. Types 17 and 18 are only used in the I-7018P, I-7018R, I-7018Z, M-7018R, M-7018Z, I-7019R, M-7019R and M-7019Z.
3. Type 19 is only used in I-7018R, I-7018Z, M-7018R, M-7018Z, I-7019R, M-7019R and M-7019Z.
4. Types 08, 09, 0A, 0B, 0C and 0D are only used in I-7017, M-7017, I-7019 and M-7019 series modules.
5. Types 07 and 1A are only used in I-7017 and M-7017 firmware version B2.2 and later, I-7018Z, M-7018Z, M-7019Z and I-7019R and M-7019R firmware version B2.7 and later.
6. Types 1B and 1C are only used in the I-7017R-A5 and M-7017R-A5.
7. When type 07, 0D or 1A is selected in I-7017, I-7017R, I-7017F, M-7017, M-7017R and M-7017F modules, an optional external 125-ohm resistor is required for each channel, as shown in Section 1.6.1.
8. When type 06 is selected in I-7018 and M-7018 series modules, an optional external 125-ohm resistor is required for each channel, as shown in Section 1.6.5.
9. When type 07 or 1A are selected in I-7018Z and M-7018Z, an optional external 125-ohm resistor is required for each channel, as shown in Section 1.6.5.
10. When type 06, 07, 0D or 1A is selected in I-7019 and M-7019 series modules, the jumper of the

corresponding channel should be shorted, as shown in
Section 1.7.2.

Data Format Setting (FF)

7	6	5	4	3	2	1	0
FS	CS	MS	Reserved			DF	

Key	Description
DF	Data format 00: Engineering unit 01: % of FSR (full scale range) 10: 2's complement hexadecimal
MS	Mode settings for I-7017F, I-7017FC, I-7017R, I-7017RC, I-7017R-A5, I-7017Z, M-7017R, M-7017RC, M-7017R-A5 and M-7017Z 0: Normal mode (16 bits) 1: Fast mode (12 bits) Reserved for other modules and should be zero.
CS	Checksum settings 0: Disabled 1: Enabled
FS	Filter settings 0: 60Hz rejection 1: 50Hz rejection Reserved for the I-7019R and M-7019R firmware version B2.6 and earlier.

Note: The reserved bits should be zero.

Analog Input Type and Data Format Table

Type code	Input Type	Data Format	+F.S	-F.S.
00[*1]	-15 to +15 mV	Engineering unit	+15.000	-15.000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
01[*1]	-50 to +50 mV	Engineering unit	+50.000	-50.000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
02[*1]	-100 to +100 mV	Engineering unit	+100.00	-100.00
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
03[*1]	-500 to +500 mV	Engineering unit	+500.00	-500.00
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
04[*1]	-1 to +1 V	Engineering unit	+1.0000	-1.0000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
05[*1]	-2.5 to +2.5 V	Engineering unit	+2.5000	-2.5000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
06[*1]	-20 to +20 mA	Engineering unit	+20.000	-20.000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
07[*5]	+4 to +20 mA	Engineering unit	+20.000	+04.000
		% of FSR	+100.00	+000.00
		2's comp HEX	FFFF	0000
08[*2]	-10 to +10 V	Engineering unit	+10.000	-10.000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
09[*2]	-5 to +5 V	Engineering unit	+5.0000	-5.0000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000

Type code	Input Type	Data Format	+F.S	-F.S.
0A[*2]	-1 to +1 V	Engineering unit	+1.0000	-1.0000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
0B[*2]	-500 to +500 mV	Engineering unit	+500.00	-500.00
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
0C[*2]	-150 to +150 mV	Engineering unit	+150.00	-150.00
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
0D[*2]	-20 to +20 mA	Engineering unit	+20.000	-20.000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
0E[*1]	Type J Thermocouple -210 ~ 760°C	Engineering unit	+760.00	-210.00
		% of FSR	+100.00	-027.63
		2's comp HEX	7FFF	DCA2
0F[*1]	Type K Thermocouple -270 ~ 1372°C	Engineering unit	+1372.0	-0270.0
		% of FSR	+100.00	-019.68
		2's comp HEX	7FFF	E6D0
10[*1]	Type T Thermocouple -270 ~ 400°C	Engineering unit	+400.00	-270.00
		% of FSR	+100.00	-067.50
		2's comp HEX	7FFF	A99A
11[*1]	Type E Thermocouple -270 ~ 1000°C	Engineering unit	+1000.0	-0270.0
		% of FSR	+100.00	-027.00
		2's comp HEX	7FFF	DD71
12[*1]	Type R Thermocouple 0 ~ 1768°C	Engineering unit	+1768.0	+0000.0
		% of FSR	+100.00	+000.00
		2's comp HEX	7FFF	0000
13[*1]	Type S Thermocouple 0 ~ 1768°C	Engineering unit	+1768.0	+0000.0
		% of FSR	+100.00	+000.00
		2's comp HEX	7FFF	0000
14[*1]	Type B Thermocouple 0 ~ 1820°C	Engineering unit	+1820.0	+0000.0
		% of FSR	+100.00	+000.00
		2's comp HEX	7FFF	0000

Type code	Input Type	Data Format	+F.S	-F.S.
15[*1]	Type N Thermocouple -270 ~ 1300°C	Engineering unit	+1300.0	-0270.0
		% of FSR	+100.00	-020.77
		2's comp HEX	7FFF	E56B
16[*1]	Type C Thermocouple 0 ~ 2320°C	Engineering unit	+2320.0	+0000.0
		% of FSR	+100.00	+000.00
		2's comp HEX	7FFF	0000
17[*3]	Type L Thermocouple -200 ~ 800°C	Engineering unit	+800.00	-200.00
		% of FSR	+100.00	-025.00
		2's comp HEX	7FFF	E000
18[*3]	Type M Thermocouple -200 ~ 100°C	Engineering unit	+100.00	-200.00
		% of FSR	+050.00	-100.00
		2's comp HEX	4000	8000
19[*4]	Type L DIN43710 Thermocouple -200 ~ 900°C	Engineering unit	+900.00	-200.00
		% of FSR	+100.00	-022.22
		2's comp HEX	7FFF	E38E
1A[*5]	0 to +20 mA	Engineering unit	+20.000	+00.000
		% of FSR	+100.00	+000.00
		2's comp HEX	FFFF	0000
1B[*6]	-150 to +150 V	Engineering unit	+150.00	-150.00
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
1C[*6]	-50 to +50 V	Engineering unit	+50.000	-50.000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000

*1: only available with the I-7018, M-7018, I-7019 and M-7019 series
*2: only available with the I-7017, M-7017, I-7019 and M-7019 series
*3: only available with the I-7018P, I-7018Z, M-7018Z, I-7019R, M-7019R and M-7019Z.
*4: only available with the I-7019 and M-7019 series.
*5: only available with I-7017/M-7017 firmware version B2.2 and later, I-7018Z, M-7018Z, M-7019Z and I-7019R/M-7019R firmware version B2.7 and later.
*6: only available with I-7017R-A5 and M-7017R-A5

Thermocouple Over Range/Under Range Reading for the I-7018 series, version B1.4 and earlier.

	Over Range	Under Range
Engineering Unit	+9999	-0000
% of FSR	+9999	-0000
2's Complement HEX	+9999	-0000

Thermocouple Over Range/Under Range Reading for the I-7018 series, version B1.5 and later, M-7018 series, I-7019 series and the M-7019 series

	Over Range	Under Range
Engineering Unit	+9999.9	-9999.9
% of FSR	+999.99	-999.99
2's Complement HEX	7FFF	8000

Thermocouple Over Range/Under Range Reading for the M-7018 series and the M-7019 series with Modbus RTU protocol

Over Range	Under Range
7FFFh	8000h

1.12 M-7000 Notes

The main difference between the I-7000 and M-7000 series is that the M-7000 series has additional support for the Modbus RTU communication protocol, which is the default protocol of the M-7000 series. The communication Baud Rates for the Modbus RTU protocol can be in the range of 1200 bps to 115200 bps, and the parity, data and stop bits are fixed as no parity, 8 data bits and 1 stop bit.

Modbus functions supported by the module are described in Chapter 3.

1.12.1 Protocol Switching

To switch to the DCON protocol:
1. Uses sub-function 06h of the function 46h and set byte 8 to a value of 1. See Section 3.3.4 for details.
2. After a power-on reset, the communication protocol will be changed to DCON.

To switch to the Modbus RTU protocol:
1. Sends the $AAPN command and set N to a value of 1. Note that the slide switch on the rear side of the module should be set to the INIT position, see the figure on the next page. See Section 2.25 for details.
2. After a power-on reset, the communication protocol will be changed to the Modbus RTU protocol.

1.12.2 INIT Mode

When the module is powered on, with the rear slide switch set to the INIT position as shown in the figure below, the module is in INIT mode, (see Section A.1 for details), and the communication settings are as follows:

1. Address: 00
2. Baud Rate: 9600 bps
3. No checksum
4. Protocol: DCON

If communication with the module is not possible, set the module to the INIT mode and use the above settings to communicate with the module. To read the current settings, send the commands $AA2, (see Section 2.9), and $AAP, (see Section 2.24). To set new settings, send the commands %AANNTTCCFF, (see Section 2.1) and $AAPN, (see Section 2.25). The new communication settings will be effective after the next power-on reset.

INIT Switch
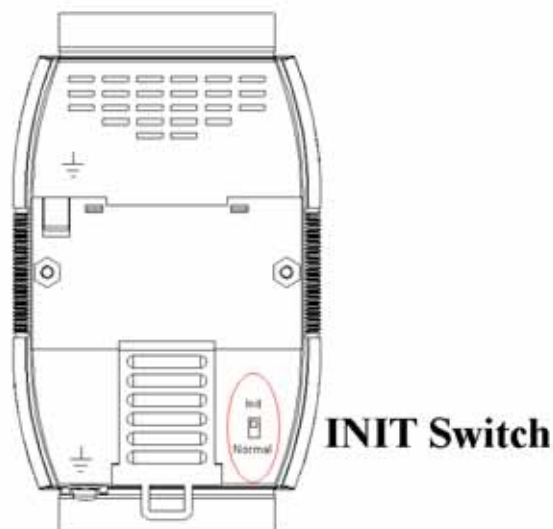
1.13 Mounting

1.13.1 DIN Rail Mounting
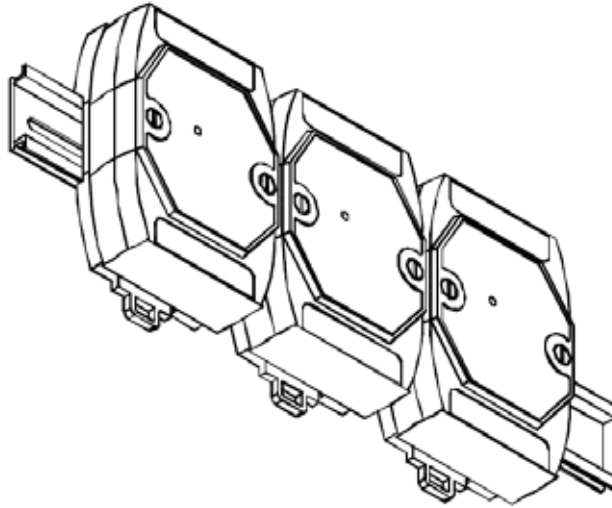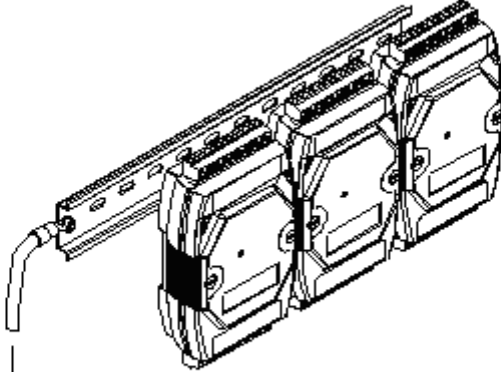
There are three new DIN rail models available. Each are made of stainless steel, which is stronger than those made of aluminum. There is a screw at one end and a ring terminal is included so that it can be easily connected to the earth ground. The three new DIN rail models are as follows.

Part number	Max number of modules	Dimensions
DRS-360	5	360mm x 35mm
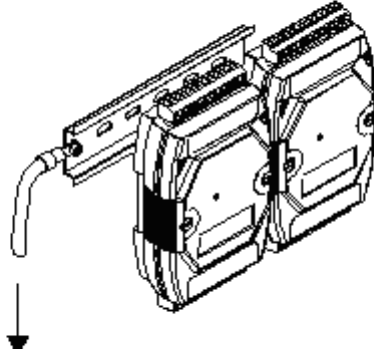
to earth ground

Part number	Max number of modules	Dimensions
DRS-240	3	240mm x 35mm

to earth ground

Part number	Max number of modules	Dimensions
DRS-125	2	125mm x 35mm

to earth ground

Note: The recommended wire to connect to the earth
ground is 16 – 14 AWG wire.

