I-87H17W
User's Manual

Warranty

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

Warning

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1. Introduction

The I-87H17W is a HART analog input module.It supports data acquisition and control modules, providing analog-to-digital, and Highway Addressable Remote Transducer. The modules can be remotely controlled using a set of commands, which we call the DCON protocol. Communication between the module and the host is in ASCII format via an RS-485 bi-directional serial bus standard. Baud Rates are software programmable and transmission speeds of up to 115.2K baud can be selected.

The common features of the I-87H17 is as follows:

- Analog input capability with or without HART
- Real-time HART data acquisition
- Full read/write access to all device information
- Support 4 ~ 20 mA current input
- 2 or 4 wire transmitters of HART
- With a built-in resistor
- Open wire detection
- 4 kV ESD protection
- 2500 VDC intra-module isolation
- Built-in Watchdog
- RoHS compliance
- Support DCON Protocol
- Provide API library and demos
- Support XPAC, WinPAC, iPAC series

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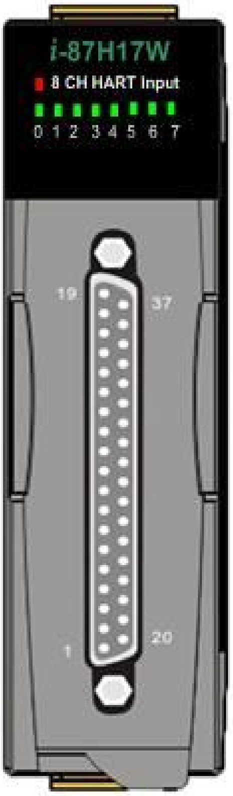
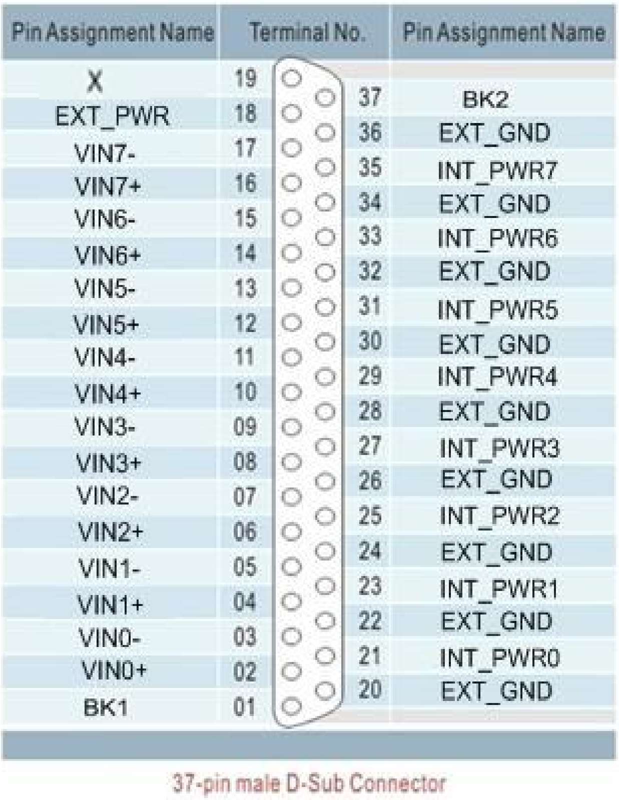
1.1 Terminal Assignment





Pin Assignment Name	Terminal No.	Terminal No.	Pin Assignment Name
X	19		
EXT_PWR	18	37	BK2
VIN7-	17	36	EXT_GND
VIN7+	16	35	INT_PWR7
VIN6-	15	34	EXT_GND
VIN6+	14	33	INT_PWR6
VIN5-	13	32	EXT_GND
VIN5+	12	31	INT_PWR5
VIN4-	11	30	EXT_GND
VIN4+	10	29	INT_PWR4
VIN3-	09	28	EXT_GND
VIN3+	08	27	INT_PWR3
VIN2-	07	26	EXT_GND
VIN2+	06	25	INT_PWR2
VIN1-	05	24	EXT_GND
VIN1+	04	23	INT_PWR1
VIN0-	03	22	EXT_GND
VIN0+	02	21	INT_PWR0
BK1	01	20	EXT_GND

