ZT-2026
User Manual

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What's in the Shipping Package?

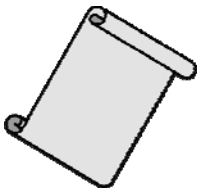
The shipping package contains the following items:



ZT-2026 Module



ANT-124-05



Quick Start



CD

If any of these items are missing or damaged, please contact your local distributor for more information. Save the shipping materials and cartons in case you need to ship the module in the future.

More Information

- Documentation:
  All documentation related to the ZT Series of devices can be found on the companion CD at:
  CD:\Napdos\ZigBee\ZT_Series\Document

  Or can be downloaded from:
  http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/zt_series/document

- Software:
  Utility software for the ZT Series of devices can be found on the companion CD at:
  CD:\Napdos\ZigBee\ZT_Series\Utility

  Or can be download from:
  http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/zt_series/utility

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1 Introduction

1.1 Introduction to ZigBee

ZigBee is a specification for a suite of high-level communication protocols using small, low-power digital radios based on the IEEE 802.15.4 standard for personal area networks. ZigBee devices are often used in mesh network form to transmit data over longer distances, passing data through intermediate devices to reach more distant ones. This allows ZigBee networks to be formed ad-hoc, with no centralized control or high-power transmitter/receiver required in order to reach all of the devices. Any ZigBee device can be tasked with running the network.

ZigBee is targeted at applications that require a low data rate, long battery life, and secure networking. ZigBee has a defined rate of 250 kbit/s, best suited for periodic or intermittent transmission of data, or for a single signal transmission from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs.

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1.2 Introduction to the ZT-2000 I/O Series

The ZT-2000 I/O series of devices are small wireless ZigBee I/O modules based on the IEEE802.15.4 standard that allow data acqusition and control via personal area ZigBee networks. See Section 3.1 for more detailed information.

The ZT-2000 I/O series is a wireless data acquisition-based client/server system. Accordingly, a Net Server for the ZigBee (ZT-2570/ZT-2550) is essential in such systems. For more information regarding any configuration issues related to the ZigBee Coordinator, refer to the "ZT-25XX ZigBee Converter Quick Start" document, which can be found at:

http://ftp.icpdas.com/pub/cd/usbcd/napdos/zigbee/zt_series/document/

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2 Hardware Information

2.1 Specifications

Analog Input	
Input Channels	4 Differential
Input Type	+/-10 V, +/-5 V, +/-1 V, +/-500 mV, +/-150 mV, -20 mA - +20 mA (-20 mA - +20mA requires an Optional External 125 Ω Resistor)
Resolution	16-bit
Sampling Rate	16-bit, 10 Samples/Sec. (Total)
Accuracy	+/-0.1% FSR
-3dB Bandwidth	15.7 Hz
Zero Drift	+/-20 μV/°C
Span Drift	+/-25 ppm/°C
Common Mode Rejection	86 dB
Normal Mode Rejection	100 dB
Input Impedance	>2 MΩ
Overvoltage Protection	240 Vrms
Individual Channel Configuration	Yes
Intra-module Isolation, Field-to-Logic	3000 V_{DC}
ESD Protection	+/-4 kV Contact for each Channel
Analog Output	
Output Channels	2
Output Type	+/-10 V_{DC}, +/-5 V_{DC}, 0 - 10 V_{DC}, 0 - 5 V_{DC}
Resolution	12-bit
Accuracy	+/-0.1% of FSR
Zero Drift	+/-30 μV/°C
Span Drift	+/-25 ppm/°C
Programmable Output Slope	0.0625 ~ 1024 V/Sec.
Voltage Capability	20 mA@10 V
Power-on and Safe Value	Yes

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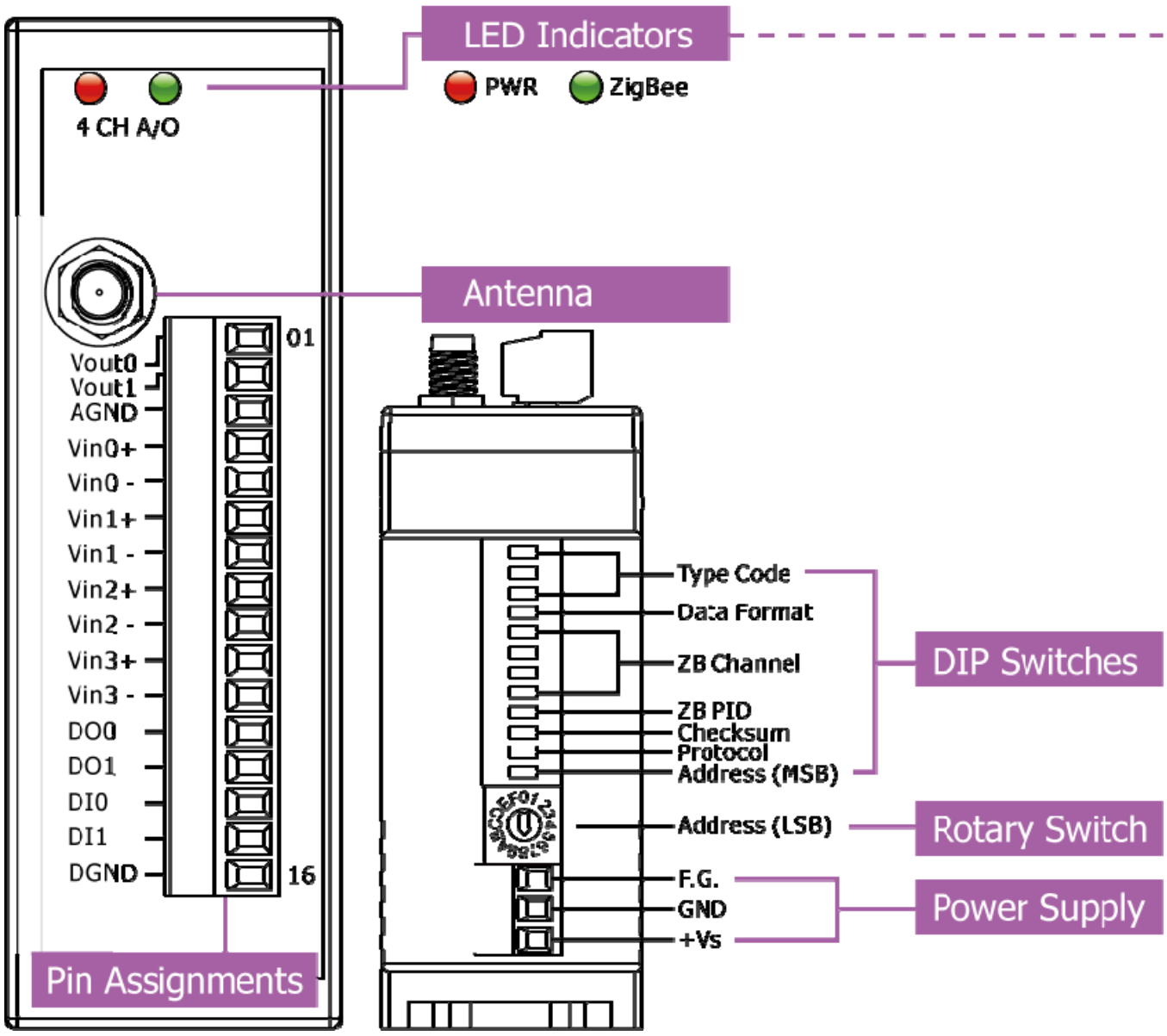
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Digital Input	
Input Channels	2 (Sink)
On Voltage Level	3.5 V_{DC} ~ 50 V_{DC}
Off Voltage Level	1 V_{DC} Max.
Input Impedance	10K ohm
Event Counters	Channels: 2
	Max. Count: 32-bit (4,294,967,295)
	Max. Input Frequency: 50 Hz
	Min. Pulse Width: 10 ms
Digital Output	
Output Channels	2 (Sink)
Output Type	Isolated Open Collector
Max.Load Current	700 mA/Channel
Load Voltage	+5 V_{DC} ~+50 V_{DC}
Short Circuit Protection	Yes
LED Indicators	
ZigBee PWR	ZigBee Device Power
ZigBee Net	ZigBee Communication Indicator
Power	
Power Consumption	1.7 W (Max.)
Environment	
Operating Temperature	-25 to +75°C
Storage Temperature	-30 to +80°C
Humidity	10 to 90%, Non-condensing
Wireless	
RF Channels	16
RF Transmit Power	11 dBm
Antenna (2.4 GHz)	5 dBi Omni directional
Transmission Range (LOS)	700 m (Typical)
Max. Slaves Supported	255
EMI Certification	CE/FCC, FCC ID

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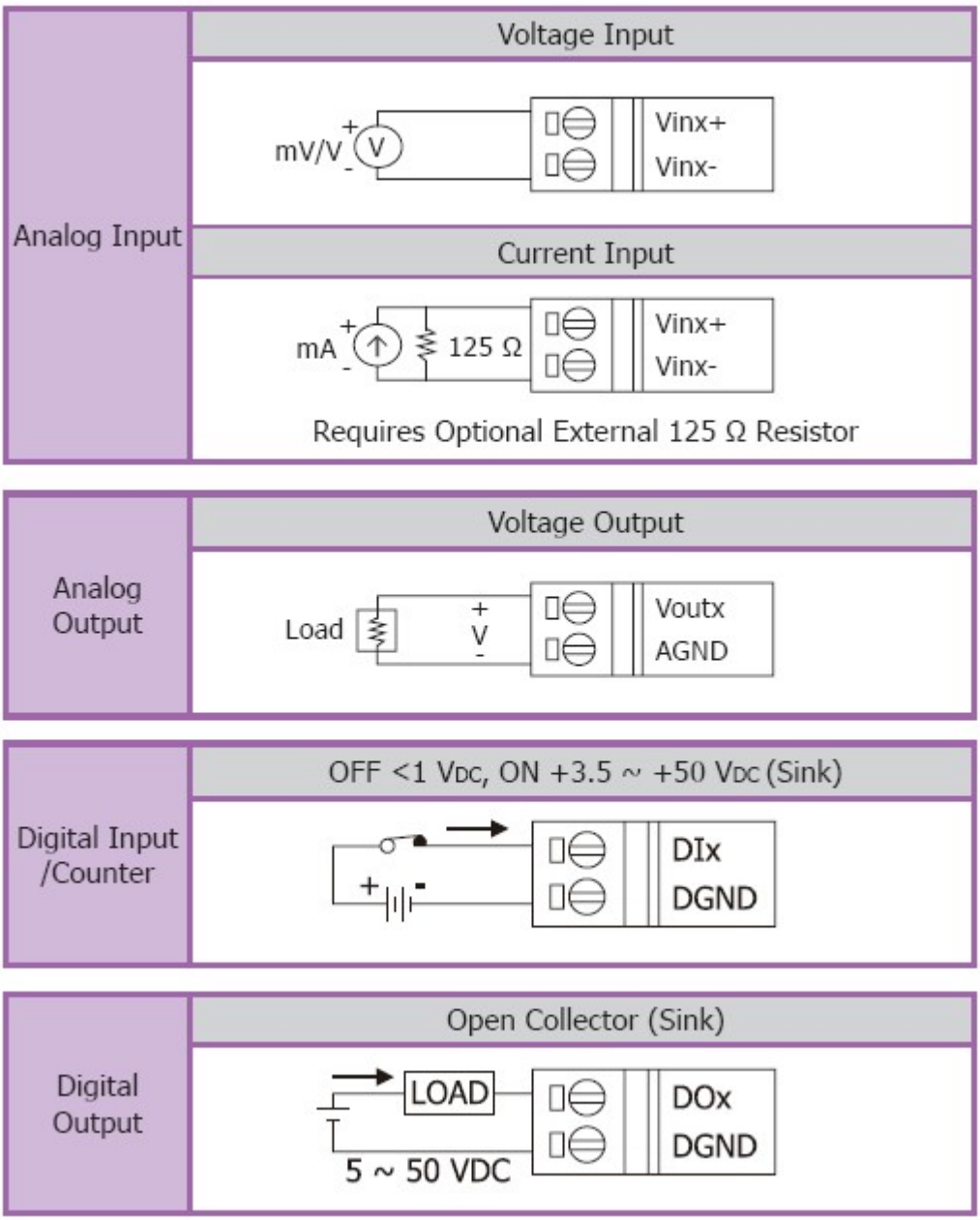
2.2 Pin Assignments



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2.3 Wire Connections



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3 Setting up the ZT-2000 I/O Device

3.1 Introduction to the Configuration Parameters

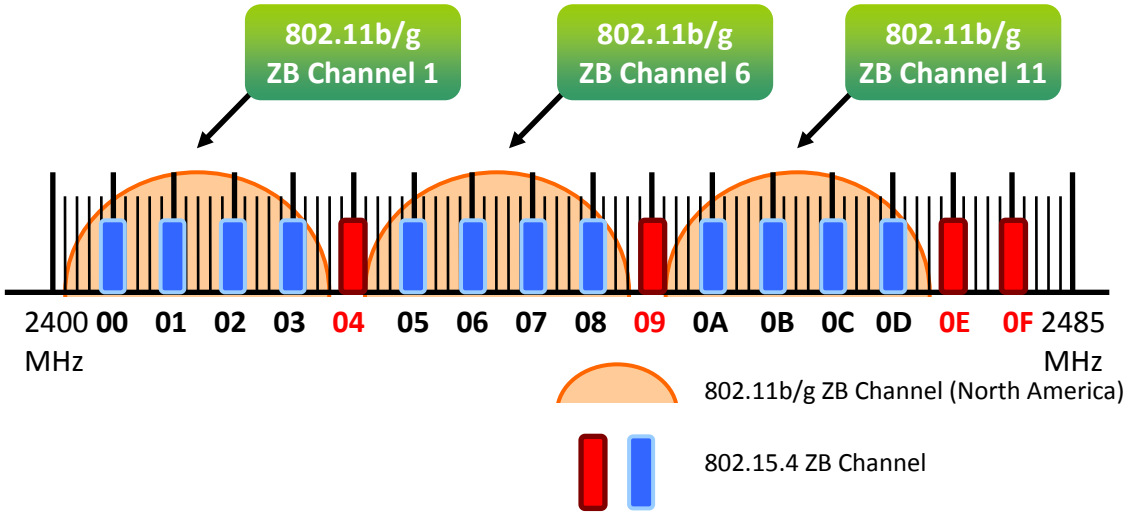
A. The **"ZB PID"** parameter is the group identity for a ZigBee network, and must be the same for all devices in the same ZigBee network.

B. The **"Node ID"** parameter is the individual identity of the specific ZigBee module, and must be unique for each device connected to the same ZigBee network.

C. The **"ZB Channel"** parameter indicates the radio frequency channel, and must be set to the same value as other modules on the same ZigBee network.

ZB Channel	0x00	0x01	……	0x0F
Frequency (MHz)	2405	2410	……	2480

※ **ZB channels 0x04, 0x09, 0x0E or 0x0F are recommended because they do not overlap with the Wi-Fi frequency band.**



D. **Protocol/Application Mode:**

When implementing custom programs based on different protocols, the following application mode(s) are recommended in order to ensure optimal performance.

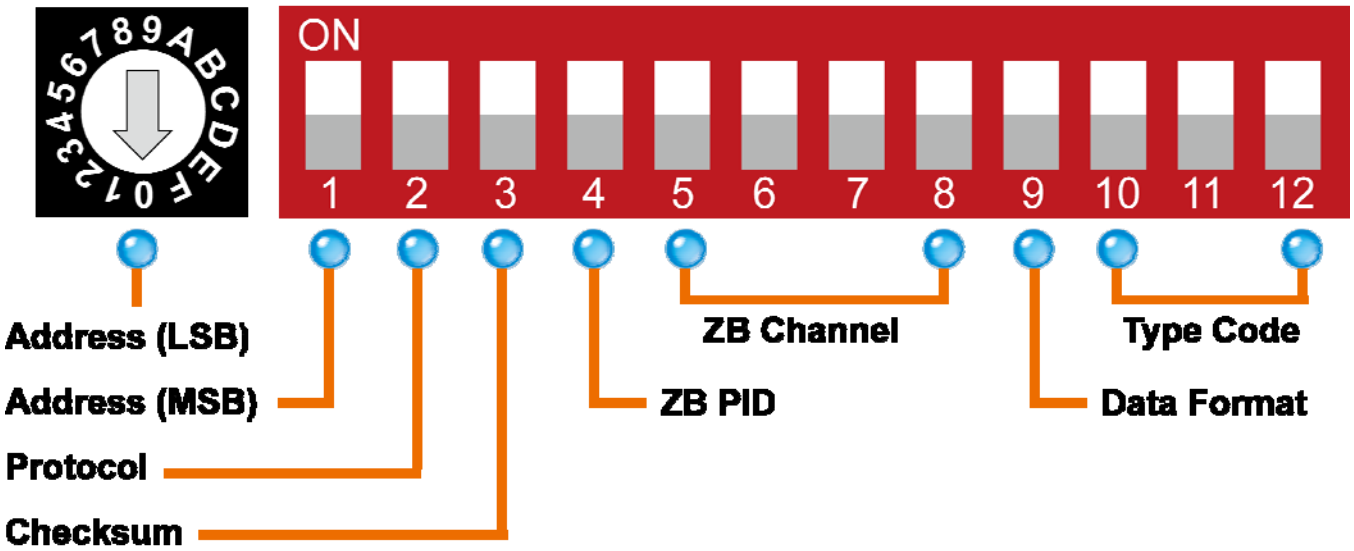
User Program Protocol	ZT-2000	ZT-2550	ZT-2570
DCON	DCON	Transparent	Transparent
Modbus RTU	Modbus RTU	Transparent Modbus Gateway	Transparent Modbus Gateway
Modbus TCP	Modbus RTU	------	Modbus Gateway

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3.2 Introduction to the Rotary and DIP Switches

The configuration of the ZT-2026 can be adjusted using a combination of the external rotary switch and the DIP switches. The ZT-2000 device should only be rebooted once the configuration is complete.