1.13.2 Piggyback Mounting

For I-7017, I-7017F, I-7018, I-7018P and I-7018BL modules
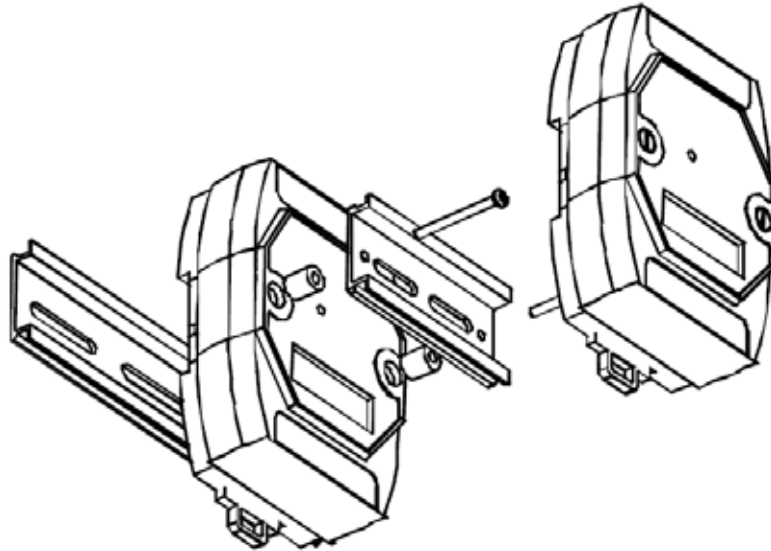
For other modules
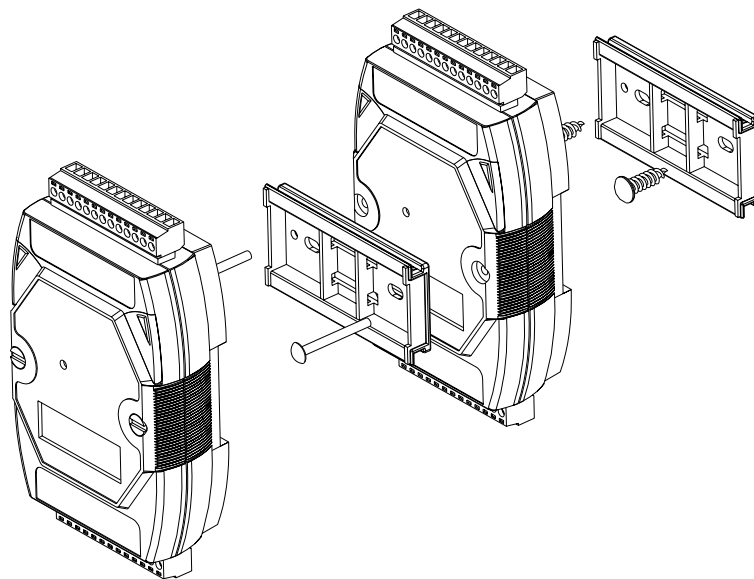
1.13.3 Wall Mounting
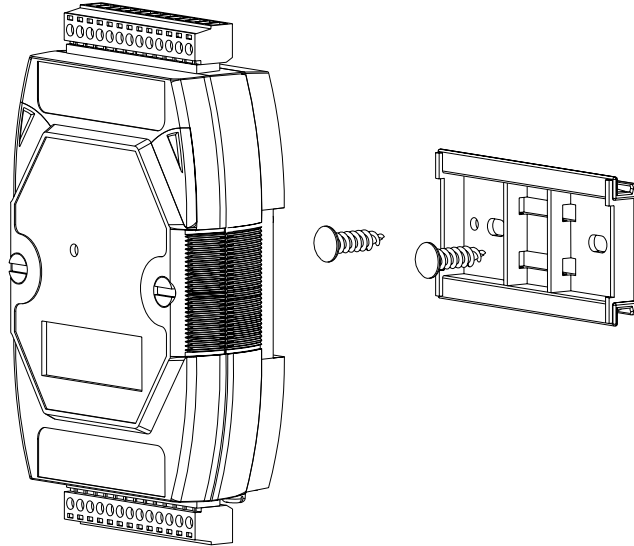
1.14 Technical Support

Should you encounter problems while using the I-7000 and M-7000 module, and are unable to find the help you need in this manual or on our website, please contact ICP DAS Product Support.

Email: support@icpdas.com
Website: http://www.icpdas.com/service/support.htm

When requesting technical support, be prepared to provide the following information about your system:
1. Module name and serial number: The serial number can be found printed on the barcode label attached to the cover of the module.
2. Firmware version: See Section 2.22 and 3.3.7 for information regarding the command used to identify the firmware version.
3. Host configuration (type and operating system)
4. If the problem is reproducible, please give full details describing the procedure used to reproduce the problem.
5. Specific error messages displayed. If a dialog box with an error message is displayed, please include the full text of the dialog box, including the text in the title bar.
6. If the problem involves other programs or hardware devices, please describe the details of the problem in full.
7. Any comments and suggestions related to the problem are welcome.

ICP DAS will reply to your request by email within three business days.

2. DCON Protocol

All communication with I-7000 modules consists of commands generated by the host and responses transmitted by the I-7000 modules. Each module has a unique ID number that is used for addressing purposes and is stored in non-volatile memory. The ID is 01 by default and can be changed using a user command. All commands to the modules contain the ID address, meaning that only the addressed module will respond. The only exception to this is commands #** (Section 2.2) and ~** (Section 2.34), which are sent to all modules, but in these cases, the modules do not reply to the command.

Command Format:

Leading Character	Module Address	Command	[CHKSUM]	CR

Response Format:

Leading Character	Module Address	Data	[CHKSUM]	CR

CHKSUM   A 2-character checksum that is present when the checksum setting is enabled. See Section 1.11 and 2.1 for details.

CR   End of command character, carriage return (0x0D)

Checksum Calculation:

1. Calculate the ASCII code sum of all the characters in the command/response string except for the carriage return character (CR).
2. The checksum is equal to the sum masked by 0ffh.

Example:

Command string: $012(CR)

1. Sum of the string = "$"+"0"+"1"+"2" = 24h+30h+31h+32h = B7h
2. Therefore the checksum is B7h, and so CHKSUM = "B7"
3. The command string with the checksum = $012B7(CR)

Response string: !01200600(CR)

1. Sum of the string = "!"+"0"+"1"+"2"+"0"+"0"+"6"+"0"+"0" = 21h+30h+31h+32h+30h+30h+36h+30h+30h = 1AAh
2. Therefore the checksum is AAh, and so CHKSUM = "AA"
3. The response string with the checksum = !01200600AA(CR)

Note:

All characters should be in upper case.

General Command Sets			
Command	**Response**	**Description**	**Section**
%AANTTCCFF	!AA	Set Module Configuration	2.1
#**	No Response	Synchronized Sampling	2.2
#AA	>(Data)	Reads the Analog Inputs of All Channels	2.3
#AAN	>(Data)	Reads the Analog Input of the Specified Channel	2.4
$AA0	!AA	Performs a Span Calibration	2.5
$AA1	!AA	Performs a Zero Calibration	2.6
$AA0Ci	!AA	Performs a Single Channel Zero calibration	2.7
$AA1Ci	!AA	Performs a Single Channel Span calibration	2.8
$AA2	!AANTTCCFF	Reads the Module Configuration	2.9
$AA3	>(Data)	Reads the CJC Temperature	2.10
$AA4	>AAS(Data)	Reads the Synchronized Data	2.11
$AA5VV	!AA	Enables/Disables the Channel	2.12
$AA6	!AAVV	Reads the Channel Enable/Disable Status	2.13
$AA7CiRrr	!AA	Sets the Single Channel Range Configuration	2.14
$AA8Ci	!AACiRrr	Reads the Single Channel Range Configuration	2.15
$AA9	!AA(Data)	Reads the CJC Offset	2.16
$AA9SNNNN	!AA	Sets the CJC Offset	2.17
$AAA	>(data)	Reads the Analog Inputs of All Channels in Hex Format	2.18
$AAA	!AAi	Reads the CJC Update Setting	2.19
$AAAi	!AA	Sets the CJC Update Setting	2.20
$AAB	!AANN	Reads the Channel Diagnostic Status	2.21
$AAF	!AA(Data)	Reads the Firmware Version	2.22
$AAM	!AA(Data)	Reads the Module Name	2.23
$AAP	!AASC	Reads the Protocol	2.24
$AAPN	!AA	Sets the Protocol	2.25

Command	Response	Description	Section
$AAS0	!AA	Internal Calibration	2.26
$AAS1	!AA	Reloads the Default Calibration Parameters	2.27
~AAC	!AAN	Reads the CJC Enable/Disable	2.28
~AACN	!AA	Enables/Disables the CJC	2.29
~AAEV	!AA	Enables/Disables the Calibration	2.30
~AAI	!AA	Soft INIT	2.31
~AAO(Name)	!AA	Sets the Module Name	2.32
~AATnn	!AA	Sets the Soft INIT Timeout	2.33
~AAEE	!AAN	Reads the Open Wire Detection Enable/Disable	2.39
~AAEEN	!AA	Enable/Disable Open Wire Detection	2.40
@AAS	!AAN	Read connecting mode	2.41
@AASN	!AA	Set connecting mode to differential or single-ended	2.42

Host Watchdog Command Sets			
Command	Response	Description	Section
~**	No Response	Host OK	2.34
~AA0	!AASS	Reads the Host Watchdog Status	2.35
~AA1	!AA	Resets the Host Watchdog Status	2.36
~AA2	!AAETT	Reads the Host Watchdog Timeout Settings	2.37
~AA3ETT	!AA	Sets the Host Watchdog Timeout Settings	2.38

2.1 %AANNTTCCFF

Description:
Sets the configuration of an analog input module.

Syntax:
%AANNTTCCFF[CHKSUM](CR)

%	Delimiter character
AA	Address of the module to be configured in hexadecimal format (00 to FF)
NN	New address of the module in hexadecimal format (00 to FF)
TT	New type code, see Section 1.11 for details. Not used by the I-7017Z, M-7017Z, I-7018Z, M-7018Z, I-7019 series and M-7019 series. For the I-7017Z, M-7017Z, I-7018Z, M-7018Z, I-7019 series and M-7019 series, use the $AA7CiRrr command to set the type of each channel, see Section 2.14 for details.
CC	New Baud Rate code, see Section 1.11 for details. To change the Baud Rate, the INIT* terminal must be connected to ground or the rear slide switch must be set to the INIT position. See Section A.1 for details.
FF	Used to set the data format, checksum, and filter settings (Section 1.11). To change the checksum setting, the INIT* terminal must be connected to ground or the rear slide switch must be set to the INIT position. See Section A.1 for details.

Note: The filter setting is not available in the I-7019R and M-7019R firmware version B2.6 and earlier.

Response:

Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**

!	Delimiter character for a valid response
?	Delimiter character for an invalid response. If changing the **Baud Rate** or **checksum** settings without connecting the INIT* pin to ground or switching the rear slide switch to the INIT position, the module will return an invalid command.
AA	Address of the module in hexadecimal format (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: %0102000600   Response: !02
    Change the address of module 01 to 02. The module
    returns a valid response.

Command: %0202000602   Response: !02
    Set the data format of module 02 to be 2 (2's
    complement hexadecimal). The module returns a
    valid response.

Command: %0101000A00   Response: ?01
    Change the Baud Rate of module 01 to 115200bps.
    The module returns an invalid command, because it
    is not in INIT* mode.

Command: %0101000A00   Response: !01
    Change the Baud Rate of module 01 to 115200bps
    and the module is in INIT* mode. The module
    returns a valid response.

Related Commands:

Section 2.9 $AA2, Section 2.31 ~AAI, Section 2.33
~AATnn

Related Topics:

Section 1.11 Configuration Tables, Section A.1 INIT
Mode

Notes:

1. Changes to the address, type code, data format and filter settings take effect immediately after a valid command is received. Changes to the Baud Rate and checksum settings take effect on the next power on reset.

2. For the I-7019 and M-7019 series modules, changing the Baud Rate and checksum settings can be achieved using software only and is performed using the following commands:

   I.   Send a ~AATnn command. See Section 2.33 for details.

   II. Send a ~AAI command. See Section 2.31 for details.

   III. Send a %AANNTTCCFF command.

   If the command is valid, the Baud Rate and checksum settings will be changed after the module responds with !AA.

2.2 #**

Description:

This command allows every analog input module to read data from every input channels when the command is received and will store the data for later retrieval.

Syntax:
#[CHKSUM](CR)**
Delimiter character
**   Synchronized sampling command

Response:

There is no response with this command. To access the data, another command, $AA4, must be sent, see Section 2.11 for details.

Examples:

Command: #**   No response

  Sends the synchronized sampling command.

Command: $014   Response:

>011+025.12+020.45+012.78+018.97+003.24+015.35+00
8.07+014.79

  Sends the command to read the synchronized data.
  The status byte of the response is 1, which means
  that it is the first time the synchronized data has
  been read since the previous #** command.

