tM-AD4P2C2
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.

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1. Introduction

The tM 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, or the standard Modbus 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 tM series feature a new design for the frame ground and INIT switch as shown in the figure. The frame ground provides enhanced static protection (ESD) abilities and ensures the module is more reliable. The INIT switch allows easier access to INIT mode. Please refer to Sections A.1 and A.3 for more details.



The features of the tM-AD4P2C2 are as follows:

1. 2500V DC inter-module isolation
2. 16-bit sigma-delta ADC to provide excellent accuracy
3. Software calibration

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4. 2-channel single-ended voltage input and 2-channel single-ended current input
5. 2-channel digital input
6. 2-channel digital output

The tM-AD4P2C2 is designed for industrial plant environments and has special input circuits to provide 120VDC continuous overload protection.

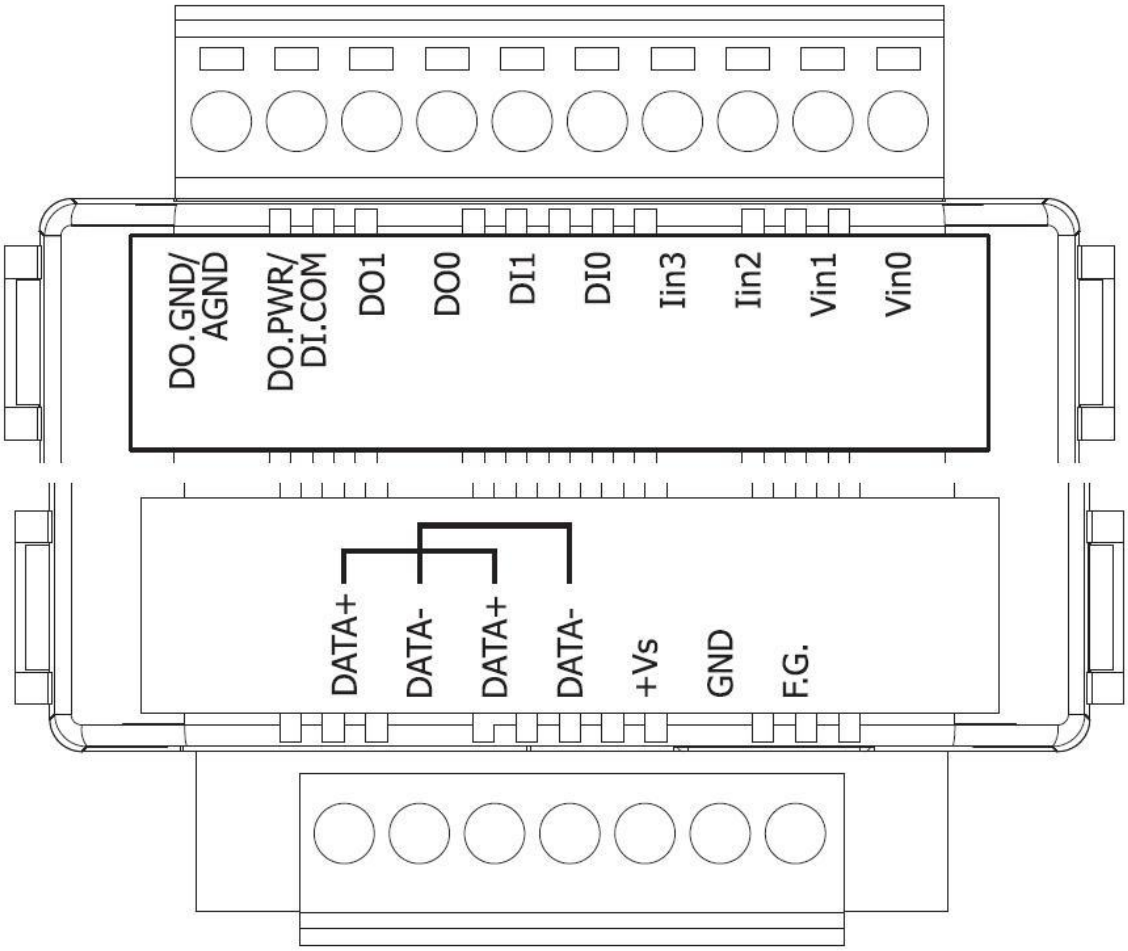
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1.1 More Information

- For details of **INIT mode** operation, please refer to Section A.1 INIT Mode.
- For details of **module watchdog** and **host watchdog**, please refer to Section A.2 Dual Watchdog Operation.
- For details of **ESD protection** and **grounding**, please refer to Section A.3 Frame Ground.

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1.2 Terminal Assignment



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1.3 Specifications

System Specifications

Communication	
Interface	RS-485
Format	(N, 8, 1), (N, 8, 2), (O, 8, 1), (E, 8, 1)
Baud Rate	1200 ~ 115200 bps
Protocol	DCON, Modbus RTU, Modbus ASCII
Dual Watchdog	Yes, Module(2.3 seconds), Communication (Programmable)
LED Indicators/Display	
System LED Indicator	Yes, 1 LED as Power/Communication Indicator
Isolation	
Intra-module Isolation, Field-to-Logic	2500 VDC
EMS Protection	
ESD (IEC 61000-4-2)	±4 kV Contact for each Terminal
	±8 kV Air for Random Point
EFT (IEC 61000-4-4)	±4 kV for Power Line
Power	
Reverse Polarity Protection	Yes
InputVoltageRange	10 ~ 30 VDC
Consumption	1 W Max.
Mechanical	
Dimensions (W x L x H)	52 mm x 98 mm x 27 mm
Installation	DIN-Rail Mounting
Environment	
Operating Temperature	-25 ~ +75°C
Storage Temperature	-30 ~ +75°C
Humidity	10 ~ 95% RH, Non-condensing