➢ Rotary Switch

Case 1: Address MSB = 0

	0	1	2	3	4	5	6	7
Address	*Note 1	01	02	03	04	05	06	07
Node ID	*Note 1	0x0001	0x0002	0x003	0x0004	0x0005	0x0006	0x0007
	8	9	A	B	C	D	E	F
Address	08	09	0A	0B	0C	0D	0E	0F
Node ID	0x008	0x0009	0x000A	0x000B	0x000C	0x000D	0x000E	0x000F

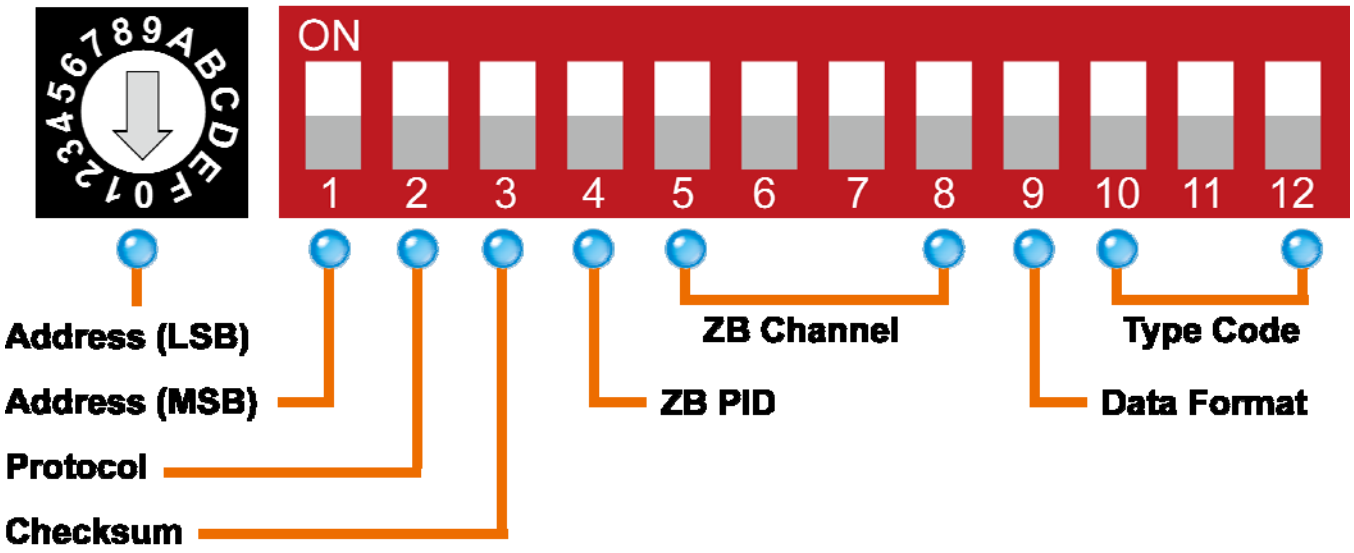
Case 2: Address MSB = 1

	0	1	2	3	4	5	6	7
Address	10	11	12	13	14	15	16	17
Node ID	0x0010	0x0011	0x0012	0x013	0x0014	0x0015	0x0016	0x0017
	8	9	A	B	C	D	E	F
Address	18	19	1A	0B	0C	1D	1E	1F
Node ID	0x018	0x0019	0x001A	0x001B	0x001C	0x001D	0x001E	0x001F

***Note 1: The "Address" and "Node ID" values are defined via the $AANNTTCCFF command. In software configuration mode, the DIP switches for "Address", "Data Format" and "Type Code" are ignored and can also be set via the %AANNTTCCFF and $AACiRrr commands.**

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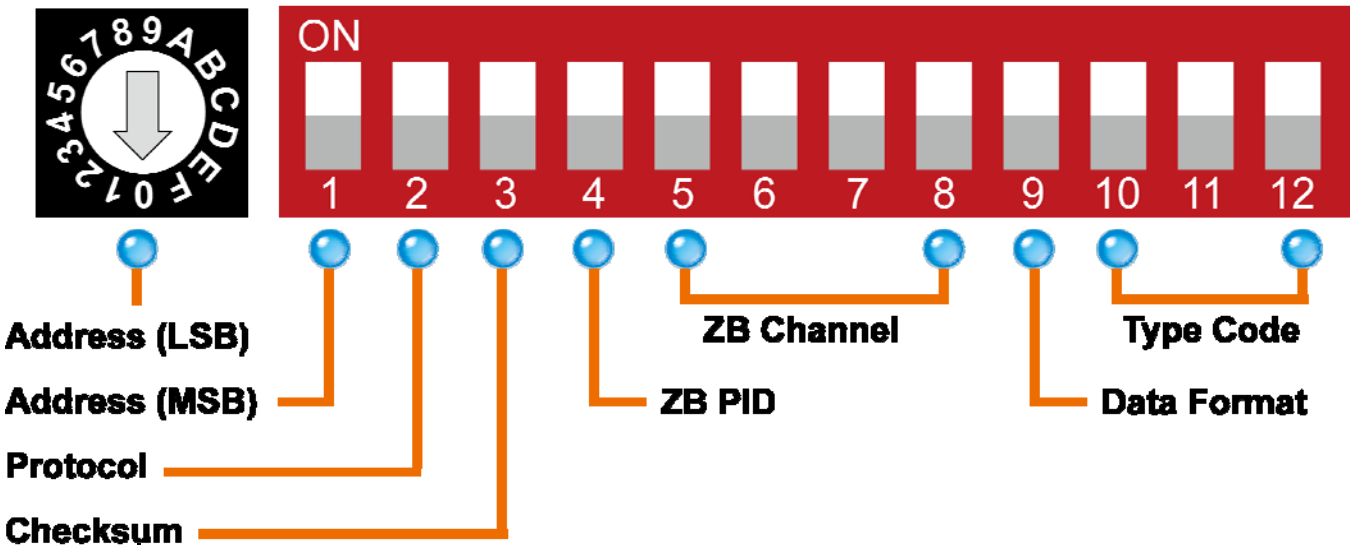


➢ DIP Switches

Number	Item	Status	Description
1	Address MSB	OFF	Valid Address (Node ID) from 0x01 to 0x0F
		ON	Valid Address (Node ID) from 0x10, 0x01 to 0x1F
2	Protocol	OFF	DCON Protocol
		ON	Modbus RTU Protocol
3	Checksum	OFF	Disabled (DCON Protocol)
		ON	Enabled (DCON Protocol)
4	ZB PID	OFF	ZigBee Pan ID = 0x0000
		ON	ZigBee Pan ID = 0x0001
5	ZB Channel	OFF	------
		ON	0x08
6		OFF	------
		ON	0x04
7		OFF	------
		ON	0x02
8		OFF	------
		ON	0x01
9	Data Format	OFF	Engineering Units Format
		ON	Hexadecimal Format

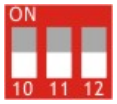
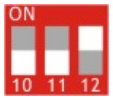
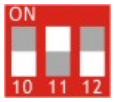
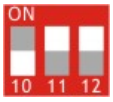
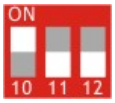
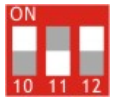
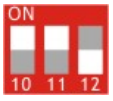
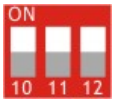
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➢ Type Code

DIP switches 10-12 are used to define the input type code for the ZT-2026, as shown below.

Switch Position	Type Code	Switch Position	Type Code	Switch Position	Type Code
	0x08		0x09		0x0A
	0x0B		0x0C		0x0D
	0x07		0x1A		

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3.3 Starting the ZT-2000 I/O Device

As the ZigBee network is controlled by the ZigBee Coordinator, the ZT-2550/ZT-2570 (ZigBee Coordinator) must be configured first. Refer to the documents section below for full details of how to configure these devices.

Once configuration of the ZigBee Coordinator has been completed, set the "ZB PID" and "ZB Channel" values for the ZT-2000 I/O device to the same values as the network, and then reboot the device. The module will automatically start to function on the ZigBee network using the default protocol.

※ **Documents**

http://ftp.icpdas.com.tw/pub/cd/usbcd/napdos/zigbee/zt_series/document/zt-255x/
http://ftp.icpdas.com.tw/pub/cd/usbcd/napdos/zigbee/zt_series/document/zt-257x/

※ **Configuration Utility** (Used to configure the ZT-2000 I/O device Coordinator)

http://ftp.icpdas.com.tw/pub/cd/usbcd/napdos/zigbee/zt_series/utility/

3.4 Communications Testing

Once the ZT-2000 I/O device has joined the ZigBee network, the signal quality can be confirmed by monitoring the status of the ZigBee Net LED indicators. If the LED indicator shows a steady light, communication with the ZT-2000 I/O device has been successfully established for data acquisition and control.

ICP DAS provides the "DCON Utility" which can be used to simulate DCON/Modbus communication. This software can also be used to verify the device settings and the ZigBee I/O functions.

The DCON Utility can be downloaded from:

http://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/dcon_utility/

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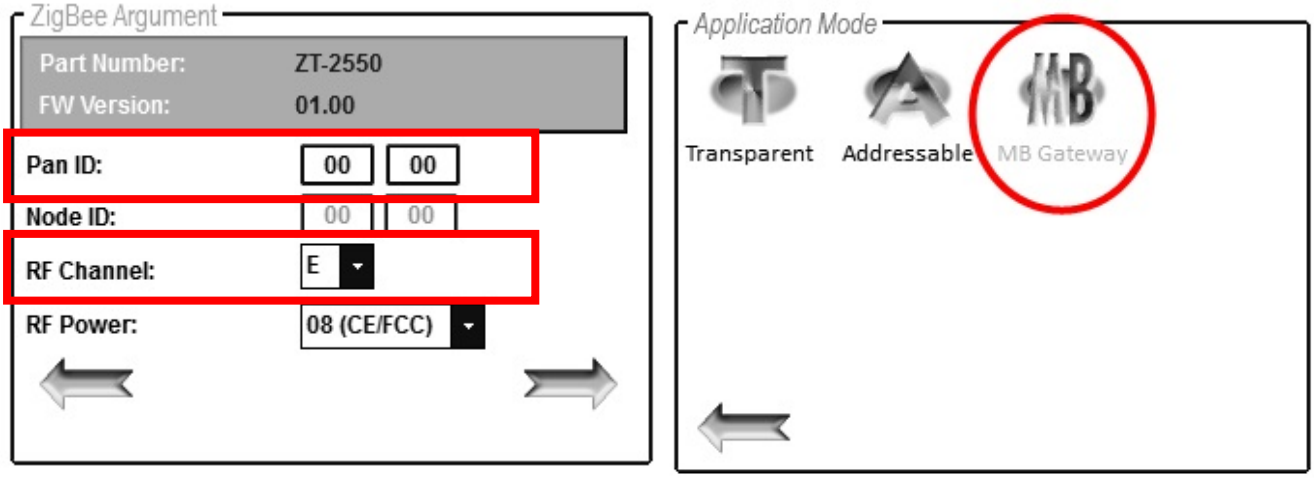
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3.5 Examples

➢ Architecture Diagram



➢ Configuring the ZT-2550/ZT-2570



➢ Configuring the ZT-2000 I/O device



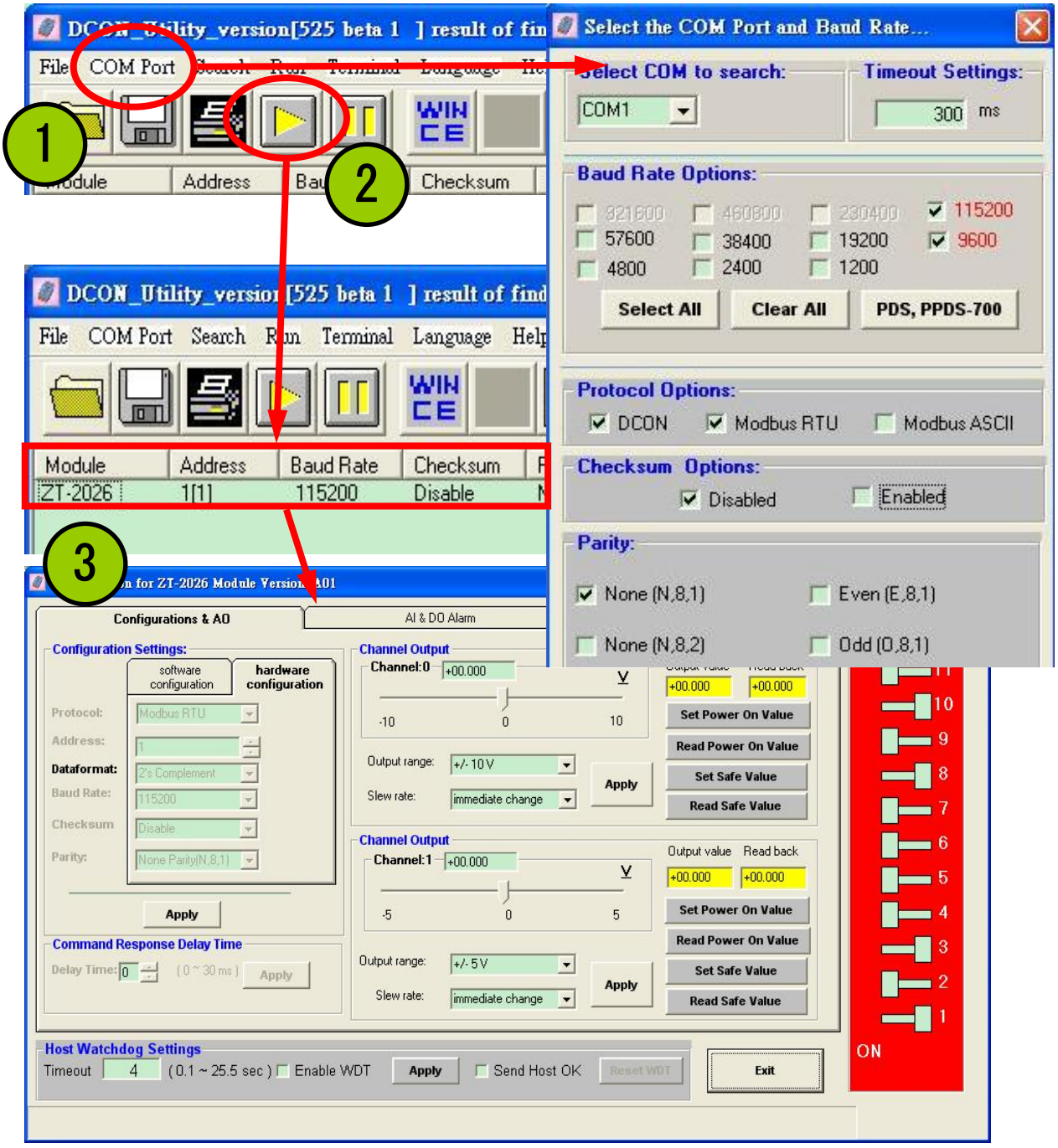
Number	Item	Status	Description	
1	Address MSB	OFF	Address/Node ID is **01** (Rotary Switch=1)	
2	Protocol	ON	Use the **Modbus RTU** Protocol	
3	Checksum	OFF	Disabled	
4	ZB PID	OFF	ZigBee Pan ID = **0x0000**	
5	ZB Channel	ON	0x08	ZigBee RF Channel = **0x0E**
6		ON	0x04	
7		ON	0x02	
8		OFF	------	

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➢ Simulating I/O channel operation via the DCON Utility

1. Launch the DCON Utility and select the appropriate COM Port settings to connect to the ZigBee Coordinator (ZT-2550/ZT-2570).
2. Click the "Search" button to start searching for ZT-2000 I/O devices connected to the same ZigBee network.
3. If any ZT-2000 I/O devices are found, they will be displayed in the device list window. Double-click the name of the module to start the operation.



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4 Analog Input Type and Data Format

Type Code	Input Type	Data Format	+F.S.	-F.S.
07	+4 to +20 mA	Engineering Units	+20.000	+04.000
		% of FSR*1	+100.00	+000.00
		2's Comp. Hex	FFFF	0000
08	-10 to +10 V	Engineering Units	+10.000	-10.000
		% of FSR*1	+100.00	-100.00
		2's Comp. Hex	7FFF	8000
0	-5 to +5 V	Engineering Units	+5.0000	-5.0000
		% of FSR*1	+100.00	-100.00
		2's Comp. Hex	7FFF	8000
0	-1 to +1 V	Engineering Units	+1.0000	-1.0000
		% of FSR*1	+100.00	-100.00
		2's Comp. Hex	7FFF	8000
0	-500 to +500 mV	Engineering Units	+500.00	-500.00
		% of FSR*1	+100.00	-100.00
		2's Comp. Hex	7FFF	8000
0	-150 to +150 mV	Engineering Units	+150.000	-150.00
		% of FSR*1	+100.00	-100.00
		2's Comp. Hex	7FFF	8000
0D	-20 to +20 mA	Engineering Units	+20.000	-20.000
		% of FSR*1	+100.00	-100.00
		2's Comp. Hex	7FFF	8000
1A	0 to +20 mA	Engineering Units	+20.000	+00.000
		% of FSR*1	+100.00	+000.00
		2's Comp. Hex	FFFF	0000
*1: FSR (Full Scale Range)				

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➢ Analog Input Over/Under Range Readings

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

➢ Analog Input Over/Under Range Readings when using the Modbus RTU protocol

Over Range	Under Range
7FFFh	8000h

➢ Data Format Settings (FF)

7	6	5	4	3	2	1	0
FS	Reserved					DF	

Key	Description
DF	Data Format 00: Engineering Units 01: % of FSR 10: 2's Complement Hexadecimal
FS	Filter Settings 0: 60 Hz Rejection 1: 50 Hz Rejection.