Command: $014   Response:

>010+025.12+020.45+012.78+018.97+003.24+015.35+00
8.07+014.79

  Sends the command to read the synchronized data.
  The status byte of the response is 0, which means
  that it is **NOT** the first time the synchronized data
  has been read since the previous #** command.

Related Commands:

Section 2.11 $AA4

Note:

1. This command is only applicable to I-7019 and M-
    7019 series modules.
2. After sending this command, there must be a 2ms delay
    before the next command can be sent.

2.3 #AA

Description:
Reads the data from every analog input channel.

Syntax:
#AA[CHKSUM](CR)

#	Delimiter character
AA	Address of the module to be read (00 to FF)

Response:

Valid Response:	**>(Data)[CHKSUM](CR)**
Invalid Response:	**?AA[CHKSUM](CR)**
>	Delimiter character for a valid response
?	Delimiter character for an invalid response
(Data)	Data from every analog input channels, see Section 1.11 for the details of data format. For the I-7019 and M-7019 series, data from disabled channels will be filled with space characters.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: #01   Response:
>+025.12+020.45+012.78+018.97+003.24+015.35+008.07+014.79

    Reads module 01 and receives the data in engineering format.

Command: #02   Response:
>4C532628E2D683A20F2ADBA16284BA71

    Reads module 02 and receives the data in hexadecimal format.

Command: #03   Response:
>-9999.9-9999.9-9999.9-9999.9-9999.9-9999.9-9999.9-9999.9

    Reads module 03 and the data is under range.

Related Commands:

Section 2.1 %AANNTTCCFF, Section 2.9 $AA2

Related Topics:

Section 1.11 Configuration Tables

2.4 #AAN, #AANN

Description:
Reads the analog input of channel N.

Syntax:
#AAN[CHKSUM](CR)

#	Delimiter character
AA	Address of the module to be read (00 to FF)
N	The channel to be read, zero based.
NN	For I-7017Z and M-7017Z single-end mode, the channel to be read, zero based in hex format.

Response:

Valid Response:	**>(Data)[CHKSUM](CR)**
Invalid Response:	**?AA[CHKSUM](CR)**
>	Delimiter character for a valid response
?	Delimiter character for an invalid response. An invalid command is returned if the specified channel is incorrect.
(Data)	Analog input data of the specified channel, see Section 1.11 for details of the data format. For I-7019 and M-7019 series modules, if the specified channel is disabled then the data field will be filled with space characters.
AA	Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: #032   Response: >+025.13

    Reads data from channel 2 of module 03.

Command: #0511   Response: >+025.13

    Reads data from channel 17 of module 05 for an
    I-7017Z in single-ended mode.

Command: #029   Response: ?02

    Reads data from channel 9 of module 02. An error is
    returned because channel 9 is invalid.

Related Commands:

Section 2.1 %AANNTTCCFF, Section 2.9 $AA2

Related Topics:

Section 1.11 Configuration Tables

2.5 $AA0

Description:
Performs a span calibration.

Syntax:
$AA0[CHKSUM](CR)

$ Delimiter character

AA   Address of the module to be calibrated (00 to FF)

0   Command for the span calibration

Response:
Valid Response: **!AA[CHKSUM](CR)**

Invalid Response: **?AA[CHKSUM](CR)**

!   Delimiter character for a valid response

?   Delimiter character for an invalid response

AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $010   Response: !01

    Performs a span calibration on module 01 and returns a valid response.

Command: $020   Response: ?02

    Performs a span calibration on module 02. An invalid command is returned because the "enable calibration" command was not sent in advance.

Related Commands:

Section 2.6 $AA1, Section 2.30 ~AAEV

Related Topics:

Section 1.10 Calibration

Notes:

1. This command is only applicable to I-7017, I-7018, M-7017 and M-7018 series modules.
2. This command is also applicable to I-7017Z, I-7018Z, M-7017Z and M-7018Z.
3. The "enable calibration" command, ~AAEV, must be sent before this command is used, see Section 1.10 for details.

2.6 $AA1

Description:
Performs a zero calibration.

Syntax:
$AA1[CHKSUM](CR)
$ Delimiter character
AA Address of the module to be set (00 to FF)
1   Command for the zero calibration

Response:
Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $011   Response: !01

      Performs a zero calibration on module 01 and returns a valid response.

Command: $021   Response: ?02

      Performs a zero calibration on module 02. An invalid command is returned because the "enable calibration" command was not sent in advance.

Related Commands:

Section 2.5 $AA0, Section 2.30 ~AAEV

Related Topics:

Section 1.10 Calibration

Notes:

1. This command is only applicable to I-7017, I-7018, M-7017 and M-7018 series modules.
2. This command is also applicable to I-7017Z, I-7018Z, M-7017Z and M-7018Z.
3. The "enable calibration" command, ~AAEV, must be sent before this command is used, see Section 1.10 for details.

2.7 $AA0Ci

Description:
Performs a zero calibration on the specified channel.

Syntax:
$AA0Ci[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be calibrated (00 to FF)
0	Command for the zero calibration
Ci	Specifies the channel to be calibrated

Response:
Valid Response: !AA[CHKSUM](CR)
Invalid Response: ?AA[CHKSUM](CR)

!	Delimiter character for a valid response
?	Delimiter character for an invalid response. An invalid command is returned if the specified channel is incorrect.
AA	Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $010C0   Response: !01

   Performs a zero calibration on channel 0 of module 01 and returns a valid response.

Command: $020C5   Response: !02

   Performs a zero calibration on channel 5 of module 02 and returns a valid response.

Command: $030C1   Response: ?03

   Performs a zero calibration on channel 1 of module 03. An invalid command is returned because the "enable calibration" command was not sent in advance.

Related Commands:

Section 2.8 $AA1Ci, Section 2.30~AAEV

Related Topics:

Section 1.10 Calibration

Notes:

1   This command is only applicable to I-7019 and M-7019 series modules.
2   The "enable calibration" command, ~AAEV, must be sent before this command is used, see Section 1.10 for details.
3   This command takes about 16 seconds for firmware version B2.6 and earlier.

2.8 $AA1Ci

Description:
Performs a span calibration on the specified channel.

Syntax:
$AA1Ci[CHKSUM](CR)
$ Delimiter character
AA   Address of the module to be calibrated (00 to FF)
1   Command for the span calibration
Ci   Specifies the channel to be calibrated

Response:
Valid Response: !AA[CHKSUM](CR)
Invalid Response: ?AA[CHKSUM](CR)
!   Delimiter character for a valid response
?   Delimiter character for an invalid response.   An invalid command is returned if the specified channel is incorrect.
AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $011C0   Response: !01
    Performs a span calibration on channel 0 of module 01 and returns a valid response.
Command: $021C5   Response: !02
    Performs a span calibration on channel 5 of module 02 and returns a valid response.
Command: $031C1   Response: ?03
    Performs a span calibration on channel 1 of module 03. An invalid command is returned because the "enable calibration" command was not sent in advance.

Related Commands:

Section 2.7 $AA0Ci, Section 2.30 ~AAEV

Related Topics:

Section 1.10 Calibration

Notes:

1. This command is only applicable to I-7019 and M-7019 series modules
2. The "enable calibration" command, ~AAEV, must be sent before this command is used, see Section 1.10 for details.
3. This command takes about 16 seconds for firmware version B2.6 and earlier.

2.9 $AA2

Description:
Reads the module configuration.

Syntax:
$AA2[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
2	Command to read the module configuration

Response:
Valid Response:　　!AATTCCFF[CHKSUM](CR)
Invalid Response:　?AA[CHKSUM](CR)

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
TT	Type code of the module, see Section 1.11 for details.
CC	Baud Rate code of the module, see Section 1.11 for details.
FF	Data format, checksum settings and filter settings of the module, see Section 1.11 for details.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $012   Response: !01050600
    Reads the configuration of module 01.
Command: $022   Response: !02030602
    Reads the configuration of module 02.

Related Commands:

Section 2.1 %AANNTTCCFF

Related Topics:

Section 1.11 Configuration Tables, Section A.1 INIT
Mode

2.10 $AA3

Description:
Reads the CJC (cold junction compensation) temperature.

Syntax:
$AA3[CHKSUM](CR)
$ Delimiter character
AA Address of the module to be read (00 to FF)
3   Command to read the CJC temperature

Response:
Valid Response: **>(Data)[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
>   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA Address of the responding module (00 to FF)
(Data) CJC temperature in degrees Celsius, consisting of a sign byte, '+' or '-', and followed by 5 decimal digits with a fixed decimal point in tenths of a degree.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $013   Response: >+0031.2

　　Reads the CJC temperature of module 01 and the module responds with 31.2℃.

Related Commands:

Section 2.16 $AA9, Section 2.17 $AA9SNNNN, Section 2.19 $AAA, Section 2.20 $AAAi, Section 2.28 ~AAC, Section 2.29 ~AACN

Notes:

1. This command is only applicable to I-7018, I-7019, M-7018 and M-7019 series modules.
2. For I-7018 and M-7018 series modules, the CJC offset is included in the reported CJC temperature. For I-7019 and M-7019 series modules, the CJC offset is not included.

2.11 $AA4

Description:
Reads the synchronized data that was obtained from the last #** command.

Syntax:
$AA4[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
4	Command to read the synchronized data

Response:
Valid Response: **>AAS(Data)[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**

>	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
S	Status of the synchronized data,
	1: first reading
	0: not the first reading
(Data)	Synchronized data. See Section 1.11 for details of the data format. For I-7019 and M-7019 series modules, data from disabled channels will be filled with space characters.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $014   Response: ?01

> Reads the synchronized data for module 01. An invalid command is returned because the #** command has not been sent in advance.

Command: #**   No response

> Sends the synchronized sampling command.

Command: $014   Response:
>011+025.56+002.34+015.79+022.66+008.53+021.43+007.06+022.88

> Reads the synchronized data for module 01. The module returns the synchronized data and sets the status byte to 1 to indicate that it is the first time the synchronized data has been read.

Command: $014   Response:
>010+25.56+002.34+015.79+022.66+008.53+021.43+007.06+022.88

> Reads the synchronized data for module 01. The module returns the synchronized data and sets the status byte to 0 to indicate that the synchronized data has been read.

Related Commands:

Section 2.2 #**

Note:

This command is only applicable to I-7019 and M-7019 series modules.

2.12 $AA5VV, $AA5VVVV

Description:
Specifies the channel(s) to be enabled.

Syntax:
$AA5VV(VV)[CHKSUM](CR)
$　　　　Delimiter character
AA　　　Address of the module to be set (00 to FF)
5　　　　Command to set the channel(s) to enabled
VV(VV)　A two-digit hexadecimal value, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 1 it means that the channel is enabled and 0 means that the channel is disabled. It is four-digit hexadecimal for I-7017Z, M-7017Z, I-7018Z, M-7018Z and M-7019Z. Note: it is six-digit hexadecimal for I-7017Z and M-7017Z in single-ended mode.

Response:
Valid Response:　**!AA[CHKSUM](CR)**
Invalid Response:　**?AA[CHKSUM](CR)**
!　　　　Delimiter character for a valid response
?　　　　Delimiter character for an invalid response. An invalid command is returned if an attempt is made to enable a channel that is not present.
AA　　　Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $0153A   Response: !01
>   Enables channels 1, 3, 4, and 5 and disables all other channels of module 01. The module returns a valid response.

Command: $016   Response: !013A
>   Reads the channel status of module 01 and returns a response of 3A, meaning that channels 1, 3, 4, and 5 are enabled and all other channels are disabled.

Related Commands:

Section 2.13 $AA6

Note:

1. It is recommended that only the channels that will be used are enabled.
2. For I-7017Z, M-7017Z, I-7018Z, M-7018Z and M-7019Z, the command is $AA5VVVV. The command is $AA5VVVVVV for I-7017Z and M-7017Z in single-ended mode.

2.13 $AA6

Description:
Reads the enabled/disabled status of each channel.

Syntax:
$AA6[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
6	Command to read the channel status

Response:

Valid Response:	**!AAVV(VV)[CHKSUM](CR)**
Invalid Response:	**?AA[CHKSUM](CR)**

!   Delimiter character for a valid response

?   Delimiter character for an invalid response

AA   Address of the responding module (00 to FF)

VV(VV) A two-digit hexadecimal value, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 1 it means that the channel is enabled and 0 means that the channel is disabled. It is four-digit hexadecimal for I-7017Z, M-7017Z, I-7018Z, M-7018Z and M-7019Z. Note: it is six-digit hexadecimal for I-7017Z and M-7017Z in single-ended mode.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $0153A   Response: !01

> Enables channels 1, 3, 4, and 5 and disables all other channels of module 01. The module returns a valid response.

Command: $016   Response: !013A

> Reads the channel status of module 01 and returns a response of 3A, meaning that channels 1, 3, 4, and 5 are enabled and all other channels are disabled.

Related Commands:

Section 2.12 $AA5VV

Note:

For I-7017Z, M-7017Z, I-7018Z, M-7018Z and M-7019Z, the format of the response is !AAVVVV. It is !AAVVVVVV for I-7017Z and M-7017Z in single-ended mode.

2.14 $AA7CiRrr

Description:
Sets the type code of a channel.