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I/O Specifications

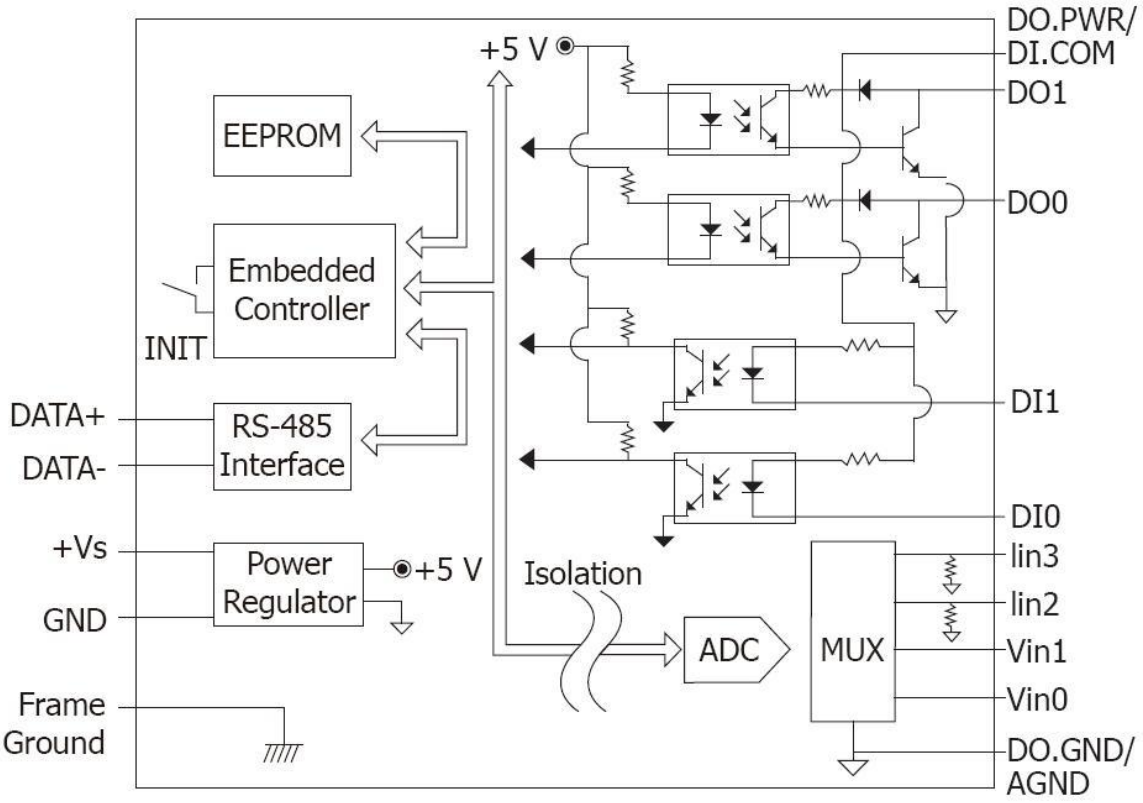
Analog Input		Voltage	Current
Channels		2 Single-ended	2 Single-ended
Type		±1 V, ±2.5 V, ±5 V, ±10 V	±20 mA, 0 ~ 20 mA, 4 ~ 20 mA
Resolution	Normal Mode	14-bit	
	Fast Mode	12-bit	
Sampling Rate	Normal Mode	10 Hz total	
	Fast Mode	200 Hz total	
Accuracy	Normal Mode	±0.1 %	
	Fast Mode	±0.5 %	
Zero Drift		±20 μV/°C	
Span Drift		±25 ppm/°C	
Input Impedance		10 MΩ	136 Ω
Overvoltage Protection		120 VDC	-
Overcurrent Protection		-	Yes, 50 mA @ 110 VDC
Digital Input			
Channels		2	
Type		Wet Contact (Source)	
On Voltage Level		+3.5 ~ 50 VDC	
Off Voltage Level		+1 VDC Max.	
Input Impedance		10 KΩ, 0.5 W	
Counters	Channels	2	
	Max. Count	65535 (16-bit)	
	Max. Input Frequency	50 Hz	
	Min. Plus Width	10 ms	
Overvoltage Protection		70 VDC	
Digital Output			
Channels		2	
Type		Isolated Open Collector (Sink)	
Max. Load Current		700 mA/Channel	
Load Voltage		+3.5 ~ 50 VDC	
Overvoltage Protection		60 VDC	
Overload Protection		1.4 A (with short circuit protection)	
Short Circuit Protection		Yes	
Power-on Value		Yes, Programmable	
Safe Value		Yes, Programmable	

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

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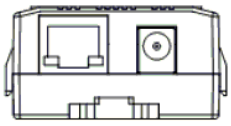
1.4 Block Diagrams

1.4.1 Block diagram for the tM-AD4P2C2

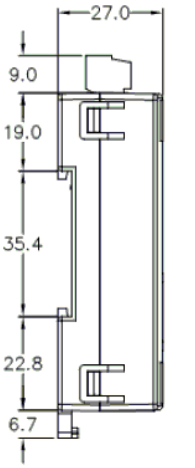


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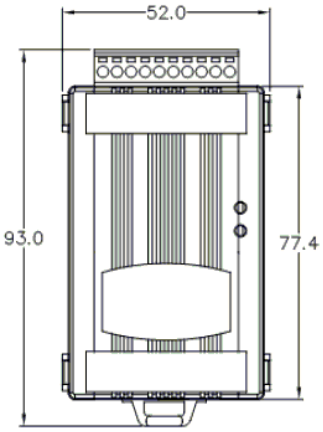
1.5 Dimensions



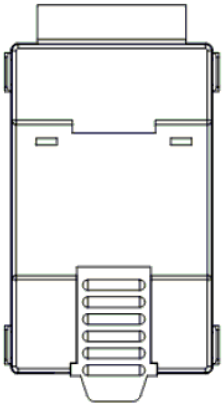
Top View



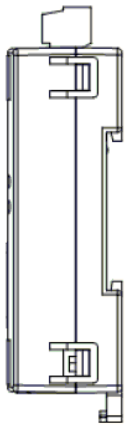
Left Side View



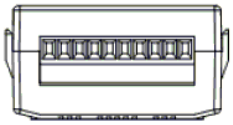
Front View



Back View



Right Side View

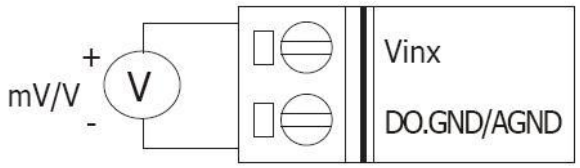
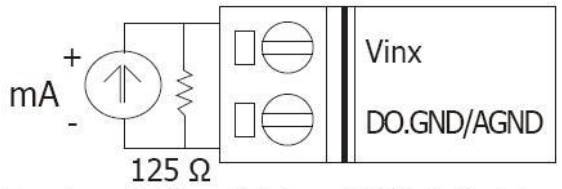


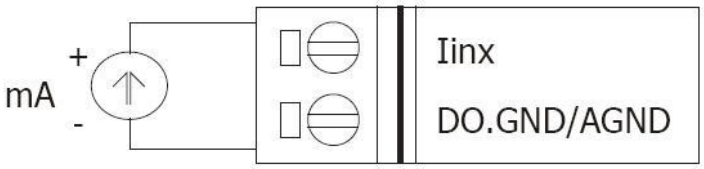
Bottom View

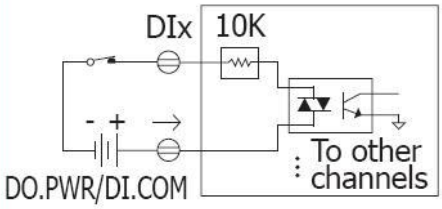
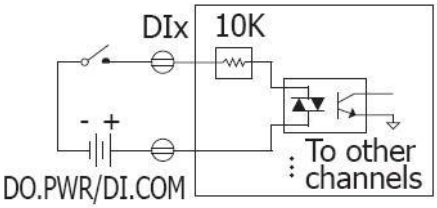
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1.6 Wiring Diagrams