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5 Analog Output Type and Slew Rate

Type Code	Input Type	Data Format	+F.S.	-F.S.
2	+0 to +10 V	Engineering Units	+10.000	+0.000
		% of FSR*1	+100.00	+000.00
		2's Comp. Hex	FFFF	0000
3	-10 to +10 V	Engineering Units	+10.000	-10.000
		% of FSR*1	+100.00	-100.00
		2's Comp. Hex	7FFF	8000
4	+0 to +5 V	Engineering Units	+05.000	+00.000
		% of FSR*1	+100.00	+000.00
		2's Comp. Hex	FFFF	0000
5	-5 to +5 V	Engineering Units	+05.000	-05.000
		% of FSR*1	+100.00	-100.00
		2's Comp. Hex	7FFF	8000
*1: FSR (Full Scale Range)				

➢ Slew Rate Control

0 Immediate Change
1 0.0625 V/Second
2 0.125 V/Second
3 0.25 V/Second
4 0.5 V/Second
5 1.0 V/Second
6 2.0 V/Second
7 4.0 V/Second
8 8.0 V/Second
9 16 V/Second
A 32 V/Second
B 64 V/Second
C 128 V/Second
D 256 V/Second
E 512 V/Second
F 1024 V/Second

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6 Calibration

➢ Warning

Performing calibration is not recommended until the process is fully understood.

6.1 Analog Input

The Analog Input calibration procedure is as follows:

1. Warm up the module for at least 30 minutes.
2. Set the Type Code to the type you wish to calibrate. Refer to Section 4 and Section 7.4.19 for details.
3. Enable calibration. Refer to Section 7.4.46 for details.
4. Apply the zero calibration voltage/current.
5. Send the zero calibration command. Refer to Section 7.4.7 for details.
6. Apply the span calibration voltage/current.
7. Send the span calibration command. Refer to Section 7.4.6 for details.
8. Repeat steps 3 to 7 three times.

➢ Notes

1. The calibration voltage/current source should be connected to channel 0.
2. Calibration voltages and currents are shown below.
3. Switch to DCON protocol mode before calibrating the module. Refer to Section 3.2 for details of how to switch protocols.

➢ Calibration Voltage Type used by the ZT-2026

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

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6.2 Analog Output

The Analog Output calibration procedure is as follows:

1. Warm up the module for at least 30 minutes.
2. Set the Type Code to the type you wish to calibrate. Refer to Section 5 and Section 7.4.23 for details.
3. Enable calibration. Refer to Section 7.4.46 for details.
4. Set the zero Analog Output voltage/current. Refer to Section 7.4.5 for details.
5. Check the meter and trim the output until zero output is achieved. Refer to Section 7.4.11 for details.
6. Send the Analog Output zero calibration command. Refer to Section 7.4.8 for details.
7. Set the span Analog Output voltage/current. Refer to Section 7.4.9 for details.
8. Check the meter and trim the output until span output is achieved. Refer to Section 7.4.11 for details.
9. Send the Analog Output span calibration command. Refer to Section 7.4.9 for details.

➢ Notes

1. For Analog Output channels, calibration must be performed for each channel individually, so the calibration voltage/current should be connected to the specific channel to be calibrated.
2. Calibration voltages/current are shown below.

➢ Calibration Voltage Type used by the ZT-2026

Type Code	2	3	4	5
Zero Output	0 V	0 V	0 V	0 V
Span Output	+10 V	+10 V	+5 V	+5 V

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7 The DCON/Modbus RTU Command Sets

7.1 Communicating with the ZT-2000 I/O Device

ICP DAS ZT-2000 I/O devices can be operated using either the DCON or the Modbus RTU protocol, which can be selected by adjusting the position of DIP Switch 2 to OFF (DCON) or ON (Modbus RTU) and then rebooting the ZT-2000 I/O device to use the new protocol.

7.2 The DCON Protocol Command Set

All ZT-2000 I/O series devices are controlled via wireless broadcast commands, so each device must have a unique address that is saved in the EEPROM of the device.

Consequently, all command and response formats contain the address of the destination module. When an I/O device receives a command, it will determine whether or not to respond based on the address contained in the command. However, there are two exceptions to this, the #** and ~** commands.

➢ DCON Command Format

Delimiter Character	Module Address	Command	[CHECKSUM]	CR

➢ DCON Response Format

Delimiter Character	Module Address	Data	[CHECKSUM]	CR

※ Note: 'CR' is the end of command (carriage return) character used to end a frame.
※ Note: All characters should be expressed in capital letters.

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7.3 Checksum

➢ Calculating the Checksum:

Sum the ASCII codes of all the characters contained in the command in addition to the 'CR' terminator. The Checksum is the sum value expressed in Hexadecimal format.

➢ Example: Command "$012(CR)"

Sum = '$' + '0' + '1' + '2' = 24h + 30h + 31h + 32h = B7h
Checksum = "B7"
DCON Command with Checksum = "$012B7(CR)"

➢ Example: Response "!01200600(CR)"

Sum = '!' + '0' + '1' + '2' + '0' + '0' + '6' + '0' + '0'
= 21h+30h+31h+32h+30h+30h+36h+30h+30h
= 1AAh
Checksum = "AA"
DCON Response with Checksum = "!01200600AA(CR)"

※ Note: The Checksum is the sum value expressed in capital letters.

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7.4 Overview of the DCON Command Set

General Command Set			
Command	Response	Description	Section
%AANNTTCCFF	!AA	Sets the Configuration of the Module	7.4.1
#**	No Response	Sends the Synchronized Sampling Command	7.4.2
#AA	>(Data)	Reads the Analog Input Data from all Channels	7.4.3
#AAN	>(Data)	Reads the Analog Input Data from a Specific Channel	7.4.4
#AAN(Data)	>	Sets the Analog Output for a Specific Channel	7.4.5
$AA0	!AA	Performs an Analog Input Span Calibration on the Module	7.4.6
$AA1	!AA	Performs an Analog Input Zero Calibration on the Module	7.4.7
$AA0N	!AA	Performs a Zero Calibration on a Specific Analog Output Channel	7.4.8
$AA1N	!AA	Performs a Span Calibration on a Specific Analog output Channel	7.4.9
$AA2	!AANNTTCCFF	Reads the Configuration of the Module	7.4.10
$AA3NVV	!AA	Trims the Calibration for a Specific Analog Output Channel	7.4.11
$AA4	!AAS(Data)	Reads the previously stored Synchronized Sampling Data	7.4.12
$AA4N	!AA	Sets the Power-on Value for a Specific Analog Output Channel	7.4.13
$AA5	!AAS	Reads the Reset Status of the Module	7.4.14
$AA5VV	!AA	Enables or Disables Specific Analog Input Channels	7.4.15
$AA6	!AAVV	Reads whether each Analog Input Channel is Enabled or Disabled	7.4.16
$AA6N	!AA(Data)	Reads the last Value received by a Specific Analog Output Channel	7.4.17
$AA7N	!AA(Data)	Reads the Power-on Value for a Specific Analog Output Channel	7.4.18
$AA7CiRrr	!AA	Sets the Type Code for a Specific Analog Input Channel	7.4.19
$AA8N	!AA(Data)	Reads the Current Value for a Specific Analog Output Channel	7.4.20

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$AA8Ci	!AACiRrr	Reads the Type Code for a Specific Analog Input Channel	7.4.21
$AA9N	!AATTS	Reads the Configuration for a Specific Analog Output Channel	7.4.22
$AA9NTS	!AA	Sets the Configuration for a Specific Analog Output Channel	7.4.23
$AAC	!AA	Clears the Status of the Latched Digital Input and Digital Output Channels	7.4.24
$AAD	!AAnn	Reads the Status of the Counter for each Digital Input Channel	7.4.25
$AADnn	!AA	Enables or Disables the Counter for each Digital Input Channel	7.4.26
$AAE	!AAnn	Reads the Status of the Counter Edge for each Digital Input Channel	7.4.27
$AAEnn	!AA	Sets the Status of the Counter Edges for each Digital Input Channel	7.4.28
$AAF	!AA(Data)	Reads the Firmware Version of the Module	7.4.29
$AAM	!AA(Data)	Reads the Name of the Module	7.4.30
$AALS	!(Data)	Reads the Status of the Latched Digital Input and Digital Output Channels	7.4.31
$AAS1	!AA	Reloads the Default Calibration Parameters	7.4.32
~AA4N	!AA(Data)	Reads the Safe Value for a Specific Analog Output Channel	7.4.39
~AA5N	!AA	Sets the Safe Value for a Specific Analog Output Channel	7.4.40
~AAD	!AATT	Reads the Digital Input and Digital Output Configuration	7.4.44
~AADTT	!AA	Sets the Digital Input and Digital Output Configuration	7.4.45
~AAEV	!AA	Enables or Disables Calibration for the Module	7.4.46
~AAO(Name)	!AA	Sets the Name of the Module	7.4.47
@AACECi	1AA	Resets the Counter for a Specific Digital Input Channel	7.4.48
@AACH	!AA	Clears the High Latch Values for all Analog Input Channels	7.4.49
@AACHi	!AA	Clears the High Latch Value for a Specific Analog Input Channel	7.4.50

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@AACHCi	!AA	Clears the Status of the High Alarm for a Specific Analog Input Channel	7.4.51
@AACL	!AA	Clears the Low Latch Values for all Analog Input Channels	7.4.52
@AACLi	!AA	Clears the Low Latch Value for a Specific Analog Input Channel	7.4.53
@AACLCi	!AA	Clears the Status of the Low Alarm for a Specific Analog Input Channel	7.4.54
@AADHCi	!AA	Disables the High Alarm for a Specific Analog Input Channel	7.4.55
@AADI	!AAOOII	Reads the Status of all Digital Input and Digital Output Channels	7.4.56
@AADLCi	!AA	Disables the Low Alarm for a Specific Analog Input Channel	7.4.57
@AAHI(Data)CiTOj	!AA	Sets the High Alarm Value for a Specific Analog Input Channel	7.4.58
@AALO(Data)CiTOj	!AA	Sets the Low Alarm Value for a Specific Analog Input Channel	7.4.59
@AADODD	!AA	Sets the Status of the Digital Output Ports	7.4.60
@AARAOj	!AAHHLL	Reads the Currently Activated Alarms associated with a Specific Digital Output Port	7.4.61
@AARECi	!AA(Data)	Reads the Counter for a Specific Digital Input Channel	7.4.62
@AARH	!AA(data)	Reads the High Latch Values for all Analog Input Channels	7.4.63
@AARHCi	!AA(data)S	Reads the High Alarm Value for a Specific Analog Input Channel	7.4.64
@AARHi	!AA(data)	Reads the High Latch Value for a Specific Analog Input Channel	7.4.65
@AARL	!AA(data)	Reads the Low Latch Values for all Analog Input Channels	7.4.66
@AARLCi	!AA(data)S	Reads the Low Alarm Value for a Specific Analog Input Channel	7.4.67
@AARLi	!AA(data)	Reads the Low Latch Value for a Specific Analog Input Channel	7.4.68

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@AAROOj	!AAHHLL	Reads whether the Alarms associated with a specific Digital Output Port are Enabled or Disabled	7.4.69

Host Watchdog Command Sets			
Command	Response	Description	Section
~**	No Response	The command to inform all modules that the Host is OK	7.4.33
~AA0	!AASS	Reads the Status of the Host Watchdog	7.4.34
~AA1	!AA	Resets the Status of the Host Watchdog Timeout	7.4.35
~AA2	!AAETT	Reads the Timeout Settings for the Host Watchdog	7.4.36
~AA3ETT	!AA	Enables or Disables the Host Watchdog and Sets the Host Watchdog Timeout Value	7.4.37
~AA4	!AA	Reads the Digital Output Power-on Value and the Digital Output Safe Value for the module	7.4.38
~AA5PPSS	!AA	Sets the Digital Output Power-on Value and the Digital Output Safe Value for the module	7.4.41
~AA6PN(Data)	!AA	Sets the Analog Output Power-on Value for a Specific Channel	7.4.42
~AA6SN(Data)	!AA	Sets the Analog Output Safe Value for a Specific Channel	7.4.43

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7.4.1 %AANNTTCCFF

Description
This command is used to set the configuration of a specific module.

Syntax	
%AANNTTCCFF[CHECKSUM](CR)	
%	Delimiter character
AA	The address of the module to be configured in hexadecimal format (00 to FF)
NN	The new address of the module in hexadecimal format (00 to FF)
TT	00 (Reserved)
CC	0A (Reserved)
FF	The command used to set the data format, checksum, and filter settings. See Section 4 for details of the data format.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	%0320000A80
Response	!03
In Normal mode, the address 0x20 is saved to the EEPROM and the data format for module 03 is set to 80 (50 Hz rejection). The module returns a response indicating that the command was successful.	

Command	%0320000A80
Response	!20
In Software Configuration mode, the address 0x20 is saved to the EEPROM and the data format for module 03 is set to 80 (50 Hz rejection). The module returns a response indicating that the command was successful.	

Command	%0303000000
Response	?03
Attempts to set the configuration for module 03, but returns a response indicating that an error occurred because the "CC" parameter must be 0A.	

※Related Commands: Section 7.4.10 $AA2
※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.2 #**

Description
This command instructs every Analog Input module to read data from every Analog Input channel and store the data for later retrieval.

Syntax	
#**[CHECKSUM](CR)	
#	Delimiter character
**	The synchronized sampling command

Response
There is no response to this command.

Examples	
Command	#**
Response	No response
Sends the synchronized sampling command to all Analog Input modules.	

Command	$034
Response	>031+025.12+020.45+012.78+018.97+003.24+015.35+008.07+014.79
Sends the command to read the synchronized sampling data from module 03. The module returns a response indicating that the command was successful, containing the data (in Engineering Units format) that was stored when the synchronized sampling command was last issued. The status byte of the response is 1, which means that it is the first time the synchronized sampling data has been read since the previous #** command was received.	

Command	$034
Response	>030+025.12+020.45+012.78+018.97+003.24+015.35+008.07+014.79
Sends the command to read the synchronized sampling data from module 03. The module returns a response indicating that the command was successful, containing the data (in Engineering Units format) that was stored when the synchronized sampling command was last issued. The status byte of the response is 0, which means that it is **NOT** the first time the synchronized sampling data has been read since the previous #** command was received.	

※Related Commands: Section 7.4.12 $AA4
※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.3 #AA

Description
This command is used to read data from all the Analog Input channels of a specified module.

Syntax	
#AA[CHECKSUM](CR)	
#	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)

Response	
Valid Command	>(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
>	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The data from all the Analog Input channels. See Section 4 for details of the data format. Data from disabled channels is filled with space characters.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Examples	
Command	#03
Response	>+025.12+020.45+012.78+018.97+003.24+015.35
Reads data from the Analog Input channels of module 03 and returns a response indicating that the command was successful, with the data from all Analog Input channels in engineering units format.	

Command	#03
Response	>4C532628E2D683A20F2ADBA1
Reads the Analog Input channels of module 03 and returns a response indicating that the command was successful, with the data from all Analog Input channels in hexadecimal format.	

Command	#03
Response	>-9999.9-9999.9-9999.9-9999.9-9999.9-9999.9
Reads the Analog Input channels of module 03, and returns a response indicating that the command was successful, but that the data is under range.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 7.4.4 #AAN, Section 7.4.10 $AA2, Section 7.4.19 $AA7CiRrr

※Related Topics: Section 4 Analog Input Type and Data Format
Section 8.1 Software Configuration Mode

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7.4.4 #AAN

Description
This command is used to read data from a specific Analog Input channel of a specified module.

Syntax	
#AAN[CHECKSUM](CR)	
#	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
N	The Analog Input channel to be read, zero based

Response	
Valid Command	>(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
>	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command.
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The data from the specified Analog Input channel. See Section 4 for details of the data format. If the specified channel is disabled, then the data field will be filled with space characters.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Examples	
Command	#032
Response	>+025.13
Reads data from Analog Input channel 2 of module 03 and returns a response indicating that the command was successful, and that the Analog Input value is +025.13 (+25.13 mV).	

Command	#039
Response	?03
Attempts to read data from Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 7.4.3 #AA, Section 7.4.10 $AA2, Section 7.4.19 $AA7CiRrr
※Related Topics: Section 4 Analog Input Type and Data Format
Section 8.1 Software Configuration Mode

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7.4.5 #AAN(Data)

Description
This command is used to set the Analog Output value for Analog Output channel N of a specified module.

Syntax	
#AAN(Data)[CHECKSUM](CR)	
#	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
N	The Analog Output channel to be set, zero based
(Data)	The Analog Output value. See the Section 5 for details of the data format.