Syntax:
$AA7CiRrr[CHKSUM](CR)

$ Delimiter character
AA   Address of the module to be set (00 to FF)
7   Command to set the channel range code
Ci   i specifies the input channel to be set (0-9 for
            I-7017Z, M-7017Z, I-7018Z, M-7018Z and
            M-7019Z, 0-7 for I-7019R and M-7019R).
            Note: i is a two digits in hex format (00-13) for
            I-7017Z and M-7017Z in single-ended mode.
Rrr   rr represents the type code of the channel to be
            set. Refer to the Analog Input Type Setting table
            in Section 1.11 for details.

Response:
Valid Response: !AA [CHKSUM](CR)
Invalid Response: ?AA[CHKSUM](CR)
!   Delimiter character for a valid response
?   Delimiter character for an invalid response or
            invalid type code

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:
Command: $017C0R03   Response: !01

> Sets the type code for channel 0 of module 01 to be 03 (-500~+500mV) and the module returns a valid response.

Command: $027C5R16   Response: !02

> Sets the type code for channel 5 of module 02 to be 16 (Type C thermocouple, +0~+2320°C) and the module returns a valid response.

Command: $037C1R30   Response: ?03

> Sets the type code for channel 1 of module 03 to be 30. The module returns an invalid response because the type code is invalid.

Related Commands:
Section 2.15 $AA8Ci

Related Topics:
Section 1.11 Configuration Tables

Note:
This command is only applicable to I-7017Z, M-7017Z, I-7018Z, M-7018Z, I-7019 and M-7019 series modules.

2.15 $AA8Ci

Description:
Reads the type code information of a channel.

Syntax:
$AA8Ci[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
8	Command to read the type code of a channel
Ci	Specifies which channel to access for the type code information (i=0-9 for I-7017Z, M-7017Z, I-7018Z, M-7018Z and M-7019Z, I=0-7 for I-7019R and M-7019R). Note: i is a two digits in hex format (00-13) for I-7017Z and M-7017Z in single-ended mode.

Response:
Valid Response: !AACiRrr[CHKSUM](CR)
Invalid Response: ?AA[CHKSUM](CR)

!	Delimiter character for a valid response
?	Delimiter character for an invalid response or invalid channel
AA	Address of the responding module (00 to FF)
Ci	Specifies which input channel to access to retrieve the type code information.
Rrr	Represents the type code of the specified input channel. Refer to the Analog Input Type Setting table in Section 1.11 for details.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $018C0   Response: !01C0R02

Reads the channel 0 input range of module 01 and returns 02 (-100~+100mV).

Related Commands:

Section 2.14 $AA7CiRrr

Related Topics:

Section 1.11 Configuration Tables

Note:

This command is only applicable to I-7017Z, M-7017Z, I-7018Z, M-7018Z, I-7019 and M-7019 series modules.

2.16 $AA9

Description:
Reads the CJC (cold junction compensation) offset value that is set by the $AA9SNNNN command (Section 2.17).

Syntax:
$AA9[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
9	Command to read the CJC offset value

Response:
Valid Response:	**!AA(Data)[CHKSUM](CR)**
Invalid Response:	**?AA[CHKSUM](CR)**
!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
(Data)	CJC offset value consisting of a sign byte, '+' or '-', followed by 4 hexadecimal digits. Each count is equal to 0.01°C.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $019   Response: !01+0010

> Reads the CJC offset of module 01 and the module responds with +10 which means +0.16°C.

Related Commands:

Section 2.10 $AA3, Section 2.17 $AA9SNNNN, Section 2.19 $AAA, Section 2.20 $AAAi, Section 2.29 ~AACN

Note:

This command is only applicable to I-7018, M-7018, I-7019 and M-7019 series modules.

2.17 $AA9SNNNN

Description:
Sets the CJC (cold junction compensation) offset value to adjust the error produced by the CJC sensor.

Syntax:
$AA9SNNNN[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
9	Command to set the CJC offset value
S	Sign byte, '+' or '-', of the offset value
NNNN	The absolute value of the offset in four hexadecimal digits, which must be less than or equal to 1000h. Each count is equal to 0.01°C.

Response:
Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $019+0010   Response: !01

> Sets the CJC offset of module 01 to +0.16°C and returns a valid response.

Related Commands:

Section 2.10 $AA3, Section 2.16 $AA9, Section 2.19 $AAA, Section 2.20 $AAAi, Section 2.29 ~AACN

Note:

This command is only applicable to I-7018, M-7018, I-7019 and M-7019 series modules.

2.18 $AAA

Description:
Reads the data from every analog input channel in hex format.

Syntax:
$AAA[CHKSUM](CR)

$ Delimiter character
AA   Address of the module to be read (00 to FF)
A   Command to read every analog input

Response:
Valid Response: **>(Data)[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**

>   Delimiter character for a valid response
?   Delimiter character for an invalid response
(Data) Data from every analog input channels in hex format.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $01A

Response: >0000012301257FFF1802744F98238124

Reads module 01 and receives the data in hex format.

Related Commands:

Section 2.3 #AA

Note:

This command is only applicable to I-7017 and M-7017 series modules.

2.19 $AAA

Description:
Reads the CJC temperature update setting.

Syntax:
$AAA[CHKSUM](CR)
$ Delimiter character
AA Address of the module to be read (00 to FF)
A   Command to read the CJC temperature update setting

Response:
Valid Response: **!AAi[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA Address of the responding module (00 to FF)
i   CJC temperature update setting:
   0= CJC temperature update has been stopped.
   1= CJC temperature update has been started.
   2= Update CJC temperature once only.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $01A   Response: !011

> Reads the CJC temperature update setting of module 01 and the module responds with1, meaning that the CJC temperature update has been started.

Related Commands:

Section 2.10 $AA3, Section 2.16 $AA9, Section 2.17 $AA9SNNNN, Section 2.20 $AAAi, Section 2.29 ~AACN

Note:

This command is only applicable to I-7019 and M-7019 series modules.

2.20 $AAAi

Description:
Sets the CJC temperature update setting.

Syntax:
$AAAi[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
A	Command to set the CJC temperature update setting
i	CJC temperature update setting:

       0= stop the CJC temperature update

       1= start the CJC temperature update (default value)

       2= update the CJC temperature only once, after the command is received.

Response:
Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $01A1   Response: !01

  Sends a command to start the CJC temperature update of module 01 and returns a valid response.

Related Commands:

Section 2.10 $AA3, Section 2.16 $AA9, Section 2.17 $AA9SNNNN, Section 2.19 $AAA, Section 2.29 ~AACN

Note:

This command is only applicable to I-7019 and M-7019 series modules.

2.21 $AAB

Description:
Diagnoses the over-range, under-range, and wire opening status of the analog inputs.

Syntax:
$AAB[CHKSUM](CR)

$ Delimiter character

AA   Address of the module to be diagnosed (00 to FF)

B   Command to diagnose the analog inputs

Response:
Valid Response: !AANN[CHKSUM](CR)

Invalid Response: ?AA[CHKSUM](CR)

!   Delimiter character for a valid response

?   Delimiter character for an invalid response

AA   Address of the responding module (00 to FF)

NN   Represents the diagnostic results of every analog input channel (00 to FF), where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 1, it means that the channel is enabled and it is either over-range, under-range or wire opening. If the bit is 0 it means that the channel is disabled or normal.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $01B   Response: !0101

> Diagnoses the analog inputs of module 01. The module returns a valid response and channel 1 is either over-range, under-range or wire opening.

Note:

This command is only applicable to I-7019 and M-7019 series modules.

2.22 $AAF

Description:
Reads the firmware version of a module.

Syntax:
$AAF[CHKSUM](CR)
$ Delimiter character
AA   Address of the module to be read (00 to FF)
F   Command to read the firmware version

Response:
Valid Response: **!AA(Data)[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)
(Data)   A string indicating the firmware version of the module

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:
Command: $01F   Response: !01A2.0
     Reads the firmware version of module 01, and shows that it is version A2.0.

2.23 $AAM

Description:
Reads the name of a module.

Syntax:
$AAM[CHKSUM](CR)
$ Delimiter character
AA   Address of the module to be read (00 to FF)
M   Command to read the module name

Response:
Valid Response: !AA(Name)[CHKSUM](CR)
Invalid Response: ?AA[CHKSUM](CR)
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)
(Name)   A string showing the name of the module

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $01M   Response: !017018

Reads the module name of module 01 and returns the name "7018".

Related Commands:

Section 2.32 ~AAO(Name)

2.24 $AAP

Description:
Reads the communication protocol information.

Syntax:
$AAP[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
P	Command to read the communication protocol

Response:
Valid Response: !AASC[CHKSUM](CR)

Invalid Response: ?AA[CHKSUM](CR)

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
S	The protocols supported by the module 0: only DCON protocol is supported 1: both the DCON and Modbus RTU protocols are supported
C	Current protocol saved in EEPROM that will be used at the next power on reset 0: the protocol set in EEPROM is DCON 1: the protocol set in EEPROM is Modbus RTU

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $01P   Response: !0110

> Reads the communication protocol of module 01 and returns a response of 10 meaning that it supports both the DCON and Modbus RTU protocols and the protocol that will be used at the next power on reset is DCON.

Related Commands:

Section 2.25 $AAPN

Note:

This command is only applicable to M-7017, M-7018 and M-7019 series modules.

2.25 $AAPN

Description:
Sets the communication protocol.

Syntax:
$AAPN[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
P	Command to set the communication protocol
N	0: DCON protocol
	1: Modbus RTU protocol

Before using this command, the rear slide switch must be in the INIT position, see Section A.1 for details. The new protocol is saved in the EEPROM and will be effective after the next power on reset.

Response:

Valid Response:	!AA[CHKSUM](CR)
Invalid Response:	?AA[CHKSUM](CR)
!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $01P1   Response: ?01

    Sets the communication protocol of module 01 to
    Modbus RTU and returns an invalid response
    because the module is not in INIT mode.

Command: $01P1   Response: !01

    Sets the communication protocol of module 01 to
    Modbus RTU and returns a valid response.

Related Commands:

Section 2.24 $AAP

Related Topics:

Section A.1 INIT Mode

Note:

This command is only applicable to M-7017, M-7018 and
M-7019 series modules.

2.26 $AAS0

Description:
Performs an internal calibration on a module.

Syntax:
$AAS0[CHKSUM](CR)

$ Delimiter character

AA   Address of module to be calibrated (00 to FF)

S0   Command to perform the internal calibration

Response:
Valid Response: **!AA[CHKSUM](CR)**

Invalid Response: **?AA[CHKSUM](CR)**

!   Delimiter character for a valid response

?   Delimiter character for an invalid response

AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:
Command: $01S0   Response: !01

      Sends the command to perform an internal calibration on module 01 and returns a valid response.

Related Commands:
Section 2.27 $AAS1

Note:
This command is only applicable to I-7019 and M-7019 series modules.

2.27 $AAS1

Description:
Reloads the factory default calibration parameters, including the internal calibration parameters.

Syntax:
$AAS1[CHKSUM](CR)

$ Delimiter character

AA   Address of the module to be reloaded (00 to FF)

S1   Command to reload the factory default calibration parameters

Response:
Valid Response: **!AA[CHKSUM](CR)**

Invalid Response: **?AA[CHKSUM](CR)**

!   Delimiter character for a valid response

?   Delimiter character for an invalid response

AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:
Command: $01S1   Response: !01

      Sends the command to reload the factory default calibration parameters and returns a valid response.

Related Commands:

Section 2.26 $AAS0

Related Topics:

Section 1.10 Calibration

Note:

1. This command is only applicable to I-7019 and M-7019 series modules.
2. This command takes about three seconds for firmware version B2.7 and later.

2.28 ~AAC

Description:
Reads the CJC (cold junction compensation) enabled/disabled status.

Syntax:
~AAC[CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be read (00 to FF)
C	Command to read the CJC enabled/disabled status

Response:
Valid Response: **!AAN[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
N	0: CJC disabled
	1: CJC enabled

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~01C   Response: !011

> Sends a command to read the CJC enabled/disabled status of module 01 and shows that the CJC is enabled.

Related Commands:

Section 2.10 $AA3, Section 2.16 $AA9, Section 2.17 $AA9SNNNN, Section 2.19 $AAA, Section 2.20 $AAAi, Section 2.29 ~AACN

Note:

This command is only applicable to I-7018, M-7018, I-7019 and M-7019 series modules.

2.29 ~AACN

Description:
Enable/disable CJC (cold junction compensation).

Syntax:
~AACN[CHKSUM](CR)

~   Delimiter character
AA   Address of the module to be read (00 to FF)
C   Command to enable/disable CJC
N   0: disable CJC
            1: enable CJC

Response:
Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~01C0   Response: !01

> Sends a command to disable CJC of module 01 and returns a valid response.

Related Commands:

Section 2.10 $AA3, Section 2.16 $AA9, Section 2.17 $AA9SNNNN, Section 2.19 $AAA, Section 2.20 $AAAi, Section 2.28 ~AAC

Notes:

This command is only applicable to I-7018, M-7018, I-7019 and M-7019 series modules.