37-pin male D-Sub Connector

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1.2 Specifications

Analog Input	
Input Channels	8 Differential 4-20 mA input channels
HART Wiring	2 or 4 wire transmitters
HART Response Time	1s per single channel
Resolution	16-bit
Zero Drift	+/- 20μV/ °C
Span Drift	+/- 25μV / °C
Common Mode Rejection	86 dB
Normal Mode Rejection	100 dB
Input Impedance	400 Ohms
Common Voltage	-200V to +200V
Open Wire Detection	Yes
4KV ESD Protection	Yes, Contact for each terminal.
Intra-module Isolation, Field to Logic	$2500V_{DC}$
Watchdog	
Dual Watchdog	Yes, Module(1.6 sec) and Communication(Programable)
LED Display	
1 LED as Power Indicator 8 LED as HART Communication Indicator	
Power	
Power Consumption	Maximum : 1.8W
Environment	
Operating Temperature	-25 to 75 °C
Storage Temperature	-30 to 75 °C
Humidity	5 to 95% RH, non-condensing
Dimensions	
30mm x 102mm x 115mm(W x L x H) Detail	

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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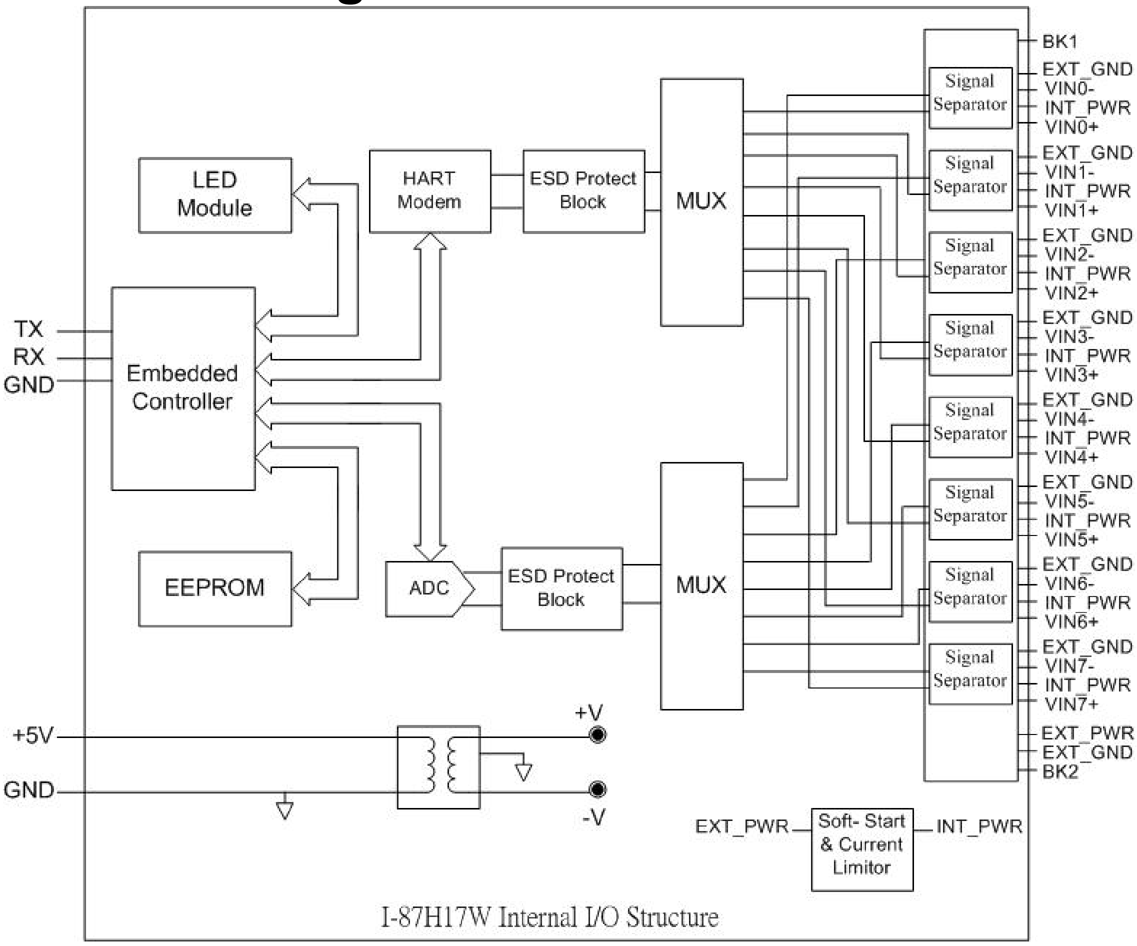
1.3 Block Diagrams