Response	
Valid Command	>[CHECKSUM](CR)
Invalid Command	?[CHECKSUM](CR)
Ignored Command	![CHECKSUM](CR)
>	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command because the Analog Output value (Data) is out of range. The Analog Output value will be restored to the closest value defined in the range settings for the module.
!	Delimiter character to indicate that the module's Host Watchdog flag is set. The command will be ignored and the Analog Output value will be set to the configured Safe 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	$039050
Response	!03
Sets the output range for Analog Output channel 0 of module 03 to -5 to +5 V and sets the slew rate to change immediately, and returns a response indicating that the command was successful.	

Command	#030+05.000
Response	>
Sets the output value for Analog Output channel 0 of module 03 to +05.000 (+5.0 V) and returns a response indicating that the command was successful.	

Command	#030+25.000
Response	?
Attempts to set the output value for Analog Output channel 0 of module 03 to +25.000 (+25 V), but returns a response indicating that the command was unsuccessful because the output value of +25.000 (+25 V) is not within the valid range. The Analog Output value will be restored to the closest value of +05.000(+5V) defined in the range settings for the module.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 7.4.22 $AA9N, Section 7.4.23 $AA9NTS
※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.6 $AA0

Description
This command is used to perform an Analog Input span calibration on a specified module.

Syntax	
$AA0[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be calibrated in hexadecimal format (00 to FF)
0	The command to perform the Analog Input span calibration

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command.
AA	The address of the responding 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	$030
Response	?03
Attempts to perform an Analog Input span calibration on module 03, but a response indicating that the command was unsuccessful is returned because the "Enable Calibration" command (~AAEV, see Section 7.4.46) was not sent in advance.	

Command	~03E1
Response	!03
Enables calibration on module 03 and returns a response indicating that the command was successful.	

Command	$030
Response	!03
Performs an Analog Input span calibration on module 03 and returns a response indicating that the command was successful.	

※Related Commands: Section 7.4.7 $AA1, Section 7.4.46 ~AAEV
※Related Topics: Section 6 Calibration
※Note: The "Enable Calibration" command, ~AAEV, and the "Zero Calibration" command, $AA1, must be sent before this command is used. See Sections 7.4.46 and 7.4.7 for details.

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7.4.7 $AA1

Description
This command is used to perform an Analog Input zero calibration on a specified module.

Syntax	
$AA1[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be calibrated in hexadecimal format (00 to FF)
1	The command to perform the Analog Input zero calibration

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	$031
Response	?03
Attempts to perform an Analog Input zero calibration on module 03, but a response indicating that the command was unsuccessful is returned because the "Enable Calibration" command (~AAEV, see Section 7.4.46) was not sent in advance.	

Command	~03E1
Response	!03
Enables calibration on module 03 and returns a response indicating that the command was successful.	

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Command	$031
Response	!03
Performs an Analog Input zero calibration on module 03 and returns a response indicating that the command was successful.	

※Related Commands: Section 7.4.6 $AA0, Section 7.4.46 ~AAEV
※Related Topics: Section 6 Calibration
※Notes:

1. The “Enable Calibration” command, ~AAEV, must be sent before this command is used. See Section 7.4.46 for details.
2. This command must be sent before the “Span Calibration” command, $AA0, is used. See Section 7.4.6 for details.

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7.4.8 $AA0N

Description
The command is used to performan an Analog Output zero calibration on Analog Output channel N of a specified module.

Syntax	
$AAON[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be calibrated in hexadecimal format (00 to FF)
0	The command to perform the Analog Output zero calibration
N	The Analog Output channel to be calibrated, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command.
AA	The address of the responding 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	$0301
Response	?03
Attempts to perform an Analog Output zero calibration on Analog Output channel 1 of module 03, but a response indicating that the command was unsuccessful is returned because the “Enable Calibration” command (~AAEV, see Section 7.4.46) was not sent in advance.	

Command	~03E1
Response	!03
Enables calibration on module 03 and returns a response indicating that the command was successful.	

Command	$0301
Response	!03
Performs an Analog Output zero calibration on Analog Output channel 1 of module 03 and returns a response indicating that the command was successful.	

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Command	$0309
Response	?03
Attempts to perform an Analog Output zero calibration on Analog Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.9 $AA1N, Section 7.4.11 $AA3NVV, Section 7.4.46 ~AAEV

※Related Topics: Section 6 Calibration

※Notes:

1. The "Enable Calibration" command, ~AAEV, must be sent before this command is used. See Section 7.4.46 for details.
2. This command must be sent before the Analog Output "Span Calibration" command, $AA1N, is used. See Section 7.4.9 for details.
3. For Analog Output channels, calibration must be performed for each channel individually.

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7.4.9 $AA1N

Description
The command is used to perform an Analog Output span calibration on Analog Output channel N of a specified module.

Syntax	
$AA1N[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be calibrated in hexadecimal format (00 to FF)
1	The command to perform the Analog Output span calibration
N	The Analog Output channel to be calibrated, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command.
AA	The address of the responding 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	$0311
Response	?03
Attempts to perform an Analog Output span calibration on Analog Output channel 1 of module 03, but a response indicating that the command was unsuccessful is returned because the “Enable Calibration” command (~AAEV, see Section 7.4.46) was not sent in advance.	

Command	~03E1
Response	!03
Enables calibration on module 03 and returns a response indicating that the command was successful.	

Command	$0311
Response	!03
Performs an Analog Output span calibration on Analog Output channel 1 of module 03 and returns a response indicating that the command was successful.	

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Command	$0319
Response	?03
Attempts to perform an Analog Output span calibration on Analog Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because the Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.8 $AAON, Section 7.4.11 $AA3NVV, Section 7.4.46 ~AAEV

※Related Topics: Section 6 Calibration

※Notes:

1. The “Enable Calibration” command, ~AAEV, and the Analog Output “Zero Calibration” command, $AAON, must be sent before this command is used. See Sections 7.4.46 and 7.4.8 for details.
2. For Analog Output channels, calibration must be performed for each channel individually.

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7.4.10 $AA2

Description
This command is used to read the configuration of a specified module.

Syntax	
$AA2[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
2	The command to read the configuration of the module

Response	
Valid Command	!NNTTCCFF[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
NN	The address of the module that is saved in the EEPROM in hexadecimal format (00 to FF)
TT	00 (Reserved)
CC	0A (Reserved)
FF	The data format, checksum settings and filter settings for the module. See Section 4 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	!FF000A00
In Normal mode, reads the configuration of module 03. The response indicates that the command was successful and shows that the address stored in the EEPROM is 0xFF, that the filter is set to 60 Hz rejection, and that the data format is Engineering Units.	

Command	$FF2
Response	!FF000A00
In Software Configuration mode, reads the configuration of module FF. The response indicates that the command was successful, and shows that the address stored in the EEPROM is 0xFF, that the filter is set to 60 Hz rejection, and that the data format is Engineering Units.	

※Related Commands: Section 7.4.1 %AANNTTCCFF
※Related Topics: Section 4 Analog Input Type and Data Format
Section 5 Analog Output Type and Slew Rate
Section 8.1 Software Configuration Mode

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7.4.11 $AA3NVV

Description
The command is used to trim the calibration for Analog Output channel N of a specified module.

Syntax	
$AA3NVV[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be trimmed in hexadecimal format (00 to FF)
3	The command to trim the calibration
N	The Analog Ouptput channel to be trimmed, zero based
VV	Two hexadecimal digits to represent the trim calibration value. Use 00 to 5F to increase the voltage in increments from 0 to 95, and use FF to A1 to decrease the voltage in increments from 1 to 95.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command.
AA	The address of the responding 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	$03301F
Response	!03
Increases the voltage of the Analog Output for channel 0 of module 03 by an increment of 31, and returns a response indicating that the command was successful.	

Command	$033060
Response	?03
Attempts to increase the voltage of the Analog output for channel 0 of module 03 by an increment 96, but returns a response indicating that the command was unsuccessful because the increment value is not within the valid range.	

※Related Commands: Section 7.4.8 $AA0N, Section 7.4.9 $AA1N, Section 7.4.46 ~AAEV
※Related Topics: Section 6 Calibration

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7.4.12 $AA4

Description
This command is used to read the synchronized sampling data that was stored of a specified module when the last #** command was issued.

Syntax	
$AA4[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
4	The command to read the synchronized sampling data

Response	
Valid Command	!AAS(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
S	The status of the synchronized sampling data 1: This is the first time the data has been read 0: This is NOT the first time the data has been read
(Data)	The synchronized sampling data. See Section 4 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	#**
Response	There is no response to this command
Sends the synchronized sampling command instructing every Analog Input module to read data from every input channel and store the data for later retrieval.	

Command	$034
Response	>031+025.12+020.45+012.78+018.97+003.24+015.35+008.07+014.79
Sends the command to read the synchronized sampling data from module 03. The module returns a response indicating that the command was successful, and containing the data (in Engineering Units format) that was stored when the synchronized sampling command was last issued. The status byte of the response is 1, which means that it is the first time the synchronized sampling data has been read since the previous #** command was receieved.	

Command	$034
Response	>030+025.12+020.45+012.78+018.97+003.24+015.35+008.07+014.79
Sends the command to read the synchronized sampling data from module 03. The module	

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returns a response indicating that the command was successful, and containing the data (in Engineering Units format) that was stored when the synchronized sampling command was last issued. The status byte of the response is 0, which means that it is **NOT** the first time the synchronized sampling data has been read since the previous #** command was received.

※Related Commands: Section 7.4.2 #**
※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.13 $AA4N

Description
This command is used to store the current Analog Output value as the Analog Output power-on value for Analog Output channel N of a specific module.

Syntax	
$AA4N[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
4	The command to store the current Analog Output value as the power-on value
N	The Analog Output channel to be set, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	#032+00.000
Response	>
Sets the Analog Output value for channel 2 of module 03 to +00.000 (0.0 V) and returns a response indicating that the command was successful.	

Command	$0342
Response	!03
Stores the current Analog Output as the Analog Output power-on value for Analog Output channel 2 of module 03 and returns a response indicating that the command was successful.	

Command	$0349
Response	?03
Attempts to store the current Analog Output as the Analog Output power-on value for Analog Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.5 #AAN(Data), Section 7.4.18 $AA7N, Section 7.4.42 ~AA6PN(Data)

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7.4.14 $AA5

Description
This command is used to read the reset status of a specified module.

Syntax	
$AA5[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
5	The command to read the reset status of the module

Response	
Valid Command	!AAS[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
S	The reset status of the module: 0: This is NOT the first time the command has been sent since the module was powered on, which denotes that there has been no module reset since the last $AA5 command was sent. 1: This is the first time the command has been sent since the module was powered on.
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	$035
Response	!031
Reads the reset status of module 03. The module returns a response indicating that the command was successful and that it is the first time the $AA5 command has been sent since the module was powered on.	

Command	$035
Response	!030
Reads the reset status of module 03. The module returns a response indicating that the command was successful and that there has been no module reset since the last $AA5 command was sent.	

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7.4.15 $AA5VV

Description
This command is used to specify the Analog Input channels to be enabled on a specified module.

Syntax	
$AA5VV[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
5	The command to enable the Analog Input channels
VV	A two-digit hexadecimal value representing the Analog Input channel, where bit 0 corresponds to channel 0, and bit 1 corresponds to channel 1, etc. When the bit is 0, it denotes that the channel is to be disabled, and 1 denotes that the channel is to be enabled.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command.
AA	The address of the responding 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	$0350A
Response	!03
Enables Analog Input channels 1 and 3 on module 03 and disables all other Analog Input channels. The module returns a response indicating that the command was successful.	

Command	$036
Response	!030A
Reads the status of the Analog Input channels on module 03, and returns a response indicating that the command was successful, with a value of 0A, which denotes that Analog Input channels 1 and 3 are enabled and all other Analog Input channels are disabled.	

※Related Commands: Section 7.4.16 $AA6

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7.4.16 $AA6

Description
This command is used to read whether each Analog Input channel of a specified module is either enabled or disabled.

Syntax	
$AA6[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
6	The command to read the status of the Analog Input channels

Response	
Valid Command	!AAVV[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
VV	A two-digit hexadecimal value, representing the Analog Input channel, where bit 0 corresponds to Analog Input channel 0, and bit 1 corresponds to Analog Input channel 1, etc. When the bit is 0, it denotes that the Analog Input channel is disabled, and 1 denotes that the Analog Input channel is enabled.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Examples	
Command	$0350A
Response	!03
Enables Analog Input channels 1 and 3 on module 03 and disables all other Analog Input channels. The module returns a response indicating that the command was successful.	

Command	$036
Response	!030A
Reads the status of the Analog Input channels on module 03, and returns a response indicating that the command was successful, with a value of 0A, which denotes that Analog Input channels 1 and 3 are enabled and all other Analog Input channels are disabled.	

※Related Commands: Section 7.4.15 $AA5VV

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7.4.17 $AA6N

Description
This command is used to read the Analog Output requisition for channel N of a specified module.

Syntax	
$AA6N[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
6	The command to read the output value requisition
N	The Analog Output channel to be read, zero based

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The output requistion value. See Section 5 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	#031+10.000
Response	!03
Sets the Analog Output requisition value for Analog Output channel 1 of module 03 to +10.000(+10 V) and returns a response indicating that the command was successful.	

Command	$0361
Response	!03+10.000
Reads the Analog Output requisition value for Analog Output channel 1 of module 03 and returns a response indicating that the command was successful, with a value of +10.000 (+10.0 V).	

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Command	$0369
Response	?03
Attempts to read the Analog Output value from the last command received by Analog Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 7.4.5 #AAN(Data),
Section 7.4.20 $AA8N, Section 7.4.23 $AA9NTS
※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.18 $AA7N

Description
This command is used to read the Analog Output power-on value for channel N of a specified module.

Syntax	
$AA7N[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
7	The command to read the Analog Output power-on value
N	The Analog Output channel to be read, zero based

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The Analog Output power-on value for the specified Analog Output 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	#032+00.000
Response	>
Sets the Analog Output value for Analog Output channel 2 of module 03 to +00.000 (0.0 V) and returns a response indicating that the command was successful.	

Command	$0342
Response	!03
Stored the current Analog Output as the power-on value for Analog Output channel 2 of module 03 and returns a response indicating that the command was successful.	

Command	$0372
Response	!03+00.000
Reads the Analog Output power-on value for Analog Output channel 2 of module 03 and returns a response indicating that the command was successful, with a value of +00.000 signifying that the Analog Output power-on value is 0.0 V.	

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Command	$0379
Response	?03
Attempts to read the Analog Output power-on value for Analog Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 7.4.5 #AAN(Data), Section 7.4.13 $AA4N, Section 7.4.42 ~AA6PN(Data)
※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.19 $AA7CiRrr

Description
This command is used to set the Type Code for a specific Analog Input channel on a specified module.

Syntax	
$AA7CiRrr[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
7	The command to set the Type Code
Ci	i specifies the Analog Input channel to be set (0-7)
Rrr	rr represents the Type Code to be set for the Analog Inpit channel. See Section 4 for details of the data format.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	$037C0R08
Response	!03
Sets the Type Code for Analog Input channel 0 of module 03 to 8 (-10 ~ +10V), and the module returns a response indicating that the command was successful.	

Command	$037C1R80
Response	?03
Attempts to set the Type Code for Analog Input channel 1 of module 03 to 80. The module returns a response indicating that the command was unsuccessful because the Type Code is incorrect.	

※Related Commands: Section 7.4.3, #AA, Section 7.4.4 #AAN, Section 7.4.21 $AA8Ci
※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.20 $AA8N

Description
This command is used to read the current Analog Output value for Analog Output channel N of a specified module.

Syntax	
$AA8N[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
8	The command to read the current Analog Output value
N	The Analog Output channel to be read, zero based

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The current Analog Output value for the specified Analog Output channel. See Section 5 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	$039051
Response	!03
Sets the configuration for Analog Output channel 0 of module 03 to an output range of -5 to +5 V and a slew rate of 0.0625 V/Second, and returns a response indicating that the command was successful.	

Command	#030+05.000
Response	>
Sets the Analog Output value for Analog Output channel 0 of module 03 to +05.000 (+5.0 V) and returns a response indicating that the command was successful.	

Command	$0380
Response	!03+02.500
Reads the current Analog Output value for Analog Output channel 0 of module 03 and returns a response indicating that the command was successful, with a value of +02.500 (+2.5 V).	

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Command	$0389
Response	?03
Attempts to read the current Analog Output value for Analog Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.5 #AAN(Data), Section 7.4.17 $AA6N, Section 7.4.23 $AA9NTS
※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.21 $AA8Ci

Description
This command is used to read the Type Code information for a specific Analog Input channel on a specified module.

Syntax	
$AA8Ci[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
8	The command to read the Type Code information for the Analog Input channel
Ci	i Specifies which Analog Input channel to access for the Type Code information (0-7)

Response	
Valid Command	!AACiRrr[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
Ci	i specifies which Analog Input channel the Type Code information relates to.
Rrr	rr represents the Type Code used for the specified Analog Input channel. See Section 4 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	$038C0
Response	!03C0R08
Reads the Analog Input Type Code information for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, with a value of 08 denoting that the input range is -10 ~ +10V.	

Command	$038C9
Response	?03
Attempts to read the Type Code information for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.3 #AA, Section 7.4.4 #AAN, Section 7.4.19 $AA7CiRrr
※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.22 $AA9N

Description
This command is used to read the Analog Output configuration for Analog Output channel N of a specified module.

Syntax	
$AA9N[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
9	The command to read the Analog Output configuration
N	The Analog Output channel to be read, zero based

Response	
Valid Command	!AATS[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
T	The Analog Output type. See Section 5 for details of the data format.
S	The Analog Output slew rate. See Section 5 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	$039051
Response	!03
Sets the configuration for Analog Output channel 0 of module 03 to an output range of -5 to +5 V and a slew rate of 0.0625 V/Second and returns a response indicating that the command was successful.	