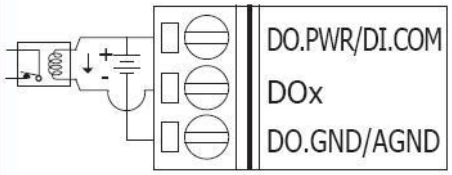
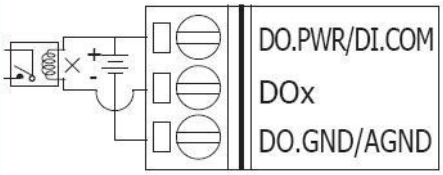
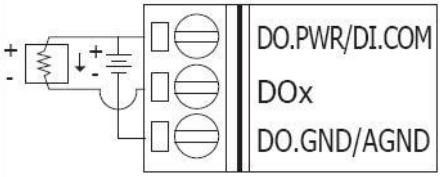
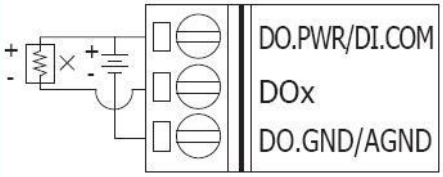
1.6.1 Wiring diagram for the tM-AD4P2C2

Voltage Input for Vin0 and Vin1	Current Input for Vin0 and Vin1
	 Requires Optional External 125 Ω Resistor

Current Input for Iin2 and Iin3


Digital Input/ Counter	ON State Readback as 1	OFF State Readback as 0
Source	+3.5 ~ +50 V_{DC}	OPEN or <1 V_{DC}
		

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Output Type	ON State Readback as 1	OFF State Readback as 0
	Relay ON	Relay OFF
Drive Relay		
Resistance Load		

1.6.2 Wiring Recommendations

- Use 26-12 AWG wire for signal connections.
- Strip the wire to a length of 7±0.5mm.
- Use a crimp terminal for wiring.
- Avoid high-voltage cables and power equipment as much as possible.
- For RS-485 communication, use insulated and twisted pair 24 AWG wire, e.g. Belden 9841.

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1.7 Quick Start

Please refer to the Quick Start for tM-AD4P2C2.

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1.8 Default Settings

Default settings for the tM-AD4P2C2 are as follows:

- Protocol: Modbus RTU
- Module Address: 01
- Voltage Input Type: type code 08, -10V to 10V
- Current Input Type: type code 0D, -20mA to 20mA
- Baud Rate: 9600 bps

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1.9 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 2.10 for details.
3. Enable calibration. Refer to Section 2.31 for details.
4. Apply the zero calibration voltage/current.
5. Send the zero calibration command. Refer to Sections 2.5 for details.
6. Apply the span calibration voltage/current.
7. Send the span calibration command. Refer to Sections 2.4 for voltage calibration and 2.6 for current calibration.
8. Repeat steps 3 to 7 three times.

Notes:

1. Connect the calibration voltage/current to channel 0.
2. Calibration voltages and currents are shown below.
3. The modules must be switched to the DCON protocol mode before calibrating. Refer to Section 3.3.4 and 3.4 for details of the switching protocol.

Calibration voltages/current used by the tM-AD4P2C2:

Type Code	05	08	09	0A	0D
Zero Input	0V	0V	0V	0V	0mA
Span Input	+2.5V	+10V	+5V	+1V	+20mA

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1.10 Configuration Tables

Baud Rate Setting (CC)

7	6	5	4	3	2	1	0
Data		Baud					

Key	Description
Baud	Baud Rate 03: 1200 04: 2400 05: 4800 06: 9600 07: 19200 08: 38400 09: 57600 0A: 115200
Data	Data Format 0: eight data bits, no parity, and one stop bit 1: eight data bits, no parity, and two stop bit 2: eight data bits, even parity, and one stop bit 3: eight data bits, odd parity, and one stop bit

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Analog Input Type Setting (TT)

Type Code	Analog Input Type	Range
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
0D	+/-20mA	-20mA ~ 20mA
1A	0 to +20mA	0 ~ 20mA

Notes:

1. Types 05, 08, 09 and 0A are only used in channel 0 and 1.
2. Types 06, 07, 0D and 1A can be used in channel 0 and 1 with optional external 125 ohm resistor.

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Data Format Setting (FF)

7	6	5	4	3	2	1	0
RS	CS	MS	RS			DF	

Key	Description
DF	Data format 00: Engineering unit 01: % of FSR (full scale range) 10: 2’s complement hexadecimal
MS	Mode setting 0: Normal mode (14 bits) 1: Fast mode (12 bits)
CS	Checksum setting 0: Disabled 1: Enabled
RS	Reserved.

Note: The reserved bits should be zero.

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Analog Input Type and Data Format Table

Type code	Input Type	Data Format	+F.S	-F.S.
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[*2]	-20 to +20 mA	Engineering unit	+20.000	-20.000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
07[*2]	+4 to +20 mA	Engineering unit	+20.000	+04.000
		% of FSR	+100.00	+000.00
		2's comp HEX	FFFF	0000
08[*1]	-10 to +10 V	Engineering unit	+10.000	-10.000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
09[*1]	-5 to +5 V	Engineering unit	+5.0000	-5.0000
		% of FSR	+100.00	-100.00
		2's comp HEX	7FFF	8000
0A[*1]	-1 to +1 V	Engineering unit	+1.0000	-1.0000
		% 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
1A[*2]	0 to +20 mA	Engineering unit	+20.000	+00.000
		% of FSR	+100.00	+000.00
		2's comp HEX	FFFF	0000
*1: only available with the channel 0 and 1 *2: requires optional external 125 ohm resistor for channel 0 and 1				

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4 ~ 20 mA and 0 ~ 20 mA under range reading with DCON protocol

	Under Range
Engineering Unit	-9999.9
% of FSR	-999.99
2’s Complement HEX	8000

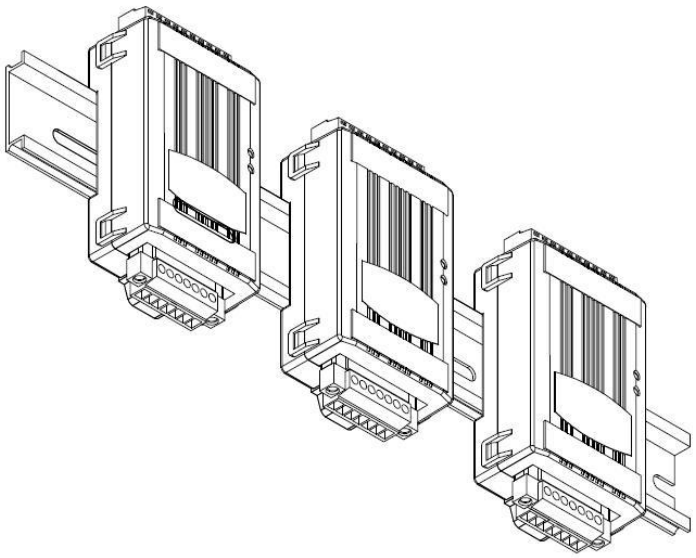
4 ~ 20 mA and 0 ~ 20 mA under range reading with Modbus protocol