I-87H17W Internal I/O Structure

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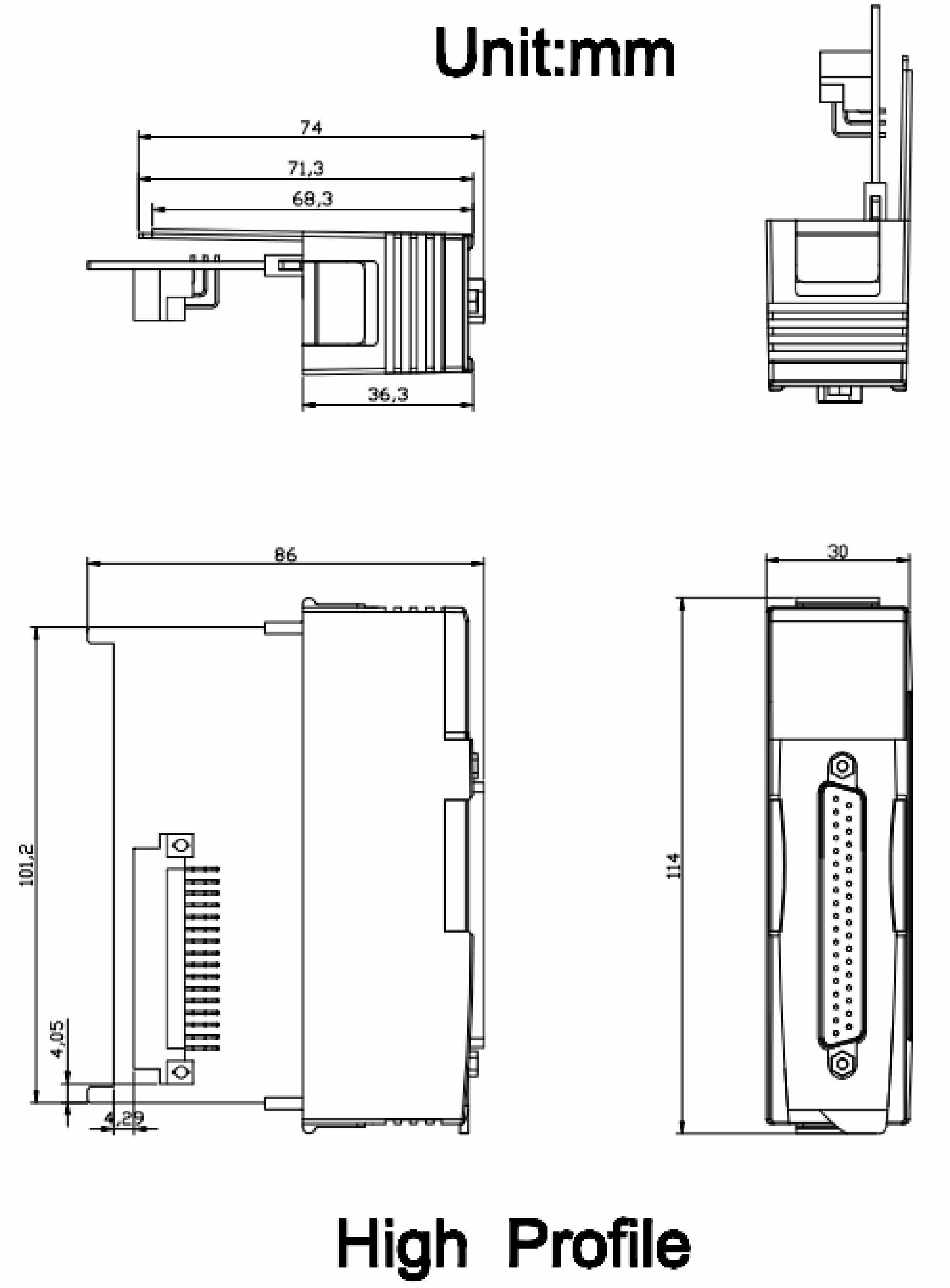
1.4 Dimensions