Command	$0390
Response	!0351
Reads the configuration for Analog Output channel 0 of module 03 and returns a response indicating that the command was successful, with a value of 51, meaning that the output range is -5 to +5 V and the slew rate is 0.0625 V/Second.	

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Command	$0399
Response	?03
Attempts to read the configuration for Analog Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.5 #AAN(Data), Section 7.4.23 $AA9NTS
※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.23 $AA9NTS

Description
This command is used to set the configuration for Analog Output channel N of a specified module.

Syntax	
$AA9NTS[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
9	The command to set the Analog Output configuration
N	The Analog Output channel to be set, zero based
T	The Analog Output type. See Section 5 for details of the data format.
S	The Analog Output slew rate. See Section 5 for details of the data format.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	$039051
Response	!03
Sets the configuration for Analog Output channel 0 of module 03 to an output range of -5 to +5 V and a slew rate of 0.0625 V/Second, and returns a response indicating that the command was successful.	

Command	$0390
Response	!0351
Reads the configuration for Analog Output channel 0 of module 03 and returns a response indicating that the command was successful, with a value of 51, meaning that the output range is -5 to +5 V and the slew rate is 0.0625 V/Second.	

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Command	$039951
Response	?03
Attempts to set the configuration for Analog Output channel 9 of module 03 to an output range of -5 to +5 V and a slew rate of 0.0625 V/Second, but returns a response indicating that the command was unsuccessful because Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.5 #AAN(Data), Section 7.4.22 $AA9N, Section 7.4.42 ~AA6PN(Data)

※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.24 $AAC

Description
This command is used to clear the Digital Input and Digital Output latche values for a specified module.

Syntax	
$AAC[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
C	The command to clear the Digital Input and Digital Output latch values

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	$03L1
Response	!030100
Reads the low latch data for module 03 and returns a response indicating that the command was successful, with a value of 030100 showing that Digital Output channels 0 and 1 and Digital Input channel 0 are latched low.	

Command	$03C
Response	!03
Clears the latch values for all channels of module 03 and returns a response indicating that the command was successful.	

Command	$03L1
Response	!000000
Reads the low latch data for module 03 and returns a response indicating that the command was successful, with a value of 000000 showing that all latched Digital Output and Digital Input channels have been cleared.	

※Related Commands: Section 7.4.31 $AALS

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7.4.25 $AAD

Description
This command is used to read whether the counter for each Digital Input channel of a specified module is enabled or disabled.

Syntax	
$AAD[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
D	The command to read the status of the counter for each Digital Input channel

Response	
Valid Command	!AAnn[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
nn	A two-digit hexadecimal value representing the Digital Input channel, where bit 0 corresponds to Digital Input channel 0, and bit 1 corresponds to Digital Input channel 1, etc. When the bit is 0, it denotes that the counter for the Digital Input channel is disabled, and 1 denotes that the counter for the Digital Input channel is enabled.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Examples	
Command	$03D03
Response	!03
Enables the counters for Digital Input channels 0 and 1 on module 03 and disables the counters for all other Digital Input channels. The module returns a response indicating that the command was successful.	

Command	$03D
Response	!0303
Reads the status of the counters for each Digital Input channel on module 03 and returns a response indicating that the command was successful, with a value of 03, which denotes that the counters for Digital Input channels 0 and 1 are enabled and that the counters for all other Digital Input channels are disabled.	

※Related Commands: Section 7.4.26 $AADnn, Section 7.4.48 @AACECi, Section 7.4.62 @AARECi

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7.4.26 $AADnn

Description
This command is used to enable or disable the counter for each Digital Input channel of a specified module.

Syntax	
$AADnn[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
D	The command to enable or disable the counter for the Digital Input channels
nn	A two-digit hexadecimal value representing the Digital Input channel, where bit 0 corresponds to Digital Input channel 0, and bit 1 corresponds to Digital Input channel 1, etc. When the bit is 0, it denotes that the counter for the Digital Input channel will be disabled, and 1 denotes that the counter for the Digital Input channel will be enabled.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	$03D03
Response	!03
Enables the counters for Digital Input channels 0 and 1 on module 03 and disables the counters for all other Digital Input channels. The module returns a response indicating that the command was successful.	

Command	$03D
Response	!0303
Reads the status of the counters for all Digital Input channels on module 03 and returns a response indicating that the command was successful, with a value of 03, which denotes that the counters for Digital Input channels 0 and 1 are enabled and the counters for all other Digital Input channels are disabled.	

※Related Commands: Section 7.4.25 $AAD, Section 7.4.48 @AACECi, Section 7.4.62 @AARECi

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7.4.27 $AAE

Description
This command is used to read whether the counter edges for each Digital Input channel of a specified module are rising or falling.

Syntax	
$AAE[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
E	The command to read the status of the counter edges for the Digital Input channels

Response	
Valid Command	!AAnn[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
nn	A two-digit hexadecimal value representing the Digital Input channel, where bit 0 corresponds to Digital Input channel 0, and bit 1 corresponds to Digital Input channel 1, etc. When the bit is 0, it denotes that the counter edge for the Digital Input channel is falling, and 1 denotes that the counter edge for the Digital Input channel is rising.
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	$03E03
Response	!03
Sets the counter edges for Digital Input channels 0 and 1 of module 03 to rising, and sets the counter edges for all other Digital Input channels to falling. The module returns a response indicating that the command was successful.	

Command	$03E
Response	!0303
Reads the status of the counter edges for all Digital Input channels on module 03 and returns a response indicating that the command was successful, with a value of 03, which denotes that the counter edges for Digital Input channels 0 and 1 are rising and the counter edges for all other Digital Input channels are falling.	

※Related Commands: Section 7.4.28 $AAEnn

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7.4.28 $AAEnn

Description
This command is used to specify whether the counter edges for each Digital Input channel of a specified module are to be rising or falling.

Syntax	
$AAEnn[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
E	The command to set the counter edges for the Digital Input channels
nn	A two-digit hexadecimal value representing the Digital Input channel, where bit 0 corresponds to Digital Input channel 0, and bit 1 corresponds to Digital Input channel 1, etc. When the bit is 0, it denotes that the counter edge for the Digital Input channel will be set to falling, and 1 denotes that the counter edge for the Digital Input channel will be set to rising.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	$03E03
Response	!03
Sets the counter edges for Digital Input channels 0 and 1 of module 03 to rising and sets the counter edges for all other Digital Input channels to falling. The module returns a response indicating that the command was successful.	

Command	$03E
Response	!0303
Reads the status of the counter edges for all Digital Input channels on module 03 and returns a response indicating that the command was successful, with a value of 03, which denotes that the counter edges for Digital Input channels 0 and 1 are rising and the counter edges for all other Digital Input channels are falling.	

※Related Commands: Section 7.4.27 $AAE

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7.4.29 $AAF

Description
This command is used to read the firmware version of a specified module.

Syntax	
$AAF[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
F	The command to read the firmware version information

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The firmware version of the module as a string 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.	

Examples	
Command	$03F
Response	!03A1.0
Reads the firmware version of module 03 and returns a response indicating that the command was successful, and showing that the firmware is version A1.0.	

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7.4.30 $AAM

Description
This command is used to read the name of a specified module.

Syntax	
$AAM[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
M	The command to read the name of the module

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The name of the module as a string 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.	

Examples	
Command	~03ZT-2026
Response	!03
Sets the name of module 03 to “ZT-2026” and returns a response indicating that the command was successful.	

Command	$03M
Response	!03ZT-2026
Reads the name of module 03 and returns a response indicating that the command was successful, and that the name of the module is “ZT-2026”.	

※Related Commands: Section 7.4.27 ~AA0(Name)

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7.4.31 $AALS

Description
This command is used to read the status of the latched Digital Output and Digital Input channels of a specified module.

Syntax	
$AALS[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
L	The command to read the status of the latched Digital Output and Digital Input channels
S	The status to be read 0: Reads the status of the low latched Digital Output and Digital Input channels 1: Reads the status of the high latched Digital Output and Digital Input channels

Response	
Valid Command	!(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The status of the latched Digital Output and Digital Input channels represented by a four digit hexadecimal value followed by 00.
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	$03L0
Response	!010200
Reads the status of the low latched Digital Output and Digital Input channels of module 03 and returns a response indicating that the command was successful, with a value of 010200 showing that Digital Output channel 0 and Digital Input channel 1 are latched low.	

Command	$03C
Response	!03
Clears the status of the latched Digital Output and Digital Input channels of module 03 and returns a response indicating that the command was successful.	

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Command	$03L0
Response	!000000
Reads the status of the low latched Digital Output and Digital Input channels of module 03 and returns a response indicating that the command was successful, with a value of 000000 showing that all low latched Digital Output and Digital Input channels have been cleared.	

Command	$03L2
Response	?03
Attempts to read the status of the latched Digital Output and Digital Input channels of module 03, but returns a response indicating that the command was unsuccessful because the status byte parameter was incorrect.	

※Related Commands: Section 7.4.24 $AAC

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7.4.32 $AAS1

Description
This command is used to reload the factory default calibration parameters for a specified module, including the internal calibration parameters.

Syntax	
$AAS1[CHECKSUM](CR)	
$	Delimiter character
AA	The address of the module where the default parameters are to be reloaded in hexadecimal format (00 to FF)
S1	The command to reload the factory default calibration parameters

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	$03S1
Response	!03
Sends a command to reload the factory default calibration parameters for module 03 and returns a response indicating that the command was successful.	

Command	$03S0
Response	?03
Attempts to send a command to reload the factory default calibration parameters for module 03, but returns a response indicating that the command was unsuccessful because the command was incorrect.	

※Related Commands: Section 7.4.6 $AA0, Section 7.4.7 $AA1, Section 7.4.8 $AA0N, Section 7.4.9 $AAA1N, Section 7.4.46 ~AAEV
※Related Topics: Section 6 Calibration

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7.4.33 ~**

Description
This command is used to inform all modules that the Host is OK.

Syntax	
~**[CHECKSUM](CR)	
~	Delimiter character
**	The “Host OK” command

Response
There is no response to this command.

Examples	
Command	~**
Response	No response
Sends a “Host OK” command to all modules.	

※Related Commands: Section 7.4.34 ~AA0, Section 7.4.35 ~AA1, Section 7.4.36 ~AA2, Section 7.4.37 ~AA3ETT
※Related Topics: Section 8.2 Dual Watchdog Operation.

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7.4.34 ~AA0

Description
This command is used to read the status of the Host Watchdog for a specified module.

Syntax	
~AA0[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
0	The command to read the status of the Host Watchdog

Response	
Valid Command	!AASS[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
SS	Two hexadecimal digits that represent the status of the Host Watchdog, where: Bit 2: 0 indicates that no Host Watchdog timeout has occurred, and 1 indicates that a Host Watchdog timeout has occurred. Bit 7: 0 indicates that the Host Watchdog is disabled, and 1 indicates that the Host Watchdog is enabled. The status of the Host Watchdog is stored in the EEPROM, and can only be reset by using the ~AA1 command. See Section 7.4.35 for more details.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Examples	
Command	~030
Response	!0380
Reads the status of the Host Watchdog for module 03 and returns a response indicating that the command was successful, with a value of 00, meaning that the Host Watchdog is enabled and no Host Watchdog timeout has occurred.	

Command	~030
Response	!0304
Reads the status of the Host Watchdog for module 03 and returns a response indicating that the command was successful, with a value of 04, meaning that a Host Watchdog timeout has occurred.	

※Related Commands: Section 7.4.33 ~**, Section 7.4.35 ~AA1, Section 7.4.36 ~AA2, Section 7.4.37 ~AA3ETT
※Related Topics: Section 8.2 Dual Watchdog Operation

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7.4.35 ~AA1

Description
This command is used to reset the status of the Host Watchdog timeout for a specified module.

Syntax	
~AA1[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be reset in hexadecimal format (00 to FF)
1	The command to reset the status of the Host Watchdog timeout

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	~030
Response	!0304
Reads the status of the Host Watchdog for module 03 and returns a response indicating that the command was successful, and that a Host Watchdog timeout has occurred.	

Command	~031
Response	!03
Resets the status of the Host Watchdog timeout for module 03 and returns a response indicating that the command was successful.	

Command	~030
Response	!0300
Reads the status of the Host Watchdog for module 03 and returns a response indicating that the command was successful, and showing that no Host Watchdog timeout has occurred.	

※Related Commands: Section 7.4.33 ~**, Section 7.4.34 ~AA0, Section 7.4.36 ~AA2, Section 7.4.37 ~AA3ETT
※Related Topics: Section 8.2 Dual Watchdog Operation

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7.4.36 ~AA2

Description
This command is used to read the Host Watchdog timeout value for a specified module.

Syntax	
~AA2[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
2	The command to read the Host Watchdog timeout value

Response	
Valid Command	!AAETT[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
E	The status of the Host Watchdog 0: The Host Watchdog is disabled 1: The Host Watchdog is enabled
TT	Two hexadecimal digits to represent the timeout value in tenths of a second. For example, 01 denotes 0.1 seconds and FF denotes 25.5 seconds.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Examples	
Command	~033164
Response	!03
Enables the Host Watchdog for module 03 and sets the Host Watchdog timeout value to 64 (10.0 seconds). The module returns a response indicating that the command was successful.	

Command	~032
Response	!03164
Reads the Host Watchdog timeout value for module 03 and returns a response indicating that the command was successful, with a value of 164, which denotes that the Host Watchdog is enabled and the Host Watchdog timeout value is 10.0 seconds.	

※Related Commands: Section 7.4.33 ~**, Section 7.4.34 ~AA0, Section 7.4.35 ~AA1, Section 7.4.37 ~AA3ETT
※Related Topics: Section 8.2 Dual Watchdog Operation

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7.4.37 ~AA3ETT

Description
This command is used to enable or disable the Host Watchdog for a specified module, and sets the Host Watchdog timeout value.

Syntax	
~AA3ETT[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be configured in hexadecimal format (00 to FF)
3	The command to enable or disable the Host Watchdog
E	The command to set the Host Watchdog: 0: Disables the Host Watchdog 1: Enables the Host Watchdog
TT	Two hexadecimal digits to represent the Host Watchdog timeout value in tenths of a second. For example, 01 denotes 0.1 seconds and FF denotes 25.5 seconds.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	~033164
Response	!03
Enables the Host Watchdog for module 03 and sets the Host Watchdog timeout value to 64 (10.0 seconds). The module returns a response indicating that the command was successful.	

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Command	~032
Response	!03164
Reads the Host Watchdog timeout value for module 03. The module returns a response indicating that the command was successful, with a value of 164, which denotes that the Host Watchdog is enabled and that the Host Watchdog timeout value is 10.0 seconds.	

※Related Commands: Section 7.4.33 ~**, Section 7.4.34 ~AA0, Section 7.4.35 ~AA1, Section 7.4.36 ~AA2, Section 7.4.38 ~AA4, Section 7.4.39 ~AA4N, Section 7.4.40 ~AA5N, Section 7.4.41 ~AA5PPSS

※Related Topics: Section 8.2 Dual Watchdog Operation

※Note: When a Host Watchdog timeout occurs, the Host Watchdog is disabled. In this case the ~AA3ETT command should be sent again to re-enable the Host Watchdog.

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7.4.38 ~AA4

Description
This command is used to read the Digital Output power-on value and the Digital Output safe value for a specified module.

Syntax	
~AA4[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
4	The command to read the Digital Output power-on value and the Digital Output safe value

Response	
Valid Command	!AAPPSS[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
PP	A two-digit hexadecimal value, representing the Digital Output power-on value, where bit 0 corresponds to Digital Output channel 0, and bit 1 corresponds to Digital Output channel 1, etc. When the bit is 0, it denotes that the Digital Output power-on is inactive, and 1 denotes that the Digital Output power-on is active.
SS	A two-digit hexadecimal value, representing the Digital Output safe value, where bit 0 corresponds to Digital Output channel 0, and bit 1 corresponds to Digital Output channel 1, etc. When the bit is 0, it denotes that the Digital Output safe value is inactive, and 1 denotes that the Digital Output safe value is active.
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	~0350102
Response	!03
Sets the Digital Output power-on value for module 03 to 01 and the Digital Output safe value to 02, and returns a response indicating that the command was successful.	

Command	~034
Response	!030102
Reads the Digital Output power-on value and the Digital Output safe value for module 03 and returns a response indicating that the command was successful, with a value of 0102, which denotes that the Digital Output power-on value is 01 and the Digital Output safe value is 02.	

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※Related Commands: Section 7.4.37 ~AA3ETT, Section 7.4.41 ~AA5PPSS
※Note: Neither the Digital Output power-on value nor the Digital Output safe value have any effect on Digital Output channels that are associated with alarm outputs.

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7.4.39 ~AA4N

Description
This command is used to read the safe value for Analog Output channel N of a specified module.

Syntax	
~AA4N[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
4	The command to read the Analog Output safe value
N	The Analog Output channel to be read, zero based

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The Analog Output safe value. See Section 5 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	#030+06.000
Response	>
Sets the Analog Output value for Analog Output channel 0 of module 03 to +06.000 (+6.0 V) and returns a response indicating that the command was successful.	

Command	~0350
Response	!03
Sets the current Analog Output value for Analog Output channel 0 as the Analog Output safe value and returns a response indicating that the command was successful.	

Command	~0340
Response	!03+06.000
Reads the Analog Output safe value for Analog Output channel 0 of module 03 and returns a response indicating that the command was successful, with a value of +06.000 (+6.0 V).	