2.30 ~AAEV

Description:
Enable/Disable module calibration.

Syntax:
~AAEV[CHKSUM](CR)

~   Delimiter character
AA   Address of the module to be set (00 to FF)
E   Command to enable/disable calibration
V   1: enable calibration
          0: disable calibration

Response:
Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: $010   Response: ?01

> Sends the command to perform a span calibration on module 01. It returns an invalid response because the "enable calibration" command was not sent in advance.

Command: ~01E1   Response: !01

> Enables calibration on module 01 and returns a valid response.

Command: $010   Response: !01

> Sends the command to perform a span calibration on module 01 and returns a valid response.

Related Commands:

Section 2.5 $AA0, Section 2.6 $AA1, Section 2.7 $AA0Ci, Section 2.8 $AA1Ci

Related Topics:

Section 1.10 Calibration

2.31 ~AAI

Description:

The Soft INIT command is used to enable modification of the Baud Rate and checksum settings using software only.

Syntax:

~AAI[CHKSUM](CR)

~   Delimiter character
AA   Address of the module to be set (00 to FF)
I   Command to set the Soft INIT

Response:

Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**

!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~01I   Response: !01

    Sets the soft INIT of module 01 and returns a valid response.

Related Commands:

Section 2.1 %AANNTTCCFF, Section 2.33 ~AATnn

Related Topics:
Section A.1 INIT Mode

Notes:
1. This command is only applicable to I-7019 and M-7019 series modules.
2. The ~AATnn command should be sent prior to sending this command, see Section 2.33 for details.

2.32 ~AAO(Name)

Description:
Sets the name of a module.

Syntax:
~AAO(Name)[CHKSUM](CR)
~   Delimiter character
AA   Address of the module to be set (00 to FF)
O   Command to set the module name
(Name)   New name of the module (max. 6 characters).

Response:
Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~01O7019A   Response: !01

> Sets the name of module 01 to be "7019A" and returns a valid response.

Command: $01M   Response: !017019A

> Reads the name of module 01 and returns "7019A".

Related Commands:

Section 2.23 $AAM

2.33 ~AATnn

Description:
Sets the soft INIT time out value.

Syntax:
~AATnn[CHKSUM](CR)

~   Delimiter character

AA   Address of the module to be set (00 to FF)

T   Command to set the soft INIT time out value

nn   Two hexadecimal digits representing the time out value in seconds. The max time out value is 60 seconds. When changing the Baud Rate or checksum settings without altering the INIT* pin, the ~AAI and %AANNTTCCFF commands should be sent consecutively and the time interval between the two commands should be less than the soft INIT time out. If the soft INIT time out is 0, then the Baud Rate and checksum settings cannot be changed using software only. The power on reset value of the soft INIT time out is 0.

Response:

Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~01I   Response: !01
    Sets the soft INIT of module 01 and returns a valid response.
Command: %0101000700   Response: ?01
    Attempts to change the Baud Rate of module 01 to 19200 without first altering the INIT * pin. The module returns an invalid response because the soft INIT time out value is 0.
Command: ~01T10   Response: !01
    Sets the soft INIT time out value of module 01 to 16 seconds and returns a valid response.
Command: ~01I   Response: !01
    Sets the soft INIT of module 01 and returns a valid response.
Command: %0101000700   Response: !01
    Changes the Baud Rate of module 01 to 19200 without first altering INIT * pin. The module returns a valid response.

Related Commands:
Section 2.1 %AANNTTCCFF, Section 2.31 ~AAI

Related Topics:
Section A.1 INIT Mode

Notes:
1. This command is only applicable to I-7019 and M-7019 series modules.
2. It is recommended that the soft INIT time out value is reset to 0 once any changes to Baud Rate and checksum settings have been completed.

2.34 ~**

Description:
Informs all modules that the host is OK.

Syntax:
~[CHKSUM](CR)**
~   Delimiter character
**   Host OK command

Response:
No response.

Examples:
Command: ~**   No response
        Sends a "Host OK" command to all modules.

Related Commands:
Section 2.35 ~AA0, Section 2.36 ~AA1, Section 2.37
~AA2, Section 2.38 ~AA3EVV

Related Topics:
Section A.2 Dual Watchdog Operation

Note:
After sending this command, there must be a 2ms delay
before the next command can be sent.

2.35 ~AA0

Description:
Reads the host watchdog status of a module.

Syntax:
~AA0[CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be read (00 to FF)
0	Command to read the module status

Response:

Valid Response:	**!AASS[CHKSUM](CR)**
Invalid Response:	**?AA[CHKSUM](CR)**
!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
SS	Two hexadecimal digits that represent the host watchdog status, where:

Bit 7: 0 indicates that the host watchdog is disabled and 1 indicates the host watchdog is enabled,

Bit 2: 1 indicates that a host watchdog time out has occurred and 0 indicates that no host watchdog time out has occurred.

The host watchdog status is stored in EEPROM and can only be reset using the ~AA1 command.

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~010   Response: !0100

> Reads the host watchdog status of module 01 and returns 00, meaning that the host watchdog is disabled and no host watchdog time out has occurred.

Command: ~020   Response: !0204

> Reads the host watchdog status of module 02 and returns 04, meaning that a host watchdog timeout has occurred.

Related Commands:

Section 2.34 ~**, Section 2.36 ~AA1, Section 2.37 ~AA2, Section 2.38 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

2.36 ~AA1

Description:
Resets the host watchdog time out status of a module.

Syntax:
~AA1[CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
1	Command to reset the host watchdog time out status

Response:

Valid Response:	**!AA[CHKSUM](CR)**
Invalid Response:	**?AA[CHKSUM](CR)**
!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~010   Response: !0104

    Reads the host watchdog status of module 01 and shows that a host watchdog time out has occurred.

Command: ~011   Response: !01

    Resets the host watchdog time out status of module 01 and returns a valid response.

Command: ~010   Response: !0100

    Reads the host watchdog status of module 01 and shows that no host watchdog time out has occurred.

Related Commands:

Section 2.34 ~**, Section 2.35 ~AA0, Section 2.37 ~AA2, Section 2.38 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

2.37 ~AA2

Description:
Reads the host watchdog time out value of a module.

Syntax:
~AA2[CHKSUM](CR)
~   Delimiter character
AA   Address of the module to be read (00 to FF)
2   Command to read the host watchdog time out
            value

Response:
Valid Response: **!AAEVV[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)
E   1: the host watchdog is enabled
            0: the host watchdog is disabled
VV   Two hexadecimal digits to represent the time out
            value in tenths of a second, for example, 01
            means 0.1 seconds and FF means 25.5 seconds.

There will be no response if the command syntax is
incorrect, there is a communication error, or there is no
module with the specified address.

Examples:

Command: ~012   Response: !011FF

Reads the host watchdog time out value of module 01 and returns FF, meaning that the host watchdog is enabled and the host watchdog time out value is 25.5 seconds.

Related Commands:

Section 2.34 ~**, Section 2.35 ~AA0, Section 2.36 ~AA1, Section 2.38 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

2.38 ~AA3EVV

Description:
Enables/disables the host watchdog and set the host watchdog time out value of a module.

Syntax:
~AA3EVV[CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
3	Command to set the host watchdog
E	1: enable the host watchdog
	0: disable the host watchdog
VV	Two hexadecimal digits to represent the time out value in tenths of a second, for example, 01 means 0.1 seconds and FF means 25.5 seconds.

Response:
Valid Response: **!AA[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~013164   Response: !01

> Enables the host watchdog of module 01 and sets the host watchdog time out value to 10.0 seconds. The module returns a valid response.

Command: ~012   Response: !01164

> Reads the host watchdog time out value of module 01. The module returns 164, meaning that the host watchdog is enabled and the host watchdog time out value is 10.0 seconds.

Related Commands:

Section 2.34 ~**, Section 2.35 ~AA0, Section 2.36 ~AA1, Section 2.37 ~AA2

Related Topics:

Section A.2 Dual Watchdog Operation

2.39 ~AAEO

Description:
Reads the open wire detection enabled/disabled status.

Syntax:
~AAEE[CHKSUM](CR)

~   Delimiter character
AA   Address of the module to be read (00 to FF)
EO   Command to read the open wire detection
            enabled/disabled status

Response:
Valid Response: **!AAN[CHKSUM](CR)**
Invalid Response: **?AA[CHKSUM](CR)**
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)
N   0: open wire detection disabled
             1: open wire detection enabled

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~01EO   Response: !011

 Sends a command to read the open wire detection enabled/disabled status of module 01 and shows that the open wire detection is enabled.

Related Commands:

Section 2.40 ~AAEON

Note:

This command is only applicable to I-7019 and M-7019 series modules firmware version B3.7 and later.

2.40 ~AAEON

Description:
Enable/disable open wire detection.

Syntax:
~AAEEN[CHKSUM](CR)

~   Delimiter character

AA   Address of the module to be read (00 to FF)

EO   Command to enable/disable open wire detection

N   0: disable open wire detection
            1: enable open wire detection

Response:
Valid Response: **!AA[CHKSUM](CR)**

Invalid Response: **?AA[CHKSUM](CR)**

!   Delimiter character for a valid response

?   Delimiter character for an invalid response

AA   Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: ~01EO0   Response: !01

> Sends a command to disable open wire detection of module 01 and returns a valid response.

Related Commands:

Section 2.39 ~AAEO

Notes:

This command is only applicable to I-7019 and M-7019 series modules firmware version B3.7 and later.

2.41 @AAS

Description:
Reads the differential/single-ended connecting mode status.

Syntax:
@AAS[CHKSUM](CR)
@   Delimiter character
AA   Address of the module to be read (00 to FF)
S   Command to read the connecting mode

Response:
Valid Response: !AAN[CHKSUM](CR)
Invalid Response: ?AA[CHKSUM](CR)
!   Delimiter character for a valid response
?   Delimiter character for an invalid response
AA   Address of the responding module (00 to FF)
N   Current connecting mode
          0: differential mode
          1: single-ended mode

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: @01S   Response: !010

> Reads the connecting mode of module 01 and returns a response of 0 meaning that it is in differential mode.

Related Commands:

Section 2.42 @AASN

Note:

This command is only applicable to I-7017Z and M-7017Z modules.

2.42 @AASN

Description:
Sets the connecting mode to differential or single-ended.

Syntax:
@AAPN[CHKSUM](CR)

@　　　　Delimiter character
AA　　　Address of the module to be read (00 to FF)
S　　　　Command to set the connecting mode
N　　　　0: differential
　　　　　1: single-ended

Response:
Valid Response:　　!AA[CHKSUM](CR)
Invalid Response:　?AA[CHKSUM](CR)
!　　　　Delimiter character for a valid response
?　　　　Delimiter character for an invalid response
AA　　　Address of the responding module (00 to FF)

There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.

Examples:

Command: @01S1   Response: !01

> Sets the connecting mode of module 01 to single-ended.

Related Commands:

Section 2.41 @AAS

Note:

This command is only applicable to I-7017Z and M-7017Z modules.

3. Modbus RTU Protocol

The Modbus protocol is developed by Modicon Inc., originally developed for Modicon controllers. Detailed information can be found at http://www.modicon.com/techpubs/toc7.html. You can also visit http://www.modbus.org to find more valuable information.

M-7000 series modules support the Modbus RTU protocol. The communication Baud Rates range from 1200bps to 115200bps. The parity, data bits and stop bits are fixed as no parity, 8 data bits and 1 stop bit. The following Modbus functions are supported.

Function Code	Description	Section
02 (0x02)	Read input status	3.1
04 (0x04)	Read input channels	3.2
70 (0x46)	Read/write module settings	3.3

Note: Function 02 is used to read the thermocouple wire opening status and is only supported by M-7019 series modules.

If the function specified in the message is not supported, then the module responds as follows.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	Function code | 0x80
02	Exception code	1 Byte	01

If a CRC mismatch occurs, the module will not respond.

3.1 02 (0x02) Read Input Status

This function code is used to read the thermocouple wire opening status of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x02
02 ~ 03	Starting channel	2 Bytes	0x80 to 0x87 (0x89 for M-7019Z), where 0x80 corresponds to channel 0, 0x81 corresponds to channel 1, etc
04 ~ 05	Number of input channels	2 Bytes	N, 1 to 8 (10 for M-7019Z); (Starting channel + N) should be less than or equal to 0x88 (0x8A for M-7019Z)

Note: This function is only available on M-7019 series modules.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x02
02	Byte count	1 Byte	1
03	Data of input channels	1 Byte	A bit corresponds to a channel. When the bit is 1 it denotes that the channel is enabled and is either over-range, under-range or wire opening. If the bit is 0 it denotes that the channel is disabled or normal.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x82
02	Exception code	1 Byte	02: starting channel out of range 03: (starting channel + number of input channels) out of range, incorrect number of bytes received

3.2 04 (0x04) Read Input Channels

This function code is used to read from contiguous analog input channels or the CJC temperature.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x04
02 ~ 03	Starting channel	2 Bytes	0 to 7 (9 for M-7017Z, M-7018Z and M-7019Z) for reading analog inputs 0x80 for reading CJC temperature
04 ~ 05	Number of input channels (N)	2 Bytes	1 to 8 (10 for M-7017Z, M-7018Z and M-7019Z); (Starting channel + N) <= 8 (10 for M-7017Z, M-7018Z and M-7019Z) for reading analog inputs. 1 for reading CJC temperature.