Under Range
8000h

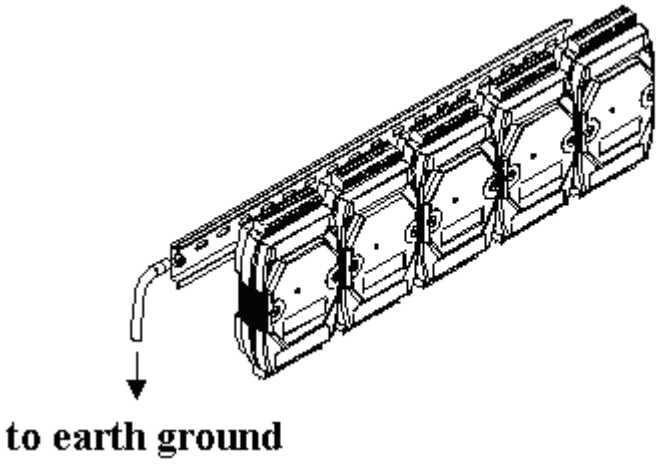
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1.11 Mounting

1.11.1 DIN Rail Mounting

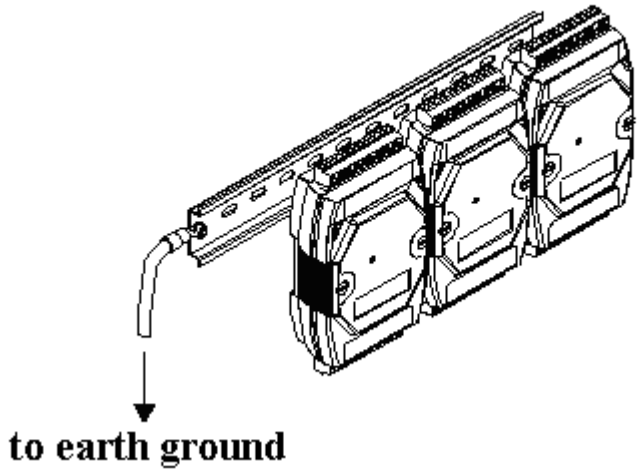


There are three new DIN rail models available. Each are made of stainless steel, which is stronger than those made of aluminum. There is a screw at one end and a ring terminal is included so that it can be easily connected to the earth ground. The three new DIN rail models are as follows.

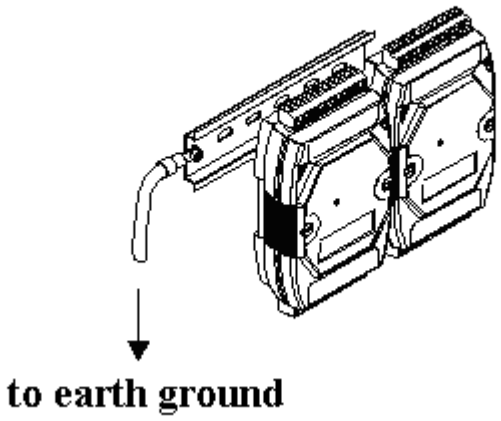
Part number	Max number of modules	Dimensions
DRS-360	5	360mm x 35mm
		
Part number	Max number of modules	Dimensions

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DRS-240	3	240mm x 35mm



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



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

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1.12 Technical Support

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

Email: service@icpdas.com
Website: http://www.icpdas.com.tw/contact_us/contact_us.html

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 2.13, 3.3.7, and 3.4 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.

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2. DCON Protocol

All communication with tM modules consists of commands generated by the host and responses transmitted by the tM 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 command ~** (Section 2.33), which is 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 1.10 and 2.1 for details.

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

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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.

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General and Analog Input Command Sets			
Command	**Response**	**Description**	**Section**
%AANNTTCCFF	!AA	Set Module Configuration	2.1
#AA	>(Data)	Reads the Analog Inputs of All Channels	2.2
#AAN	>(Data)	Reads the Analog Input of the Specified Channel	2.3
$AA0	!AA	Performs a Span Calibration	2.4
$AA1	!AA	Performs a Zero Calibration	2.5
$AA0Ci	!AA	Performs a Single Channel Span calibration	2.6
$AA2	!AANNTTCCFF	Reads the Module Configuration	2.7
$AA5VV	!AA	Enables/Disables the Channel	2.8
$AA6	!AAVV	Reads the Channel Enable/Disable Status	2.9
$AA7CiRrr	!AA	Sets the Single Channel Range Configuration	2.10
$AA8Ci	!AACiRrr	Reads the Single Channel Range Configuration	2.11
$AAA	>(data)	Reads the Analog Inputs of All Channels in Hex Format	2.12
$AAF	!AA(Data)	Reads the Firmware Version	2.13
$AAM	!AA(Data)	Reads the Module Name	2.14
$AAP	!AASC	Reads the Protocol	2.15
$AAPN	!AA	Sets the Protocol	2.16
~AAEV	!AA	Enables/Disables the Calibration	2.31
~AAO(Name)	!AA	Sets the Module Name	2.32
~AARD	!AAVV	Reads the response delay time	2.40
~AARDVV	!AA	Sets the response delay time	2.41

Digital Input and Output Command Sets			
Command	**Response**	**Description**	**Section**
@AACECi	!AA	Clears the Digital Input Counter	2.17
@AADI	!AA0OOII	Reads the DIO status	2.21
@AADODD	!AA	Sets the DO status	2.22
@AARECi	!AA(Data)	Reads the Digital Input Counter	2.28

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Analog Input Alarm Command Sets			
Command	**Response**	**Description**	**Section**
@AACHCi	!AA	Clears the high latched alarm	2.18
@AACLCi	!AA	Clears the low latched alarm	2.19
@AADACi	!AA	Disables the alarm	2.20
@AAEATCi	!AA	Enables the alarm	2.23
@AAHI(data)Ci	!AA	Sets the high alarm limit	2.24
@AALO(data)Ci	!AA	Sets the low alarm limit	2.25
@AARACi	!AAS	Reads the alarm setting	2.26
@AARAO	!AAHHLL	Reads the high/low alarm status	2.27
@AARHCi	!AA(data)	Reads the high alarm limit	2.29
@AARLCi	!AA(data)	Reads the low alarm limit	2.30

Host Watchdog Command Sets			
Command	**Response**	**Description**	**Section**
~**	No Response	Host OK	2.33
~AA0	!AASS	Reads the Host Watchdog Status	2.34
~AA1	!AA	Resets the Host Watchdog Status	2.35
~AA2	!AAETT	Reads the Host Watchdog Timeout Settings	2.36
~AA3ETT	!AA	Sets the Host Watchdog Timeout Settings	2.37
~AA4	!AAPPSS	Reads the power-on value and safe value	2.38
~AA5PPSS	!AA	Sets the power-on value and safe value	2.39

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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 1.10 for details. Not used by the tM-AD4P2C2. For the tM-AD4P2C2, use the $AA7CiRrr command to set the type of each channel, see Section 2.10 for details.