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Command	~0349
Response	?03
Attempts to read the Analog Output safe value for Analog Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Output channel 9 does not exist.	

※Related Commands: Section 7.4.5 #AAN(Data), Section 7.4.37 ~AA3ETT, Section 7.4.40 ~AA5N

※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.40 ~AA5N

Description
This command is used to set the safe value for Analog Output channel N of a specified module.

Syntax	
~AA5N[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
5	The command to set the Analog Output safe value
N	The Analog Output channel to be set, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	#030+06.000
Response	>
Sets the Analog Output value for Analog Output channel 0 of module 03 to +06.000 (+6.0 V) and returns a response indicating that the command was successful.	

Command	~0350
Response	!03
Sets the current Analog Output value for Analog Output channel 0 of module 03 as the Analog Output safe value and returns a response indicating that the command was successful.	

Command	~0340
Response	!03+06.000
Reads the Analog Output safe value for channel 0 of module 03 and returns a response indicating that the command was successful, with a value of +06.000 (+6.0 V).	

Command	~0359
Response	?03
Attempts to set the current Analog Output value for Analog Output channel 9 of module 03 as the Analog Output safe value, but returns a response indicating that	

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the command was unsuccessful because Analog Output channel 9 does not exist.

※Related Commands: Section 7.4.5 #AAN(Data), Section 7.4.37 ~AA3ETT, Section 7.4.39 ~AA4N
※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.41 ~AA5PPSS

Description
This command is used to set the Digital Output power-on value and the Digital Output safe value for a specified module.

Syntax	
~AA5PPSS[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
5	The command to set the Digital Output power-on value and the Digital Output safe value
PP	A two-digit hexadecimal value, representing the Digital Output power-on value, where bit 0 corresponds to Digital Output channel 0, and bit 1 corresponds to Digital Output channel 1, etc. When the bit is 0, it denotes that the Digital Output power-on is inactive, and 1 denotes that the Digital Output power-on is active.
SS	A two-digit hexadecimal value, representing the Digital Output safe value, where bit 0 corresponds to Digital Output channel 0, and bit 1 corresponds to Digital Output channel 1, etc. When the bit is 0, it denotes that the Digital Output safe value is inactive, and 1 denotes that the Digital Output safe value is active.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	~0350102
Response	!03
Sets the Digital Output power-on value for module 03 to 01 and the Digital Output safe value to 02, and returns a response indicating that the command was successful.	

Command	~034
Response	!030102
Reads the Digital Output power-on value and the Digital Output safe value for module 03 and returns a response indicating that the command as successful, with a value of 0102, which denotes that the Digital Output power-on value is 01 and the Digital Output safe value is 02.	

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※Related Commands: Section 7.4.37 ~AA3ETT, Section 7.4.38 ~AA4
※Note: Neither the Digital Output power-on value nor the Digital Output safe value have any effect on the Digital Output channels that are associated with alarm outputs.

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7.4.42 ~AA6PN(Data)

Description
This command is used to set the power-on value for Analog Output channel N of a specified module.

Syntax	
~AA6PN(Data)[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
6P	The command to set the Analog Output power-on value
N	The Analog Output channel to be set, zero based
(Data)	The Analog Output value. See the Section 5 for details of the data format.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	~036P0+05.000
Response	!03
Sets the Analog Output power-on value for Analog Output channel 0 of module 03 to +05.000 (+5.0 V) and returns a response indicating that the command was successful.	

Command	~036P0+25.000
Response	?03
Attempts to set the Analog Output power-on value for Analog Output channel 0 of module 03 to +25.000 (+25.0 V), but returns a response indicating that the command was unsuccessful because the value is not within the valid output range.	

※Related Commands: Section 7.4.5 #AAN(Data), Section 7.4.13 $AA4N, Section 7.4.18 $AA7N, Section 7.4.23 $AA9NTS
※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.43 ~AA6SN(Data)

Description
This command is used to set the safe value for Analog Output channel N of a specified module.

Syntax	
~AA6SN(Data)[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
6S	The command to set the Analog Output safe value
N	The Analog Output channel to be set, zero based
(Data)	The Analog Output value. See Section 5 for details of the data format.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	~036S0+05.000
Response	!03
Sets the Analog Output safe value for Analog Output channel 0 of module 03 to +05.000 (+5.0 V), and returns a response indicating that the command was successful.	

Command	~036S0+25.000
Response	?03
Attempts to set the Analog Output safe value for Analog Output channel 0 of module 03 to +25.000 (+25.0 V), but returns a response indicating that the command was unsuccessful because the value is not within the valid output range.	

※Related Commands: Section 7.4.5 #AAN(Data), Section 7.4.23 $AA9NTS, Section 7.4.37 ~AA3ETT, Section 7.4.39 ~AA4N, Section 7.4.40 ~AA5N
※Related Topics: Section 5 Analog Output Type and Slew Rate

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7.4.44 ~AAD

Description
This command is used to read the Digital Input and Digital Output configuration for a specified module.

Syntax	
~AAD[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
D	The command to read the Digital Input and Digital Output configuration

Response	
Valid Command	!AATT[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
TT	Two hexadecimal digits that represent the miscellaneous settings as follows Bit 0: Specifies the active state of the Digital Input signal 0: an output value of 1 indicates that the relay is active an output value of 0 indicates that the relay is inactive 1: an output value of 0 indicates that the relay is active an output value of 1 indicates that the relay is inactive Bit 1: Specifies the active state of the Digital Output signal 0: an input value of 1 indicates that there is no signal or the voltage is low an input value of 0 indicates that the voltage is high 1: an input value of 0 indicates that there is no signal or the voltage is low an input value of 1 indicates that the voltage is high
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	~03D01
Response	!03
Sets the miscellaneous settings for module 03 to 01, meaning that the Digital Output channels are in inactive mode, and returns a response indicating that the command was successful.	

Command	~03D
Response	!0301

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Reads the miscellaneous settings for module 03 and returns a response indicating that the command was successful, with a value of 01, which denotes that the Digital Output channels are in inactive mode.

※Related Commands: Section 7.4.45 ~AADTT, Section 7.4.56 @AADI, Section 7.4.60 @AADODD

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7.4.45 ~AADTT

Description
This command is used to set the Digital Input and Digital Output configuration for a specified module.

Syntax	
~AADTT[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
D	The command to set the Digital Input and Digital Output configuration
TT	Two hexadecimal digits that represent the miscellaneous settings as follows: Bit 0: Specifies the active state of the Digital Input signal 0: an output value of 1 sets the relay to active an output value of 0 sets the relay to inactive 1: an output value of 0 sets the relay to active an output value of 1 sets the relay to inactive Bit 1: Specifies the active state of the Digital Output signal 0: an input value of 1 sets the signal to none or the voltage to low an input value of 0 sets the voltage to high 1: an input value of 0 sets the signal to none or the voltage to low an input value of 1 sets the voltage to high

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	~03D01
Response	!03
Sets the miscellaneous settings for module 03 to 01, meaning that the Digital Output channels are in inactive mode, and returns a response indicating that the command was successful.	

Command	~03D
Response	!0301
Reads the miscellaneous settings for module 03 and returns a response indicating that the command was successful, with a value of 01, which denotes that the Digital	

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Output channels are in inactive mode.

※Related Commands: Section 7.4.44 ~AAD, Section 7.4.56 @AADI, Section 7.4.60 @AADODD

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7.4.46 ~AAEV

Description
This command is used to enable or disable calibration for a specified module.

Syntax	
~AAEV[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module where calibration is to be enabled or disabled in hexadecimal format (00 to FF)
E	The command to enable or disable calibration
V	The command to enable or disable calibration 0: Disables calibration 1: Enables calibration

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	$030
Response	?03
Attempts to send a command to perform a span calibration on module 03, but returns a response indicating that the command was unsuccessful because the "Enable Calibration" command (~AAEV) has not yet been sent.	

Command	~03E1
Response	!03
Enables calibration on module 03 and returns a response indicating that the command was successful.	

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Command	$030
Response	!03
Sends a command to perform a span calibration on module 03 and returns a response indicating that the command was successful.	

※Related Commands: Section 7.4.6 $AA0, Section 7.4.7 $AA1, Section 7.4.8 $AA0N, Section 7.4.9 $AA1N, Section 7.4.32 $AAS1
※Related Topics: Section 6 Calibration
※Note: This command must be sent before any other calibration commands can be used.

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7.4.47 ~AAO(Name)

Description
This command is used to set the name of a specified module.

Syntax	
~AAO(Name)[CHECKSUM](CR)	
~	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
O	The command to set the name of the module
(Name)	The new name of the module (Max. 8 characters)

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	~03OZT-2026
Response	!03
Sets the name of module 03 to “ZT-2026” and returns a response indicating that the command was successful.	

Command	$03M
Response	!03ZT-2026
Reads the name of module 03 and returns a response indicating that the command was successful, with the name “ZT-2026”.	

Command	~030123456789ABCDEF
Response	?03
Attempts to set the name of module 03 to “123456789ABCDEF”, but returns a response indicating that the command was unsuccessful, because the name is longer than 8 characters..	

※Related Commands: Section 7.4.30 $AAM

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7.4.48 @AACECi

Description
This command is used to reset the counter for a specific Digital Input channel of a specified module.

Syntax	
@AACECi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be reset in hexadecimal format (00 to FF)
CE	The command to reset the counter
Ci	i specifies the Digital Input channel where the counter is to be reset, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03REC0
Response	!0300000008
Reads data from Digital Input channel 0 of module 03 and returns a response indicating that the command was successful, with a counter value of 00000008.	

Command	@03CEC0
Response	!03
Resets the counter for Digital Input channel 0 of module 03 to the preset value and returns a response indicating that the command was successful.	

Command	@03REC0
Response	!0300000000
Reads data from Digital Input channel 0 of module 03 and returns a response indicating that the command was successful, with a counter value of 000000000.	

Command	@03CEC9
Response	!03
Attempts to reset the counter for Digital Input channel 9 of module 03 to the preset value, but returns a response indicating that the command was unsuccessful because	

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Digital Input channel 9 does not exist.

※Related Commands: Section 7.4.25 $AAD, Section 7.4.26 $AADnn, Section 7.4.62 @AARECi

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7.4.49 @AACH

Description
This command is used to clear the high latch values for all Analog Input channels of a specified module.

Syntax	
@AACH[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
CH	The command to clear the high latch values for all Analog Input channels

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03RH0
Response	!03+05.000
Reads the high latch value for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, with a value of +05.000 (+5.0 V).	

Command	@03CH
Response	!03
Clears the high latch values for all Analog Input channels of module 03 and returns a response indicating that the command was successful.	

Command	@03RH0
Response	!03+00.000
Reads the high latch value for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, with a value of +00.000 (0.0 V) signifying that the high latch has been cleared.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 7.4.50 @AACHi, Section 7.4.63 @AARH, Section 7.4.65 @AARHi

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7.4.50 @AACHi

Description
This command is used to clear the high latch value for a specific Analog Input channel of a specified module.

Syntax	
@AACHi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
CH	The command to clear the high latch value for the Analog Input channel
i	The Analog Input channel to be cleared, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03RH1
Response	!03+06.000
Reads the high latch value for Analog Input channel 1 of module 03 and returns a response indicating that the command was successful, with a value of +06.000 (+6.0 V).	

Command	@03CH1
Response	!03
Clears the high latch value for Analog Input channel 1 of module 03 and returns a response indicating that the command was successful.	

Command	@03RH1
Response	!03+00.000
Reads the high latch value for Analog Input channel 1 of module 03 and returns a response indicating that the command was successful, with a value of +00.000 (0.0 V) signifying that the high latch value has been cleared.	

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Command	@03CH9
Response	?03
Attempts to clear the high latch value for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 7.4.49 @AACH, Section 7.4.63 @AARH, Section 7.4.65 @AARHi

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7.4.51 @AACHCi

Description
This command is used to clear the status of the high alarm for a specific Analog Input channel of a specified module.

Syntax	
@AACHCi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
CHC	The command to clear the status of the high alarm for the Analog Input channel
i	The Analog Input channel to be cleared, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03RA00
Response	!038000
Reads the current status of the alarms associated with Digital Output chanel 0 of module 03 and returns a response indicating that the command was successful, and that a high alarm has occurred on Analog Input channel 7.	

Command	@03CHC7
Response	!03
Clears the status of the high alarm for Analog Input channel 7 of module 03 and returns a response indicating that the command was successful.	

Command	@03RA00
Response	!030000
Reads the current status of the alarms associated with Digital Output chanel 0 of module 03 and returns a response indicating that the command was successful, and that no alarms have occurred.	

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Command	@03CHC9
Response	?03
Attempts to clear the status of the high alarm for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.55 @AADHCi, Section 7.4.58 @AAHI(Data)CiTOj, Section 7.4.61 @AARAOj, Section 7.4.63 @AARH, Section 7.4.64 @AARHCi

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7.4.52 @AACL

Description
This command is used to clear the low latch values for all Analog Input channels of a specified module.

Syntax	
@AACL[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
CL	The command to clear the low latch values for all Analog Input channels

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03RL0
Response	!03-05.000
Reads the low latch value for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, with a value of -05.000 (-5.0 V).	

Command	@03CL
Response	!03
Clears the low latch values for all Analog Input channels of module 03 and returns a response indicating that the command was successful.	

Command	@03RL0
Response	!03+00.000
Reads the low latch value for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, with a value of +00.000 (0.0 V) signifying that the low latch value has been cleared.	

※Related Commands: Section 7.4.53 @AACLi, Section 7.4.66 @AARL, Section 7.4.68 @AARLi

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7.4.53 @AACLi

Description
This command is used to clear the low latch value for a specific Analog Input channel of a specified module.

Syntax	
@AACLi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
CL	The command to clear the low latch value for the Analog Input channel
i	The Analog Input channel to be cleared, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03RL1
Response	!03-06.000
Reads the low latch value for Analog Input channel 1 of module 03 and returns a response indicating that the command was successful, with a value of -06.000 (-6.0 V).	

Command	@03CL1
Response	!03
Clears the low latch value for Analog Input channel 1 of module 03 and returns a response indicating that the command was successful.	

Command	@03RL1
Response	!03+00.000
Reads the low latch value for Analog Input channel 1 of module 03 and returns a response indication that the command was successful, with a value of +00.000 (0.0 V) signifying that the low latch value has been cleared.	

Command	@03CL9
Response	?03
Attempts to clear the low latch value for Analog Input channel 9 of module 03,	

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but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.

※Related Commands: Section 7.4.52 @AACL, Section 7.4.66 @AARL, Section 7.4.68 @AARLi

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7.4.54 @AACLCi

Description
This command is used to clear the status of the low alarm for a specific Analog Input channel of a specified module.

Syntax	
@AACLCi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be cleared in hexadecimal format (00 to FF)
CLC	The command to clear the status of the low alarm for the Analog Input channel
i	The Analog Input channel to be cleared, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03RA00
Response	!030080
Reads the current status of the alarms associated with Digital Output channel 0 for module 03 and returns a response indicating that the command was successful, and that a low alarm has occurred on Analog Input channel 7.	

Command	@03CLC7
Response	!03
Clears the status of the low alarm for Analog Input channel 7 of module 03 and returns a response indicating that the command was successful.	

Command	@03RA00
Response	!030000
Reads the current status of the alarms associated with Digital Output channel 0 for module 03 and returns a response indicating that the command was successful, and that no alarms have occurred.	

Command	@03CLC9
Response	?03

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Attempts to clear the status of the low alarm for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.

※Related Commands: Section 7.4.57 @AADLCi, Section 7.4.59 @AALO(Data)CiTOj, Section 7.4.61 @AARAOj, Section 7.4.67 @AARCi, Section 7.4.69 @AARAOOj

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7.4.55 @AADHCi

Description
This command is used to disable the high alarm for a specific Analog Input channel of a specified module.

Syntax	
@AADHCi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be configured in hexadecimal format (00 to FF)
DH	The command to disable the high alarm for the Analog Input channel
Ci	The Analog Input channel where the alarm is to be disabled, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03R000
Response	!038000
Reads whether the alarms associated with Digital Output channel 0 of module 03 are enabled or disabled and returns a response indicating that the command was successful, and that the high alarm for Analog Input channel 7 is enabled.	

Command	@03DHC7
Response	!03
Disables the high alarm for Analog Input channel 7 of module 03 and returns a response indicating that the command was successful.	

Command	@03R000
Response	!030000
Reads whether the alarms associated with Digital Output channel 0 of module 03 are enabled or disabled and returns a response indicating that the command was successful, and that the alarms for all Analog Input channels have not been enabled.	

Command	@03DHC9
Response	?03

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Attempts to disable the high alarm for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.

※Related Commands: Section 7.4.51 @AACHCi, Section 7.4.58 @AAHI(Data)CiTOj, Section 7.4.61 @AARAOj, Section 7.4.64 @AARHCi, Section 7.4.69 @AAROOj

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7.4.56 @AADI

Description
This command is used to read the status of all Digital Input and Digital Output channels of a specified module.

Syntax	
@AADI[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
DI	The command to read the status of all Digital Input and Digital Output channels

Response	
Valid Command	!AA0OOII[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
O	Reserved
OO	A two-digit hexadecimal value representing the status of the Digital Output, where bit 0 corresponds to Digital Output channel 0, and bit 1 corresponds to Digital Output channel 1, etc. When the bit is 0, it denotes that the Digital Output is inactive, and 1 denotes that the Digital Output is active.
II	A two-digit hexadecimal value representing the status of the Digital Input, where bit 0 corresponds to Digital Input channel 0, and bit 1 corresponds to Digital Input channel 1, etc. When the bit is 0, it denotes that the Digital Input is inactive, and 1 denotes that the Digital Input is active.
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	@03DO01
Response	!03
Sets Digital Output channel 0 of module 03 to ON, and sets Digital Output channel 1 to OFF, and returns a response indicating that the command was successful.	