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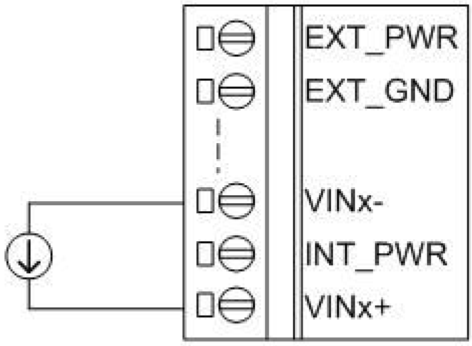
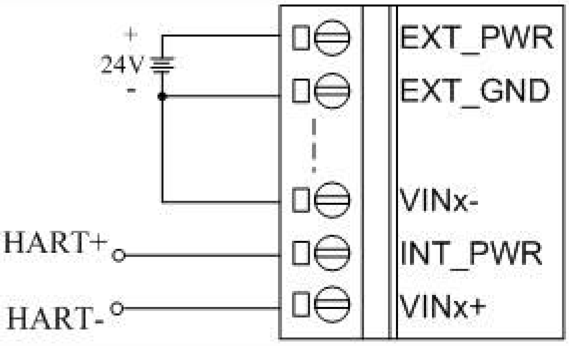
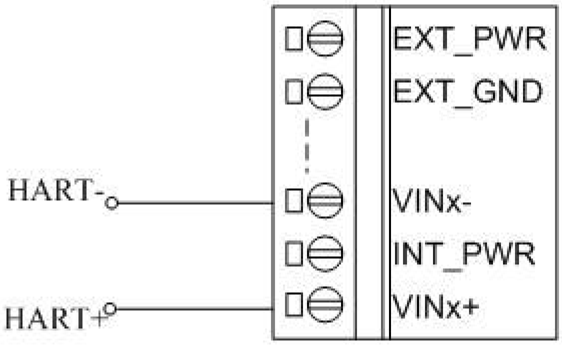
1.5 Wiring Diagrams

Wiring for Current input



Wiring for HART input

2-wire	 + 24V - HART+ HART- EXT_PWR EXT_GND VINx- INT_PWR VINx+
4-wire	 HART- HART+ EXT_PWR EXT_GND VINx- INT_PWR VINx+

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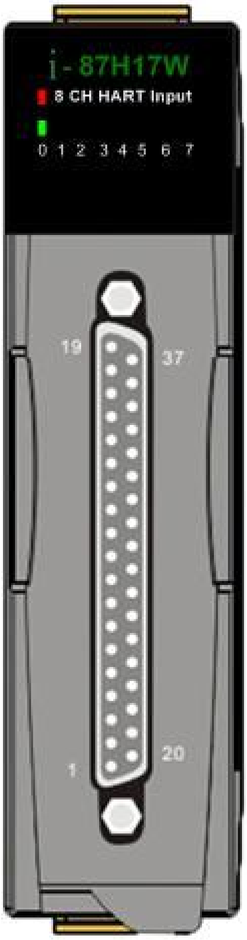
1.6 LED Function

PWR LED: 1 LED as Power indicator. When the module power on, PWR LED is shown red, other is shown dark.

HART LED: 8 LEDs as HART communication indicators. When the specific channel is communicating with HART device, the HART LED is hown green, other is shown dark. Refer to below picture, the channel 0 is communicating to HART device.



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1.7 Quick Start

To install the module, follow the steps below:

1. Connect the analog input. See Section 1.5 the wiring diagram.
2. Connect the module to the RS-485 network using the Remote I/O Expansion Unit.
3. For this modules, configure the module by sending the %AANNTTCCFF command. See Section 2.1 for details. The default settings for the module can be found in Section 1.7.
4. For this modules, in order to read analog input value from the input channels, send either the #AA or #AAN command to the module and send $AAHTNNppdd(aa)cc , #AAHTSNN(data) or #AAHTTNN to read HART frame frome HARTdevice. See Sections 2.2, 2.3, 2.14, 2.15, 2.16 for details.

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1.8 Default Settings

Default settings for the I-87H17W module is:

- Module address: 01
- Analog input type: 4mA to 20mA
- Baud Rate: 115200 bps
- Checksum disabled
- Engineering unit format

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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. Enable calibration. Refer to Section 2.13 for details.
3. Apply 0mA to the zero calibration.
4. Send the zero calibration command. Refer to Sections 2.4 for details.
5. Apply 25mA to the span calibration.
6. Send the span calibration command. Refer to Sections 2.5 details.
7. Repeat steps 3 to 7 three times.