CC New Baud Rate code, see Section 1.10 for details. To change the Baud Rate, the right slide switch must be set to the INIT position. See Section A.1 for details.

FF Used to set the data format, checksum, and mode settings (Section 1.10). To change the checksum setting, the right slide switch must be set to the INIT position. See Section A.1 for details.

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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 switching the right 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.

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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 2.7 $AA2

Related Topics:

Section 1.10 Configuration Tables, Section A.1 INIT Mode

Notes:

1. Changes to the address, type code, data format and mode 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.

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2.2 #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 1.10 for the details of data 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.

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Examples:

Command: #01 Response:
>+025.12+020.45+012.78+018.97
Reads module 01 and receives the data in engineering format.
Command: #02 Response: >4C532628E2D683A2
Reads module 02 and receives the data in hexadecimal format.
Command: #03 Response: >-9999.9-9999.9-9999.9-9999.9
Reads module 03 and the data are under range.

Related Commands:

Section 2.1 %AANNTTCCFF, Section 2.7 $AA2

Related Topics:

Section 1.10 Configuration Tables

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2.3 #AAN

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.

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 1.10 for details of the data format.
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.

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Examples:

Command: #032 Response: >+025.13

Reads data from channel 2 of module 03.

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 2.7 $AA2

Related Topics:

Section 1.10 Configuration Tables

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2.4 $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.

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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 2.5 $AA1, Section 2.31 ~AAEV

Related Topics:

Section 1.9 Calibration

Notes:

1. This command is only applicable to tM-AD4P2C2.
2. The “enable calibration” command, ~AAEV, must be sent before this command is used, see Section 1.9 for details.

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2.5 $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.

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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 2.4 $AA0, Section 2.31 ~AAEV

Related Topics:

Section 1.9 Calibration

Note:

The "enable calibration" command, ~AAEV, must be sent before this command is used, see Section 1.9 for details.

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2.6 $AA0Ci

Description:

Performs a span 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 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.

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Examples:

Command: $010C0 Response: !01

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

Command: $020C3 Response: !02

Performs a span calibration on channel 3 of module 02 and returns a valid response.

Command: $030C1 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 2.5 $AA1, Section 2.31 ~AAEV

Related Topics:

Section 1.9 Calibration

Notes:

1. This command is only applicable to tM-AD4P2C2 current type calibration.
2. The "enable calibration" command, ~AAEV, must be sent before this command is used, see Section 1.9 for details.

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2.7 $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 1.10 for details. 00 for tM-AD4P2C2
CC	Baud Rate code of the module, see Section 1.10 for details.
FF	Data format, checksum settings and mode settings of the module, see Section 1.10 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.

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Examples:

Command: $012 Response: !01000600

Reads the configuration of module 01.

Command: $022 Response: !02000602

Reads the configuration of module 02.

Related Commands:

Section 2.1 %AANNTTCCFF

Related Topics:

Section 1.10 Configuration Tables, Section A.1 INIT Mode

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2.8 $AA5VV

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	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.

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)

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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: $0150A Response: !01

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

Command: $016 Response: !010A

Reads the channel status of module 01 and returns a response of 0A, meaning that channels 1 and 3 are enabled and all other channels are disabled.

Related Commands:

Section 2.9 $AA6

Note:

It is recommended that only the channels that will be used are enabled.

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2.9 $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	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.

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.

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Examples:

Command: $0150A Response: !01

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

Command: $016 Response: !010A

Reads the channel status of module 01 and returns a response of 0A, meaning that channels 1 and 3 are enabled and all other channels are disabled.

Related Commands:

Section 2.8 $AA5VV

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2.10 $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 (0-3 for tM-AD4P2C2).
Rrr	rr represents the type code of the channel to be set. Refer to the Analog Input Type Setting table in Section 1.10 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

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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: $017C0R0A Response: !01

Sets the type code for channel 0 of module 01 to be 0A (-1 ~ +1V) 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 2.11 $AA8Ci

Related Topics:

Section 1.10 Configuration Tables

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2.11 $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=0-3 for tM-AD4P2C2).

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 1.10 for details.

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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: !01C0R0A

Reads the channel 0 input range of module 01 and returns 0A (-1 ~ +1V).

Related Commands:

Section 2.10 $AA7CiRrr

Related Topics:

Section 1.10 Configuration Tables

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2.12 $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.

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Examples:

Command: $01A
Response: >0000012301257FFF
Reads module 01 and receives the data in hex format.

Related Commands:

Section 2.2 #AA

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2.13 $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.

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2.14 $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.

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Examples:

Command: $01M Response: !017018

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

Related Commands:

Section 2.32 ~AAO(Name)

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2.15 $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 3: all of the DCON and Modbus RTU/ASCII 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 3: the protocol set in the EEPROM is Modbus ASCII

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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 2.16 $AAPN

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2.16 $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 3: Modbus ASCII protocol Before using this command, the right 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.

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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 2.15 $AAP

Related Topics:

Section A.1 INIT Mode

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2.17 @AACECi

Description:

Clears the digital input counter of channel i.

Syntax:

@AACECi[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be read (00 to FF)
CE	Command to clear the channel counter
Ci	i specifies the channel to be read (0 to 1).

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.

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Examples:

Command: @03REC1 Response: !0300103

Reads data from channel 1 of module 03 and the returned counter value is 103.

Command: @03CEC1 Response: !03

Clears the counter value of channel 1 of module 03 and returns a valid response.

Command: @03REC1 Response: !0300000

Reads counter data from channel 1 of module 03 and the returned counter value is 0.

Related Commands:

Section 2.28 @AARECi

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2.18 @AACHCi

Description:

Clears the high latched alarm of a channel.

Syntax:

@AACHCi[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be set (00 to FF)
CH	Command to clear the high latched alarm
Ci	i represents which channel should have the high latched alarm cleared.

Response:

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

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command or invalid channel
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.

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Examples:

Command: @01CHC1 Response: !01

Clears the high latched alarm of channel 1 of module 01, and the module returns a valid response.

Related Commands:

Section 2.19 @AACLCi, Section 2.20 @AADACi, Section 2.23 @AAEATCi, Section 2.24 @AAHI(data)Ci, Section 2.25 @AALO(data)Ci, Section 2.27 @AARAO

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2.19 @AACLCi

Description:

Clears the low latched alarm of a channel.

Syntax:

@AACLCi[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be set (00 to FF)
CL	Command to clear the low latched alarm
Ci	i represents which channel should have the low latched alarm cleared.

Response:

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

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command or invalid channel
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.

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Examples:

Command: @01CLC1 Response: !01

Clears the low latched alarm of channel 1 of module 01, and the module returns a valid response.