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Command	@03DI
Response	!030102
Reads the status of the Digital Input and Digital Output for all channels of module 03 and returns a response indicating that the command was successful, and showing that the Digital Output is active on channel 0 and that the Digital Input is active on channel 1.	

※Related Commands: Section 7.4.45 ~AADTT , Section 7.4.60 @AADODD

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7.4.57 @AADLCi

Description
This command is used to disable the low alarm for a specific Analog Input channel of a specified module.

Syntax	
@AADLCi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be configured in hexadecimal format (00 to FF)
DL	The command to disable the low alarm
Ci	The Analog Input channel where the alarm is to be disabled, zero based

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03R000
Response	!030001
Reads whether the alarms associated with Digital Output channel 0 of module 03 are enabled or disabled and returns a response indicating that the command was successful, and that the high alarm for Analog Input channel 7 is enabled.	

Command	@03DLC0
Response	!03
Disables the low alarm for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful.	

Command	@03R000
Response	!030000
Reads whether the alarms associated with Digital Output channel 0 of module 03 are enabled or disabled and returns a response indicating that the command was successful, and that the low alarms for all Analog Input channels have not been enabled.	

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Command	@03DLC9
Response	?03
Attempts to disable the low alarm for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.54 @AACLCi, Section 7.4.59 @AALO(Data)CiTOj, Section 7.4.61 @AARAOj, Section 7.4.67 @AARLCi, Section 7.4.69 @AAROOj

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7.4.58 @AAHI(Data)CiTOj

Description
This command is used to enable the high alarm, and set the high alarm limit and Alarm Type for a specific Analog Input channel of a specified module.

Syntax	
@AAHI(Data)CiTOj[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be enabled in hexadecimal format (00 to FF)
HI	The command to enable the high alarm for the Analog Input channel
(Data)	The high alarm limit, which should be consistent with the engineering units format. Refer to Section 4 for details of the data format.
Ci	The Analog Input channel where the high alarm is to be enabled, zero based
T	The Alarm Type: M: Momentary Alarm L: Latched Alarm
Oj	j specifies the Digital Output port to be used for the alarm ouput

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03HI+09.000COMO
Response	!03
Sets the high alarm limit for Analog Input channel 0 of module 03 to +09.000 (+9.0 V), sets the Alarm Type to momentary, and sets Digital Output channel 1 as the high alarm output, and returns a response indicating that the command was successful.	

Command	@03RHC0
Response	!03+09.000101
Reads the status of the high alarms for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, and that the high alarm limit is +09.000 (+9.0 V), the Alarm Type is momentary and Digital Output channel 1 is set as the high alarm output.	

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Command	@03HI+09.000C9MO
Response	!03
Attempts to set the high alarm limit for Analog Input channel 9 of module 03 to +09.000 (+9.0 V), the Alarm Type to momentary and Digital Output channel 1 as the high alarm output, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.51 @AACHCi, Section 7.4.55 @AADHCi, Section 7.4.61 @AARAOj, Section 74.64 @AARHCi, Section 7.4.69 @AAROOj

※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.59 @AALO(Data)CiTOj

Description
This command is used to enable the low alarm, and set the low alarm limit and Alarm Type for a specific Analog Input channel of a specified module.

Syntax	
@AALO(Data)CiTOj[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
LO	The command to enable the low alarm for the Analog Input channel
(Data)	The low alarm limit, which should be consistent with the engineering units format. Refer to Section 4 for details of the data format.
Ci	The Analog Input channel where the low alarm is to be enabled, zero based
T	The Alarm Type: M: Momentary Alarm L: Latched Alarm
Oj	j specifies the Digital Output port to be used for the alarm ouput

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03LO-03.000C1L00
Response	!03
Sets the low alarm limit for Analog Input channel 1 of module 03 to -03.000 (-3.0 V), sets the Alarm Type to latched and sets Digital Output channel 0 as the low alarm output, and returns a response indicating that the command was successful.	

Command	@03RLC1
Response	!03-03.000200
Reads the status of the low alarms for Analog Input channel 1 of module 03 and returns a response indicating that the command was successful, and that the low alarm limit is -03.000 (-3.0 V), the Alarm Type is latched and Digital Output channel 0 is set as the low alarm output.	

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Command	@03L0-03.000C9L00
Response	!03
Attempts to set the low alarm limit for Analog Input channel 9 of module 03 to -03.000 (-3.0 V), the Alarm Type to latched and Digital Output channel 0 as the low alarm output, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.54 @AACLCi, Section 7.4.57 @AADLCi, Section 7.4.61 @AARA0j, Section 7.4.67 @AARLCi, Section 7.4.69 @AAR00j

※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.60 @AADODD

Description
This command is used to specify whether the Digital Output channels for a specified module are set to active or inactive.

Syntax	
@AADODD[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be set in hexadecimal format (00 to FF)
DO	The command to set the Digital Output ports to active or inactive
DD	A two-digit hexadecimal value representing the Digital Output port, where bit 0 corresponds to Digital Output channel 0, and bit 1 corresponds to Digital Output channel 1, etc. When the bit is 0, it denotes that the Digital Output port will be inactive, and 1 denotes that the Digital Output port will be active.

Response	
Valid Command	!AA[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding 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	@03D001
Response	!03
Sets Digital Output channel 0 of module 03 to active, and sets Digital Output channel 1 to inactive and returns a response indicating that the command was successful.	

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Command	@03DI
Response	!030102
Reads the status of the Digital Input and Digital Output for all channels of module 03 and returns a response indicating that the command was successful, and showing that the Digital Output is active on channel 0 and that the Digital Input is active on channel 1.	

※Related Commands: Section 7.4.45 ~AADTT, Section 7.4.56 @AADI
※Notes:

1. If the Digital Output port is already set as an alarm output port, then the value written to the port is ignored.
2. If a Host Watchdog timeout occurs, the module will return a response indicating that the command was invalid and the Digital Output value that was sent will be ignored.

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7.4.61 @AARAOj

Description
This command is used to read the currently activated alarm associated with a specific Digital Output channel of a specified module.

Syntax	
@AARAOj[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RA	The command to read the currently activated alarms associated with the Digital Output channel.
Oj	j specifies the Digital Output port to be read, zero based

Response	
Valid Command	!AAHHLL[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
HH	A two-digital hexadecimal value representing the currently activated high alarms associated with the Digital Output port, where bit 0 corresponds to channel 0, and bit 1 corresponds to channel 1, etc. When the bit is 0, it denotes that there are no activated high alarm associated with the channel, and 1 denotes that there is an activated high alarms associated with the channel.
LL	A two-digital hexadecimal value respresenting the currently activated low alarms associated with the Digital Output port, where bit 0 corresponds to channel 0, and bit 1 corresponds to channel 1, etc. When the bit is 0, it denotes that there are no activated low alarm associated with the channel, and 1 denotes that there is an 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	@03RA01
Response	!031122
Reads the currently activated alarms associated with the Digital Output channel 1 of module 03, and returns a response indicating that command was successful with a value of 1122, which denotes that there is an activated high alarm associated with channels 0 and 4, and an activated low alarm associated with channels 1 and 5.	

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Command	@03RA09
Response	?03
Attempts to read the currently activated alarms associated with the Digital Output channel 9 of module 03, but returns a response indicating that command was unsuccessful because Digital Output channel 9 does not exist.	

※Related Commands: Section 7.4.51 @AACHCi, Section 7.4.54 @AACLCi, Section 7.4.55 @AADHCi, Section 7.4.57 @AADLCi, Section 7.4.58 @AAHI(Data)CiTOj, Section 7.4.59 @AALO(Data)CiTOj, Section 7.4.64 @AARHCi, Section 7.4.67 @AARLCi, Section 7.4.69 @AAROOj

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7.4.62 @AARECi

Description
This command is used to read the counter value for a specific Digital Input channel of a specified module.

Syntax	
@AARECi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RE	The command to read the counter value for the Digital Input channel.
Ci	The Digital Input channel to be read, zero based

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The counter value for the specified Digital Input 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	@03REC0
Response	!0300000008
Reads data from Digital Input channel 0 of module 03 and returns a response indicating that the command was successful, with a counter value of 00000008.	

Command	@03CEC0
Response	!03
Resets the counter for Digital Input channel 0 of module 03 to the preset value and returns a response indicating that the command was successful.	

Command	@03REC0
Response	!0300000000
Reads data from Digital Input channel 0 of module 03 and returns a response indicating that the command was successful, with a counter value of 00000000.	

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Command	@03REC9
Response	?03
Attempts to read data from Digital Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because the Digital Input channel 9 does not exist.	

※Related Commands: Section 7.4.25 $AAD, Section 7.4.26 $AADnn, Section 7.4.48 @AACECi

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7.4.63 @AARH

Description
This command is used to read the high latch values for all Analog Input channels of a specified module.

Syntax	
@AARH[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RH	The command to read the high latch values for all Analog Input channels

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The high latch values for all Analog Input channels. See Section 4 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	@03RH
Response	!03+08.000+00.000+00.000+00.000+00.000+00.000+00.000+00.000
Reads the high latch values for all Analog Input channels on module 03 and returns a response indicating that the command was successful, with the data in engineering units format.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 74.49 @AACH, Section 7.4.50 @AACHi, Section 7.4.65 @AARHi
※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.64 @AARHCi

Description
This command is used to read the status of the high alarm for a specific Analog Input channel of a specified module.

Syntax	
@AARHCi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RH	The command to read the status of the high alarm for the Analog Input channel
Ci	The Analog Input channel to be read, zero based

Response	
Valid Command	!AA(Data)SOj[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The high alarm value for the specified Analog Input channel in engineering units format. See Section 4 for details of the data format.
S	The Alarm Type: 0: Alarm Disabled 1: Momentary Alarm 2: Latched Alarm
Oj	j specifies the Digital Output port
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	@03HI+09.000COM00
Response	!03
Sets the high alarm limit for Analog Input channel 0 of module 03 to +09.000 (+9.0 V), sets the Alarm Type to momentary and sets Digital Output channel 0 as the high alarm output, and returns a response indicating that the command was successful.	

Command	@03RHC0
Response	!03+09.000100
Reads the status of the high alarms for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, and that the high alarm limit is +09.000 (+9.0 V), the Alarm Type is momentary, and Digital Output channel 0 is set as the high alarm output.	

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Command	@03RHC9
Response	?03
Attempts to read the status of the high alarms for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.51 @AACHCi, Section 7.4.55 @AADHCi, Section 7.4.58 @AAHI(Data)CiTOj, Section 7.4.61 @AARAOj, Section 7.4.69 @AAROOj

※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.65 @AARHi

Description
This command is used to read the high latch value for a specific Analog Input channel of a specified module.

Syntax	
@AARHCi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RH	The command to read the high latch value for the Analog Input channel
i	The Analog Input channel to be read, zero based

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The high latch value for the specified Analog Input channel. See Section 4 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	@03RH0
Response	!03+08.000
Reads the high latch value for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, with the data in engineering units format.	

Command	@03RH9
Response	?03
Attempts to read the high latch value for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.1 %AANNTTCCFF, Section 7.4.49 @AACH, Section 7.4.50 @AACHi, Section 7.4.63 @AARH
※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.66 @AARL

Description
This command is used to read the low latch values for all Analog Input channels of a specified module.

Syntax	
@AARL[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RL	The command to read the low latch values for all Analog Input channels

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The low latch values for all Analog Input channels. See Section 4 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	@03RL
Response	!03-02.000+00.000+00.000+00.000+00.000+00.000+00.000+00.000
Reads the low latch values for all Analog Input channels on module 03 and returns a response indicating that the command was successful, with the data in engineering units format.	

※Related Commands: Section 7.4.52 @AACL, Section 7.4.53 @AACLi, Section 7.4.68 @AARLi

※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.67 @AARLCi

Description
This command is used to read the status of the low alarm for a specific Analog Input channel of a specified module.

Syntax	
@AARLCi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RL	The command to read the status of the low alarm for the Analog Input channel
Ci	The Analog Input channel to be read, zero based

Response	
Valid Command	!AA(Data)SOj[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The status of the low alarm for the specified Analog Input channel in engineering units. See Section 4 for details of the data format.
S	The Alarm Type: 0: Alarm Disabled 1: Momentary Alarm 2: Latched Alarm
Oj	J specifies the Digital Output channel that was read, zero based.
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	@03L0-03.000C1L01
Response	!03
Sets the low alarm limit for Analog Input channel 1 of module 03 to -03.000 (-3.0 V), sets the Alarm Type to latched, and sets Digital Output channel 1 as the low alarm output, and returns a response indicating that the command was successful.	

Command	@03RLC1
Response	!03-03.000201
Reads the status of the low alarms for Analog Input channel 1 of module 03 and returns a response indicating that the command was successful, and that the alarm limit is -03.000 (-3.0 V), the Alarm Type is latched, and Digital Output channel 1 is set as the low alarm output.	

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Command	@03RLC9
Response	?03
Attempts to read the status of the low alarms for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.54 @AACLCi, Section 7.4.57 @AADLCi, Section 7.4.59 @AALO(Data)CiTOj, Section 7.4.61 @AARAOj, Section 7.4.69 @AAROOj

※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.68 @AARLi

Description
This command is used to read the low latch value for a specific Analog Input channel of a specified module.

Syntax	
@AARLi[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RL	The command to read the low latch value for the Analog Input channel
i	The Analog Input channel to be read, zero based

Response	
Valid Command	!AA(Data)[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
(Data)	The low latch value for the specified Analog Input channel. See Section 4 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	@03RL0
Response	!03-02.000
Reads the low latch value for Analog Input channel 0 of module 03 and returns a response indicating that the command was successful, with the data in engineering units format.	

Command	@03RL9
Response	?03
Attempts to read the low latch value for Analog Input channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Analog Input channel 9 does not exist.	

※Related Commands: Section 7.4.52 @AACL, Section 7.4.53 @AACLi, Section 7.4.66 @AARL
※Related Topics: Section 4 Analog Input Type and Data Format

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7.4.69 @AAROOj

Description
This command is used to read whether the alarms associated with a specific Digital Output channel of a specified module are enabled or disabled.

Syntax	
@AAROOj[CHECKSUM](CR)	
@	Delimiter character
AA	The address of the module to be read in hexadecimal format (00 to FF)
RO	The command to read the alarms associated with the specific Digital Output port
Oj	j specifies the Digital Output channel to be read, zero based.

Response	
Valid Command	!AAHHLL[CHECKSUM](CR)
Invalid Command	?AA[CHECKSUM](CR)
!	Delimiter character to indicate a valid command
?	Delimiter character to indicate an invalid command
AA	The address of the responding module in hexadecimal format (00 to FF)
HH	A two-digit hexadecimal value representing the status of the high alarms associated with the specified Digital Output channel, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 0, it denotes that the high alarm for the channel is disabled, and 1 denotes that the high alarm for channel is enabled.
LL	A two-digit hexadecimal value representing the status of the low alarms associated with the specified Digital Output channel, where bit 0 corresponds to channel 0, bit 1 corresponds to channel 1, etc. When the bit is 0, it denotes that the low alarm for the channel is disabled, and 1 denotes that the low alarm for the channel is enabled.
There will be no response if the command syntax is incorrect, there is a communication error, or there is no module with the specified address.	

Example	
Command	@03RO01
Response	!030102
Reads the status of the alarms associated with Digital Output channel 1 of module 03, and returns a response indicating that the command was successful with a value of 1122 meaning that the high alarm on Analog Input channel 0 and the low alarm on Analog Input channel 1 are associated with the Digital Output channel 1.	

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Command	@03R009
Response	?03
Attempts to read the status of the alarms associated with the Digital Output channel 9 of module 03, but returns a response indicating that the command was unsuccessful because Digital Output channel 9 does not exist.	