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1.10 Configuration Tables

Baud Rate Setting (CC)

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

Note: The data bits are fixed at one start bit, eight data bits, no parity and one stop bit.

Analog Input Type Setting (TT)

Type Code: 4~20 mA

Data Format Setting (FF)

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

Key	Description
DF	Data format 00: Engineering unit 01: % of FSR (full scale range) 10: 2’s complement hexadecimal
MS	none
CS	Checksum settings 0: Disabled 1: Enabled
FS	none

Note: The reserved bits should be zero.

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Analog Input Type and Data Format Table

Data Format	+F.S.	-F.S.
Engineering Unit	+20.000	+04.000
% of FSR	+100.00	+000.00
2’s Complement HEX	7FFF	0000

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

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1.11 INIT Mode

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

1. Address: 00
2. Baud Rate: 115200 bps
3. No checksum
4. Engineering unit format
5. Protocol: DCON

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1.12 Technical Support

Should you encounter problems while using the I-87H17W module, and are unable to find the help you need in this manual or on our website, please contact ICP DAS Product Support.

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

When requesting technical support, be prepared to provide the following information about your system:

1. Module name and serial number: The serial number can be found printed on the barcode label attached to the cover of the module.
2. Firmware version: See Section 2.8 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 I-87K modules consists of commands generated by the host and responses transmitted by the I-87K modules. Each module has a unique ID number that is used for addressing purposes and is stored in non-volatile memory. The ID is 01 by default and can be changed using a user command. All commands to the modules contain the ID address, meaning that only the addressed module will respond. The only exception to this is commands #** (Section 2.2) and ~** (Section 2.18), which are sent to all modules, but in these cases, the modules do not reply to the command.

Command Format:

Leading Character	Module Address	Command	[CHKSUM]	CR

Response Format:

Leading Character	Module Address	Data	[CHKSUM]	CR

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

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

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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 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
$AA0CN	!AA	Performs a Single Channel Span calibration	2.4
$AA1CN	!AA	Performs a Single Channel Zero calibration	2.5
$AA2	!AATTCCFF	Reads the Module Configuration	2.6
$AAF	!AA(Data)	Reads the Firmware Version	2.7
$AAM	!AA(Data)	Reads the Module Name	2.8
@AACS	!AA	Clear maximum/minimum analog inputs	2.9
@AAOD	!AAN	Reads the connection status of daughter board	2.10
@AACSN	!AA	Clear maximum/minimum analog input of specified channel	2.11
@AARS	!(Data)	Read maximum/minimum analog inputs	2.12
@AARSN	!(Data)	Read maximum/minimum analog input of specified channel	2.13
~AAEV	!AA	Enables/Disables the Calibration	2.14

HART Command Sets

Command	Response	Description	Section
$AAHTNppdd(aa)cc	!AAN	Sets HART Information	2.15
#AAHTSN(data)	>AAN	Sets HART Data	2.16
#AAHTRN	>AA(length)(all Info)	Reads HART Data	2.17

Host Watchdog Command Sets

Command	Response	Description	Section
~**	No Response	Host OK	2.18
~AA0	!AASS	Reads the Host Watchdog Status	2.19
~AA1	!AA	Resets the Host Watchdog Status	2.20
~AA2	!AAEVV	Reads the Host Watchdog Timeout Settings	2.21
~AA3EVV	!AA	Sets the Host Watchdog Timeout Settings	2.22

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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 00

CC New Baud Rate code, see Section 1.10 for details. To change the Baud Rate, the INIT* terminal must be connected to ground or the rear slide switch must be set to the INIT position. See Section A.1 for details.

FF Used to set the data format, checksum, and filter settings (Section 1.11). To change the checksum setting, the INIT* terminal must be connected to ground or the rear slide switch must be set to the INIT position. See Section A.1 for details.

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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 connecting the INIT* pin to ground or switching the rear slide switch to the INIT position, the module will return an invalid command.
AA	Address of the module in hexadecimal format (00 to FF)

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

Examples:

Command: %0102000600 Response: !02

Change the address of module 01 to 02. The module returns a valid response.

Command: %0202000602 Response: !02

Set the data format of module 02 to be 2 (2's complement hexadecimal). The module returns a valid response.

Command: %0101000A00 Response: ?01

Change the Baud Rate of module 01 to 115200bps. The module returns an invalid command, because it is not in INIT* mode.