Related Commands:

Section 2.18 @AACHCi, Section 2.20 @AADACi, Section 2.23 @AAEATCi, Section 2.24 @AAHI(data)Ci, Section 2.25 @AALO(data)Ci, Section 2.27 @AARAO

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2.20 @AADACi

Description:
Disables the alarm of a channel.

Syntax:
@AADACi[CHKSUM](CR)

@ Delimiter character
AA Address of the module to be set (00 to FF)
DA Command to disable the alarm
Ci i represents which channel should have the alarm disabled.

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

! Delimiter character for a valid command
? Delimiter character for an invalid command or invalid channel
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.

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Examples:

Command: @01DAC1 Response: !01

Disables the high alarm of channel 1 of module 01, and the module returns a valid response.

Related Commands:

Section 2.18 @AACHCi, Section 2.19 @AACLCi, Section 2.23 @AAEATCi, Section 2.24 @AAHI(data)Ci, Section 2.25 @AALO(data)Ci, Section 2.27 @AARAO

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2.21 @AADI

Description:

Reads the status of the digital input and output ports.

Syntax:

@AADI[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be read (00 to FF)
DI	Command to read the digital input and output ports

Response:

Valid command: **!AA0OOII[CHKSUM](CR)**

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command
AA	Address of the responding module (00 to FF)
OO	A two-digit hexadecimal value, where bit 0 corresponds to DO0, bit 1 corresponds to DO1, etc. When the bit is 1, it denotes that the digital output port is on, and 0 denotes that the digital output port is off.
II	A two-digit hexadecimal value, where bit 0 corresponds to DI0, bit 1 corresponds to DI1, etc. When the bit is 1, it denotes that the digital input port is on, and 0 denotes that the digital input port is off.

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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: @01DI Response: !0100102

Reads the digital input and output port status of module 01 and returns 00102h, which denotes that DO0 and DI` are on and DO1 and DI0 are off.

Related Commands:

Section 2.22 @AADODD

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2.22 @AADODD

Description:

Sets the digital output ports.

Syntax:

@AADODD[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be set (00 to FF)
DO	Command to set the digital output ports
DD	A two-digit hexadecimal value, where bit 0 corresponds to DO0, bit 1 corresponds to DO1, etc. When the bit is 1, it denotes that the digital output port is on, and 0 denotes that the digital output port is off.

Response:

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

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command
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.

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Examples:

Command: @01DO02 Response: !01

Sets DO0 to off and DO1 to on, and the module returns a valid response.

Related Commands:

Section 2.21 @AADI

Notes:

1. If the digital output port is already set to be an alarm output port, then the value written to the port is ignored.
2. When a host watchdog timeout occurs, the module will respond with an invalid command for this command and the DO value that was sent is ignored.

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2.23 @AAEATCi

Description:

Enable analog input alarm of a channel.

Syntax:

@AAEATCi[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be set (00 to FF)
EA	Command to enable alarm
T	Alarm type: M: momentary alarm L: latched alarm
Ci	i represents the channel to enable alarm.

Response:

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

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command or invalid channel
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.

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Examples:

Command: @01EAMC0 Response: !01

Enable alarm of channel 0 of module 01. The alarm type is momentary.

Command: @01EALC1 Response: !01

Enable alarm of channel 1 of module 01. The alarm type is latched.

Related Commands:

Section 2.18 @AACHCi, Section 2.19 @AACLCi, Section 2.20 @AADACi

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2.24 @AAHI(data)Ci

Description:

Sets the high alarm limit of a channel.

Syntax:

@AAHI(data)Ci[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be set (00 to FF)
HI	Command to set the high alarm limit
(data)	High alarm limit in engineering data format
Ci	i represents which channel is to be checked for the high alarm.

Response:

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

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command or invalid channel
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.

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Examples:

Command: @01HI+09.000C0 Response: !01

Sets the high alarm limit of channel 0 of module 01. The alarm limit is 9.0.

Command: @01HI+01.000C1 Response: !01

Sets the high alarm limit of channel 1 of module 01. The alarm limit is 1.0.

Related Commands:

Section 2.18 @AACHCi, Section 2.19 @AACLCi, Section 2.20 @AADACi, Section 2.23 @AAEATCi, Section 2.25 @AALO(data)Ci

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2.25 @AALO(data)Ci

Description:

Sets the low alarm limit of a channel.

Syntax:

@AALO(data)Ci[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be set (00 to FF)
LO	Command to set the low alarm limit
(data)	Low alarm limit in engineering data format
Ci	i represents which channel is to be checked for the low alarm.

Response:

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

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command or invalid channel
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.

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Examples:

Command: @01LO-05.000C0 Response: !01

Sets the low alarm limit of channel 0 of module 01. The alarm limit is -5.0.

Command: @01LO+01.000C1 Response: !01

Sets the low alarm limit of channel 1 of module 01. The alarm limit is 1.0.

Related Commands:

Section 2.18 @AACHCi, Section 2.19 @AACLCi, Section 2.20 @AADACi, Section 2.23 @AAEATCi, Section 2.24 @AAHI(data)Ci

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2.26 @AARACi

Description:

Reads the alarm setting of a channel.

Syntax:

@AARACi[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be read (00 to FF)
RA	Command to read the alarm setting.
Ci	i represents from which channel the alarm setting should be read.

Response:

Valid command: **!AAS[CHKSUM](CR)**

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command or invalid channel
AA	Address of the responding module (00 to FF)
S	Alarm type: 0: alarm disabled 1: momentary alarm 2: latched alarm

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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: @01RAC0 Response: !011

Reads the alarm setting of channel 0 of module 01. The module responds that the alarm type is momentary.

Command: @01RAC1 Response: !012

Reads the high alarm settings of channel 1 of module 01. The module responds that the alarm type is latched.

Related Commands:

Section 2.18 @AACHCi, Section 2.19 @AACLCi, Section 2.20 @AADACi, Section 2.23 @AAEATCi, Section 2.24 @AAHI(data)Ci, Section 2.25 @AALO(data)Ci, Section 2.29 @AARHCi, Section 2.30 @AARLCi

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2.27 @AARAO

Description:

Reads the currently activated alarms.

Syntax:

@AARAO[CHKSUM](CR)

@ Delimiter character
AA Address of the module to be read (00 to FF)
RAO Command to read the currently activated alarms.

Response:

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

! Delimiter character for a valid command
? Delimiter character for an invalid command or invalid port
AA Address of the responding module (00 to FF)
HH A two-digit hexadecimal value to represent the currently activated high alarms, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 1, it denotes that there is an activated high alarm associated with the channel. When the bit is 0, it denotes that there are no activated high alarms associated with the channel.

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LL A two-digit hexadecimal value to represent the currently activated low alarms, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 1, it denotes that there is an activated low alarm associated with the channel. When the bit is 0, it denotes that there are no activated low alarms associated with the channel.

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: @01RAO Response: !010102

Reads the currently activated alarms of module 01. The module responds with 0102, which denotes that there is an activated high alarm associated with channel 0, and an activated low alarm associated with channel 1.