Note: The CJC temperature is only available on M-7018 and M-7019 series modules.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x04
02	Byte count	1 Byte	2 x N
03 ~	Data of input channels	2 x N Bytes	When used for the CJC temperature, this is a 2's complement hex value in 0.01°C increments.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x84
02	Exception code	1 Byte	02: starting channel out of range 03: (starting channel + number of input channels) out of range, incorrect number of bytes received

3.3 70 (0x46) Read/Write Module Settings

This function code is used to read the settings of the module or change the settings of the module. The following sub-function codes are supported.

Sub-function Code	Description	Section
00 (0x00)	Read the module name	3.3.1
04 (0x04)	Set the module address	3.3.2
05 (0x05)	Read the communication settings	3.3.3
06 (0x06)	Set the communication settings	3.3.4
07 (0x07)	Read the type code	3.3.5
08 (0x08)	Set the type code	3.3.6
32 (0x20)	Read the firmware version	3.3.7
37 (0x25)	Read the channel enable/disable status	3.3.8
38 (0x26)	Set the channel enable/disable	3.3.9
41 (0x29)	Read the miscellaneous settings	3.3.10
42 (0x2A)	Write the miscellaneous settings	3.3.11
43 (0x2B)	Read the CJC offset	3.3.12
44 (0x2C)	Write the CJC offset	3.3.13
45 (0x2D)	Read the CJC enable/disable status	3.3.14
46 (0x2E)	Set the CJC enable/disable	3.3.15
47 (0x2F)	Read the CJC update setting	3.3.16
48 (0x30)	Write the CJC update setting	3.3.17

If the module does not support the sub-function code specified in the message, then it responds as follows.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	02: invalid sub-function code

3.3.1 Sub-function 00 (0x00) Read module name

This sub-function code is used to read the name of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x00

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x00
03 ~ 06	Module name	4 Bytes	0x00 0x70 0x17 0x00 for M-7017 series modules 0x00 0x70 0x18 0x00 for M-7018 series modules 0x00 0x70 0x19 0x00 for M-7019 series modules

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: incorrect number of bytes received

3.3.2 Sub-function 04 (0x04) Set module address

This sub-function code is used to set the address of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x04
03	New address	1 Byte	1 to 247
04 ~ 06	Reserved	3 Bytes	0x00 0x00 0x00

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x04
03	Set address result	1 Byte	0: OK, others: error
04 ~ 06	Reserved	3 Bytes	0x00 0x00 0x00

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: new address out of range, reserved bytes should be filled with zero, incorrect number of bytes received

3.3.3 Sub-function 05 (0x05) Read communication settings

This sub-function code is used to read the communication protocol settings of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x05
03	Reserved	1 Byte	0x00

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x05
03	Reserved	1 Byte	0x00
04	Baud Rate	1 Byte	Baud Rate code, see Section 1.11 for details.
05 ~ 07	Reserved	3 Bytes	0x00 0x00 0x00
08	Mode	1 Byte	0: DCON protocol 1: Modubs RTU protocol
09 ~ 10	Reserved	2 Bytes	0x00 0x00

Note: This information is the data saved in the EEPROM and will be used for the next power-on reset. It is not the currently used settings.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: reserved byte should be filled with zero, incorrect number of bytes received

3.3.4 Sub-function 06 (0x06) Set communication settings

This sub-function code is used to set the communication protocol of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x06
03	Reserved	1 Byte	0x00
04	Baud Rate	1 Byte	Baud Rate code, see Section 1.11 for details.
05 ~ 07	Reserved	3 Bytes	0x00 0x00 0x00
08	Mode	1 Byte	0: DCON protocol 1: Modubs RTU protocol
09 ~ 10	Reserved	2 Bytes	0x00 0x00

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x06
03	Reserved	1 Byte	0x00
04	Baud Rate	1 Byte	0: OK, others: error
05 ~ 07	Reserved	3 Bytes	0x00 0x00 0x00
08	Mode	1 Byte	0: OK, others: error
09 ~ 10	Reserved	2 Bytes	0x00 0x00

Note: The new Baud Rate and protocol will be effective after the next power-on reset.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: Baud Rate or mode out of range, reserved bytes should be filled with zero, incorrect number of bytes received

3.3.5 Sub-function 07 (0x07) Read type code

This sub-function code is used to read the type code information of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x07
03	Reserved	1 Bytes	0x00
04	Channel	1 Byte	0x00 ~ 0x07 for M-7019R 0x00 for M-7017 and M-7018 series modules 0x00 ~ 0x09 for M-7017Z, M-7018Z and M-7019Z

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x07
03	Type code	1 Byte	Type code, see Section 1.11 for details.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: reserved bytes should be filled with zero, channel out of range for M-7017Z, M-7018Z and M-7019 series modules, incorrect number of bytes received

3.3.6 Sub-function 08 (0x08) Set type code

This sub-function code is used to set the type code of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x08
03	Reserved	1 Byte	0x00
04	Channel	1 Byte	0x00 ~ 0x07 for M-7019R 0x00 for M-7017 and M-7018 series modules 0x00 ~ 0x09 for M-7017Z, M-7018Z and M-7019Z
05	Type code	1 Byte	Type code, see Section 1.11 for details.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x08
03	Type code	1 Byte	0: OK others: error

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: type code out of range, channel out of range for M-7017Z and M-7018Z and M-7019 series modules, reserved bytes should be filled with zero, incorrect number of bytes received

3.3.7 Sub-function 32 (0x20) Read firmware version

This sub-function code is used to read the firmware version information of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x20

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x20
03	Major version	1 Byte	0x00 ~ 0xFF
04	Minor version	1 Byte	0x00 ~ 0xFF
05	Build version	1 Byte	0x00 ~ 0xFF

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: incorrect number of bytes received

3.3.8 Sub-function 37 (0x25) Read channel enabled/disabled status

This sub-function code is used to read the enabled/disabled status of each channel in a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x25

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x25
03	Enabled/disabled status	1 Byte/2 Byte/3 Byte	0x00 ~ 0xFF, enabled/disabled status of each channel, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 1 it denotes that the channel is enabled and 0 denotes that the channel is disabled. 0x0000 ~ 0x03FF for M-7017Z, M-7018Z and M-7019Z 0x000000 ~ 0x0FFFFF for M-7017Z in single-ended mode

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: incorrect number of bytes received

3.3.9 Sub-function 38 (0x26) Set channel enable/disable

This sub-function code is used to specify the channels to be enabled in a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x26
03	Enable/disable setting	1 Byte/ 2 Byte/3 Byte	0x00 ~ 0xFF, enable/disable setting of each channel, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 1 it denotes that the channel is enabled and 0 denotes that the channel is disabled. 0x0000 ~ 0x03FF for M-7017Z, M-7018Z and M-7019Z 0x000000 ~ 0x0FFFFF for M-7017Z in single-ended mode

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x26
03	Enable/disable setting	1 Byte	0: OK others: error.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: enable/disable setting out of range, incorrect number of bytes received

3.3.10 Sub-function 41 (0x29) Read miscellaneous settings

This sub-function code is used to read the miscellaneous settings of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x29

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x29
03	Miscellaneous settings	1 Byte	Bit 7: filter setting, reserved for M-7019R modules firmware version B2.6 and earlier 0: 60Hz rejection 1: 50Hz rejection Bit 6: reserved Bit 5: for M-7017R, M-7017R-A5 and M-7017Z only, reserved for other modules 0: normal mode 1: fast mode Bit 4~0: reserved

Note: The reserved fields are filled with zeros.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: incorrect number of bytes received

3.3.11 Sub-function 42 (0x2A) Write miscellaneous settings

This sub-function code is used to set the miscellaneous settings of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2A
03	Miscellaneous settings	1 Byte	Bit 7: filter setting, reserved for M-7019R modules firmware version B2.6 and earlier 0: 60Hz rejection 1: 50Hz rejection Bit 6: reserved Bit 5: for M-7017R, M-7017R-A5 and M-7017Z only, reserved for other modules 0: normal mode 1: fast mode Bit 4~0: reserved

Note: The reserved fields are filled with zeros.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2A
03	Miscellaneous settings	1 Byte	0: OK others: error

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: reserved bits should be filled with zero, incorrect number of bytes received

3.3.12 Sub-function 43 (0x2B) Read CJC offset

This sub-function code is used to read the CJC offset setting of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2B
03	Channel	1 Byte	0x00 for module CJC offset 0x80 ~ 0x87 (0x89 for M-7018Z and M-7019Z) for channel CJC offset, where 0x80 denotes channel 0, 0x81 denotes channel 1, etc.

Note: This sub-function is only available on M-7018 and M-7019 series modules.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2B
03 ~ 04	CJC offset	2 Bytes	This is a 2's complement hex CJC offset value. For module CJC offset, it is in 0.01°C increments. For channel CJC offset, it is in 0.1°C increments where 00 denotes 0°C, 7F denotes 12.7°C, FF denotes -0.1°C and 80 denotes -12.8°C.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: incorrect number of bytes received, reserved byte is not zero

3.3.13 Sub-function 44 (0x2C) Write CJC offset

This sub-function code is used to set the CJC offset setting of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2C
03	Channel	1 Byte	0x00 for module CJC offset 0x80 ~ 0x87 (0x89 for M-7018Z and M-7019Z) for channel CJC offset, where 0x80 denotes channel 0, 0x81 denotes channel 1, etc.
04 ~ 05	CJC offset	2 Bytes	This is a 2's complement hex CJC offset value. For module CJC offset, it is in 0.01°C increments and the absolute value should be less than or equal to 0x1000. For channel CJC offset, it is in 0.1°C increments and in the range 00 ~ FF, where 00 denotes 0°C, 7F denotes 12.7°C, FF denotes -0.1°C and 80 denotes -12.8°C.

Note: This sub-function is only available on M-7018 and M-7019 series modules.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2C
03	Set CJC offset	1 Byte	0: OK, others: error

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: reserved byte should be zero, CJC offset value out of range, incorrect number of bytes received

3.3.14 Sub-function 45 (0x2D) Read CJC enabled/disabled status

This sub-function code is used to read the CJC enabled/disabled status of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2D
03	Reserved	1 Byte	0x00

Note: This sub-function is only available on M-7018 and M-7019 series modules.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2D
03	CJC enabled/disabled status	1 Byte	0: CJC disabled 1: CJC enabled

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: incorrect number of bytes received

3.3.15 Sub-function 46 (0x2E) Set CJC enable/disable

This sub-function code is used to enable/disable the CJC of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2E
03	Reserved	1 Byte	0x00
04	Enable/disable CJC	1 Byte	0: disable CJC 1: enable CJC

Note: This sub-function is only available on M-7018 and M-7019 series modules.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2E
03	Miscellaneous settings	1 Byte	0: OK others: error.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: reserved byte is not zero, setting byte incorrect, incorrect number of bytes received

3.3.16 Sub-function 47 (0x2F) Read CJC update setting

This sub-function code is used to read the CJC update settings of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2F

Note: This sub-function is only available on M-7019 series modules.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x2F
03	CJC temperature update setting	1 Byte	0: CJC temperature update has been stopped 1: CJC temperature update has been started 2: Update CJC temperature once only

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: incorrect number of bytes received

3.3.17 Sub-function 48 (0x30) Write CJC update setting

This sub-function code is used to set the CJC update setting of a module.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x30
03	CJC temperature update setting	1 Byte	0: stop CJC temperature update 1: start CJC temperature update 2: Update CJC temperature once only, after the command is received

Note: This sub-function is only available on M-7019 series modules.

Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x46
02	Sub function code	1 Byte	0x30
03	Miscellaneous settings	1 Byte	0: OK, others: error.

Error Response

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0xC6
02	Exception code	1 Byte	03: setting byte incorrect, incorrect number of bytes received

3.4 Address Mappings

3.4.1 M-7017 Series Address Mappings

For M-7017 series firmware version B300 and later, the Modbus address mappings are as follows.