Command: %0101000A00 Response: !01

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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 2.6 $AA2

Related Topics:

Section 1.10 Configuration Tables

Notes:

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

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2.3 #AA

Description:

Reads the data from every analog input channel.

Syntax:

#AA[CHKSUM](CR)

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

Response:

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

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

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

Examples:

Command: #01

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

Reads module 01 and receives the data in engineering format.

Command: #02

Response: >4C532628E2D683A20F2ADBA16284BA71

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Reads module 02 and receives the data in hexadecimal format.

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

Reads module 03 and the data is under range.

Related Commands:

Section 2.1 %AANNTTCCFF, Section 2.6 $AA2

Related Topics:

Section 1.10 Configuration Tables

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2.4 #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	Specifies the channel to be read

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.
AA	Address of the responding module (00 to FF)
(Data)	Analog input data of the specified channel, see Section 1.10 for details of the 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.

Examples:

Command: #032 Response: >+025.13
Reads data from channel 2 of module 03.

Command: #051 Response: >+025.13
Reads data from channel 1 of module 05

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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 2.6 $AA2

Related Topics:

Section 1.10 Configuration Tables

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2.5 $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.

Examples:

Command: $010C0 Response: !01
Performs a span calibration on channel 0 of module 01 and returns a valid response.
Command: $020C5 Response: !02
Performs a span calibration on channel 5 of module 02 and returns a valid response.

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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 $AA1Ci, Section 2.14 ~AAEV

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2.5 $AA1Ci

Description:

Performs a zero calibration on the specified channel.

Syntax:

$AA1Ci[CHKSUM](CR)

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

Response:

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

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

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

Examples:

Command: $011C0 Response: !01

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

Command: $021C5 Response: !02

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

Command: $031C1   Response: ?03

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

Related Commands:

Section 2.4 $AA0NN, Section 2.14~AAEV

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2.6 $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 00

CC Baud Rate code of the module, see Section 1.10 for details.

FF Data format, checksum settings and filter 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 %AANNCCFF

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2.7 $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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2.8 $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: !01I-87H17W

Reads the module name of module 01 and returns the name “I-87H17W”.

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2.9 @AACS

Description:

Clear maximum/minimum analog inputs

Syntax:

@AACS[CHK](cr)

@	a delimiter character
AA	address of setting module (00 to FF)
C	command for clear maximum or minimum values
S	S = H for clear maximum analog inputs S = L for clear minimum analog inputs

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)

Examples:

Command: @01CH Response: !01

Clear maximum inputs of address 01, response success.

Command: @02CL Response: !02

Clear maximum inputs of address 02, response success.

Related Commands:

Section 2.11 @AACSN

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2.10 @AACSN

Description:

Clear maximum/minimum analog input of specified channel

Syntax:

@AACSN[CHK](cr)

@	Delimiter character
AA	Address of the module to be read (00 to FF)
C	command for clear maximum or minimum values
S	S = H for clear maximum analog inputs S = L for clear minimum analog inputs
N	Specifies the channel to be cleared

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: @01CH0 Response: !01

Clear maximum inputs on channel 0 of module 01, response success.

Command: @02CL1 Response: !02

Clear maximum inputs on channel 1 of module 02, response success.

Related Commands:

Section 2.10 @AACS

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2.11 $AAOD

Description:

Reads the connection status of daughter board.

Syntax:

$AAOD[CHKSUM](CR)

$	Delimiter character
AA	Address of the module to be read (00 to FF)
OD	command for reading open wire detection status

Response:

Valid Response: !AAN[CHKSUM](CR)

Invalid Response: ?AA[CHKSUM](CR)

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
N	0: daughter board connected 1: no daughter board connected

Examples:

Command: $01OD Response: !011

Reads the Open wire status of module 01, and shows that it is opening.

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2.12 @AARS

Description:

Read maximum/minimum analog inputs.

Syntax:

@AARS[CHK](cr)

@	Delimiter character
AA	Address of module to be calibrated (00 to FF)
R	command for read maximum or minimum values
S	S = H for clear maximum analog inputs S = L for clear minimum analog inputs

Response:

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

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
(Data)	maximum/minimum data of all channels

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: @01RL
Response: *!+04.000+05.000+06.123+05.134+09.123*
+05.345+07.145+08.145

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Description: Read minimum inputs of address 01,
response 4.000, 5.000, 6.123, 5.134, 9.123,
5.345, 7.145, 8.145

Related Commands:

Section 2.13 @AARSN

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2.13 @AARSN

Description:

Read maximum/minimum analog input of specified channel.