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2.28 @AARECi

Description:

Reads the digital input counter of channel i.

Syntax:

@AARECi[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be read (00 to FF)
RE	Command to read the channel counter
Ci	i specifies the channel to be read (0 to 1).

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)	Five decimal digits representing the digital input counter data of the specified channel (00000 to 65535).

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.

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Examples:

Command: @03REC1 Response: !0300103

Reads data from channel 1 of module 03 and the returned counter value is 103.

Command: @02REC9 Response: ?02

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

Related Commands:

Section 2.17 @AACECi

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2.29 @AARHCi

Description:

Reads the high alarm limit of a channel.

Syntax:

@AARHCi[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be read (00 to FF)
RH	Command to read the high alarm limit.
Ci	i represents from which channel the high alarm limit should be read.

Response:

Valid command: **!AA(Data)[CHKSUM](CR)**

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command or invalid channel
AA	Address of the responding module (00 to FF)
(data)	High alarm limit in engineering data format

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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: @01RHC0 Response: !01+09.000

Reads the high alarm limit of channel 0 of module 01. The module responds that the high alarm limit is 9.0.

Command: @01RHC1 Response: !01+01.000

Reads the high alarm limit of channel 1 of module 01. The module responds that the high alarm limit is 1.0.

Related Commands:

Section 2.18 @AACHCi, Section 2.19 @AACLCi, Section 2.20 @AADACi, Section 2.23 @AAEATCi, Section 2.24 @AAHI(data)Ci, Section 2.25 @AALO(data)Ci, Section 2.30 @AARLCi

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2.30 @AARLCi

Description:

Reads the low alarm limit of a channel.

Syntax:

@AARLCi[CHKSUM](CR)

@	Delimiter character
AA	Address of the module to be read (00 to FF)
RL	Command to read the low alarm limit.
Ci	i represents from which channel the low alarm limit should be read.

Response:

Valid command: **!AA(Data)[CHKSUM](CR)**

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command or invalid channel
AA	Address of the responding module (00 to FF)
(data)	Low alarm limit in engineering data format

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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: @01RLC0 Response: !01+01.000

Reads the low alarm limit of channel 0 of module 01. The module responds that the low alarm limit is 1.0.

Command: @01RLC1 Response: !01-02.000

Reads the low alarm limit of channel 1 of module 01. The module responds that the low alarm limit is -2.0.

Related Commands:

Section 2.18 @AACHCi, Section 2.19 @AACLCi, Section 2.20 @AADACi, Section 2.23 @AAEATCi, Section 2.24 @AAHI(data)Ci, Section 2.25 @AALO(data)Ci, Section 2.29 @AARHCi

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2.31 ~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.

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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 2.4 $AA0, Section 2.5 $AA1, Section 2.6 $AA0Ci

Related Topics:

Section 1.9 Calibration

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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.

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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 2.14 $AAM

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2.33 ~**

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

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2.34 ~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.

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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 2.33 ~**, Section 2.35 ~AA1, Section 2.36 ~AA2, Section 2.37 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

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2.35 ~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.

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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 2.33 ~**, Section 2.34 ~AA0, Section 2.36 ~AA2, Section 2.37 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

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2.36 ~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.

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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 2.33 ~**, Section 2.34 ~AA0, Section 2.35 ~AA1, Section 2.37 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

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2.37 ~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.

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

Related Topics:

Section A.2 Dual Watchdog Operation

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2.38 ~AA4

Description:

Reads the power-on DO and safe DO values of a module.

Syntax:

~AA4[CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be read (00 to FF)
4	Command to read the power-on DO and safe DO values

Response:

Valid command : **!AAPPSS[CHKSUM](CR)**

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command
AA	Address of the responding module (00 to FF)
PP	Two hexadecimal digits to represent the power-on DO value.
SS	Two hexadecimal digits to represent the safe DO value.

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.

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Examples:

Command: ~014 Response: !010000

Reads the power-on DO value and the safe DO value of module 01 and returns 0000.

Related Commands:

Section 2.39 ~AA5PPSS

Related Topics:

Section A.2 Dual Watchdog Operation

Notes:

Both the power-on value and the safe value have no effect on the DO ports that are associated with alarm outputs.

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2.39 ~AA5PPSS

Description:

Sets the power-on DO and safe DO values of a module.

Syntax:

~AA5PPSS[CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be set (00 to FF)
5	Command to set the power-on and safe DO values
PP	Two hexadecimal digits to represent the power-on DO value.
SS	Two hexadecimal digits to represent the safe DO value.

Response:

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

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

!	Delimiter character for a valid command
?	Delimiter character for an invalid command
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.

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Examples:

Command: ~0150000 Response: !01

Sets the power-on DO value to 0 and the safe DO value to 0. The module returns a valid response.

Command: ~014 Response: !010000

Reads the power-on DO value and the safe DO value of module 01. The module returns 0000, which denotes that both the power-on DO value and the safe DO value are 0.

Related Commands:

Section 2.38 ~AA4

Related Topics:

Section A.2 Dual Watchdog Operation

Notes:

Both the power-on value and the safe value have no effect on the DO ports that are associated with alarm outputs.

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2.40 ~AARD

Description:

Reads the response delay time value of a module.

Syntax:

~AARD[CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be read (00 to FF)
RD	Command to read the response delay time value

Response:

Valid Response: !AAVV[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	Two hexadecimal digits to represent the response delay time value in milli-second, for example, 01 denotes 1ms and 1E denotes 30ms. The max allowable value is 30 (1Eh).

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.

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Examples:

Command: ~01RD Response: !0102

Reads the response delay time value of module 01 and returns 02, which denotes that the response delay time value is 2ms.

Related Commands:

Section 2.41 ~AARDVV

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2.41 ~AARDVV

Description:

Sets the response delay time value of a module.

Syntax:

~AARDVV[CHKSUM](CR)

~	Delimiter character
AA	Address of the module to be read (00 to FF)
RD	Command to set the communication protocol
	VV Two hexadecimal digits to represent the response delay time value in milli-second, for example, 01 denotes 1ms and 1E denotes 30s. The max allowable value is 30 (1Eh).

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.

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Examples:

Command: ~01RD06 Response: !01

Sets the response delay time value to 6ms. The module returns a valid response.

Command: ~01RD Response: !0106

Reads the response delay time value of module 01. The module returns 06, which denotes that the response delay time value is 6ms.

Related Commands:

Section 2.40 ~AARD

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3. Modbus 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.

The tM series modules support both the Modbus RTU and Modbus ASCII protocols. The communication Baud Rates range from 1200bps to 115200bps. 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

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.

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3.1 02 (0x02) Read Input Status

This function code is used to read the open wire status of a module in the current input type.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x02
02 ~ 03	Starting channel	2 Bytes	0x80 to 0x83, where 0x80 corresponds to channel 0, 0x81 corresponds to channel 1, etc
04 ~ 05	Number of input channels	2 Bytes	N, 1 to 4; (Starting channel + N) should be less than or equal to 0x84

Note: This function is only available on tM-AD4P2C2.