Address	Description	Attribute
10129 ~ 10136 00129 ~ 00136	Over/under range status of channel 0 to 7 for 4 ~ 20mA or 0 ~ 20mA ranges	R
30001 ~ 30008 40001 ~ 40008	Analog input value of channel 0 to 7	R
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word)	R
40484	Module name (high word)	R
40485	Module address, valid range: 1 ~ 247	R/W
40486	Bits 5:0 Baud rate, 0x03 ~ 0x0A <table><tr><td>Code</td><td>0x03</td><td>0x04</td><td>0x05</td><td>0x06</td></tr><tr><td>Baud</td><td>1200</td><td>2400</td><td>4800</td><td>9600</td></tr><tr><td>Code</td><td>0x07</td><td>0x08</td><td>0x09</td><td>0x0A</td></tr><tr><td>Baud</td><td>19200</td><td>38400</td><td>57600</td><td>115200</td></tr></table> Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bits 10: even parity, 1 stop bit 11: odd parity, 1 stop bit	R/W
40487	Type code	R/W
40488	Modbus response delay time in ms, valid range: 0 ~ 30	R/W

Address	Description	Attribute
40489	Host watchdog timeout value, 0 ~ 255, in 0.1s	R/W
40490	Channel enable/disable, 00h ~ FFh	R/W
40492	Host watchdog timeout count, write 0 to clear	R/W
00257	Protocol, 0: DCON, 1: Modbus RTU	R/W
00259	Filter setting, 0: 60Hz rejection, 1: 50Hz rejection	R/W
00261	1: enable, 0: disable host watchdog	R/W
00269	Modbus data format, 0: hex, 1: engineering	R/W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status	R/W
00271[*]	1: enable, 0: disable fast mode	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on	R

Note: Address 00271 is only available to the M-7017R and M-7017R-A5.

3.4.2 M-7017Z Address Mappings

Address	Description	Attribute
10129 ~ 10138 00129 ~ 00138	Over/under range status of channel 0 to 9 for 4 ~ 20mA or 0 ~ 20mA ranges	R
30001 ~ 30020 40001 ~ 40020	Analog input value of channel 0 to 19	R
40257 ~ 40276	Type code of channel 0 to 19	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word)	R
40484	Module name (high word)	R
40485	Module address, valid range: 1 ~ 247	R/W
40486	Bits 5:0 Baud rate, 0x03 ~ 0x0A <table><tr><td>Code</td><td>0x03</td><td>0x04</td><td>0x05</td><td>0x06</td></tr><tr><td>Baud</td><td>1200</td><td>2400</td><td>4800</td><td>9600</td></tr><tr><td>Code</td><td>0x07</td><td>0x08</td><td>0x09</td><td>0x0A</td></tr><tr><td>Baud</td><td>19200</td><td>38400</td><td>57600</td><td>115200</td></tr></table> Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bits 10: even parity, 1 stop bit 11: odd parity, 1 stop bit	R/W
40488	Modbus response delay time in ms, valid range: 0 ~ 30	R/W
40489	Host watchdog timeout value, 0 ~ 255, in 0.1s	R/W

Address	Description	Attribute
40490	Channel enable/disable, low word	R/W
40492	Host watchdog timeout count, write 0 to clear	R/W
40497	Channel enable/disable, high word	R/W
00257	Protocol, 0: DCON, 1: Modbus RTU	R/W
00259	Filter setting, 0: 60Hz rejection, 1: 50Hz rejection	R/W
00260	Modbus host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status	R/W
00261	1: enable, 0: disable host watchdog	R/W
00269	Modbus data format, 0: hex, 1: engineering	R/W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status	R/W
00271	1: enable, 0: disable fast mode	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on	R
00277	1: single-ended mode, 0: differential mode	R/W

3.4.3 M-7018 Series Address Mappings

For M-7018 series firmware version B305 and later, the Modbus address mappings are as follows.

Address	Description	Attribute
30001 ~ 30008 40001 ~ 40008	Analog input value of channel 0 to 7	R
30129 40129	CJC temperature in 0.01°C	R
40353 ~ 40360	CJC offset of channel 0 to 7 in 0.1°C. 1 for 0.1, 127 for 12.7, 255 for –0.1, 128 for –12.8	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word)	R
40484	Module name (high word)	R
40485	Module address, valid range: 1 ~ 247	R/W
40486	Bits 5:0 Baud rate, 0x03 ~ 0x0A <table><tr><td>Code</td><td>0x03</td><td>0x04</td><td>0x05</td><td>0x06</td></tr><tr><td>Baud</td><td>1200</td><td>2400</td><td>4800</td><td>9600</td></tr><tr><td>Code</td><td>0x07</td><td>0x08</td><td>0x09</td><td>0x0A</td></tr><tr><td>Baud</td><td>19200</td><td>38400</td><td>57600</td><td>115200</td></tr></table> Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bits 10: even parity, 1 stop bit 11: odd parity, 1 stop bit	R/W
40487	Type code	R/W
40488	Modbus response delay time in ms, valid range: 0 ~ 30	R/W
40489	Host watchdog timeout value, 0 ~ 255, in 0.1s	R/W
40490	Channel enable/disable, 00h ~ FFh	R/W

Address	Description	Attribute
40491	Module CJC offset in 0.01°C	R/W
40492	Host watchdog timeout count, write 0 to clear	R/W
00257	Protocol, 0: DCON, 1: Modbus RTU	R/W
00259	Filter setting, 0: 60Hz rejection, 1: 50Hz rejection	R/W
00260	Modbus host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status	R/W
00261	1: enable, 0: disable host watchdog	R/W
00268	1: enable, 0: disable CJC	R/W
00269	Modbus data format, 0: hex, 1: engineering	R/W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on	R

3.4.4 M-7018Z Address Mappings

For M-7018Z the Modbus address mappings are as follows.

Address	Description	Attribute
30001 ~ 30010 40001 ~ 40010	Analog input value of channel 0 to 9	R
30129 40129	CJC temperature in 0.01°C	R
40257 ~ 40266	Type code of channel 0 to 9	R/W
40353 ~ 40362	CJC offset of channel 0 to 9 in 0.1°C. 1 for 0.1, 127 for 12.7, 255 for –0.1, 128 for –12.8	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word)	R
40484	Module name (high word)	R
40485	Module address, valid range: 1 ~ 247	R/W
40486	Bits 5:0 Baud rate, 0x03 ~ 0x0A <table><tr><td>Code</td><td>0x03</td><td>0x04</td><td>0x05</td><td>0x06</td></tr><tr><td>Baud</td><td>1200</td><td>2400</td><td>4800</td><td>9600</td></tr><tr><td>Code</td><td>0x07</td><td>0x08</td><td>0x09</td><td>0x0A</td></tr><tr><td>Baud</td><td>19200</td><td>38400</td><td>57600</td><td>115200</td></tr></table> Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bits 10: even parity, 1 stop bit 11: odd parity, 1 stop bit	R/W
40488	Modbus response delay time in ms, valid range: 0 ~ 30	R/W

Address	Description	Attribute
40489	Host watchdog timeout value, 0 ~ 255, in 0.1s	R/W
40490	Channel enable/disable, 000h ~ 3FFh	R/W
40491	Module CJC offset in 0.01°C	R/W
40492	Host watchdog timeout count, write 0 to clear	R/W
00257	Protocol, 0: DCON, 1: Modbus RTU	R/W
00259	Filter setting, 0: 60Hz rejection, 1: 50Hz rejection	R/W
00260	Modbus host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status	R/W
00261	1: enable, 0: disable host watchdog	R/W
00268	1: enable, 0: disable CJC	R/W
00269	Modbus data format, 0: hex, 1: engineering	R/W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on	R

3.4.5 M-7019R Address Mappings

For M-7019R firmware version B300 and later, the Modbus address mappings are as follows.

Address	Description	Attribute
10129 ~ 10136 00129 ~ 00136	Over/under range status of channel 0 to 7	R
30001 ~ 30008 40001 ~ 40008	Analog input value of channel 0 to 7	R
30129 40129	CJC temperature in 0.01°C	R
40257 ~ 40264	Type code of channel 0 to 7	R/W
40289 ~ 40296	Temperature offset of channel 0 to 7 in 0.1°C, valid range: -128 ~ 127	R/W
40353 ~ 40360	CJC offset of channel 0 to 7 in 0.01°C, valid range: -4096 ~ 4096	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word)	R
40484	Module name (high word)	R
40485	Module address, valid range: 1 ~ 247	R/W
40486	Bits 5:0 Baud rate, 0x03 ~ 0x0A <table><tr><td>Code</td><td>0x03</td><td>0x04</td><td>0x05</td><td>0x06</td></tr><tr><td>Baud</td><td>1200</td><td>2400</td><td>4800</td><td>9600</td></tr><tr><td>Code</td><td>0x07</td><td>0x08</td><td>0x09</td><td>0x0A</td></tr><tr><td>Baud</td><td>19200</td><td>38400</td><td>57600</td><td>115200</td></tr></table> Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bits 10: even parity, 1 stop bit 11: odd parity, 1 stop bit	R/W

Address	Description	Attribute
40488	Modbus response delay time in ms, valid range: 0 ~ 30	R/W
40489	Host watchdog timeout value, 0 ~ 255, in 0.1s	R/W
40490	Channel enable/disable, 00h ~ FFh	R/W
40491	Module CJC offset in 0.01°C	R/W
40492	Host watchdog timeout count, write 0 to clear	R/W
40493	CJC update setting, 0 ~ 2	R/W
00257	Protocol, 0: DCON, 1: Modbus RTU	R/W
00259	Filter setting, 0: 60Hz rejection, 1: 50Hz rejection	R/W
00260	Modbus host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status	R/W
00261	1: enable, 0: disable host watchdog	R/W
00268	1: enable, 0: disable CJC	R/W
00269	Modbus data format, 0: hex, 1: engineering	R/W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status	R/W
00272	Write 1 to load factory calibration parameters	W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on	R
00274	Sampling rate, 1: 8Hz, 0: 10Hz	R/W
00276	Open thermocouple detection, 1: enable, 0: disable (for firmware version B307 and later)	R/W

Notes:

1. The max number of analog output registers written in a command is 11.

2. The command of loading factory calibration parameters takes about 3 seconds. The next command should be sent after 3 seconds.

3.4.6 M-7019Z Address Mappings

Address	Description	Attribute
10129 ~ 10138 00129 ~ 00138	Over/under range status of channel 0 to 9	R
30001 ~ 30010 40001 ~ 40010	Analog input value of channel 0 to 9	R
30129 40129	CJC temperature in 0.01°C	R
40257 ~ 40266	Type code of channel 0 to 9	R/W
40289 ~ 40298	Temperature offset of channel 0 to 9 in 0.1°C, valid range: -128 ~ 127	R/W
40353 ~ 40362	CJC offset of channel 0 to 9 in 0.01°C, valid range: -4096 ~ 4096	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word)	R
40484	Module name (high word)	R
40485	Module address, valid range: 1 ~ 247	R/W

40486	Bits 5:0 Baud rate, 0x03 ~ 0x0A
	
	Bits 7:6
	  00: no parity, 1 stop bit
	  01: no parity, 2 stop bits
	  10: even parity, 1 stop bit
	  11: odd parity, 1 stop bit
		R/W

40488	Modbus response delay time in ms, valid range: 0 ~ 30	R/W

Baud rate table (within address 40486):

Code	0x03	0x04	0x05	0x06
Baud	1200	2400	4800	9600
Code	0x07	0x08	0x09	0x0A
Baud	19200	38400	57600	115200

Address	Description	Attribute
40489	Host watchdog timeout value, 0 ~ 255, in 0.1s	R/W
40490	Channel enable/disable, 000h ~ 3FFh	R/W
40491	Module CJC offset in 0.01°C	R/W
40492	Host watchdog timeout count, write 0 to clear	R/W
40493	CJC update setting, 0 ~ 2	R/W
00257	Protocol, 0: DCON, 1: Modbus RTU	R/W
00259	Filter setting, 0: 60Hz rejection, 1: 50Hz rejection	R/W
00260	Modbus host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status	R/W
00261	1: enable, 0: disable host watchdog	R/W
00268	1: enable, 0: disable CJC	R/W
00269	Modbus data format, 0: hex, 1: engineering	R/W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status	R/W
00272	Write 1 to load factory calibration parameters	W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on	R
00276	Open thermocouple detection, 1: enable, 0: disable	R/W

Notes:
1. The max number of analog output registers written in a command is 11.
2. The command of loading factory calibration parameters takes about 3 seconds. The next command should be sent after 3 seconds.

3.5 Engineering Data Format Table

Type Code	Input Type	Min.	Max.
00	-15 mV ~ +15 mV	-15000	15000
01	-50 mV ~ + 50 mV	-5000	5000
02	-100 mV ~ +100 mV	-10000	10000
03	-500 mV ~ +500 mV	-5000	5000
04	-1 V ~ +1 V	-10000	10000
05	-2.5 V ~ +2.5 V	-25000	25000
06	-20 mA ~ +20 mA	-20000	20000
07	+4 mA ~ +20 mA	4000	20000
08	-10 V ~ +10 V	-10000	10000
09	-5 V ~ +5 V	-5000	5000
0A	-1 V ~ +1 V	-10000	10000
0B	-500 mV ~ +500 mV	-5000	5000
0C	-150 mV ~ +150 mV	-15000	15000
0D	-20 mA ~ +20 mA	-20000	20000
0E	Type J Thermocouple	-2100	7600
0F	Type K Thermocouple	-2700	13720
10	Type T Thermocouple	-2700	4000
11	Type E Thermocouple	-2700	10000
12	Type R Thermocouple	0	17680
13	Type S Thermocouple	0	17680
14	Type B Thermocouple	0	18200
15	Type N Thermocouple	-2700	13000
16	Type C Thermocouple	0	23200
17	Type L Thermocouple	-2000	8000
18	Type M Thermocouple	-20000	10000
19	Type $L_{DIN43710}$ Thermocouple	-2000	9000
1A	0 ~ +20 mA	0	20000
1B	-150 V ~ +150 V	-15000	15000
1C	-50 V ~ +50 V	-5000	5000

The under range value is –32768 and the over range value is +32767. For the hex data format, please refer to Section 1.11.