Syntax:

$AARSN[CHKSUM](CR)

$ Delimiter character

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

R command for read maximum or minimum values

S S = H for clear maximum analog inputs
S = L for clear minimum analog inputs

N Specifies the channel to be read

Response:

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

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

! Delimiter character for a valid response

? Delimiter character for an invalid response

AA Address of the responding module (00 to FF)

(Data) maximum/minimum data of specified 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: @01RL3
Response: *! -05.134*

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Description: Read minimum input of channel 3 of address 01, response -5.134.

Related Commands:

Section 2.12 @AARS

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2.14 ~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: $010C0 Response: ?01

Sends the command to perform a span calibration on address 0 of 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: $010C0 Response: !01

Sends the command to perform a span calibration on address 0 of module 01 and returns a valid response.

Related Commands:

Section 2.4 $AA0CN, Section 2.5 $AA1CN

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2.15 $AAHTNppdd(aa)cc

Description:

Set the frame of preamble, delimiter, address, command to HART device.

Syntax:

$AAHTNppdd(aa)cc **[CHKSUM](CR)**

$	Delimiter character
AA	Address of the module to be read (00 to FF)
HT	HART frame
N	Specifies the channel to be set
pp	Preamble frame, only set 5 ~ 20 (0xff)
dd	Delimiter frame,
aa	HART Address, support short or long address
cc	Support Universal, Common-Practice and Transmitter-Specific command.

Response:

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

!	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
N	Specifies the channel to have be set

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: $01HT0005028000
Response: !010

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Send frame of HART device to channel 0 of module 01.
The Preamble frame is FFFFFFFFFF.
The Delimiter is 0x02(short frame).
The Address of HART device is 0 and set Primary Master.
The Command is command 0.

Related Commands:

Section 2.16 #AAHTSN(Data),
Section 2.17 #AAHTRN

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2.16 #AAHTSN(Data)

Description:

Sets the data frame to HART Device.

Syntax:

#AAHTSN(Data) **[CHKSUM](CR)**

#	Delimiter character
AA	Address of the module to be read (00 to FF)
HT	HART frame
S	Send data.
N	Specifies the channel to be set
(Data)	HART Data

Response:

Valid Response: **>AAN[CHKSUM](CR)**

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

>	Delimiter character for a valid response
?	Delimiter character for an invalid response
AA	Address of the responding module (00 to FF)
N	Specifies the channel to be set

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: #01HTS0 Response: >010

Send the data of HART device to channel 0 of module 01.The data of HART device is no data.

Command: #01HTS101020304 Response: >011

Send the data of HART device to channel 1 of module 01.The data of HART device is 01020304.

Related Commands:

Section 2.15 $AAHTNppdd(aa)cc,
Section 2.17 #AAHTRN

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2.17 #AAHTRN

Description:

Read the HART frame frome HART Device.

Syntax:

#AAHTRN **[CHKSUM](CR)**

#	Delimiter character
AA	Address of the module to be read (00 to FF)
HT	HART command
R	Read HART data
N	Specifies the channel to be set

Response:

Valid Response: **>AA(length)(all Info)[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)	Response information from HART field device

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: $01HTR0

```
Response: >FFFFFFFF0286000E0020FE010203040506070
           8090A0BDE
```

Read information from HART field device.

Related Commands:

Section 2.15 $AAHTNppdd(aa)cc,
Section 2.16 #AAHTSN

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2.18 ~**

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 2.19 ~AA0, Section 2.20 ~AA1, Section 2.21 ~AA2, Section 2.22 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

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2.19 ~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 2.18 ~**, Section 2.20 ~AA1, Section 2.21 ~AA2, Section 2.22 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

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2.20 ~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 2.18 ~**, Section 2.19 ~AA0, Section 2.21 ~AA2, Section 2.22 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

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2.21 ~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 2.18 ~**, Section 2.19 ~AA0, Section 2.20 ~AA1, Section 2.22 ~AA3EVV

Related Topics:

Section A.2 Dual Watchdog Operation

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2.22 ~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 2.18 ~**, Section 2.19 ~AA0, Section 2.20 ~AA1, Section 2.21 ~AA2

Related Topics:

Section A. Dual Watchdog Operation

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Appendix
A. 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 I-87H17W 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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