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

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3.2 04 (0x04) Read Input Channels

This function code is used to read from contiguous analog input channels.

Request

00	Address	1 Byte	1 to 247
01	Function code	1 Byte	0x04
02 ~ 03	Starting channel	2 Bytes	0 to 3 for reading analog inputs
04 ~ 05	Number of input channels (N)	2 Bytes	1 to 4; (Starting channel + N) <= 4 for reading analog inputs.

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	

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

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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

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

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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	0x07 0x22 0x40 0x01

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

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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

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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	Protocol supported	1 Byte	0x00: Modbus RTU 0x03: Modbus RTU & ASCII
04	Baud Rate	1 Byte	Baud Rate code, see Section 1.10 for details.
05	Reserved	1 Bytes	0x00
06	Data format	1 Byte	0x00: no parity, 1 stop bit 0x01: no parity, 2 stop bits 0x02: even parity, 1 stop bit 0x03: odd parity, 1 stop bit
07	Reserved	1 Bytes	0x00
08	Mode	1 Byte	0x00: DCON protocol 0x01: Modubs RTU protocol 0x03: Modbus ASCII 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

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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 1.10 for details.
05	Reserved	1 Byte	0x00
06	Data format	1 Byte	0x00: no parity, 1 stop bit 0x01: no parity, 2 stop bits 0x02: even parity, 1 stop bit 0x03: odd parity, 1 stop bit
07	Reserved	1 Byte	0x00
08	Mode	1 Byte	0x00: DCON protocol 0x01: Modubs RTU protocol 0x03: Modubs ASCII protocol
09 ~ 10	Reserved	2 Bytes	0x00 0x00

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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	0x00: OK, others: error
05	Reserved	1 Byte	0x00 0x00 0x00
06	Data format	1 Byte	0x00: OK, others: error
07	Reserved	1 Byte	0x00
08	Mode	1 Byte	0x00: 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

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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 ~ 0x03

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 1.10 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

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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 ~ 0x03
05	Type code	1 Byte	Type code, see Section 1.10 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	0x00: 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, reserved bytes should be filled with zero, incorrect number of bytes received

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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

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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	0x00 ~ 0x0F, 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.

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

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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	0x00 ~ 0x0F, 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.

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

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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 7~6: reserved Bit 5: mode setting 0: normal mode 1: fast mode Bit 4~2: reserved Bit 1: DO active state Bit 0: DI active state

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

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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 7~6: reserved Bit 5: mode setting 0: normal mode 1: fast mode Bit 4~2: reserved Bit 1: DO active state Bit 0: DI active state

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

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3.4 Address Mappings

tM-AD4P2C2 Address Mappings

<table>
<tr><th>Address</th><th>Description</th><th>Attribute</th></tr>
<tr><td>30001 ~ 30004
40001 ~ 40004</td><td>Analog input value of channel 0 to 3</td><td>R</td></tr>
<tr><td>30129 ~ 30130
40129 ~ 40130</td><td>Counter value of digital input channel 0 to 1</td><td>R</td></tr>
<tr><td>40257 ~ 40260</td><td>Analog input type code of channel 0 to 3</td><td>R/W</td></tr>
<tr><td>40225 ~ 40226</td><td>High alarm limit of channel 0 to 1</td><td>R/W</td></tr>
<tr><td>40233 ~ 40234</td><td>Low alarm limit of channel 0 to 1</td><td>R/W</td></tr>
<tr><td>40481</td><td>Firmware version (low word)</td><td>R</td></tr>
<tr><td>40482</td><td>Firmware version (high word)</td><td>R</td></tr>
<tr><td>40483</td><td>Module name (low word), 0x4001</td><td>R</td></tr>
<tr><td>40484</td><td>Module name (high word), 0x0722</td><td>R</td></tr>
<tr><td>40485</td><td>Module address, valid range: 1 ~ 247</td><td>R/W</td></tr>
<tr><td>40486</td><td>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</td><td>R/W</td></tr>
<tr><td>40488</td><td>Modbus response delay time in ms, valid range: 0 ~ 30</td><td>R/W</td></tr>
</table>

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Address	Description	Attribute
40489	Host watchdog timeout value, 0 ~ 255, in 0.1s	R/W
40490	Channel enable/disable, 00h ~ 0Fh	R/W
40492	Host watchdog timeout count, write 0 to clear	R/W
00033 ~ 00034 10033 ~ 10034	Digital input value of channel 0 to 1	R
00065 ~ 00066 10065 ~ 10066	High latched value of DI	R
00073 ~ 00074 10073 ~ 10074	High latched value of DO	R
00097 ~ 00098 10097 ~ 10098	Low latched value of DI	R
00105 ~ 00106 10105 ~ 10106	Low latched value of DO	R
00225 ~ 00228 10225 ~ 10228	Over/under range status of analog input channel 0 to 3 for 4 ~ 20mA or 0 ~ 20mA ranges	R
00001 ~ 00002	Digital output value of channel 0 to 1	R/W
00129 ~ 00130	Safe value of digital output channel 0 to 1	R/W
00161 ~ 00162	Power on value of digital output channel 0 to 1	R/W

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Address	Description	Attribute
00193 ~ 00194	Counter update trigger edge of digital input channel 0 to 1	R/W
00257	Protocol, 0: DCON, 1: Modbus RTU	R/W
00258	Protocol, 0: determined by 00257, 1: Modbus ASCII	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
00264	Write 1 to clear latched DIO states	W
00265	DI active state	R/W
00266	DO active state	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
00289 ~ 00290	Low alarm status of channel 0 to 1. Write 1 to clear low latched alarm of channel 0 to 1	R/W
00305 ~ 00306	High alarm status of channel 0 to 1. Write 1 to clear high latched alarm of channel 0 to 1	R/W
00321 ~ 00322	Enable/disable alarm of channel 0 to 1	R/W
00337 ~ 00338	Alarm type, momentary or latched, of channel 0 to 1	R/W
00513 ~ 00514	Write 1 to clear counter value of digital input channel 0 to 1	W

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3.5 Engineering Data Format Table

Type Code	Input Type	Min.	Max.
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
0D	-20 mA ~ +20 mA	-20000	20000
1A	0 ~ +20 mA	0	20000

The under range value is –32768 and the over range value is +32767. For the hex data format, please refer to Section 1.10.

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4. Troubleshooting

If you are having difficulty using the tM 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 1.12.

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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.

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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. The type code is set by using the %AANNTTCCFF command, see Section 2.1 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 1.9 in detail before doing any calibration.

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A. Appendix

A.1 INIT Mode

Each tM 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 tM 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 2.14 for details.

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The tM modules have the INIT switch located on the right 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.



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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.

The tM 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.

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A.3 Frame Ground

Electronic circuits are constantly vulnerable to ESD which become worse in a continental climate area. The tM 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.

Connect the frame ground terminal to a wire/DIN rail and connect the wire/DIN rail to the earth ground will provide a better protection for the module.

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