※Related Commands: Section 7.4.51 @AACHCi, Section 7.4.54 @AACLCi, Section 7.4.55 @AADHCi, Section 7.4.57 @AADLCi, Section 7.4.58 @AAHI(Data)CiTOj, Section 7.4.59 @AALO(Data)CiTOj, Section 7.4.61 @AARAOj, Section 7.4.64 @AARHCi, Section 7.4.67 @AARLCi

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7.5 Modbus RTU Protocol Command set

The Modbus Protocol was developed by Modicon Inc., and was originally designed for Modicon controllers. Detailed information regarding the Modbus RTU Protocol can be found at:
http://www.modicon.com
and http://www.modbus.org

- Modbus RTU Command Format

Field 1	Field 2	Field 3	Field 4~n	Field n+1~n+2
Module Address	Function Code	Sub Function	Configuration Field	CRC16

Function Code	Description
0x04	Reads the input channels
0x46	Reads/writes the module settings

Examples:

A. To read the Analog Input value for module 01, the following command should be sent:
   01 04 00 00 00 08 F1 CC
B. To read the name of the module, the following command should be sent:
   01 46 00 12 60

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7.5.1 Modbus Address Mapping

Address Mapping		
Address	Description	Attribute
00001 ~ 00002	The Digital Output value	R/W
00065 ~ 00066	The Digital Input high latch value	R/W
00073 ~ 00074	The Digital Output high latch value	R/W
00097 ~ 00098	The Digital Input low latch value	R/W
00105 ~ 00106	The Digital Output low latch value	R/W
00129 ~ 00130	The Digital Output safe value	R/W
00161 ~ 00162	The Digital Output power-on value	R/W
00193 ~ 00194	The status of the Digital Input counter edge: 0: Falling Edge 1: Rising Edge	R/W
00225 ~ 00226	The status of the Digital Input counter: 0: Disabled 1: Enabled	R/W
00259	The Filter settings: 0: 60Hz rejection 1: 50Hz rejection	R/W
00260	The Modbus Host Watchdog mode: 0: The same as the I-7000 series modules 1: The Analog Output and Digital Output commands can be used to clear the status of the Host Watchdog timeout	R/W
00261	Enables or disables the Host Watchdog: 0: Disable 1: Enable	R/W
00264	The Digital Input/Digital Output high latch and low latch values. Write 1 to clear channels 0 to 1	W
00266	The status of the Digital Input counter. Write 1 to clear channels 0 to 1.	W
00269	The Modbus Data Format: 0: Hexadecimal 1: Engineering Units	R/W
00270	The status of the Host Watchdog timeout. Write 1	W

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	to clear.	
00272	The factory calibration parameters. Write 1 to load.	W
00273	The Reset status: 0: This is NOT the first time the module has been read after being powered on 1: This is the first time the module has been read after being powered on	R
00278	The Digital Input active mode: 0: Normal 1: Inverse	R/W
00279	The Digital Output active mode: 0: Normal 1: Inverse	R/W
00280	The high latch values for all Analog Input channels. Write 1 to clear.	W
00281	The low latch values for all Analog Input channels. Write 1 to clear.	W
00284	Enables or disables calibration: 0: Disable 1: Enable	R/W
00513 ~ 00516	The high latch values for Analog Input channels 0 to 3. Write 1 to clear.	W
00545 ~ 00548	The low latch values for Analog Input channels 0 to 3. Write 1 to clear.	W
00577 ~ 00580	Enables or disables the high alarm for Analog Input channels 0 to 3: 0: Disable 1: Enable	R/W
00609 ~ 00612	Enables or disables the low alarm for Analog Input channels 0 to 3: 0: Disable 1: Enable	R/W
00641 ~ 00644	The high Alarm Type for Analog Input channels 0 to 3: 0: Momentary 1: Latch	R/W
00673 ~ 00676	The low Alarm Type for Analog Input channels 0 to 3: 0: Momentary 1: Latch	R/W
00705 ~ 00708	The status of the high alarm for Analog Input channels 0 to 3	R/W
00737 ~	The status of the low alarm for Analog Input	R/W

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00740	channels 0 to 3	
10033 ~ 10034	The status of the Digital Input for Digital Input channels 0 to 1	R
30001 ~ 30004	The Analog Input value for Analog Input channels 0 to 3	R
30065 ~ 30066	The current Analog Output value	R
30129 ~ 30132	The Digital Input counter for Digital Input channels 0 to 1	R
30513 ~ 30516	The high latch value for Analog Input channels 0 to 3	R
30545 ~ 30548	The low latch value for Analog Input channels 0 to 3	R
30705 ~ 30706	The current alarms associated with the Digital Output port for Digital Output channels 0 to 1	R
30737 ~ 30738	The alarms associated with the Digital Output port for Digital Output channels 0 to 1	R
40033 ~ 40034	The Analog Output value for Analog Output channels 0 to 1	R/W
40097 ~ 40098	The Analog Output safe value for Analog Output channels 0 to 1	R/W
40193 ~ 40194	The Analog Output power-on value for Analog Output channels 0 to 1	R/W
40257 ~ 40260	The Type Code for Analog Input channels 0 to 3	R/W
40289 ~ 40290	The slew rate for Analog Output channels 0 to 1	R/W
40321 ~ 40324	The Digital Output port as high alarm for Analog Input channels 0 to 3	R/W
40329 ~ 40332	The Digital Output port as low alarm value for Analog Input channels 0 to 3	R/W
40417 ~ 40418	The Type Code for Analog Output channels 0 to 1	R/W
40481 ~ 40482	The Firmware Version	R
40483 ~ 40484	The Module Name	R
40485	The Module Address. The valid range is 1 ~ 247	R
40486	The Baud Rate: Bit 5:0 Baud Rate. Always set to 0x0A Bit 7:6 Reserved	R
40489	The Host Watchdog timeout value. The valid range is 0 ~ 255, in 0.1 second intervals	R/W

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40490	Enables or disables each Analog Input channel	R/W
40492	The Host Watchdog timeout counter value. Write 0 to clear.	R/W
40577 ~ 40580	The high alarm value for Analog Input channels 0 to 3	R/W
40609 ~ 40612	The low alarm value for Analog Input channels 0 to 3	R/W
40673 ~ 40674	Trims the Analog Output for Analog Output channels 0 to 1	W
40769 ~ 40772	The Analog Input calibration type: 0x5A45: Zro Calibration 0x5350: San Calibration	W
40801 ~ 40802	The Analog Output calibration type: 0x5A45: Zro Calibration 0x5350: San Calibration	W

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7.5.2 PLC Address Mapping

Function Code	Description	Section
0x01	Reads the Coils	7.5.3
0x02	Reads the Discrete Inputs	7.5.4
0x03	Reads Multiple Registers	7.5.5
0x04	Reads Multiple Input Registers	7.5.6
0x05	Writes a Single Coil	7.5.7
0x06	Writes Multiple Registers	7.5.8
0x0F	Writes Multiple Coils	7.5.9
0x46	Reads/Writes the Module Settings	7.5.10

If the function specified in the message is not supported, then the module will respond with an error code as per the tablk below. Note that the address mapping for the Modbus protocol is Base 0.

Error Response

Number	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	Function code + 0x80
02	Exception Code	1	01

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

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7.5.3 01 (0x01) Reading the Coils

Description
This function code is used to read the current Digital Output values from the ZT-2000 I/O module.

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x01
02~03	Starting Channel Number or Address Mapping	2	See Section 7.5.1 for details
03~05	Output Channel Number or Bit Count	2	0x0001 to 0x0020

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x01
02	Byte Count	1	Byte Count of the Response (B=(Bit Count + 7)/8)
03	Bit Values	B	(Bit Values)

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x81
02	Exception Code	1	Refer to the Modbus standard for more details

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7.5.4 02 (0x02) Reading the Discrete Inputs

Description
This function code is used to read the current Digital Input values from the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x02
02~03	Starting Channel Number or Address Mapping	2	See Section 7.5.1 for details
04~05	Input Channel Number or Bit Count	2	0x0001 to 0x0020

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x02
02	Byte Count	1	Byte Count of the Response (B=(Bit Count + 7)/8)
03	Bit Values	B	(Bit Values)

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x82
02	Exception Code	1	Refer to the Modbus standard for more details

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7.5.5 03 (0x03) Reading Multiple Registers

Description
This function code is used to read the current Digital Input counter values from the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x03
02~03	Starting Channel Number or Address Mapping	2	See Section 7.5.1 for details
04~05	Input Channel Number or Bit Count	2	0x0001 to 0x0020

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x03
02	Byte Count	1	Byte Count of the Response (B=2 * Word Count)
03~	Register Values	B*2	Register Values

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x83
02	Exception Code	1	Refer to the Modbus standard for more details

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7.5.6 04 (0x04) Reading Multiple Input Registers

Description
This function code is used to read the current Analog Input values from the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x04
02~03	Starting Channel Number or Address Mapping	2	See Section 7.5.1 for details
04~05	Input Channel Number or Bit Count	2	0x0001 to 0x0020

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x04
02	Byte Count	1	Byte Count of the Response (B=2 * Word Count)
03~	Register Values	B*2	Register Values

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x84
02	Exception Code	1	Refer to the Modbus standard for more details

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7.5.7 05 (0x05) Writing a Single Coil

Description
This function code is used to write the Digital Output value for the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x05
02~03	Starting Channel Number or Address Mapping	2	See Section 7.5.1 for details
04~05	Output Value	2	A value of 0xFF00 sets the output to ON. A value of 0x0000 sets the output to OFF.

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x05
02~03	Output Channel Number	2	This value is the same as bytes 02 and 03 of the Request
04~05	Output Value	2	This value is the same as bytes 04 and 05 of the Request

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x85
02	Exception Code	1	Refer to the Modbus standard for more details

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7.5.8 06 (0x06) Writing Multiple Registers

Description
This function code is used to configurethe settings for the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x06
02~03	Address Mapping	2	See Section 7.5.1 for details
04~05	Register Value	2	Register Value

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x06
02~03	Address Mapping	2	The value is the same as bytes 02 and 03 of the Request
04~05	Register Value	2	Register value

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x86
02	Exception Code	1	Refer to the Modbus standard for more details

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7.5.9 15 (0x0F) Writing Multiple Coils

Description
This function code is used to write the Digital Output values for the ZT-2000 I/O module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x0F
02~03	Starting Cchannel Number	2	See Section 7.5.1 for details
04~05	Output Channel Number	2	0x0001 to 0x0020
06	Byte Count	1	B=(Bit Count + 7)/8
07	Output Value	2	A bit corresponds to a channel. When the bit is '0', it denotes that the channel that was set is OFF or Disabled. If the bit is '1', it denotes that the channel that was set is ON or Enabled.

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x0F
02~03	Starting Channel Number	2	The value is the same as bytes 02 and 03 of the Request
04~05	Output Channel Number	2	0x0001 ~ 0x0020

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x8F
02	Exception Code	1	Refer to the Modbus standard for more details

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7.5.10 70 (0x46) Reading/Writing the Module Settings

Description		
This function code is used to read the configuration settings from the module or to change the settings for the module. The following sub-function codes are supported.		
Sub-function Code	**Description**	**Section**
00 (0x00)	Reads the Name of the Module	A.1
04 (0x04)	Sets the Address of the Module	A.2
07 (0x07)	Reads the Type Code	A.3
08 (0x08)	Sets the Type Code	A.4
32 (0x20)	Reads the Firmware Version	A.5
37 (0x25)	Reads whether a Specific Channel is Enabled or Disabled	A.6
38 (0x26)	Sets a Specific Channel to Enabled or Disabled	A.7
41 (0x29)	Reads the Miscellaneous Settings	A.8
42 (0x2A)	Writes the Miscellaneous Settings	A.9

If the sub-function code specified in the message is not supported, then the module will respond with an error code as per the table below:

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

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A.1 00 (0x00) Reading the Name of a Module

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

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x00

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x00
03~06	Module Name	4	0x54 0x20 0x26 0x00

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 00 [12 60]
Response	01 46 00 54 20 26 00 [0E FC]

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A.2 04(0x04) Setting the Address of the Module

Description
This sub-function code is used to set the address fo the module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x04
03	New Address	1	1 to 247
04~06	Reserved	3	0x00 0x00 0x00

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x04
03	New Address	1	1 to 247
04~06	Reserved	3	0x00 0x00 0x00

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 04 02 00 00 00 [F5 1E]
Response	01 46 04 00 00 00 00 [F4 A6]

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A.3 07 (0x07) Reading the Analog Input Type Code

Description
This sub-function code is used to read the Type Code information for a specific Analog Input channel of a module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x07
03	Reserved	1	0x00
04	Channel Number	1	0x00 to 0x07

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x07
03	Type Code	1	The Type Code. See Section 4 for details of the data format.

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 07 00 01 [7C 89]
Response	01 46 07 08 [E3 FB]

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A.4 08 (0x08) Setting the Analog Input Type Code

Description
This sub-function code is used to set the Type Code for a specific Analog Input channel of a module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x08
03	Reserved	1	0x00
04	Channel Number	1	0x00 ~ 0x07
05	Type Code	1	The Type Code. See Section 4 for details of the data format.

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x08
03	Type Code	1	0: OK Others: Error

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 20 [13 B8]
Response	01 46 20 01 00 00 [D2 05]

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A.5 32 (0x20) Reading the Firmware Version Information

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

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x20

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x20
03	Major Version	1	0x00 to 0xFF
04	Minor Version	1	0x00 to 0xFF
05	Reserved	1	0x00
06	Build Version	1	0x00 to 0xFF

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 20 [13 B8]
Response	01 46 20 0A 01 00 00 [D6 B9]

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A.6 37 (0x25) Reading whether a Analog Input Channel is Enabled or Disabled

Description
This sub-function code is used to read whether each Analog Input channel of a module is enabled or disabled.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x25

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x25
03	Enabled/Disabled Status	1	0x00 to 0xFF. The enabled/disabled status of each Analog Input channel, where bit 0 corresponds to Analog Input channel 0, and bit 1 corresponds to Analog Input channel 1, etc. When the bit is 0, it denotes that the Analog Input channel is disabled, and 1 denotes that the Analog Input channel is enabled.

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 25 [D3 BB]
Response	01 46 25 07 [BB 5F]

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A.7 38 (0x26) Enabling or Disabling a Analog Input Channel

Description
This sub-function code is used to specify which Analog Input channels of a module are to be enabled.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x26
03	Enabled/Disabled Settings	1	0x00 to 0xFF. The enabled/disabled settings for each Analog Input channel, where bit 0 corresponds to Analog Input channel 0, and bit 1 corresponds to Analog Input channel 1, etc. When the bit is 0, it denotes that the Analog Input channel is disabled, and 1 denotes that the Analog Input channel is enabled.

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x26
03	Enabled/Disabled Settings	1	0: OK Others: Error

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 26 01 [3B AD]
Response	01 46 26 00 [FA 6D]

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A.8 41 (0x29) Reading the Miscellaneous Settings

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

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x29

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x29
03	Miscellaneous Settings	1	The data format. See Section 4 for details of the format.

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 29 [D3 BE]
Response	01 46 29 02 [7E 5C]

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A.9 42(0x2A) Writing the Miscellaneous Settings

Description
This sub-function code is used to configure the miscellaneous settings for a module.

Request			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x2A
03	Miscellaneous Settings	1	The data format. See Section 4 for details of the format.

Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0x46
02	Sub-function Code	1	0x2A
03	Miscellaneous Settings	1	0: OK Others: Error

Error Response			
Byte	Description	Length	Value
00	Address	1	1 to 247
01	Function Code	1	0xC6
02	Exception Code	1	Refer to the Modbus standard for more details

Example	
Command	01 46 2A 00 [FF 6D]
Response	01 46 2A 00 [FF 6D]

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8 Appendix

8.1 Software Configuration Mode

Each ZT-2000 I/O device contains a built-in EEPROM memory that is used to store configuration information, such as the address, the data format, the Analog Input Type Code and other information. When the module is powered on with the Address (Node ID) set to 0x00, the ZT-2000 I/O device will be set to software configuration mode. In this mode, the configuration details (Address (Node ID), data format and Analog Input Type Code) are loaded from the EEPROM. The settings can then be changed using the %AANNTTCCFF and $AA7CiRrr commands. When the ZT-2000 I/O device is set to software configuration mode, the switch settings are ignored.

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8.2 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 Watchdog circuit allows the module to operate 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 timeout occurs, the module will reset all outputs to a safe state in order to prevent any erroneous operations of the controlled target.

ZT-2000 series devices include an internal Dual Watchdog, making the control system more reliable and stable.

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8.3 Reset Status

The reset status of a module is set when the module is powered-on, or when the module is reset by the Module Watchdog, and is cleared after responding to the first $AA5 command. This can be used to check whether the module has been previously reset. When the response to the $AA5 command indicates that the reset status has been cleared, it means that the module has not been reset since the last $AA5 command was sent. When the response to the $AA5 command indicates that the reset status has been set and it is not the first time the $AA5 command has been sent, it means that the module has been reset and the Digital Output value has been changed to the power-on value.

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9 Troubleshooting

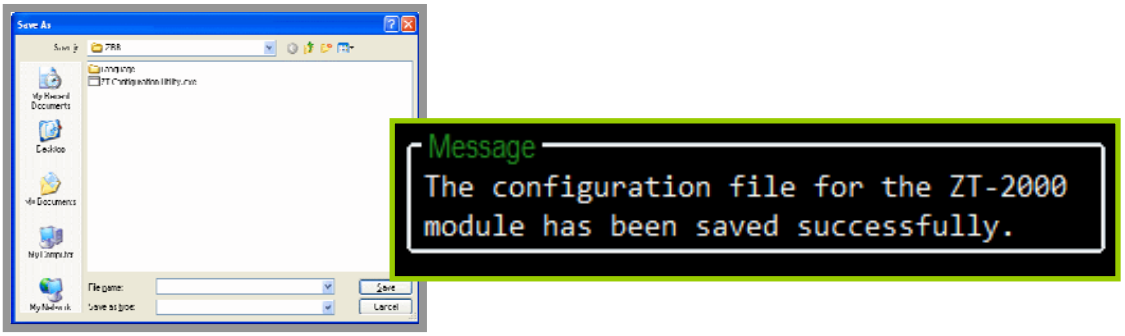
A. Technical Support.
If you have any difficulties using your ZT-2000 series I/O device, please send a description of the problem to service@icpdas.com
Include the following items in your email:

- *A description or diagram of the current DIP switch positions.*
- *A copy of the configuration file for the ZT-2000 coordinator. This file can be obtained using the procedure outlined below and should be attached to your email.*

B. Set the DIP switch for the ZT-255x device to the [ZBSET] position then reboot the device. Launch the ZT Configuration Utility and select the [Save Log] icon to save the configuration of the ZT-255x as a file.



C. After clicking the [Save Log] icon, enter the "File Name" and the "File Path" in the Windows "Save" dialog box. Once the configuration has been successfully saved, the following message will be displayed.



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