4. Troubleshooting

If you are having difficulty using the I-7000 or M-7000 module, here are some suggestions that may help. If you cannot find the answers you need in these guides, contact ICP DAS Product Support. Contact information is located in Section 1.14.

4.1 Communicating with the module

If you attempt to communicate with the module and
receive no response, first check the following:

□ Make sure the supplied power is within the range of
+10 to +30 V DC. If the supplied power is OK, then
the power LED should be on.

□ When the module receives a command, the power LED
is set to "off". The power LED is shown as "on" after
the module responds. This method can be used to
check whether the module has received a command
sent from the host.

□ If possible, use another device to check whether the
host can communicate with the device through the
same RS-485 network.

□ If the host is a PC installed with a Windows operating
system, then execute the DCON Utility to determine
whether the module can be found. The DCON Utility
can be downloaded from the ICP DAS website
http://www.icpdas.com. The DCON Utility
documentation can be found in the "**Getting Started
For I-7000 Series Modules**" manual.

□ Set the module to "INIT mode" and communicate with
the module using the following settings: address 00,
Baud Rate 9600bps, no checksum and DCON protocol.
See Section A.1 for details.

4.2 Reading Data

If the data read from the input channel is not correct, first check the following:

▫ Make sure the type code and data format settings are correct. For I-7017, I-7018, M-7017 and M-7018 series modules, the type code is set by using the %AANNTTCCFF command, see Section 2.1 for details. For I-7017Z, M-7017Z, I-7018Z, M-7018Z, I-7019 and M-7019 series modules, the type code is set by using the $AA7CiRrr command, see Section 2.17 for details. The data format is set by using the %AANNTTCCFF command. For the Modbus RTU protocol, the type code is set by using sub-function 08h of the function 46h.

▫ If the voltage read by the module is incorrect, then it may be because the calibration parameters stored in the non-volatile memory are corrupted. You can calibrate the module by yourself. Be sure to read Section 1.10 in detail before doing any calibration. For I-7019 and M-7019 series modules, use the $AAS1 command to reload the factory calibration parameters, see Section 2.27 for details.

A. Appendix

A.1 INIT Mode

Each I-7000 and M-7000 module has a built-in EEPROM to store configuration information such as module address, type code, Baud Rate, etc. Occasionally, the configuration of a module may be forgotten and there are no visual indications of the configuration of the module. It is difficult to communicate with the module when the configuration of the module is unknown. To help avoid this problem, the I-7000 and M-7000 series has a special mode called **"INIT mode"**. When the module is powered on in **"INIT mode"** the configuration of the module is reset as follows, allowing it to be operated as normal.

1. Address: 00
2. Baud Rate: 9600 bps
3. No checksum
4. Protocol: DCON

The configuration information stored in the EEPROM is not changed and they can be read by sending the $002(CR) command at 9600bps.

There are commands that require the module to be in INIT mode. They are:

1. %AANNTTCCFF when changing Baud Rate and checksum settings. See Section 2.1 for details.
2. $AAPN, see Section 2.25 for details.

Originally, the INIT mode is accessed by connecting the INIT* terminal to the GND terminal. For the I-7017 and I-7017F modules, the INIT* terminal is shared with the Vin7- terminal. The JP1 jumper should be set correctly as shown in Section 1.7.1. New I-7000 and M-7000 modules have the INIT switch located on the rear side of the module allow easier access to INIT mode. For these modules, INIT mode is accessed by sliding the INIT switch to the Init position as shown below.

INIT Switch
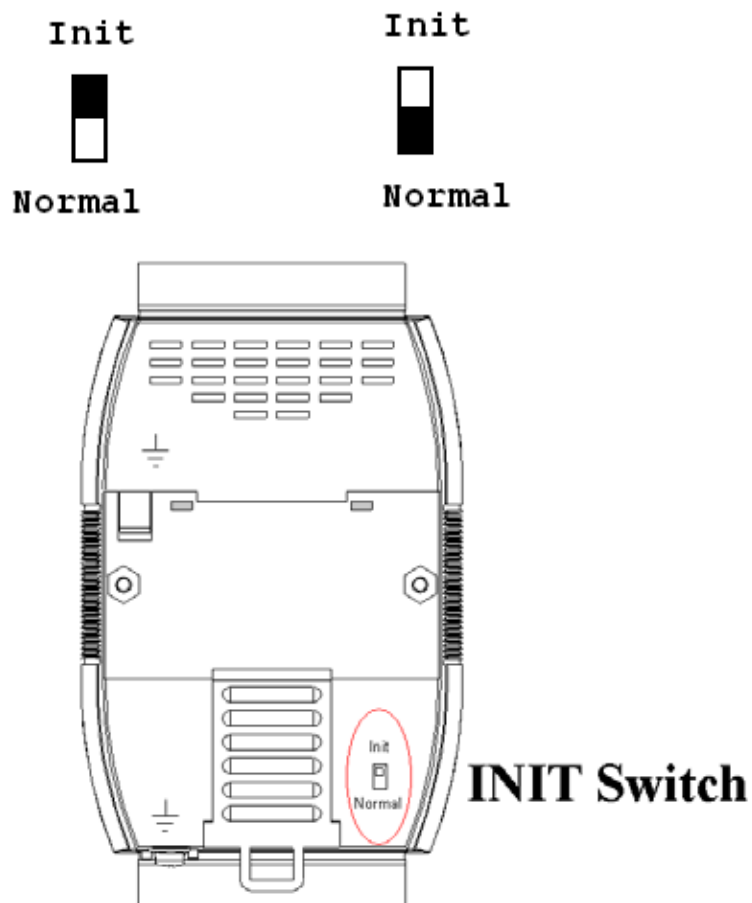
A.2 Dual Watchdog Operation

Dual Watchdog = Module Watchdog + Host Watchdog

The Module Watchdog is a hardware reset circuit that monitors the operating status of the module. While working in harsh or noisy environments, the module may be shut down by external signals. The circuit allows the module to work continuously without disruption.

The Host Watchdog is a software function that monitors the operating status of the host. Its purpose is to prevent problems due to network/communication errors or host malfunctions. When a host watchdog time out occurs, the module will reset all outputs to a safe state in order to prevent any erroneous operations of the controlled target.

I-7000 and M-7000 series modules include an internal Dual Watchdog, making the control system more reliable and stable.

For more information regarding the Dual Watchdog, please refer to Chapter 5 of the "**Getting Started For I-7000 Series Modules**" manual that can be downloaded from the ICP DAS website http://www.icpdas.com.

A.3 Thermocouple

When two wires composed of dissimilar homogeneous metals are joined at one end, a thermoelectric electromotive force (emf) appears that depends only on the metals and the junction temperature. This is called the Seebeck effect. A pair of different metals with a fixed junction at one end constitutes a **thermocouple**. For small changes in temperature, the emf is linearly proportional to the temperature. This implies that the temperature reading can be obtained by measuring the emf.

We cannot measure the emf, V_1, directly because when a voltmeter is connected to the thermocouple, another emf, V_2, is created at the (cold) junction of the thermocouple and the voltmeter. The cold junction compensation method is used to resolve the problem. Using another sensor, e.g. a thermistor, to measure the cold junction temperature, T_2, we can calculate the emf, V_2, which corresponds to T_2. The thermocouple emf, V_1, can be obtained by adding V_2 to that measured by the voltmeter and then the temperature.

CJC sensor
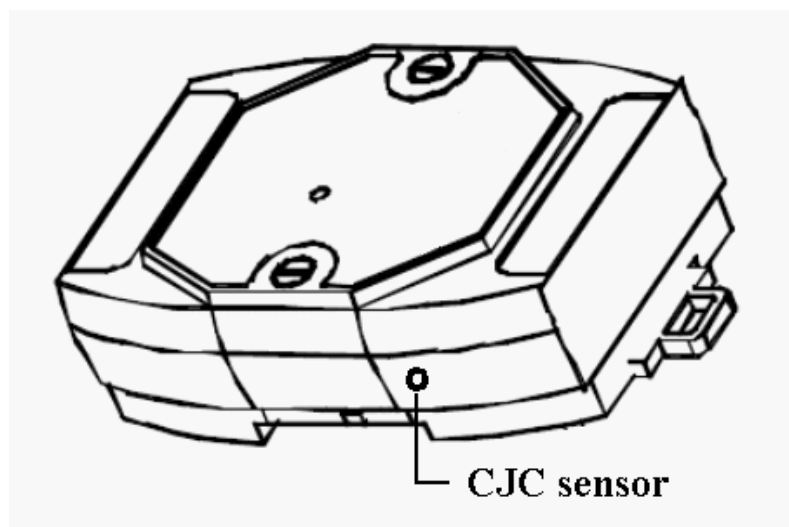
A.4 Frame Ground

Electronic circuits are constantly vulnerable to ESD which become worse in a continental climate area. Some I-7000, and all M-7000, modules feature a new design for the frame ground. The frame ground provides a path for bypassing ESD, which provides enhanced static protection (ESD) abilities and ensures the module is more reliable.

Either of the following options will provide a better protection for the module:
1. If the module is DIN rail mounted, connect the DIN rail to the earth ground because the DIN rail is contacted with the upper frame ground as shown in the figure below.
2. Alternatively, connect the lower frame ground terminal, as shown in the figure below, to a wire and connected the wire to the earth ground.
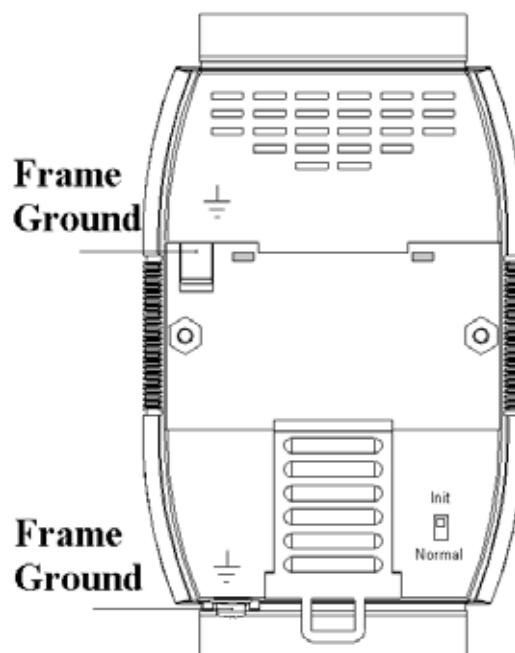
New DIN rail models are available that can easily be connected to the earth ground. Each are made of stainless steel, which is stronger than those made of aluminum. There is a screw at one end and a ring terminal is included as shown in the figure below. Refer to Section 1.13.1 for more information about the new DIN rail models.
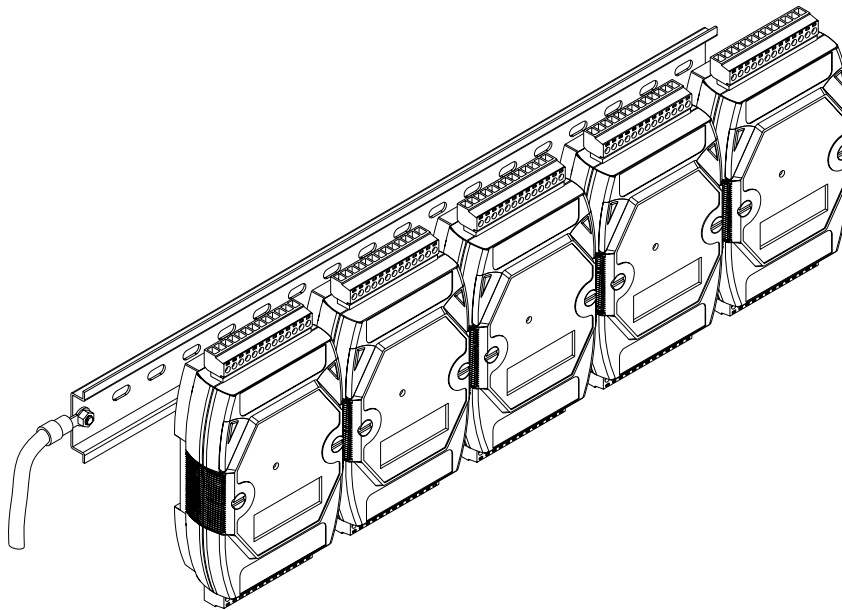
A.5 Node Information Area

Each I-7000 and M-7000 module has a built-in EEPROM to store configuration information such as module address, type code, Baud Rate, etc. One minor drawback is that there are no visual indications of the configuration of the module. New I-7000 and M-7000 modules include node information areas that are protected by a cover, as shown below, and can be used to make a written record of the node information, such as module address, Baud Rate, etc. To access the node information areas, first slide the covers outward, as shown in the figure below.